SUSTAINABILITY BOUND?
A study of interdisciplinarity and values in universities

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I declare that this thesis is my own work except in one instance of co-authorship.

Collaboration with supervisor Libby Robin produced a book chapter on which Section 2.3 is based, and her contribution was most substantive in Section 2.3.1 within that. My supervisors and advisors provided comments on all or parts of the rest of the thesis, but were not otherwise collaborators in the work.

Kate Sherren
April 2008
To Simon
for making it happen;

To Reg and Ellen
for making it possible; and,

To Margaret and Rowena
for making it likely.
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Abstract

The United Nations declared 2005 to 2014 to be the Decade of Education for Sustainable Development. This agenda is being implemented enthusiastically in university facilities management and operations, and while research in sustainability is increasingly common, tertiary curriculum has not experienced a similar push. This thesis undertakes to explore the expressions of sustainability in the academic activities of universities, and to determine what sort of change (if any) is appropriate. It also seeks to mediate what has become a polarised debate between idealists and pragmatists around the implementation of EFS. Two key features of the work are: 1) the investigation of sustainability in the aggregate student experience, rather than individual subjects; and 2) returning to first principles to avoid a normative stance a priori.

A range of methods is employed adaptively through the process of this alternately broad and deep exploratory study, including: participant observation, interviews, content analysis, questionnaires, social network analysis, bibliometrics, and data clustering. A systemic approach to Canadian and Australian case work captures the diversity of institutional roles and academic motivations at play in adaptation to the EFS agenda.

A stasis exists between the literature around higher education curriculum for sustainability and its implementation. The problem is exacerbated by the lack of pedagogical training in most university academics. A long-standing utilitarian sectoral culture and an increasingly job-focused student market further challenge such public-good concepts as sustainability in the academy. Four simple ideas sit at the heart of 35 years of environmental and sustainability education literature, despite changes in jargon: liberal education and broad foundations; interdisciplinarity in problem-solving; cosmopolitan philosophies; and civic action. Relevant disciplinary content includes biology, environmental science, policy, philosophy, human society, economics, and culture. Most of these elements are rare in the Australian sector, which instead offers science and technology-focused environmental programs with flexible requirements. A transition to the human realm is evident in programs targeting sustainability.

Curriculum cannot be viewed in isolation, however, as it concerns only one of a university’s many constituencies, and one facet of academic staff scholarship. For example, even in higher education sectors more sympathetic to a diversity of university niches and curricular models, like Canada’s, sustainability offerings operate at a tension from low-cost and low-effort teaching models. So-called ‘umbrella’ networking structures on cross-cutting topics must walk a careful line to be comprehensive yet non-competitive. They present great opportunities for sustainability teaching but are almost uniformly research-focused. A distinct sense emerges that the erosion of the collective identity and activities of academe has weakened the ability of universities to respond to new information and challenges in anything but corporate, isomorphic ways.

Two detailed Australian cases of research, research training and curriculum development activities around sustainability paint a rich picture of the agenda. The
intractability of fragmentation between disciplines is evident, even in so-called interdisciplinary units. Problem-based topics often do not have an established social network or committee structure, and priorities can differ by budget unit. Disciplines provide identity, peers and cohesive research directions that can be compelling for individual academics. The most fascinating pattern that arises during the mapping of research co-authorship and co-supervisory relationships around sustainability is the bi-directional orientation: academics collaborate outside their departmental home on papers, but within that home to mentor research students. This combination unifies two contrasting theories of social capital transmission – those preferring dense and sparse networks, respectively – and may be ideal. Students then receive consistent messages while gaining access to the largest (non-redundant) set of human and technical resources via their supervisors’ personal networks. This hypothesis should be explored further: if supported, it would have major impacts on the rhetoric around collaboration in interdisciplinary units in particular.

Curriculum design processes in utilitarian universities are subject to the same fallibilities in adapting to sustainability as other institutions and the wider society. Change is motivated and moderated by financial imperatives and the scale of thought is often coincident with budgets. Engagement processes are often incomplete or undemocratic, hampered by inadequate leadership and shifting membership. Group learning via research, experimentation or vigorous debate is surprisingly rare. Finally, ad-hoc or project-based academic teams are rarely mandated to tackle the causes of problems, some of which can be intractable, and are limited to treating the symptoms. Incremental pragmatism may be a necessary element to university adaptation for EFS.

A number of recommendations are offered to improve interdisciplinarity and university values more generally. Individual academics should: offer additive alternatives to metrics and incentive schemes that maintain existing functions; act on common ground to rebuild a community of scholars; wield to the fullest the freedom in the classroom, and the opportunity to reflect, that university teaching allows; and, continue to debate ideas with passion and rigour, avoiding ‘academic correctness’. University management can contribute by: establishing a clear academic identity for the university beyond ‘excellence’, and supporting firm foundations for students based on that particular vision; taking a proactive view of course review and development and facilitating experimentation in those settings; intentionally fostering interdisciplinary units differently to disciplinary ones; and, establishing and recognising equivalence across a range of successful academic career archetypes.

This methodologically innovative work also suggests opportunities for extending the research, including: refining and testing the sustainability canon developed here; better understanding collaborative behaviour and the impact of various models of supervisory teams on student career paths; and, finding better ways of defining, modelling and evaluating interdisciplinary scholarship. Sustainability is likeliest to emerge from a healthy and independent tertiary sector, than one operating as an overt policy instrument.
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<td>AAC&amp;U</td>
<td>Association of American Colleges and Universities</td>
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<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<td>ACF</td>
<td>Australian Conservation Foundation</td>
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<td>ACTS</td>
<td>Australasian Campuses Towards Sustainability</td>
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<td>ARC</td>
<td>Australian Research Council</td>
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<tr>
<td>ARIES</td>
<td>Australian Research Institute in Education for Sustainability</td>
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<tr>
<td>AUCC</td>
<td>Association of Universities and Colleges of Canada</td>
</tr>
<tr>
<td>AVCC</td>
<td>Australian Vice Chancellor’s Committee (now Universities Australia)</td>
</tr>
<tr>
<td>AUQA</td>
<td>Australian Universities Quality Agency</td>
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<tr>
<td>CAE</td>
<td>College of Advanced Education</td>
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<tr>
<td>CERI</td>
<td>Centre for Educational Research and Innovation (OECD)</td>
</tr>
<tr>
<td>CRC</td>
<td>Cooperative Research Centre</td>
</tr>
<tr>
<td>CSIR</td>
<td>Council for Scientific and Industrial Research (precursor to CSIRO)</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
</tr>
<tr>
<td>DEST</td>
<td>Department of Education, Science and Training</td>
</tr>
<tr>
<td>DVC</td>
<td>Deputy Vice-Chancellor – denotation of (A) refers to an Academic DVC</td>
</tr>
<tr>
<td>ECR</td>
<td>Early career researcher</td>
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<tr>
<td>EE</td>
<td>Environmental education</td>
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<tr>
<td>EFS</td>
<td>Education for sustainability</td>
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<tr>
<td>EM</td>
<td>Environmental management</td>
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<tr>
<td>EIANZ</td>
<td>Environment Institute of Australia and New Zealand</td>
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<tr>
<td>ESD</td>
<td>Ecologically sustainable development</td>
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<tr>
<td>ESDRC</td>
<td>Environment and Sustainable Development Research Centre (UNB)</td>
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<tr>
<td>GIS</td>
<td>Geographic information systems</td>
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<tr>
<td>GNI</td>
<td>Gross national income</td>
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<tr>
<td>HEP</td>
<td>Higher education provider</td>
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<tr>
<td>HERDC</td>
<td>Higher Education Research Data Collection</td>
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<tr>
<td>ICT</td>
<td>Information and communication technologies</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>IRES</td>
<td>Institute for Resources, Environment and Society (UBC)</td>
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<tr>
<td>IRIS</td>
<td>Institute for Research and Innovation in Sustainability (York University)</td>
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<tr>
<td>ISI</td>
<td>Institute for Scientific Information</td>
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<tr>
<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MEA</td>
<td>Millennium Ecosystem Assessment</td>
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<td>MTA</td>
<td>Mount Allison University</td>
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<td>NRM</td>
<td>Natural resource management</td>
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<td>NSW</td>
<td>New South Wales</td>
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<td>NSW CEE</td>
<td>NSW Council on Environmental Education</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>OED</td>
<td>Oxford English Dictionary</td>
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<td>RFCD</td>
<td>Research Fields, Courses and Disciplines</td>
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<td>RMIT</td>
<td>Royal Melbourne Institute of Technology</td>
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<td>RQF</td>
<td>Research Quality Framework</td>
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<td>SFU</td>
<td>Simon Fraser University</td>
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<td>SNA</td>
<td>Social network analysis</td>
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<td>St. Thomas University</td>
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<td>Technical and Further Education</td>
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<td>TER</td>
<td>Tertiary Entrance Rank</td>
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<td>TOR</td>
<td>Terms of reference</td>
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<tr>
<td>UBC</td>
<td>University of British Columbia</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>ULSF</td>
<td>University Leaders for a Sustainable Future</td>
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<td>UN</td>
<td>United Nations</td>
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<td>UNS</td>
<td>Unified National System</td>
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<tr>
<td>UNB</td>
<td>University of New Brunswick</td>
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<tr>
<td>UNEP</td>
<td>UN Environment Programme</td>
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<tr>
<td>UNESCO</td>
<td>UN Education, Scientific and Cultural Organisation</td>
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<tr>
<td>US</td>
<td>United States</td>
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<tr>
<td>VC</td>
<td>Vice-Chancellor</td>
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<tr>
<td>WCED</td>
<td>World Commission on Environment and Development</td>
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CHAPTER ONE THE CONTEXT FOR CHANGE

This chapter outlines the issues presented by sustainability education in universities, establishes the rationale for the research direction chosen, and introduces the key literatures, methods and conventions employed to undertake the work.

1.1 Statement of the problem

By the time of the launch of the United Nations Education, Scientific and Cultural Organization (UNESCO) Decade of Education for Sustainable Development (The UN Decade) in 2005, many universities were already starting to tackle the task of education for sustainability (EFS). Eight of Australia’s universities had signed the Talloires Declaration (University Leaders for a Sustainable Future (ULSF) 1990), committing themselves to implementing sustainable practices throughout their institutions. Operations ‘greening’ and research are covered by these commitments, as is curriculum development to create specialists in sustainability and sustainability literacy in all graduates. Specialist sustainability education is more the purview of this thesis. This research began from a desire to understand how the tertiary sector’s academic offerings have responded to the EFS movement. Its primary focus has become determining the degree to which universities are able to adapt to any such external initiative without sacrificing those roles they uniquely provide: disinterested research towards the improvement of knowledge, mind-expanding higher study based on the passions of experts, and providing a cultural and disciplinary ‘Noah’s Ark’ in a utilitarian government and market environment. Such risks echo throughout this exploratory thesis. In this introductory chapter, a review is presented of the literature that informed the key research questions, and the methods and definitions used. More detailed literature and methods sections appear in later chapters where they are most relevant.

1.2 Literature survey

Modern universities face pressures from all directions for and against change: from above, in the form of government funding policies and university governance and quality assurance arrangements; from below, in the form of an employment-focused student market and sometimes sceptical taxpayers; and laterally, from the traditional disciplines and those who have made their careers in them, and competing research institutes. For example, integration between disciplines and stakeholders has long been mooted as one solution to problems around sustainability, but corresponding change within universities has been slow. Formulating a rational and singular way to tackle the preliminary guiding question of “what expressions is sustainability finding in universities?” involved reading across the history of the Australian higher education sector, the concept of sustainability, environmental education (EE) and EFS, cross-disciplinarity and – perhaps incongruously – the trajectory of geography and environmental studies as academic disciplines in Australia. The rest of this section presents a survey of that influential literature, some of which is expanded on later.
1.2.1 Higher education

Higher education in this thesis refers to universities alone, and does not include the technical and further education (TAFE) institutions which provide vocational tertiary study. Universities and parliaments are the only institutions which have survived intact since the medieval period (Spade 2004). The history of universities in Australia is explored in detail in Section 2.2. In this introduction a snapshot of the larger sector is given to provide context for the material to come.

Many Western nations are currently experiencing similar trends in their university sectors, including: the rise of post-normal or Mode II science that breaks down the monopoly and isolation of universities; moves towards the transformation of undergraduate education in light of fast-changing careers and an information-rich environment; the impact of neo-liberalism and managerialism; and, the internationalisation of education (and concomitant reliance on fee-paying international students). These are introduced only briefly here but will be touched on throughout the rest of the thesis.

Mode II knowledge production, a term coined by Gibbons et al. (1994; also Nowotny et al. 2001), describes the increase in context-driven, interdisciplinary, problem-based research that is not limited to the disciplinary realm of the academy. Post-normal science (Funtowicz and Ravetz 1993) argues for highly participative decision-making processes when uncertainty and stakes are high, and is related to Mode II in its broaching of university walls in the research of complex issues. These ideas mark in part the increasing prevalence of private and public research centres that compete with universities but lack the teaching pressures they face. The franchised research monopoly granted in the past by governments to universities as a reward for their teaching role has become a free market, but government-subsidised universities can also compete in commercial research. Ziman (1996) perceives science as at risk of losing its objectivity and collegiality as research grows more directed and competitive, and outcomes become protected intellectual property. Slaughter and Leslie (1997) describe this phenomenon as ‘academic capitalism’, and Marginson and Considine (2000) call such institutions ‘enterprise universities’. Such a “climate of commercialism and competition” (Bosselmann 2001, p. 169) can filter into the culture of learning institutions such as universities (Anderson 2001).1 The humanities, fine arts and social sciences are also increasingly marginalised in this context (Axelrod 2002; Moses 1990).

Universities have been particularly vulnerable to such trends since the 1980s, when ‘Thatcherism’ (also called neo-liberalism or economic rationalism) opened the sector up to market forces while maintaining tight oversight around status, offerings, fees, and funding. In the United States (US) this was accelerated by the decision to allow universities to patent the results of publicly funded research (Scott 2004). Many polytechnics and other para-professional institutions became universities during the

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1 The September/October 2005 issue of Canadian Dimensions (vol. 39, no. 5), a double, thematic issue on ‘The Battle for Canadian Universities’, cites many interesting cases of this.
Chapter 1: The context for change

1980s and 1990s in Commonwealth nations. Yet these same nations have all experienced a crisis in the academy that Readings (1996) identifies as resulting from a collapse of two key ideas of the modern university under the spectre of global capitalism: reason or the search for truth (after Kant), and preserving culture (after Humboldt) (Peters and Roberts 1999). What remains is the quest for ‘excellence’, which is a meaningless referent when it lacks a subject (Readings 1996). The bureaucratic environment that has arisen depends on comparative metrics and rankings to assert the difference and value of universities to society. The universities “at the same time [are] assuring prospective students that their institution can do everything that its competitors do, only better!” (Marginson 1999, p. 12). Growth is the key measure of success.

Globalisation has additionally fractured the academy by removing the modern university from the project of nation-building (Marginson 2002; Peters and Roberts 1999). The Colombo Plan was established in 1950 to provide economic and social development in Asia and the Pacific nations. Increased access to donor nations’ higher education institutions has been a major element of that Plan’s implementation. In recent years, however, foreign students have been increasingly viewed as valuable revenue sources and universities are increasingly courting that market, including opening spur campuses in other countries and ‘internationalising’ the curriculum (Marginson and Considine 2000). Tuition fees for this cohort have increased relative to fees for citizens, and the programs most attractive to these wealthy foreign students have swollen. Recently, a ‘Bologna Process’ has begun the standardisation of educational offerings (quality and credit size) within a ‘European Higher Education Area’ (roughly the European Union), to facilitate student exchanges and skilled migration. Other national sectors like Australia’s are strongly considering aligning with those standards to increase competitiveness within that market (Illing 2006).

Universities have always been at the forefront of employing information and communications technologies (ICT) in research and teaching (Marginson and Considine 2000). The rise of internet search engines, and their spin-off services for mapping, academic research, and image and news compilation, has changed the nature of scholarship. An academic’s peers are becoming less and less likely to be those with whom they sit around the tea room (Marceau 2000), and collaboration between institutions is increasing as scientists optimise their collegial relationships among a growing number of players (Hicks and Katz 1996). The university sector has become much more accessible, also, making first year study the site for ‘levelling’ intake, rather than exploring new areas (Boyer Commission 1998). Professional credentials are increasingly more attractive than liberal study or research careers as student costs rise.


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2 The Organisation for Economic Cooperation and Development (OECD) (2006) shows that international enrolments are highest (and increasing) in Australia (16.5%) but they are also high in the UK (13.5%) and Canada (9%). That market makes up a large percentage of those undertaking non-research second degrees as well as undergraduate qualifications.
of the Boyer Commission (1998) in the US have pleaded for a re-examination of undergraduate education to counter such trends. Recommendations have emphasised the role of higher study to provide an environment for personal transformation and foster the acquisition of generic life skills rather than ‘training’, information transfer, or inculcation with the previous generation’s accepted canon (see Section 3.1.1.1 for a thorough discussion of liberal education). The Boyer Commission produced a list of “ten ways to change undergraduate education” (1998, p. 14) in research universities that echoes many of the needs of sustainability education as discussed later in this thesis (see Table 1.1).

Table 1.1 Summary of the Boyer Commission’s (1998) ten recommendations for transforming undergraduate education.

1. Make research-based learning the standard, using mentors, internships, and undergraduate research.
2. Construct an inquiry-based freshman year, using seminars, block scheduling, and requiring secondary remediation before admission.
3. Build on the freshman foundation, and integrate transfer students carefully into their new programs.
4. Remove barriers to interdisciplinarity education and introduce such work early in programs.
5. Link communication skills and coursework throughout programs.
6. Use information technology creatively, to enrich teaching and span distances.
7. Culminate with a capstone experience.
8. Educate graduate students as apprentice teachers.
9. Change faculty reward systems to reward teaching and research.
10. Cultivate a sense of community in the diverse set of learners, learning modes and levels.

1.2.2 Australian higher education

Higher education is a ‘positional’ product (Hirsch 1977): its value declines with ubiquity (Marginson 1993). The OECD (2006, p. 13) suggests that “rising educational levels among citizens seem generally not to have led to an inflation of the labour-market value of qualifications”, but graduates in Australia starting out are increasingly earning less than average incomes unless they also have a graduate degree (Australian Bureau of Statistics (ABS) 2004a). The Australian government has improved public access for credentials, creating extremely large tertiary institutions, and they have now “become too large and expensive to be permitted to go [their] own way”, as Ziman noted of the American sector (1996, p. 752). Performance management is increasingly used to monitor research outcomes and measure universities against one another to determine the amount of funding they will receive from government. Being self-accredited, universities are evaluated by a third party, the Australian Universities Quality Agency (AUQA) based on their own goals. Nationally prescribed research priorities assure that academic research is ‘relevant’. Such measures allow governments to justify public investment in universities to taxpayers, and render the universities utterly dependent. At the same time, per-student federal investment has dropped (Marginson 2001) and funding to Australia’s tertiary sector has not kept up with that directed to its primary and secondary sectors (OECD 2006).
There is a heightened sense of competition both between universities (for students, grants, and government rewards) and within universities (for much the same). This climate has changed the nature of academic life in Australia, inspiring a spate of writing on the sector’s decline (Coady 2000; Lowe 1994; Marginson and Considine 2000; Milne 2001; Murray and Dollery 2005; Ryckmans 1996; Slaughter and Leslie 1997). Australian higher education institutions are reporting greater inequities following the flattening of the old binary system in 1987, despite an emphasis on equality of status between the new and the old (Marginson and Considine 2000, and discussed in more detail in Section 2.2.7). Indeed, stratification is increasing as the longstanding research institutions are rewarded above new entrants who lack the research resources or momentum. Many of the ex-technical colleges brought vocational and para-professional fields like marketing and nursing into the tertiary sector, too, increasing the complexity of what constitutes higher education. At the same time, Ramsden and Moses (1992) found that the dominant ideology of universities of a symbiosis of teaching and research (in terms of quality of outputs of both) was a myth in Australian universities. Such a causal relationship is often presented to defend the unique place of universities, but a ‘zero sum game’ may instead be at play, especially in the ‘new universities’.

Ease of measurement promotes certain indicators over others, such as the number of publications over the impact of published work, and these come to be considered proxies of the thing being measured, however badly it is approximating that reality. For example, it has been common in university promotions to assume research quality is a good proxy of teaching expertise. In the case of universities, such metrics and accounting systems often make activities that would be likely to improve sustainability outcomes into irrational choices for individuals to make. Such activities include collaborative research (in which case rewards for publication are shared between more participants), team teaching, and interdisciplinary student co-supervision. Aggregation of performance metrics by budget unit can be illogical, too. Disciplines are increasingly amalgamated into schools or other administrative units to ensure economic viability (Harvey et al. 2002) and facilitate administration, rather than along existing or potential axes of collaboration.

The definition of higher education has also expanded since the federal government discussion paper, Building University Diversity (Department of Education Science and Training (DEST) 2005a). A number of private, niche-based higher education providers (HEPs) have been approved since then, and students of some of them can access federal tuition fee support. In 2005, 25 new providers were approved, largely with one area of interest – either theological, or one area of study such as business, ICT, hospitality and

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3 It is perhaps ironic that students are co-opting the indices by which they are measured (such as the Tertiary Entrance Rank (TER) in NSW), by using the corresponding index thresholds for acceptance into individual programs as indicative of the ‘value’ of those courses. This creates a positive feedback loop that takes popular programs or universities to stratospheric levels, irrespective of job opportunities or income or difficulty (e.g. terror studies, viz. Macnamara 2006). Such programs then increase their TER threshold and are viewed even more positively by students (Ferrari 2007; Moodie 2007).
alternative health – and total enrolments 0.8% of that of the rest of the sector (DEST 2005c).\(^4\) Few of these will be competitors for research funding, but with international students primarily interested in business and ICT degrees, as these new providers gain credibility, they may become competitive with public providers in the lucrative fee-paying student market.

Managerialism – principles of management science applied uniformly, heedless to the nature of the product – is common in the tertiary sector and reduces the organisational creativity that might allow universities to respond better to the complexity of their role in modern life. Interestingly, increased pressure on universities has not resulted in a highly diversified market amongst the public universities\(^5\). Marginson and Considine (2000) document the fact that university management, concentrating power in higher echelons than before, seem to be steering their ships towards the same distant point that defines success. They are becoming less differentiated in range and level of offerings, research focus and marketing approach. As a point of comparison, universities in North America tend to pursue niches, some choosing to be introductory, generalist two-year colleges, others primarily undergraduate but comprehensive and only a few awarding doctorates (Clark 1997; Milne 2001). Australian universities under stress have chosen a different route to survival in the existing context: comprehensive research and course offerings, particularly those that attract fee-paying student numbers and quality research students. The internet has changed the game, allowing universities to modify their outward profile to provide the most chances of ‘hits’ from search engines.\(^6\) A university can appear via its website to have a sizable department or research group dedicated to a field or problem area, but this may not reflect reality.

Federal policies have had unforeseen impacts in other ways. As enrolment growth slows and even drops, universities are forced to lower standards of intake and progression in order to maintain their student-based income (Coady 2000; Lowe 1994). The student market is also determining the range of offerings (Anderson et al. 2003), and not always in light of the realities of the job market. Although there is a backswing now away from the narrowly focused, ‘named’ degrees of the 1990s (O’Keefe 2006), curriculum development is highly market- and cost-driven. Some specialised degree programs are still launched to satisfy faddish interest in topics such as forensic science, computer games technology or sports management, but students can sometimes arrive to find that a curriculum has been cobbled together from existing subject offerings without the industry-specific focus in subjects or in experience by teaching staff they expected.

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\(^4\) One interesting private entrant to the market is Australia’s first exclusively liberal arts college (Fraser 2006), the Catholic Campion College in Western Sydney which offers one degree and numbers approximately 40 students in its 2\(^{nd}\) year of operation.

\(^5\) An interviewee of a later stage of this research likened the isomorphic marketing model resulting in this lack of diversity in universities, to that used by airlines in Australia when more than one is competing on the same route. Rather than providing customers with one flight – alternating the provider – each hour of the day, they will offer two (or more!) at the exact same time, two hours apart.

\(^6\) The term ‘search engine marketing’ describes this practice.
adult student market, also often full fee-paying, is hungry for courses that will be immediately and obviously relevant to their vocation, and industry is simply not yet demanding sustainability-related skills. Bosselmann hypothesises that a historical analysis of university courses, hiring and research activities would show increasing preference for a “growth and development” orientation to the detriment of sustainability (2001, p. 174).

As will be discussed further in Chapter Two, the Australian tertiary sector has always been driven by utilitarian priorities. A philosophical question lingers throughout this thesis about whether it is the role of universities to respond to society’s priorities – thus emphasising them – or pressure for new ones. Should universities adapt to maximise goodness-of-fit with their social environment, or act as nagging, inconvenient burrs to the status quo (Goodin 1996; also Section 5.3)? While this is an interesting philosophical question, financial pressures do not permit public institutions the luxury of testing it.

1.2.3 The sustainability idea

Environmental awareness increased in the 1960s following the first publication of Rachel Carson’s Silent Spring in 1962. Public awareness of local environmental degradation increased, independent environmental action groups were formed, and many western governments responded with the formation of environmental policy departments (Liverman 1999). The United Nations (UN) held its first environmentally focused conference in Stockholm in 1972, where the United Nations Environmental Program (UNEP) was founded (Wilbanks 1994). Global environmental issues such as ozone depletion and climate change galvanised the public in the 1980s amidst news of famine in Africa and the new spectre of Acquired Immune Deficiency Syndrome. The World Commission on Environment and Development (WCED), formed in 1983, defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987, p. 43). It was the first of many definitions to be proposed for the term.

At the end of the 1980s the Cold War was ending and the worldwide marketplace was becoming more powerful than national or international politics, a phenomenon that came to be called ‘globalisation’. The 1992 UN Conference on Environment and Development in Rio focused more on these global issues, resulting in the production of the ‘Agenda 21’ sustainable development blueprint. Since 2000, the UN’s Millennium Development Goals (MDGs) (UN 2000) have become a major focus of international aid investment, but progress towards the 2015 deadline has been slow. Popular campaigns such as Bob Geldof’s 2005 ‘Make Poverty History’ initiative have attempted to pressure heads of developed states to commit the 0.7% of gross national income (GNI) required to meet such goals.

In Australia, the term ‘ecologically sustainable development’ (ESD) is used in government policy circles (Robin 2007), defined by the Department of Environment and Heritage (1992, n.p.) as “using, conserving and enhancing the community's
resources so that ecological processes … are maintained, and the total quality of life, now and in the future, can be increased”. Stated public concern for the environment has dropped from 72% to 57% of the population between 1992 and 2003 in Australia, the largest decline being seen among the young (ABS 2004b). Australia’s overseas development aid has increased from 0.25% to 0.28% of Gross National Income (GNI) since 2005 (AusAID 2005), but a survey indicates that the Australian electorate is largely unmoved by international aid targets such as the MDGs when compared with local issues (Philips 2007). Electoral results similarly suggest an insular attitude (Singer and Gregg 2004). Summarising documents like the UN’s Agenda 21 and Australia’s National Strategy for Environmentally Sustainable Development, Connor and Dovers (2003) draw a picture of the difficult task ahead:

Sustainable development is about far more than ‘the environment’. It presents a suite of interrelated and significant challenges: protecting ecological life-support systems; reconciling ecological, social and economic imperatives in the long term; correcting grossly inequitable levels of human development; developing precautionary approaches to interventions in natural systems; creating participatory modes of policy and management; and using innovative policy tools. (p. 203)

Sustainable development is being called for worldwide, yet the manifold definitions have conflicting policy implications. Dobson (1996) and Pearce (1993) have each developed classifications of the range of sustainability conceptions displayed in the literature, and – along with Pezzey (1992) – have concluded that a key concept distinguishing the definitions is how ‘substitutable’ natural capital or resources are for other capital (human or intellectual). As human societies become increasingly clever, better tools can result in the use of fewer resources in order to produce the same amount of overall value; this emphasis on maintained value indicates a belief in substitutability and a somewhat ‘weak’ sustainability results (according to Pearce’s terms). If the natural capital has intrinsic value and should be kept intact for its own sake, substitutability makes no sense and you get what Pearce calls ‘very strong’ sustainability. Both systems show that there is a wide spectrum of sustainability ideas in existence, and that there is no one ‘right’ answer to the question of what most deserves to be sustained. It is a moral and ethical issue with a lexical vagueness that can “attract hypocrites and foster delusions” (Robinson 2004, p. 2980; see also Stables and Scott 1999). Those who hold the idea that both development and the environment can be maintained at current levels exhibit a variant of George Orwell’s ‘double-think’, whereby two opposite and mutually exclusive meanings of a term are simultaneously accepted (Wals and Jickling 2002). ‘Sustainable damage’ might be more realistic as a goal (Gammage 1994).

Sustainable development as an idea thus includes the values of environmental/ecological, economic and social sustainability (Vargas 2000). These three pillars are often criticised for conceiving of humanity as separate from the environment on which it depends, and on equal footing with an economic institution that it has created (Beder 1994; Dawe and Ryan 2003). Fien (2002) and Hawkes (2001) add a cultural/political element to the definition, and Blewitt (2004) adds a further three facets: technological, philosophical, and scientific. ULSF defines sustainable activities
as those which are “ecologically sound, socially just, economically viable and humane”, and able to “continue to be so for future generations” (1999, p. 1). The ill-defined nature of the term (Dobson 1996) means that all sides of complex issues can comfortably espouse sustainability without any consensus on what the term means. It is also inextricably linked to the idea of growth as a goal (Bell 2004a; Robinson 2004) and is therefore more of a ‘slogan’ than an “actionable” concept (Wilbanks 1994, p. 541). Several authors have thus warned against the transformation of education into indoctrination in the uncertain image of sustainability (Foster 2001; Gough and Scott 2001; Jickling 2001; Wals and Jickling 2002).

What makes an unsatisfying idea for educational transformation also presents a fascinating one for researchers. The undertaking of sustainability is vast and takes in almost every area of endeavour. Dovers (2005a, p. 9) captures the scale of sustainability with a list of issues covering “resource depletion and degradation”, “pollution and wastes”, “fundamental ecological life support services” and “society and the human condition”, any one of which contains a staggering range of constituent issues each embodying enormous complexity. The nascent interdisciplinary field of ‘sustainability science’ will need to:

1. Span the range of spatial scales between such diverse phenomena as economic globalization and local farming practices;
2. account for both the temporal inertia and urgency of processes like ozone depletion;
3. deal with functional complexity such as is evident in recent analyses of environmental degradation resulting from multiple stresses; and
4. recognise the wide range of outlooks regarding what makes knowledge usable within both science and society. (Kates et al. 2001, p. 641)

Sustainability is big, difficult and important. Tackling even one facet, such as adequate shelter, in a sustainable and globally equitable fashion, is an enormous undertaking. Yet, since 1992, the majority of the world’s nations have committed themselves to that agenda via countless laws, policies and agreements. Education is one key to success.

### 1.2.4 Education for sustainability

In the EFS world as elsewhere, ‘sustainable development’ is considered a problematic term for its ‘growth’ ethic, and has been largely replaced by ‘sustainability’, which is more vague and just as beset by “systemic non-competence” (Bosselmann 2001, p. 168). EFS has evolved from nature studies and EE, both of which centred on pre-tertiary education. Orr (1992) considers ‘ecological literacy’ to be the key goal of EFS, which he defines as “a broad understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainably” (p. 92). The EFS movement is intended to indicate a switch from education about the environment, to an education that will enable better stewardship of it (e.g. Tilbury and Wortman 2004). Such a distinction is valid in theory, as a person who is well-versed in scientific species names and water balance equations is not necessarily qualified to manage the phenomena they represent.

Yet history shows that EE and EFS have much in common. The Tbilisi Declaration from the 1977 UNESCO/UNEP Conference on Environmental Education stressed the
importance of knowledge on the “interaction of ... biological, physical, social, economic and cultural aspects” of natural and built environments (UN 2005). It also stressed the importance of changing values and attitudes as well as imparting knowledge and practical skills. Ideas that arise in the proceedings of the OECD’s Centre for Educational Research and Innovation (CERI) conferences on EE that were held throughout the early 1970s (CERI 1973; 1976) reoccur in the implementation documents for the UN Decade on EFS, which began in 2005 (see Table 1.2). It certainly does not appear to be dissent that is hindering progress, but vogues in jargon (Leal Filho 2000) and perhaps a fragmentation of debate and action in the tertiary sector. Unsurprisingly, stasis has resulted.  

Table 1.2 Similarity of terms and phrases found in Landmark EE and EFS documents (CERI 1973, 1976; UNESCO 2004).

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<td>A problem focus</td>
<td>Problem-based</td>
</tr>
<tr>
<td>Transdisciplinary and interdisciplinary</td>
<td>Interdisciplinary and holistic across ‘pillars’</td>
</tr>
<tr>
<td>Involve all university activities</td>
<td>Life-long learning</td>
</tr>
<tr>
<td>Led by student initiative and curiosity</td>
<td>Critical thinking and problem solving</td>
</tr>
<tr>
<td>Experiential education</td>
<td>Multiple method pedagogy</td>
</tr>
<tr>
<td>Future time orientation</td>
<td>Future focus</td>
</tr>
<tr>
<td>Entire brotherhood of man</td>
<td>Intergenerational and intragenerational equity</td>
</tr>
<tr>
<td>Comparisons across space</td>
<td>World citizenship</td>
</tr>
<tr>
<td>Community action</td>
<td>Participatory and/or team-based</td>
</tr>
<tr>
<td>Education for both employment and citizenship</td>
<td>Applicable to day-to-day and professional life</td>
</tr>
</tbody>
</table>

The discovery of this impasse in the literature is a key moment in this thesis research. Rather than simply tracking and assessing the progress of a sector in contributing to a widely held (though recently set) societal goal, looking backward is required to understand that sector’s response to previous incarnations of the same concept. Rather than viewing the universities as taking an unreasonably resistant position, as the normative tone of the EFS literature occasionally suggested, the undertaking must be considered in light of the realities of the sector, the particularities of the academic career, and the unique social psychology (even ‘ecology’) that they create en masse.

Other sectors and cohorts have had more success than university academics at implementing EFS. In Australia there are federal and state level action plans active for all educational sectors (e.g. Department of Environment and Heritage 2000; NSW Council on Environmental Education 2002). Many nations also now have journals dedicated to EE (e.g. Canada, Australia, South Africa, and the United Kingdom (UK)).

It is not unusual for academic literature to be cyclical. Andrew Abbott describes in *Chaos of Disciplines* (2001) how academia has a fractal nature, both laterally and longitudinally (in time). Lateral or parallel cycles occur during sub-specialising (such as the diversity vs. unity (DNA) approaches to biology as discussed in Quammen 2006). Longitudinal cycles occur when a young academic discovers an idea that has lain at rest in the literature and enjoys moderate success by reviving it at an apt moment, resulting in repeating fashions roughly every 25 years within disciplines.
Curricula and resources are centrally regulated for primary and secondary education, as well as vocational higher education (e.g. TAFE), and this makes them more efficient policy instruments when seeking normative change. Governments capitalise on this central control, sometimes for political ends as seen in many recent public debates about history curricula and values-based education (Aplin 2007). These sectors also feature a good fit between practitioner education and individual daily tasks, and have a cohesive professional identity, dominating meetings of the Australian Association of Environmental Education and Australian Association for Research in Education.

1.2.5 Higher education for sustainability

Dovers (2005a) identifies many of the activities that take place at universities as being potential policy instruments. For example, environmental teaching and research at the tertiary level increasingly involves stakeholder engagement, impact and risk assessment, policy analysis, public education, legal case discussion, and the development of accounting metrics and monitoring programs. In other contexts, most of these activities are explicitly aimed at changing behaviours to improve environmental outcomes, which marks them as instrumental (Dovers 2005a). Such inculcation is rarely overt in universities, and even if it is, distortion results from other characteristics of the sector. First, the tertiary sector is highly decentralised in terms of the curriculum development processes. Each institution and discipline within it operates largely autonomously, especially considering the self-accrediting approach the sector employs. Second, practitioners are rarely trained educationalists, but rather experts in other fields who teach that area. Even if there was a common message emanating from government or the literature on such a topic as EFS (which there is not), it is unlikely that academics would be listening. Finally, even if they are listening, university instructors can find pedagogical literature impenetrable and difficult to implement (Fien 2002; Lattuca and Stark 1994), and often resent and resist violations of their academic freedom.

Despite such difficulties, universities are increasingly aligning with sustainability principles, where they serve as useful models of the feasibility of the undertaking in wider society. Edited volumes (Corcoran and Wals 2004; Blewitt and Cullingford 2004; Leal Filho and Carpenter 2006) and journals (e.g. International Journal of Sustainability in Higher Education) on the issue of sustainability and universities attest to the degree of interest in the topic. The American-based ULSF and the European COPERNICUS programs support universities wishing to commit to sustainability, and Macquarie University hosts the federally supported Australian Research Institute on Education for Sustainability (ARIES), on behalf of the National Environmental Education Council. The Australian Vice Chancellor’s Committee (AVCC) has a comprehensive and supportive policy on EFS (2006). ULSF sponsors the Talloires

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8 One example of an overt policy initiative in higher education is the mid-90s UK experiment to inculcate the capacity for individual enterprise throughout university curriculum (Jones 1996).

9 COperation Programme in Europe for Research on Nature and Industry through Coordinated University Studies
Declaration (see Table 1.2) that currently numbers 362 signatory universities internationally, eleven of which are Australian (ULSF 2006). However, signing such an agreement is just the beginning (Gudz 2004; Moore et al. 2005; Wright 2004). Barriers to implementing the commitment come from four key sources, according to Moore (2005c, p. 537): “the problems of disciplinarity, the competitive environment of universities, misdirected criteria for evaluating students and faculty, and multiple priority-setting by the administration”. All of these barriers are explored in depth during this thesis.

Table 1.3 Main tenets of the Talloires Declaration on Education for Sustainable Development (ULSF 1990, n.p.).

We, the presidents, rectors, and vice chancellors of universities from all regions of the world…agree to take the following actions:

- Increase awareness of environmentally sustainable development;
- Create an institutional culture of sustainability;
- Educate for environmentally responsible citizenship;
- Foster environmental literacy for all;
- Practice institutional ecology;
- Involve all stakeholders;
- Collaborate for interdisciplinary approaches;
- Enhance capacity of primary and secondary schools;
- Broaden service and outreach, nationally and internationally; and,
- Maintain the movement.

The idea that universities are just getting too big to ignore as agents of unsustainable behaviour and owners of large ecological footprints (Orr 1991) has led to a very active role of facilities management and university administration in sustainability. Though university operations such as purchasing and grounds management are not part of this research, it is worth noting the considerable progress that has been made in this area (Bekessy and Burgman 2001; Beringer 2006; Carpenter and Meehan 2002; Condon 2002; Howard et al. 2000; Sharp 2002; Shriberg 2002). Bosselmann (2001) suggests that sustainability must be institutionalised in universities, just as equal opportunity policies were adopted several decades ago and are not questioned today. Most universities now have environmental officers, and these – for want of a better place – have been housed either within facilities management or within human resources along with occupational health and safety. The location of agents within human resources departments can facilitate the institutionalisation of sustainability policies. If located in facilities management, sustainability managers can influence those who control the physical environment of the university. Due to highly decentralised purchasing processes and academic autonomy, however, what happens inside the schools and research centres is harder to affect from central locations. In Australia and New

10 As of early 2005, university strategic plans in Australia rarely referenced such commitments (see footnote 1 on page 113 for more detail). Full audits of university sustainability policies or mission statements in other higher education sectors are still uncommon.
Zealand, campus sustainability managers meet regularly at Australasian Campuses Towards Sustainability (ACTS) conferences, which are also occasionally attended by academics whose teaching involves campus-based restoration or auditing projects. Unfortunately interactions between general staff involved in facilities management and academic teaching and research staff remain rare, and curriculum ‘greening’ is barely evident in Australia (Noonan and Thomas 2004).

Teaching and research are each governed by very separate hierarchies within universities, although both are increasingly voicing support for sustainability. In the nearly 30 years since the United Nations first mooted the concept of ‘sustainable development’, the term has been commonly misused in marketing and public relations in order to attract a ‘green’ stamp of approval (Cullingford 2004). In higher education, the sustainability stamp has recently begun to be used to impress prospective students (Bekessy et al. 2003, quoting the Australian National Union of Students), industry collaborations and government funding. However, in the rush to fill this new promotional niche, it is not evident that there has been enough time given to discourse on if and explicitly how universities should prepare students for participation and leadership in a sustainable future. The EFS literature is rich in cases (successful and not) of implementing sustainability subjects in the curriculum of many universities worldwide (e.g. Alvarez and Roberts 2006; Buchan et al. 2007; Davis et al. 2003; Geli de Ciurana and Leal Filho 2006; Leroy et al. 2001; Muijen 2004; Reddy and Schreuder 2004; Verbitskaya et al. 2002; Wemmenhove and de Groot 2001), many of which are facing similar challenges in their national tertiary sectors as Australia. The literature also comprises a large number of big-picture, conceptual articles that debate desired values or generic skills above the level of the practical considerations of individual sectors (e.g. Bowers 2001a; Orr 1992; Lautensach 2004; Stables 2001; Sterling 2001). Only review articles have synthesised the two with a view towards pragmatic concerns (Bosselmann 2001; Vargas 2000), although such guidance is clearly needed by tertiary practitioners undertaking change. As Lattuca and Stark (1994) observe of interdisciplinarity, “in the arena of curriculum reform … rhetoric is too seldom followed by useful suggestions” (p. 401).

In universities, sustainability has been alternatively “discussed as an ill-defined concept, as a paradigm, as an integrating, or heuristic device or as a subject of normative and ethical discussions” (Corcoran et al. 2004, p. 8). Without agreement on what EFS entails, the experiences offered to students can be fragmented (Pearson et al. 2005). Should sustainability education be theory-rich, focused on collaborative learning methods, deeply cross-disciplinary, or grounded in practical skills? It is emerging that relevant graduate characteristics arise not from more or deeper theory, but in education that is “more problem-based, more interdisciplinary and more applied” (Corcoran et al. 2004, p. 8) as well as experiential (Bosselmann 2001; Wals and Jickling 2002). Most commentators feel that all graduates should leave university with skills in sustainability

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11 The semi-annual Environmental Management for Sustainable Universities (EMSU) conferences are the American equivalent.
Sustainability bound?

(Bekessy et al. 2003) and all staff should learn to act sustainably in all their activities (Bosselmann 2001). A distinct fear suffuses the literature that sustainability content will appear to students as ‘additive’, an afterthought as compared with key knowledge, if not included throughout the curriculum (Manathunga 2003; Thomas 2004a). Some preliminary progress in curriculum transformation towards EFS in Australia has thus resulted from a focus on professional development for staff (Holdsworth et al. 2006; Tilbury et al. 2004). Though theoretical knowledge about the environment is an important attribute for future decision-makers, the ability to address problems holistically, critically and collectively is more generically needed. Education that encourages critical thinking across disciplines—more traditionally known as a liberal education—may be analogous to sustainability education (Foster 2001).

1.2.6 Academic disciplines

Many different typologies or categorisations of disciplines have been developed based on paradigmatic development (Biglan), learning style (Kolb), knowledge type (Becher), and organisational structure (Whitley) (see the summary in Moses 1990, p. 359; also Lattuca and Stark 1995). Most such systems produce graphs of opposing concepts to allow disciplines to be mapped relative to each other. Typical is a set of axes “juxtaposing a concrete/applied to hard/pure dimension against a reflective/hard to active/soft” one (Lattuca and Stark 1994, p. 404). The main academic ‘cultures’ are often identified as science, social science and the humanities (Snow 1959; see also Poole 1994 on this divide in Australian universities). The first believes in cumulative knowledge development, the last builds knowledge recursively, and the middle combines the two (Lattuca and Stark 1995). Adler (1982, cited in Donald 1986) describes their tendency to elevate respectively the skills of: measuring and calculating, exercising critical judgment, and communication. These cultures are reputedly the most difficult boundaries to cross academically as their content varies in emphasis, they differ in their response to the institutional context and they employ divergent pedagogical forms (Lattuca and Stark 1995). Interdisciplinary topics like sustainability must integrate all three cultures.

But such visualisations emphasise differences over commonalities. Descriptive analyses of disciplines allow different fields to be viewed in relation to what is shared. Donald (1986) asserts that any discipline is easily definable by the nature of the concepts it uses to describe phenomena, the logical structure of those concepts, the criteria for judging truth and the research methods it employs. Lattuca and Stark (1994, summarising Dressel and Marcus 1982) identify the five components of a discipline as:

(1) the substantive component (which includes assumptions, variables, concepts, principles and relationships); (2) the linguistic component (the symbolism whereby elements can be identified and the relationships defined and explored); (3) the syntactical component (the search and

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12 Prof. John Fien, in the opening address to the 2004 ACTS conference (held 30 September and 1 October at the EcoCentre, Griffith University, Brisbane) envisioned a future where environmental courses no longer existed because sustainability was so deeply entrenched in all courses.
Chapter 1: The context for change

organizing process around which the discipline develops); (4) the value component (commitments about what is worth study and how it should be studied); and (5) the conjunctive component (the disciplines’ relation to other disciplines). (p. 403)

Patterns of research, research training and education differ unapologetically by discipline as a result of variables like those above (Moses 1990), but there is also a social dynamic. Disciplinary traditions, practices, norms and language define academic identity (Becher 1989). Abbott (2001) describes disciplines as being self-organised, extending Becher’s characterisation of them as self-regulating and self-sustaining. In self-organisation, simple, assuming rational responses to need and environment combine to create complex group patterns. Such aggregate group patterns in turn create the culture that guides later individual actions. This duality is clearly at play in universities, although they are institutions that “endure beyond the lives of those individuals whose activities constitute them at any given moment” (Giddens 1987, p. 145). Despite the tertiary sector’s value as a public good, and a common altruism amongst academics in terms of their time usage, university structures are an expression of collective self-interest.

Individuals making personal choices self-organise at many scales of the tertiary sector – academics, departments, and universities—where uniform pressure results in the remarkably similar academic structures that Marginson and Considine (2000) found in Australia. Considering the range of technical, para-professional and academic institutions that became ‘universities’ after the top two layers of Australia’s three layered tertiary sector were collapsed in the late 1980s, various structures, courses and governance arrangements could have emerged, but in fact did not. Under these pressures, similar local behaviours were adopted to enable each university to maintain both prestige and revenue flow (Slaughter and Leslie 1997). Isomorphism has increased along with the bureaucratisation and external control of the tertiary sector since then (DiMaggio and Powell 1983). In this context, disciplines are considered by managers to be “troublesome” when they resist the sort of amalgamations and changes desired for more pragmatic reasons (Marginson and Considine 2000, p. 10).

Richard Whitley, in his 1984 study of scientific disciplines, develops a typology based on two characteristics: interdependence and the degree of task uncertainty. Interdependence comes in two forms: 1) dependence on others to set the research agenda and priorities (what he calls functional dependence); and, 2) dependence on others for the acquisition of reputation or prestige (strategic dependence). The second variable in the typology is task uncertainty, which describes the degree of routine and exclusivity in tasks. Task uncertainty can come from: 1) a lack of clarity over what choice of methodology to adopt or the predictability of outcomes from that method

13 This duality brings to mind the behaviour of schooling fish or swarming bees. They do not have a particular goal in mind and no one is in charge; they simply respond constantly to maintain their position in relation to immediate neighbours and so a small reaction to an obstacle or predator echoes through the population.

14 The value of disciplines is also frequently dismissed by ardent interdisciplinarians.
Sustainability bound?

(technical task uncertainty); or, 2) a lack of agreement about what direction the research should take to meet established goals (strategic task uncertainty) (Whitley 1984). Task uncertainty is seen to be low if the choice of methodology is automatic, the results are predictable, and outcomes are likely to be widely received as valuable. This type of discipline has the collective focus to allow for long-range planning and the division of labour between researchers. It also facilitates successful grant writing, as outcomes are easily anticipated and described, which works to advance progress in that discipline. Scientific disciplines of this type are described by Beaver and Rosen (1978; 1979) as having been ‘professionalised’, or organised “along a set of attributes … inclusive and exclusive” (1978, p. 66). Fields with well-accepted social utility are better resourced and tend to be more stratified, as there is motivation (in esteem and funding) for leaders to emerge and to protect their position from outsiders (Beaver and Rosen 1979; Hogg and Terry 2000). They can also support more collaboration (Adams et al. 2005).

Comparatively, the approach to be taken to solve an environmental problem is often unclear, the peers to whom one will look for support (and publications to which output will be directed) may vary throughout the research, and the outcomes are unpredictable. Fragmentation occurs around methods, and each individual shard seeks publication and prestige in different places, making literature reviews challenging. Such undeveloped scientific paradigms are a hurdle to success in winning grants, which can negatively affect discipline development and personal success (Long and Fox 1995). Peer review cannot progress easily without peers, and a different kind of evaluation is needed to overcome cognitive bias in ensuring rigour in interdisciplinary research (Laudel 2006b).

Newly birthed interdisciplines often feel pressure to close ranks (become ‘professionalised’) in order to gain “disciplinary status” (White 1999, p. 604) or credibility. This process involves developing common research goals, defining central concepts and methods, narrowing research tasks, and working on the reproduction of the field through the training of research students. The risk is that such activities will isolate the nascent interdiscipline from the fertile fields from which it grew, and starve it of new cognitive nutrients. Fields such as human ecology, ecological economics and environmental history are thus constantly in dialogue about their status.

It is also problematic when a field of inquiry forms no nucleus. Problem-based quasi-disciplines such as EFS can become mired, “citing only and cited only by itself” (White 1999, p. 605). Like hyphenating names after marriage, it only works for one generation. You may draw on the work of the established fields, but no one draws on yours. As Myra Strober (2006) puts it:

The extraordinary complexity of knowledge in today’s world creates a paradox. On the one hand, its sheer volume and intricacy demand disciplinary specialisation, even sub-specialisation; innovative research or scholarship increasingly requires immersion in the details of one’s disciplinary dialogue. On the other hand, that very immersion can limit innovation. (p. 315).

15 As with ponzi schemes, it’s best to get in early when building new fields. Your citation rates will grow exponentially as each following entrant has to cite your groundbreaking work. This is a gamble, as the new field will not always survive infancy, but creates a perverse incentive to fragment.
1.2.7 Crossing disciplinary boundaries

Knowledge fragmentation is a common complaint in and about the ‘siló’-based university (Vargas 2000; Owens 2001). Despite increasing calls for crossing disciplines, academic research careers are still predominantly formed and developed through the pursuit of peer recognition in a narrow field. Even crossing sub-disciplinary boundaries can be difficult, much less the major knowledge ‘cultures’ (Metcalfe et al. 2006; Snow 1959). Organisational boundaries can be confounding, too, but as the structure of universities change, it is getting difficult to pinpoint just ‘where’ research happens (Marceau 2000). Academic administrative units rarely comprise a thorough group of peers on any topic, but this is particularly so with complex sustainability problems. Such dispersion of players comes into direct conflict with established disciplinary fields and traditions, and progress in cross-disciplinarity is further frustrated by the fact that sustainability is simply not yet considered to be a career-building interest (Bosselmann 2001). This section discusses three kinds of cross-disciplinary activity: integration in teams, integrators or team facilitators, and individual interdisciplinarians. First, however, the vocabulary to be used, and its history, requires clarification.

Research across disciplines is variously understood, undertaken and esteemed. Most feel that it requires teamwork, with people from various disciplines collaborating (Turner and Carpenter 1999). In the 1960s, Price (1965) noted a pattern of increased research collaboration in the US and concluded that that it had become necessary to combine skills from increasingly narrow disciplines to make progress in scientific work. This trend was later identified as reaching back to the early 20th century, a period of increasing professionalisation and stratification in science resulting from improved financial stakes, as well as rising acknowledgement in published work of research assistance (Beaver and Rosen 1979). Braun and Schubert (2003) find an exponential increase in the use of the terms ‘multidisciplinarity’ and ‘interdisciplinarity’ in the science literature between 1980 and 1999, doubling every seven years. Hicks and Katz (1996) similarly establish that the number of articles written by four or more authors is increasing and those with fewer than four decreasing in number, but we do not learn the disciplinary origins and allegiances of these collaborators.

Regardless of the academic home of research collaborators, it does appear that diffuse environmental fields are disproportionately reliant on theory developed in well-defined disciplines; environmental science cites such fields more often than the source disciplines do in return (Rinia et al. 2002). Team-based interdisciplinarity thus assumes healthy disciplinarity (Abbott 2001; Russell 2005): “the world of scholarship must be broken up into disciplines to make progress possible” (Daily and Ehrlich 1999, p. 280, italics in original). As such, silos are effective structures for hastening progress in this ‘raw material’. Considering the social capital vested in disciplines, developing a common, focused research question and methodology amongst or between them is a non-trivial challenge.

The challenges of integration start with language (Morillo et al. 2003). Cross-disciplinarity is used as a non-specific collective here, as recommended by Grigg
Interdisciplinarity was coined in 1937 (Oxford English Dictionary (OED)) as fragmentation increased within universities, and describes the integration of multiple theories and methods to form a research approach, rather than a cluster of individuals using their disciplinary expertise on a common problem (which would be multidisciplinarity, using most definitions). Transdisciplinarity is a vexing term as it is occasionally used as a synonym of multidisciplinarity (as in Daily and Ehrlich 1999), occasionally to refer to integrating agents outside traditional academic settings into the research and decision-making processes (Naiman 1999; Tress et al. 2003), and also to refer to new theory-building at the nexus of established disciplines (CERI 1972). The following definitions are adopted here:

By interdisciplinarity we mean projects that involve several unrelated academic disciplines in a way that forces them to cross subject boundaries to solve a common research goal. By transdisciplinarity, we mean projects that integrate both academic researchers from different unrelated disciplines and user-group participants to reach a common goal. (Tress et al. 2003, p. 10)

This definition of transdisciplinarity discounts the necessity of building new theory in the practice of problem-based study (Conrad 2002). Although much of this kind of work is applied, it is not only applied research that is interdisciplinary (Morillo et al. 2003).

Cross-disciplinary research for sustainability often happens in teams, which requires boundary crossing in several dimensions, and “shared interests … do not translate into a research plan with predetermined bridges between the disciplines” (Lele and Norgaard 2005, p. 967). Collaboration is shown to increase academic productivity even for players from different disciplines, and for those early in their research careers (Landry et al. 1996). The highs of collaborative research are demonstrable, but the lows can be paralysing as a result of disciplinary chauvinism, differing worldviews, demographic diversity and operational concerns (Younglove-Webb et al. 1999). Teams must be carefully engineered. According to Barjak (2006), a curvilinear relationship exists between diversity and performance; teams work best when only two (small teams) or three fields (large) are being combined at most, and when only 20-25% of team members did their doctorate in another country. Melin (2000, p. 36) similarly notes that his interviewees “want their [collaborator’s] minds to think differently [to their own], but still work along the same lines in order to understand each other”.

A number of approaches are used when cross-disciplinary teams are attempting to understand complicated systems, to elicit and choose options, and implement and assess decisions. Integration approaches usually involve translation into a common place, unit or language. Area-based methods include interdisciplinary ethnography (Austin 2003; Erickson and Stull 1998), human ecology (Boyden 1981), integrated modelling (Jakeman et al. 2007, Pahl-Wostl and Hare 2004), indices (van Dijk and Mingshun 2005) and impact assessment (Slootweg et al. 2001). More conceptual and graphical approaches are not necessarily linked to a particular location, such as systems thinking

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16 Interdisciplinarity is the elder statesman of such terms; multidisciplinarity was first used in 1944, and transdisciplinarity in 1972 (OED).
and group model building (Vennix 1999), or other visualisation methods (Bella and Williamson 1976). Decision analysis environments use rankings or weightings (Cork and Proctor 2005; Dubois et al. 2001; Saaty 1996; Voogd 1983), probabilities (Cain et al. 2003), econometrics (Garrod and Wills 1999) or units of resources (Lenzen et al. 2004). Policy analysis itself can be used to integrate disparate fields (Dovers 2005a; b). Still other approaches are used when laypersons and those with differing ways of knowing are involved in transdisciplinary research programs. These include deliberative methods, participatory action research and scenario planning (Barreteau et al. 2003; Rauschmayer and Risse 2005).

Some individuals take on the role of facilitating such teams, and these are often called ‘integrators’. Bammer (2005) proposes that a new field of study be developed to house analytical methods and philosophies that facilitate integration and implementation in any number of disciplines or interdisciplines. There is natural suspicion in the academy, however, of individuals who believe they are able to generate new knowledge or generate answers to otherwise intractable problems without possessing the requisite area- or problem-specific knowledge. Project members with disciplinary contributions to make will not necessarily acknowledge the need for an individual to ‘integrate’ them, either. Integrators currently occupy an uncertain position in the academy, although they are valued by some for their creative role in more applied, participatory environments (Aslin and Brown 2004).

Team-based interdisciplinarity and integration facilitation both differ from individual interdisciplinarity, what Qin et al. (1997) would call ‘scientist-information’ interdisciplinarity as compared with ‘scientist-scientist’ between team members. Such a research strategy is rare in academia due to pressures to master more than one discipline.17 Campbell (1969) called instead for a version of ‘omniscience’ where every possible research area is covered like ‘fish scales’, and that a person only ever has to choose one. As he memorably says: “Let me be a novel fish-scale. Let my pattern of inevitably incomplete competence cover areas neglected by others.” (Campbell 1969, p. 342) However, the more fish scales that exist, the more difficult it becomes to exercise peer-review (Hadorn et al. 2006; Porter and Rossini 1985; Tress et al. 2006). Mediocrity is a real risk, as is personal isolation. Campbell acknowledges that such individuals, if clustered into administrative units, will still experience a social and administrative “centralising bias” (Campbell 1969, p. 335) that could cause further atrophy in interstitial research areas. Social identity theory also predicts that constant group- and self-categorisation in comparison with prototypes will render individual interdisciplinarity an uncomfortable state of being. The risks of being seen as aprototypical is real in academic career-building that relies on peer review: a common response is to reject a marginal ‘deviant’ to protect in-group distinctiveness (Hogg and Terry 2000). Without explicit institutional support for interdisciplinarity, nascent researchers could survive their doctorates only to be felled by organisational charts.

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17 This type of interdisciplinarity is what Campbell (1969) refers to as a ‘Leonardesque’ approach after Leonardo Da Vinci, the famous polymath, and what Daily and Ehrlich call a ‘renaissance person’ (1999).
Though ‘fish-scale’ science has not become a reality, many individuals do pursue individual interdisciplinary scholarship, and transform their own discipline by their personal engagement with another.

To practise individual or team interdisciplinarity is still a difficult career choice. In a study of six interdisciplinary research centres, Rhoten (2004, p. 9) notes that “30% of those surveyed reported that they felt their interdisciplinary affiliation had not helped and in some cases had even hindered their careers”. Initial doctoral study will be challenging in many ways, “finding an advisor … mastering knowledge and reconciling conflicting methodologies … finding an intellectual community … [and] overcoming fears [of peer review and employability at the end]” (Golde and Gallagher 1999, p. 283-284). The interdisciplinarian will also “come into conflict with individuals with greater detailed expertise in various limited subject areas which he [sic] has trespassed” (Bella and Williamson 1976) and become concerned with meeting such diverse standards as well as their own. A supervisor may recommend a firmly discipline-based project to avoid these difficulties, deferring integration to the post-doc. Citation rates, the fodder of performance management, will certainly suffer by taking a broad topic early in a career (Husic 2006). Even assuming successful interdisciplinary study, future peers may be sceptical of the choice (McNeill 1999):

“Any of us who have worked in interdisciplinary areas have had experiences with people who are drawn to the fuzzy interface between disciplines because of a relative lack of success within the home discipline.” (Daily and Ehrlich 1999 p.279)

The OECD agrees (1998, quoted in Grigg 1999, p. xii) that, “the researcher who conducts inter-disciplinary research should be ‘an excellent specialist of a discipline … [as] highly competent proficiency in a single discipline is the only acceptable basis for inter-disciplinary success’”. In the entire Ecosystems journal special edition on interdisciplinarity, the value mentioned for an individual interdisciplinarian was refereeing interdisciplinary papers (Naiman 1999), though others have recommended roles including reviewing cross-disciplinary research grant applications (Grigg 1999), facilitating cross-disciplinary research teams (Barnett et al. 2003), heading multidisciplinary departmental units, and supervising the next generation of interdisciplinarians. While the current model of multidisciplinary research often sees disciplines like statistics (Redman 1999) and social science (Donovan 2003) providing ‘service’ skills, in the future the interdisciplinarians may be the enslaved, employed to assure quality in work done by teams. But how can such academically suspect individuals be trusted to rigorously assess quality?

It is here that we encounter a disjoint in the literature of the ‘chicken and egg’ variety. The future availability of experienced interdisciplinarians seems to depend on someone making a consciously bad career choice at some point. The current incentives from government, universities and academic tradition create a tendency towards strong disciplinarity, so it remains to be seen why and when an academic might decide to become an individual interdisciplinarian under existing conditions (Klein 1996). Not for the PhD, but after? After they publish a few high-quality papers? The acknowledged tendency is towards increased conservativeness as one ages, decreasing the likelihood of
one taking the difficult step backward to become a disciplinary fringe-dweller. Without the experienced interdisciplinarian, there will be no (quality) young ones – without a young one, there will never be an experienced one.

Just as in research, “it is easy for interdisciplinary teaching and learning to slip back into monodisciplinarity” (Bradbeer 1999, p. 382). Research challenges are echoed at the level of academic teaching, and for students as well as academics. Complex problems require integration and teamwork because neither the data nor the answers lie in one discipline. Although causality is still unclear, interdisciplinary teaching may:

(a) forge connections to students’ prior knowledge and experience; (b) assist students in developing complex understandings in particular subject areas; (c) promote the development of sophisticated views of knowledge and learning; (d) influence thinking skills; (e) build students’ capacity to recognise, evaluate, and use differing (multiple) perspectives; (f) engage student interest and increase motivation; and, (g) enact constructivist and active learning strategies. (Lattuca et al. 2004, p. 44)

Appropriate pedagogy may impact the role and authority of the lecturer in the classroom, the individual-based assessment they practice, the institutional structure within which they work, and the values and competencies around which the curriculum is focused. Broadly educated students are also at risk of being compared unfavourably with specialists in the fields they attempt to overlap during study and later in the employment market (Canning 2005; Taussik 1998). While interdisciplinary academic units accept research students from a range of backgrounds, scholarships awarded by average marks can favour the sciences over social sciences and humanities. An interdisciplinary curriculum is thus a risk to staff and students, as well as a great opportunity, and must be carefully implemented. Section 3.1.1.2 discusses interdisciplinary teaching in more detail.

1.2.8 Geography and environmental studies in Australia

Geography and environmental studies serve as instructive cases and perhaps cautionary tales for the undertaking of sustainability in universities. Geography was one of the original holistic, cross-disciplinary sciences, dedicated to understanding human-environment relationships at many scales (Skole 2004), yet it somehow missed the opportunity to be a leader in sustainable development (Barnett et al. 2003). Some of this is because of the internal tensions discussed in the previous section that are so characteristic of diffuse fields. Liverman (1999) links the lack in geographers’ engagement in global environmental research and policy with three other characteristics of the field: 1) geography is not entrenched in places of power as are disciplines such as law or economics; 2) the generalist, interdisciplinary nature of geographical education results in scepticism on the part of pure physical or social scientists towards the contribution geographers can make (viz. the suspicion of ‘integrators’ mentioned earlier); and, 3) while social, ‘environmental justice’ research outcomes are often used to justify research activities, the resources thus acquired are rarely injected into that facet (Liverman 1999). Yet, in a Presidential Address to the Association of the American Geographers, Thomas J. Wilbanks observed “seldom does an academic
discipline have an opportunity to draw so deeply upon its strengths to contribute so profoundly to questions of such significance to both general learning and social decision-making” (1994, p. 541).

Geography as a field of study has been declining in profile in Australia at secondary and tertiary levels. As early as 1985, a Monash University lecturer in geography was bemoaning the low profile of the field in secondary schools and the disappearance of academic subjects in the area (Powell 1985). In the largest state in Australia, interest in the topic peaked in 1991. That year, over 20,000 students chose geography as one of their final year options, but ten years later it dropped to 50% of that (see Figure 1.1). The decline likely fuelled the removal of ‘advanced’ (level 3) subjects in the discipline after 2000, leaving only level 2, after which the uptake dropped another 50% in the next four years (New South Wales (NSW) Board of Studies, 2005). In 1992, 20% more students opted into geography for Year 12 than had taken it in Year 11. By 2001 the numbers dropped below par with only ¾ as many Year 12 students as Year 11 opting in.

Figure 1.1 NSW Year 12 higher school certificate enrolments in geography, 1991 to 2004, showing the ratio of those choosing final year study in the topic compared to those who opted in the previous year (Data: NSW Board of Studies 2005).

A special issue of the journal *Australian Geographical Studies* in 2002 reflected on declining enrolments and autonomy of geography programs in Australian universities (Harvey *et al.* 2002; Lees 2002; Holmes 2002). A small improvement in enrolments resulted from the location of remote sensing and GIS within geography departments, but even this is seen as below potential (Lees 2002). Geography has always been a difficult discipline to house, as its major components all have strong affinity (and potentially sunnier futures) with outside disciplines (Taylor 1985). Geographers are natural adapters, providing tools and ways of thinking applicable to many other fields, and

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18 Wilbanks (1994) and Liverman (1999) both provide a thorough history of the role geographers have played in global climate change research, including impact assessment, vulnerability assessment, land use cover change analysis and paleo-environmental climate studies at various temporal and spatial scales.
“absorb[ing] ideas and techniques from neighbouring intellectual territories” (Becher 1989, p. 37). This ability and willingness to integrate jeopardises the discipline as much as its recent loss of departmental status (Holmes 2002).

In Australia, stand-alone geography departments have slowly disappeared over the last two decades, merged in order to maintain a critical mass of staff and students with departments of geology, planning, anthropology and GIS but most often with environmental studies (Harvey et al. 2002). Interestingly, where departmental mergers have occurred, courses have often remained separate, particularly at the postgraduate level (Harvey et al. 2002). Harvey et al. conclude that despite the varying reasons for, and outcomes of, the mergers, geography and environmental studies “are stronger together than their pre-merger components could ever have been” (2002, p. 32). There are “good grounds for geography to identify itself as an (inter)discipline with substantial historical and ontological credentials in the field of sustainability” (Barnett et al. 2003, p. 70) and this role is not nullified by the mergers.

Environmental studies and geography both lean towards the diffuse side of the disciplines in all of Whitley’s (1984) categories, and so retain the capacity to be creative in their research approach. Indeed, many subdisciplines, schools of thought, and research paradigms have been spawned in the pursuit of solving environmental problems, but what futures do Whitley (1984) and Abbott (2001) foresee for these new fields? Abbott suggests that problem-based studies have “limited life-cycles” because they still depend on disciplines to form new theories and methods (2001, p. 135), a theory that has also been raised in interdisciplinary social science (Conrad 2002) and science (Rinia et al. 2002). How stable and mature are the (inter)disciplines of environmental studies? Abbott (2001) suggests that the sign that a new field has become established is when it employs mostly individuals who hold doctorates in the same area, and it would be curious to apply this test to the environmental studies departments in Australia. The reproduction of the discipline of geography is certainly in question if the collective identity disappears entirely, a reality that is foreboded by the fragmented nature of many geography conferences (Baker and Sherren in prep.). According to Thomashow (2005),

> academic environmental studies is [also] a perennially adapting field … dwelling at the confluence of … educational tensions … [like] the meaning of interdisciplinary, the substantive foundations of curriculum, the role of theory and practice, research approaches, experimental pedagogy, and developmental/cognitive sequences. (p. 1)

Environmental content in Australian undergraduate programs has increased according to a survey by Thomas (1993, cited in Brown and Clarke 1997, p. 46), and formal environmental offerings are dispersed under three different course names:

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19 Harvey et al. (2002) do admit, however, that human geography may be a real casualty of the processes, however, since few of the mergers include anthropology departments.

20 The disciplinary background of the academic staff is also interesting from the perspective of confirming or challenging the perceived prevalence of ad-hoc, emergent curriculum development (Cosgrove and Thomas 1996), briefly explored in Section 3.2.
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environmental studies, environmental science, and environmental or resource management. Baxter et al. (1999) discern similar categories from the content of twelve Australian wildlife management courses: those that focus on managing human systems, ecological systems, and the environment as a whole. Career paths differ as widely as course options. Brown and Clarke (1997) studied the employability of Australian environmental studies graduates using job advertisements in newspapers, and they find that ads tend to be generic on the degree requirements and specific in the listing of required skills to bypass the difficulty of matching course name with graduate outcomes (see also Section 4.5). Recent job guides by the Graduate Careers Council of Australia (2003) and the Victoria-based Environmental Jobs Network (2005) confirm the many paths available. Environment is not one clear job market, but “several different markets [in] a very large, diverse, segmented industry” (Mitchell 2007, quoting a large environmental employer). This rich diversity unfortunately makes career options less identifiable for the purpose of attracting future students.

1.3 Research direction

The above literature review, undertaken to set the overall thesis direction, resulted in five key observations that directly contributed to the somewhat idiosyncratic genesis and direction of this thesis:

- Public good fields and ideas are increasingly struggling in the societal and market context of universities.
- The conceptual flexibility of ‘sustainability’ makes it a valuable marketing slogan but an amorphous thing towards which to transform any established institution.
- Universities lack an EFS model that recognises the sector’s singular role and structure, and the degree that on-going financial strictures affect EFS implementation.
- Interdisciplinary investigations rely on healthy disciplines, although the problem of assuring quality in such work remains and risk is lower for teams than individuals.
- The EFS literature advocates outcomes similar to EE, but is at an impasse, and this is partially because it is not speaking to non-educationalist university lecturers.

This last observation arose as much from my position within universities as from the literature. One moment from early 2004 is particularly illustrative. The NSW Council on Environmental Education (NSW CEE), run by that state’s Environmental Protection Agency, developed a policy action plan, *Learning for Sustainability, 2002-2005* (2002), on which it was seeking responses from universities. The document landed on the agenda of an environmental curriculum committee meeting I was attending for another purpose. The Faculty Dean at this NSW university had requested a response to the document to forward to the agency. The plan was introduced at the busy meeting with an unmistakable sense of discomfort. Is environment the same as sustainability? Is there any chance that this policy will involve more work? The committee quickly saw that its only recommendation for universities (other than teacher education) was to “expand the
number of places available in environmental education courses and make environmental electives readily available” (NSW CEE 2002, p. 38). Everyone laughed: they were having trouble filling the places in both that they already offered. It was happily discarded as irrelevant within minutes of being raised and the committee was back to the (real) work at hand.

1.3.1 Goals and objectives

The overall goal of this doctoral study is to break out of the cyclical debate, utopianism and linguistic isolation of the EFS literature; gain some clear understanding about the degree to which universities should adapt to initiatives such as sustainability education; and, describe what an appropriate response might be. It was important to me that this be done in a style which is accessible to a non-educationalist audience, with consideration of the uniquely Australian history of the sector, and in light of the wide-ranging ramifications of any conclusions. It is not a deeply theoretical piece of work, but a work of conceptual exploration and synthesis, and of translation between disciplinary languages.

My specific objectives are threefold.

- To develop a sense of the progress, trajectory and undertaking of EFS in Australia. This is undertaken by: reviewing the history of universities and social and environmental movements in Australia; auditing existing tertiary programs relevant to EFS; surveying experts in the field about their sense of appropriate curriculum; and, developing a set of characteristics (disciplinary and pedagogical) for tertiary EFS.

- To establish an understanding of the overlapping motivations and pressures within the context for tertiary change towards EFS. This is undertaken by synthesising relevant literature from sociology (resource dependence, social network analysis, and institutional design), higher education, and public administration. Case vignettes from Canada are used to further illustrate the interconnecting concerns of individuals, disciplines, universities and the public in innovating for EFS.

- To follow Australian cases of real university curriculum and structural change relevant to EFS to understand the players and motivations at various stages of the decision-making processes.

1.3.2 Research questions

This thesis wends through many literatures, methods, theories and philosophies in answering a series of questions which are interwoven throughout this document:

- What does it mean to be educated for sustainability by a university?

- What individual, social, and structural pressures and motivations complicate the adoption of EFS principles in the tertiary sector?
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- How do real cases of curriculum redesign respond to the sociological, market-based and policy context in which they are embedded?

1.4 Research process

The diversity of academic life includes variously overlapping activities and loyalties to society, discipline, school, student body and career, and is a complex context to study. This thesis is an unapologetic demonstration of the importance of balancing breadth and depth in an interdisciplinary research approach. In addition to the breadth of theoretical synthesis that answering the above research questions has necessitated, a range of paradigms and methods – qualitative and quantitative – are also used (see Ashley and Boyd (2006) for definitions). In addition to this methodological pluralism (Norgaard 1989), an adaptive approach (Layder 1998) has been employed to redirect focus during each cycle of theory building and testing. Details about the individual methods will be given in the chapter where they are used. Here only a brief description and a rationale for each choice are given.

1.4.1 Paradigms and key literatures

This research comprises two main elements: the exploratory or baseline stage that fleshes out the preliminary literature review; and, the iterative system of theory development and testing. The first, although not methodologically novel or surprising, is crucial given the fragmented and often repetitive nature of relevant literature, and yields new insights. The latter is informed by three major paradigms: adaptive theory, comparative case theory, and structuralist sociological theories.

1.4.1.1 Adaptive theory

Layder’s (1998) adaptive theory approach to sociological research provides a middle ground between the deeply positivist philosophy of quantitative or causal approaches and the post-modern carte blanche of grounded theory or subjective narrative approaches. The concept maintains connections to traditional sociological theory in order to advance it, accepts the value of serendipitous data and theory discovery, and does not reject objectivity and truth seeking or explanation. It results from interplay between data and theory: “the theory both adapts to, or is shaped by, incoming evidence while the data is simultaneously filtered through, and is thus adapted by, the prior theoretical materials (frameworks, concepts, ideas) that are relevant to their analysis” (Layder 1998, p. 5). The theoretical basis moves quickly in this study from that of education, used in the scoping stages but found to be weak in its utility for the higher education sector, to sociology and institutional behaviour for the case studies. Adaptive theory is particularly useful for understanding the agency-structure interconnections that characterise university activities. Frequent interplay between theories and data occurred during all stages of this research, and new literatures were explored as necessary throughout. Such emergent research is appropriate in a diffuse area that lacks agreement on methods and is suffering stasis under more typical approaches.
1.4.1.2 Comparative case study

Case studies are the obvious method for studying EFS in universities, although the literature to date has been seen to be insufficiently generalisable or critical in its built theory to be transformative for the sector (Corcoran et al. 2004; Fien 2002). The number of variables affecting EFS adoption outnumbers the possible cases, the phenomenon can not be separated from its context, and it needs questions like ‘why?’ and ‘how?’ to be answered in order to extrapolate lessons for decision-making (Kyburz-Grabner 2004; Yin 2003). Here, two detailed and seven minor cases are utilised to collectively understand the challenge of change for sustainability (Stake 2000). The detailed cases are modern universities grappling with the cross-cutting nature of environment and sustainability; despite their structural anomalies, analysing them as cases is instrumental to understanding the system-based pressures of their journey (Stake 2000). The detailed cases do not methodically replicate one class of player, nor do they form a complete cross-section, but opportunistically take advantage of real processes in which a participant-observer role opened up (Dillon and Reid 2004; Shipman 1988; Yin 2000; 2003). This limitation reduces the capacity to use them for explanatory purposes, but the authenticity of the processes improves descriptive richness. An immersive narrative improves the chance that the reader will learn vicariously from the experience of the case, whether it is similar to or contrasts with their own experience (Stevenson 2004).

1.4.1.3 New institutionalism

Fien (2002) notes the ‘a-theoretical’ nature of most research in higher education, which lacks grounding in social or organisational theory. This thesis has been deeply influenced by several related theoretical traditions. New institutionalism is a movement in the social sciences that disregards the traditional over- and under-socialised conceptions of human action, in favour of one which embeds individual action in a larger context (Granovetter 1985). That context is comprised of institutions and other forms of organisation that mediate individual choices, while the institutions are also constituted by those same choices (Giddens 1987; Goodin 1996; Gornitzka 1999). Structuralism is a research paradigm that holds the same tenets, and is often implemented through the use of social network analysis (discussed below) (Degenne and Forsé 1999; Scott 1991; Wellman 1983). New institutionalism and structuralism also accept that universities (and their atomic units) are not closed systems, but are open and vulnerable to the outside world. Universities employ a diversity of strategies to maintain necessary resources (e.g. funding, esteem, information) within that operating environment (Brennan and Pettit 2004; Gumport and Sporn 1999; Pfeffer and Salancik 1978). A range of such strategies contribute theoretical bases to trends in individual and group behaviour observable in this work.

1.4.2 Key methods

A study of this type cannot be approached with crisp methods because of its adaptive methodology. Even the research questions are determined progressively through
experimentation, literature review and peer advice. Three key approaches are employed at various stages. The exploration stage involves a series of baseline surveys and audits. The case work integrates quantitative and qualitative methods, including social network analysis, scientometrics, participant observation and interviews. University ethics processes are followed in all methods as required.

### 1.4.2.1 Social network analysis and scientometrics

Sociometrics involves the use of evidence of interactions to develop understanding of social networks, and scientometrics is a subset of this that maps interaction visible in the scientific literature like citation and co-publication (Gläser and Laudel 2001; Hicks and Katz 1996; Price 1965; Saha 1997). Here, co-publication and co-supervision on sustainability topics is graphed for two Australian case study universities. Beyond the qualitative interpretation of the sociograms, custom metrics are applied to quantify the social networks, but without seeking causality of statistical significance (Doreian 2001). The metrics primarily test the number of linkages that cross organisational boundaries at various levels of the university hierarchy – individual, subgroup, school, faculty (or equivalent), problem-based umbrella group, and university – and describe the density of connections through time. These data are combined with qualitative research and theoretical synthesis to develop a rich picture of the phenomenon (Leydesdorff 1989). There are precedents to studying academia in this way, though rarely specifically intra-university dynamics (Crane 1969; Frank 1996; Newman 2001; Rhoten 2003).

### 1.4.2.2 Interviews and participant observation

Qualitative methods are generally used to practise grounded theory, but in this case, a more interpretive approach is taken: seeking to understand what motivates particular decisions when universities are undertaking changes relevant to sustainability, and comparing these across case contexts. Interviews, social networks, document analysis and participant observation of case processes are used to build construct validity or ‘triangulation’ (Jick 1979; Yin 2003) in the case work. I am embedded to a different degree (and at a different rank) in each detailed case, and have a personal stake in both outcomes, so research neutrality is impossible (Silverman 2001). All the same, the research does not feature the iterative, applied learning that characterises action research. Canadian vignettes are built from interviewee reflections about a range of relevant change processes ex post facto. I observe both Australian case processes from start to finish, capture policy documents, minutes and informal communications, and interview key players. In both the Canadian and Australian cases, interview analysis focuses moments of transition, filling what Fien (2002) notes is a gap in research around organisational change.

### 1.4.2.3 Audits, questionnaires and content analysis

An internet audit of environment and sustainability offerings in Australia is employed to reduce the risk of non-response which other research has experienced (Thomas 2004b). Desirable core content is also elicited from experts at sustainability and EFS gatherings
using questionnaires. Characteristics of audited subjects and programs are assessed qualitatively, using content analysis to categorise and count usages of particular terms in course names and descriptions, and quantitatively, comparing courses to one another, or to aggregated ‘ideal’ core disciplinary content. Reliability and subjectivity is an issue whenever classification is occurring, as in the assignation of subjects, theses and papers to discipline codes here, but is offset by blind-checking a subset with others (Silverman 2001). These methods provide a rich picture of context and status quo.

1.5 Thesis structure and conventions

This section explains the document’s structure, the use of sections in published work and conventions of language and acknowledgement.

1.5.1 Thesis structure

This thesis involves four key phases, resulting in two logical parts: context and cases (see diagram in Figure 1.2). The first stage establishes initial research questions from a broad literature, and identifies key theoretical paradigms and methods with which to undertake the research, as well as the historical context for the sector. The next phase builds a theoretical basis for implementing sustainability in university curriculum. The third stage uses broad-scale case work and sociological literature to develop a case for systemic studies of sustainability education, rather than targeting narrow academic functions in isolation. This is followed by detailed case work on two Australian universities. The two elements of each phase are undertaken in parallel, with many interconnections during theory-building. In the tradition of adaptive research (Layder 1998), each phase also generates the approach to be taken in following ones.

Figure 1.2 Thesis structure, showing the elements of the research process. Light gray boxes indicate Part A of the thesis, covering context, and darker gray represents the Part B case work.

Part A covers the context-building stages of the research, and builds directly on the preliminary literature review. Its first three chapters are reorganised from published or submitted works to improve the logical flow and remove duplication (as shown in Table 1.4). This section concludes with a chapter that develops the logic for a more systemic approach to looking at sustainability education in universities.
Part B contains analysis from the nine universities studied in Canada and Australia, and the ultimate synthesis chapter. The Canadian case work inspired the sociological literature study that precedes it in the thesis, and thus does not benefit as much from it. Those theories are instead drawn upon as the Australian cases of research collaboration and curriculum design are followed and analysed. A final chapter summarises the key findings of the thesis, and makes recommendations for further study. These chapters more closely follow published output than those in the first part.

1.5.2 Scholarly contributions

Peer review is a critical element of any thesis, but it is particularly important when the researcher is crossing and interrogating many disciplines in which they have little previous exposure, with a similarly diverse advisory panel. This research has been tested in the published literature as well as at conferences on sustainable development, education, EFS, geography and sociology. Nine manuscripts have been produced so far, two of which are still in review (see Table 1.4). Two national journals and three international journals in environmental education or environmental management have been targeted, in addition to an edited volume and national conference proceedings.

Three abstracts and one invited lecture contributed to thinking and theorising during this work, both in the preparation stages and post-seminar feedback:

- ‘The before picture: Australian universities at the beginning of the UN Decade of Education for Sustainable Development’. Presented on September 21, 2005 at the Forest Sciences Centre, University of British Columbia, Canada.

1.5.3 Language and attribution

Language follows Australian conventions, regardless of where the work was originally published. In Australia, the term higher education has traditionally been used to refer to the two types of post-secondary institution that were merged in the late 1980s: universities and Colleges of Advanced Education (CAEs) (Everett and Entrekin 1987). TAFEs are oriented towards more skill-based and vocational fields and will not be discussed in this thesis except in reference to dual sector higher education institutions. To clarify language that varies between universities, the terms ‘course’ or ‘degree’ are used to describe a sequence of units or ‘subjects’ undertaken for academic credit.

Co-authors of published or planned papers (Table 1.4) are identified in Part headers.
Table 1.4 Matrix of published/in press (grey) or planned (white) research outputs to thesis chapters.

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<td>‘Curriculum for a cause?’ In: <em>Sustainability in the Australasian University Context</em>. p. 33-44, 2006. (co-authored with Libby Robin)</td>
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<td><strong>‘A history of the future of education for sustainability’. Environmental Education Research,</strong> in press, expected 06/08.</td>
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<td>‘Is there a sustainability canon? An exploration and aggregation of expert opinions”, <em>The Environmentalist</em>, Vol 27, pp. 341-347, 2007.</td>
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<td><strong>‘Higher environmental education: Core disciplines and the transition to sustainability” Australasian Journal of Environmental Management.</strong> In press, expected 09/08.</td>
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Sustainability bound?
PART A:
What does it mean to be educated for sustainability?

This section is comprised of three chapters that establish a picture of what degree of undertaking EFS represents for the Australian higher education sector, and one that sets the direction for the second part of the thesis. The four chapters together provide a rich, empirically based and theoretically grounded picture.

Chapter Two briefly surveys the history of Australia’s education sectors and popular attitudes to the environment and sustainability since British occupation in the late 1700s. It also includes a more detailed investigation of the past three decades of intensive interest in EE, using enrolment statistics and other surveys to flesh out trends in the tertiary market for such programs. This chapter was originally published as two chapters introducing an edited volume, so some minor duplication appears between sections 2.2 and 2.3. The latter derives from a chapter co-published with Dr. Libby Robin, a co-supervisor of this research. She contributed considerably to section 2.3.1 in particular.

Chapter Three identifies the set of pedagogical approaches, normative perspectives and theoretical content which should be embodied by sustainability education, based on literature reviews and questionnaires (rather than actual programs). It focuses intentionally on those neglected or particularly challenged by the Australian university context. It is this set of concepts that is referred to later in the thesis as the ‘sustainability canon’. It is comprised of three publications in one Australian and two international refereed journals, all solo-authored.

Chapter Four uses an internet-based audit to evaluate Australian tertiary programs on the characteristics of a sustainability education identified in Chapter Three. Some basic statistical clustering is undertaken on the core curricula of relevant programs to determine how content differs by program name. Chapter Four includes a solo-authored, refereed publication in one international and one national journal.

Chapter Five provides the theoretical basis to move from consideration of curriculum design in isolation, to an approach that considers the entire academic ‘system’ that individual players face in their careers. It draws upon theories from sociology, organisational behaviour and institutional design to build a bridge to the case work in Part B. A manuscript is in development for a national journal from this chapter.
CHAPTER TWO

A LOCAL HISTORY OF SUSTAINABILITY AND HIGHER EDUCATION

Universities reflect the values of the society in which they exist, and – as institutions – they are extremely path-dependent (Connor and Dovers 2003). A utilitarian view of universities has been cemented in Australia through the traditional resource dependency of the economy, the anti-elitism of the nation’s citizenry, government schemes to ensure equitable access to higher education, and the recent dominance of economic rationalism. Credentialism – the vogue for specific, named degrees – and managerialism – the blind application of business theory regardless of the nature of the product – are additional pressures (Marginson and Considine 2000). Vocational courses and those dedicated to ‘development’ are consistently squeezing out liberal or conservation-oriented ones (Bosselmann 2001). So, despite the emphatically colonial origins of the Australian higher education sector, only a localised history can provide an appropriate context for the activities detailed in this thesis.¹

2.1 Why look backward?

It is not yet universally accepted that sustainability has an important place in the university and this is nowhere more the case than in modern Australian ‘enterprise universities’ (Marginson and Considine, 2000). Sustainability itself is a misnomer whose lexical flexibility allows it to be misappropriated by all sides of difficult debates. It gives the impression that everything can and should be sustained, when some factors quite obviously cannot and should not. A utilitarian view of universities does not easily allow for the integration of sustainability unless it is first perceived to have greater value in a market sense: by students, by employers or by government. Additionally, if the answer to sustainability continues to be assumed to lie in better technology rather than behavioural change, as evidenced by the current focus on science and innovation in universities, current trends will continue.

This chapter is not a full history of the higher education sector, but a personal reading of past events, and is therefore selective rather than definitive. It relies heavily on Macintyre’s (1999) A Concise History of Australia for the key narrative threads. It looks at the recent (settler) history of the country, and particularly traces the role that universities and intellectuals have played in Australian society, as well as – early on – in the British society from which it arose. The four ‘pillars’ of sustainability – social, cultural, economic and environmental – are sketched through time in their nascent forms, via the attitudes of the public and its government towards nature, other nations and cultures, indigenous populations, and economic security. Such a longitudinal

¹ I immigrated to Australia as an adult, and was raised in a political and educational system which – while similar in history, language and culture (see Chapter Six) – also differs on many counts. This chapter was thus essential background work for understanding the operational context.
picture helps to create a sense of the trajectory of the higher education sector, and of sustainability within it.

2.2 Broad brush surveys of sustainability and higher education

Seven periods are used here to map the positioning and role of the higher education sector in Australia, and societal changes around social equity and environment. The periods are delineated by dotted vertical lines in Figure 2.1, but these divisions are more gradual than those lines suggest. Broad historical reviews of these seven periods are followed by a more detailed study of the past three decades.

Figure 2.1 The time periods used in this chapter, in relation to national population and university expansion (data source: ABS 2005, individual university websites).

2.2.1 1788 to 1850 - Colonial ‘cringe’

The penal nature of Australia’s colonisation and the ‘tyranny of distance’ (Blainey 1994) created a persistently odd relationship between Australia and Britain, as well as the wider world, that is often referred to as the ‘cringe’. Britain offloaded its large surplus of petty criminals by sentencing them to ‘transportation’ to New South Wales and Van Diemen’s Land, and – later – the Swan River Colony. These fleets (containing plentiful free labour) were responsible for building much of the nation’s infrastructure and opening up the pastoral areas that would make New South Wales the best wool-producing region in the world by 1850 (Lee 2003). The wool focus of the economy also helped to maintain ties with Britain, rather than developing some in Southeast Asia, because the former was the primary market for the product (Blainey 1994). The colonies (which later became states) remained quite localised in settlement and isolated from each other. The population of free settlers doubled every decade through generous migration offers (exclusively) to Britons. By the 1850s, a movement to end convict transportation had begun in earnest (Blainey 1994), but the ‘cultural cringe’ (Phillips 1950) associated with the practice would prove to be much more persistent.

The Australian continent is the oldest, flattest and – after Antarctica – the driest on the earth. Its novel ecology includes well-adapted plants and animals. Until European settlement there were no soil-compacting hoofed mammals (Dunlap 1999). The harsh
impacts of early farming and resource exploitation gives the impression that the environment was perceived by early settlers as simply a barrier to progress that must be made useful. Bonyhady (2000), however, argues that there was a diversity of views of the environment then as today. Jordan (2002) reports G.T.W.B. Boyes’ (the Colonial Auditor in Hobart circa 1824) description of a novel power structure around the environment in early Tasmania. The higher-class, educated, particularly female, residents protested some of the more wholesale environmental destruction in support of the “picturesque”, while the lower-class settlers with “no pretensions to the possession of taste” were its enemies (Jordan 2002, p. 342).

Jordan (2002) notes, however, that the preservation instinct of these upper-class residents did not extend to the local Aboriginal people. A boom in the European population between 1820 and 1830 brought Europeans and the Aboriginal population into physical conflict over resources. This increased contact also proliferated disease. The Aboriginal population declined in numbers until white settlers perceived them as relegated to the past, able to be safely and romantically rekindled through story-telling and art (Jordan 2002). Only this denial of Aborigines allowed for the perception of the Australian landscape as Arcadian instead of alien (Nolan 1997).

At the time of ‘transportation’, the recent revolutionary activity on the continent and rapid industrialisation and urbanisation had increased class tensions in Britain between the town-dwelling commercial class and the working class (Bowen 1981). Higher education was still largely the realm of the upper classes, although the lower-born did have some opportunities. At the beginning of the 19th century the curriculum of the classical ‘grammar schools’ such as Eton was limited to rote-learning Greek and Latin texts. These prestigious schools completely lacked Mathematics and science (Bowen 1981). The aristocracy was fading in real power, but the rising, self-made bourgeoisie still largely opted for a classical, liberal education despite the different needs presented by rapid industrialisation. The lower classes were left to technical or scientific schooling (Bowen 1981). By 1850 the British parliament was so dissatisfied with grammar schools that they made those institutions the subject of a Royal Commission of Inquiry. The schools were subsequently reformed to remove religious requirements, improve accessibility, and modernise the curriculum (Bowen 1981).

Jeremy Bentham, the Scottish philosopher, was frustrated by the class division in his country and developed the utilitarian idea that so changed the nature of education during this period. If the classical, liberal education of the bourgeoisie was designed to inculcate the learner with virtue and morality, the utilitarian educational system assigned value based on the “greatest good of the greatest number” (Bowen 1981, p. 286). This idea inspired mass primary and secondary schooling in order to enable social mobility with literacy (Cowie 1995). Scotland became a major centre of Enlightenment learning in the 18th century, basing its universities on a very European utilitarian, scientific-empirical structure (Cowie 1995, p. 150); they remained the models for progressive institutions into the 19th century. Colonial universities founded after this time had these two basic templates from which to choose.
In the Australian colony, natural history was imported with the very first explorers, but until the mid 1800s, they largely collected specimens for study in British and French institutions (Home 1996; in press). Beyond a few quarrelsome, nascent ‘natural philosophy’ and agricultural societies, the social infrastructure simply did not yet exist for local comparative analysis of these specimens (Finney 1993). From 1827 to 1842 ‘Mechanics Institutes’ were founded in the larger Australian centres, followed by rural locations until roughly 1870. The idea, transplanted from Britain, used analogies to the natural world (‘natural theology’) ostensibly for the basic science education and moral elevation of the working classes, but was also concerned for the maintenance of the social status quo and improved worker efficiency (Finney 1993). In the years leading to the discovery of gold in the colonies, amateur natural history began to be encouraged as a social antidote to the corruptions of life, although the local emphasis was on collection over the understanding of natural processes (Finney 1993); theorising was left “to the masterminds of the old world” (Hector 1879, p. 563, cited by Home in press).

2.2.2 1850 to 1890 - Gold rush affluence

Gold rushes in 1851-2 very quickly brought affluence to the towns of Melbourne and Sydney and a multicultural population explosion in the gold districts. The Industrial Revolution was in full swing in the mother country, and ideas such as steam and water power were also transplanted to the colonies for use in mills, ships and – later – trains (Lee 2003). Trends in population and mechanisation increased forestry activity (Dargavel 1994). Engineers were revered, though their attempts to import water equations from other climatic regimes were less than successful (Powell 2000). Macintyre (1999, p. 89) describes the region as having been “in thrall to progress” during this period, with little time for book learning. Sport was also becoming an obsession, particularly horse racing and cricket (Finney 1993).

The political situation in Britain was becoming increasingly democratic after the Reform Bill of 1832, and the mother country began instigating self-government in its colonies (Macintyre 1999). The founding of the first university in Australia was less a reflection of these modern British political developments, nor a demand by the public for local higher education, but a desire to establish a higher class or ‘peerage’ in the far-flung colonies (Gardner 1979). Newly independent colonial legislators were desperate to prepare Australian-born elites to lead the colonies, and this gave momentum to the founding of the University of Sydney in 1851.2 Established on the liberal, ‘Oxbridge’ model, in a location where only those with their own transportation would be able to attend, Sydney struggled. The University of Melbourne was established in 1853 and more closely followed the utilitarian Scottish model, creating a Medical school (1862-3), a Law school (1875) and an Engineering school much earlier than Sydney. Both Sydney and Melbourne universities were dependent on public funding, and found stability by focusing on professional training, rather than liberal studies (Macintyre

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2 The actual date of Sydney’s founding differs in various sources from 1850 to 1852, but it seems widely agreed that it took its first students in 1853.
Both universities also had foundation chairs in science at a time when the classics were still dominant in Britain (Home in press).

The University of Adelaide was founded with a land grant in 1874, but all three early universities were only modest successes, however, due to the ‘cultural cringe’ and the middling quality of those enrolled (Gardner 1979). Secondary education was not yet adequate or universal, and the upper classes who dominated those secondary places still sent their sons to British universities (Cowie 1995). Academic disciplines in colonial institutions were ignored by those in the mother country, leading to the formation of the Australasian Association for the Advancement of Science (later including New Zealand) in 1888 (Home in press). The selection committees for colonial universities were still convened in London of “the best in Oxford, Cambridge, London and Edinburgh” and for professorial chairs they recommended the brightest young minds of the times, most of who originated in the urban, British middle class (Smith 1990, p. 3). At the same time, Australian scientific life was disproportionately led by German expatriates (Home 1996) whose scientific communities were the most highly professionalised in Europe (Beaver and Rosen 1979). The German Humboldtian university structure also became an “exemplar for [the] joining of research and teaching” (Moses 1990, p. 353).

The environmental impacts of the gold era were just as devastating as those of the wool boom, with “land stripped bare of trees to line the workings and fuel the pumps and batteries, … polluted waterways, heaps of ransacked earth and chemical residues” (Macintyre 1999, p. 91). By 1870, wool had again surpassed gold in exports, and when there was a price downturn, the pastoralists responded by pushing yet more land into production. This quickly became untenable and retreat followed. Population increases meant that the land was supporting more people by 1880 than it ever had, and 50% of these lived in towns of 2500 or more (Macintyre 1999). Hutton and Connors (1999) and Bradsen (2000) detail environmental movements around species loss, wise resource use and land degradation during this period, but the urban issues were paramount. The founding of the Royal National Park outside Sydney in 1879, Australia’s first, was not about saving places for nature to exist on its own terms, but engineering vistas for use by the urban middle class and proletariat (Nolan 1997). The resident Aboriginal group was driven out, and an idealised European-style landscape was moulded (evidence of a severe ecological cringe), with a convenient transportation system developed to ensure maximum accessibility.

Throughout, the Australian character was being formed. A local version of unionism and anti-authoritarianism was crystallised during the Eureka rebellion of 1854, the larrikin bushranger Ned Kelly became a popular anti-hero in 1860, and more explorers were setting out to explore the continent, becoming heroes as much in failure as in success. Williams’ (1975, cited in Nolan 1997) observations of class division around landscape in England, setting apart “the lived experience of rural populations who made their livelihood from the countryside in direct exploitation of nature” from “a fiction of the country developed by bourgeois intellectuals” (p. 7), is as applicable in Australia today as it was then. The difficult times to come would only emphasise this dichotomy.
2.2.3 1890 to 1910 - Depression, drought and nationhood

The years around the turn of the century and the onset of nationhood (1901) were a trying time in Australia. Environmental and economic decline led to serious deliberations about class, gender, race and governance. Wool prices and exports had been declining since 1870 and foreign loans became harder to acquire, causing banks to cease trading in 1893. Union actions were failing as the employers gained the upper hand, and a class war began that resulted in the founding and rapid rise of the Australian Labor Party. Immigration practically ceased. There were droughts in the late 1880s, floods in 1890, followed by further droughts in the most populated (and most stressed) areas of the continent from 1895 to 1903, including the ‘Federation Drought’ (Bonyhady 2000). Exotic species such as rabbits reached plague status and accelerated denudation of the land; subsequent dust storms were immense (Macintyre 1999).

This hardship helped to solidify the national identity of the ‘battler’, whose ideals were those of the downtrodden unions; especially exulted were mateship and the ‘fair go’ (Macintyre 1981). Ironically, the creators of much of this legend were urban intellectuals, writing or drawing for the weekly Bulletin magazine, who took short forays into the bush for material. A.B. ‘Banjo’ Patterson, renowned bush poet, published a nationalist tract in 1889 called Australia for the Australians which had little to say about the Aboriginal population. At the same time, much of the land was still held by a few large landowners, many from overseas (Clark 1981). While male legends were exulted, the women’s movement was also growing. Women were seeking out “higher education, professional careers, less constrictive clothing and …the bicycle” (Macintyre 1999, p. 134), as well as the vote and reproductive rights, though the rights of Aboriginal women were handed over almost as a trade. Australians began to feel unease about their geographical location and to perceive an Asian threat, fuelling racism towards the Chinese who had contributed so much as gold rush immigrants. The ‘White Australia’ policy was one of the primary platforms of the new Australian Labor Party. The fate of the Aborigines worsened, and they were made wards of the state during this time, to be ‘cared for’ until their so-called inevitable extinction, as predicted by Darwinian science, or until they intermarried and contributed to the dilution of their race and culture (Macintyre 1999).

The relationship of people with the environment during this period was also in the hero-making vein. Native animals and trees gained iconic status, and were used in national symbols, commercial brands, and the colours of uniforms. The nation-building programme included selective immigration (further linking Australia to Europe to the detriment of Asia), government support for liveable working conditions, and protectionist trade arrangements, all of which inspired another increase in production. The progressive leadership of President Theodore Roosevelt in the US was inspiring environment movements in Britain and Europe, which seeped slowly into the colonies as well (Hutton and Connors 1999).

Wise resource use and nature protection were … two strands of early conservation that capitalised on nationalistic progressivism. On the other hand, the mastery of those resources by human scientific and technical skills was doubly praised. (Hutton and Connors 1999, p. 21)
Australian-led scientific exploration of Antarctica began with Mawson’s expedition in 1911-13, though a number of Australian scientists had earlier participated in Shackleton’s ill-fated British expedition in 1906-8 (Home in press).

As Macintyre (1999) notes, it was the improvisation and experimentation born of necessity and, if any, a practical mechanical or mining education, that was valued in this new nation. An 1898 issue of the Melbourne version of the satirical magazine *Punch* complained of the University of Melbourne: “No farmer comes in contact with it; no miner looks towards its professors to teach him how to save the gold in refractory ores” (Rich 1990, p. 32). The language of ‘excellence’ and ‘efficiency’ began then to creep into all the activities of the new nation, foreshadowing later developments in higher education. After 1890, Australian universities began to produce their own honours-level graduates and universities began to appoint and promote their ‘own’, albeit usually after further study overseas (Smith 1990, p. 7). Only the last few ‘state’ universities were founded during this time, the University of Tasmania at the beginning of the period (1890) and the universities of Queensland (1909) and Western Australia (1911) around the end.3 No more universities were to be established until after World War II, and those that did exist were struggling for students. They began catering to the employed by allowing part-time study, introducing evening lectures, allowing students to miss lectures entirely and allowing – even facilitating – study from a distance (Anderson 1990).

### 2.2.4 1910 to 1945 – Years of conflict (war and inter-war)

Australia was generous in support of Britain in World War I and II, making major sacrifices in troops. It also contributed to the war efforts through agricultural exports. Following the battle of Gallipoli in 1915 – another mythic, hero-making experience involving failure – volunteer enlistments rose. The war crippled the economy by absorbing key labour resources into service and making many key markets unreachable. It also fragmented the young nation. The debate over conscription in World War I created serious social unrest involving many ‘isms’ like jingoism and racism, and resulted in lasting rifts between nationalists, imperialists and communists, as well as between the genders (Macintyre 1999) and religions (Clark 1987).

The Great Depression of 1929 had a devastating impact due to the country’s narrow dependency on agricultural exports. The rural hardships and unemployment increased the “townward tendency” resulting from the transition to secondary production (Clark 1987, p. 80). By 1928, a third of the population lived in Sydney or Melbourne and the public services these urbanites required were a financial strain on state and federal government coffers. Credit collapsed in 1929, just before the stock market crash in New York. Australia appeased the fascist regimes of Europe in the years leading to World War II, and demonstrated a lack of concern at similar developments in Asia. When

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3 The Royal Melbourne Institute of Technology (RMIT) was founded in 1887 and though not yet a university, it was such an influential and successful higher education institution that it retained the ‘IT’ in its post-1989 university title, RMIT University.
Japan entered the war in 1941 and Singapore fell, Australia found that counting on Britain’s navy and under-funding its own was a bad decision (Macintyre 1999). It developed a closer relationship with the US, which is still evident today.

Development had again become a mania during the Depression, particularly geared towards extending the agricultural productivity of the country through clearing and irrigation. Returned soldiers and British migrants were given rural land to ‘improve’ through settlement schemes (Frost 2004). Dissenting voices such as those of Griffith Taylor (a geographer) and Harold Swain (a forester) were ignored and sidelined. Despite this, Frost (2004) argues that there was widespread scepticism of the development focus of the time, including a prescient desire to diversify the economy away from agriculture and a significant – if still minority – concern growing for the environment. Certainly, interaction with the environment became popular as a pastime after World War I, as the generation raised with nature studies as part of their schooling reached adulthood. Citizens, including recently enfranchised women and newly returned servicemen, became novice naturalists, scenic tourists, and – due to its low cost – avid bushwalkers. Some of the resort areas in Australia, including the Blue Mountains and the Dandenong Ranges, had significantly more accommodation capacity in 1929 than they do today (Frost 2004).

A new ‘nature studies’ curriculum was emerging around 1902 and encouraged not only an end to the biological cringe, as Australian children were encouraged to embrace the fascinations their country held. A zeal for science and values of environmental care and advocacy also resulted among the (now mandatorily educated) primary and secondary school students (Kohlstedt 1997). Festivals such as Wattle Day and Arbor Day supported this movement (Robin 2002). While the British model included as components; “an emphasis on living things, attention to the seasonal and other contextual elements of natural objects, and concern for deepening children’s understanding of the physical world” (Kohlstedt 1997, p. 446), in Australia it was also linked to agriculture and horticulture. Nature study thus experienced resurgence in the 1930s in Australia, when elsewhere it was squeezed out permanently by science (Kohlstedt 1997).

Robin (1997) uses the establishment of the Council for Scientific and Industrial Research (CSIR) in 1926 as evidence of the feeling in Australia that government, not industry, should fund science and that science is ‘for’ development purposes. Agriculture was essential to the national identity and economy and so the field was moved from the agricultural colleges to become ‘applied science’ in the universities after 1910 (Robin 1997, p. 67). CSIR tended to focus on primary industry applications instead of industrial, though its predecessor had adapted pulp and paper technologies to Australian tree species in 1919 (Dargavel 1994). Even the early ecology work in Australia was on pest control issues (Dunlap 1999). Sciences like forestry and soil

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4 In fact, at the height of the Depression, a ‘Grow More Wheat’ year accelerated the degradation of areas already environmentally stressed, such as the Wimmera and Mallee in Victoria (Robin 2007).
conservation emerged in universities in the late 1920s and 1930s, also largely with a development ethic (Bradsen 2000; Dargavel 1994). When Griffith Taylor founded the young country’s first geography department at the University of Sydney in 1921, its academic focus was considered subversive (Powell 2000).

In 1935, Australia’s six universities still only had 10,000 undergraduates, 0.15% of the population. Though the gender bias was declining, a class bias was still very much in evidence (Anderson 1990). Even secondary school was still largely perceived as superfluous; a low school-leaving age of 14 saw many students leaving to work while still in primary education (Cowie 1995). The intellectual community within universities was finally beginning to flourish and – despite a cultural clash with the pragmatic governing men – academics were brought in as experts to a number of the era’s policy discussions (Macintyre 1999). Post-World War II reconstruction resulted in an expansion of the bureaucracy that created demand for more university graduates. Additionally, when returned soldiers were employed on the land or at rebuilding industry, increased mechanisation often meant retraining was required. University enrolments doubled between 1939 and 1946 (Martin 1990), and the strain on the institutions was severe. The Universities Commission was established in 1943 to ensure adequate training was available, bringing the first comprehensive federal involvement to undergraduate education, previously a state concern (Martin 1990).

**2.2.5 1945 to 1960 - Cold War and mass immigration**

The Western Alliance, solidified in the previous war, began a cold war against the Communist Bloc. Australia and Britain were participants, but – both with labour governments – were perceived as socialist and left out of much of the intelligence work and collaboration with the US. The Australian Security and Intelligence Organisation was founded in 1949, and in a mania of debate over communism within and without, began surveilling a large number of suspected communists including scientists, academics and writers. Macintyre describes how “the Cold War was prosecuted in the government’s scientific organisation, the universities, literary associations and almost every corner of civic life” (1999, p. 214). Defence-related science was deemed to require secrecy in the post-war political climate, and divisive debate took place in government, the CSIR and universities over the policy of free scientific exchange. In 1949, the CSIR became the CSIRO – now a Commonwealth ‘organisation’, not a government body – whose staff were screened and had to undertake an oath of allegiance (Collis 2002). The Weapons Research Establishment (now the Defence, Science and Technology Organisation) took on the explicitly military research.

Meanwhile, Australia was experiencing a post-war boom in population, employment, living conditions and leisure time. Sport became central to the national identity, and dominance in it – especially after the Melbourne Olympics in 1956 – one of the

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5 In the sciences, the class bias favoured upper-class women – usually of independent means – and middle-class men; botany even had more women than men (Robin 2007).
Sustainability bound?

fundamental sources of national pride. Migration boomed, this time from the beleaguered Eastern and Southern European nations. While some of the newcomers were tertiary-educated, many became indentured workers on public works schemes (usually development-oriented) for two years after resettlement as an exchange for their passage and care (Macintyre 1999). The Snowy Mountains Hydroelectric Scheme was the most famous, the recruitment for which occurred in displaced persons camps in Europe: “You won’t be Balts and Slavs… you will be men of the Snowy” (Sir William Hudson, first commissioner of the scheme) (Libby Robin, pers. comm. 13 Mar 2005).

Wool prices increased after war was declared on Korea, and – despite full public coffers – the government began its focus on self-reliance and what today is called the ‘aspirational class’. Access to public secondary education improved, further increasing demand on university places (Anderson 1990).

Students in scientific and technical areas were not called to serve in World War II from 1943, and these coveted places were filled by quota on performance in matriculation examinations (Anderson 1990). Such militarily strategic functions increased support to universities (Encel 1971) and four new institutions were founded between 1946 and 1958; in Sydney, Melbourne, Armidale, and Canberra. The last, the Australian National University (ANU), was a dedicated research institute with nuclear physics as its jewel (Macintyre 1999). The first Australian doctorate degrees were awarded in 1948 (Home in press). The Commonwealth Reconstruction Training Scheme gave assistance for university attendance, and the Colombo Plan in 1950 started the flow of international students to Australia. The baby boomers were reaching school age too, which necessitated increases in university places for people to teach them (Anderson 1990).

Robert Menzies, Australia’s Prime Minister from 1939-41 and again from 1949-1966, was educated at the University of Melbourne during World War I. He was a believer in the ideal of the autonomous university. Even so, it took some pressure from the AVCC and CSIRO in 1956 for him to establish the Murray Commission (Murray 1957). It visited all 10 existing universities the following year, and its recommendations to the Commonwealth government – to establish a permanent University Grants Committee based on the UK model, and, until such time, provide (considerable) emergency funds – were fully accepted (Martin 1990). Only at this time were universities other than ANU – previously state-funded only for the purposes of teaching – expected to undertake research (Encel 1971). Adequate defence science may have been the primary concern at the outset, but the result was a much more wide-ranging impact on all fields. Another recommendation that had a large impact in later decades was not to increase the stringency of acceptance requirements to ease the pressure; universities should instead be enabled to educate all qualified applicants (Murray 1957, p. 2).  

6 What it means to be ‘qualified’ for higher education, and thus deserving of a place, has been disputed since then. Currently a high school leaving score of 53 is the minimum although most individual courses have higher cut-offs. The AVCC feels that enough places exist for the qualified (Illing 2007), but some dispute the suggestion that those who do not earn places are below par (O’Keefe 2005).
2.2.6 1960 to 1980 - Social and environmental revolutions

Urban sprawl had begun in earnest in 1960 with high rates of home ownership, suburbanisation and the development of industrial estates. These were reached by motor car, which – though around for decades – began to transform daily life; public transportation and bushwalking declined in popularity accordingly. Conspicuous consumption and convenience were the primary values of marketing appeals found in both print and television, the latter of which had arrived in 1956 in time for the Melbourne Olympics (Macintyre 1999). Militant unions had clawed back many of the rights women won during wartime when their skills were needed in industry. Social life was rigidly structured, but rebellion of such traditional norms was also building (e.g. the growing divorce rate). A divide arose between modernist intellectuals and the suburban majority and a great number of the former emigrated to Britain or to the inner-cities attracted by the European cultures taking root there. In addition, applied economists arose from the universities to challenge the engineers’ constructionist approach to natural resource management (Powell 2000).

The New Left, a phenomenon of young people in universities worldwide, rejected consumerism and its concomitant environmental destruction, as well as the rigidity of the social structures and morality of their parents’ generation (Macintyre 1999). Its power centre on campuses resulted in an intellectual resurgence; the repression of women, homosexuals, Aborigines and other races was emphatically and quite successfully challenged. When Australia contributed a small conscripted force to Vietnam in the late 1960s, the resulting protest by the New Left accelerated an early withdrawal by 1972.

Colonies worldwide were seeking independence. Australia discarded its White Australia Policy and also came to give more consideration to its Indigenous populations. Aboriginal land rights had begun in 1946, when striking Aboriginal pastoral workers founded a co-operative settlement, and in 1966 a similar situation resulted in demands for the return of their land. Between these two periods, active assimilation policies resulted in what is today known as the ‘stolen generation’. Protests such as the ‘bark petition’ of the Yolngu people against a mining company in 1963 were quashed by government, but black pride and power was increasing. In 1972, the Aboriginal tent embassy was established on the lawn of the Parliament House in Canberra (Macintyre 1999), where it remains today.

The Martin Committee, formed in 1963, recommended an increase in higher education capacity, establishing a dual structure of universities and CAEs (Anderson 1990). As a result, almost one new university was founded per year between 1964 and 1977, practically doubling the number of such institutions from ten to 19 in 14 years. CAEs numbered 80 at the same time (Anderson 1990). The launch of Sputnik in 1957 increased public interest in science, and academic ‘experts’ were invited back to the table for government policy discussions (Macintyre 1999). The Labor government of Gough Whitlam in the early 1970s ushered in a renaissance in government support for the Arts and other intellectual pursuits, the abolition of tuition fees, nascent support for
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multiculturalism and gender equity, and abandonment of the assimilation policy. Public and private expenditure on education reached its apex in 1977-8 at 6.8% of GDP, and has fallen ever since (Burke and Spaull 2001). The oil crisis following this period affected Australia, despite the nation’s self-reliance in this area, and the economy plummeted. Remarkably, the Governor General exercised his right to dismiss the Whitlam government in 1975.

Rachel Carson’s Silent Spring in 1962 is often identified as the inspiration for the ‘environmental revolution’, a social and political movement of the 1960s that culminated in the first celebration of Earth Day in 1970 (Dunlap 1999; Hays 1987; Robin 1998; Worster 1977). Carson was a marine biologist and gifted writer, who captured the imagination of international audiences with the notion of an impending ‘silent spring’, a spring without birdsong or new life. Another biologist, Paul Ehrlich, published The Population Bomb in 1968 and the year after, the Apollo mission sent back an evocative picture of the small and vulnerable blue earth as viewed from the moon, emphasising in a new way that there was ‘only one earth’. The Club of Rome urged environmental concern with an economic slant in Limits to Growth (1972, edited by biophysicist, Donella Meadows), which was a major precursor of ‘sustainable development’ as articulated in 1987 in the Brundtland Commission Report, Our Common Future (WCED 1987).

The environment was becoming a popular political issue both locally and internationally. The UN, formed at the end of WWII, held its first environmentally focused conference in Stockholm in 1972, and Australia appointed its first national environmental policy minister in the same year. The Australian Conservation Foundation (ACF) was formed in 1965, and the world’s first ‘green’ party was established in Tasmania in 1972 (Pybus and Flanagan 1990). A series of successful and unsuccessful environmental, anti-development actions during the 1970s and early 1980s furthered the environmental cause, and each resulted in lessons that increased the professionalism of the activist approach. An alliance between environmentalists and union leaders resulted in ‘green bans’ from 1971 to 1975, halting an estimated $5 billion worth of development, and linking the environment with Labor governments. Don Chipp resigned his Liberal membership in 1977 and formed a new party, the Australian Democrats, with the slogan “Keep the bastards honest” (Warhurst 1997). Gender equity and the environment were both key elements of the Democrats’ platform.

Though Australia was not yet a member nation, a survey in 1971 found that only 2% of tertiary students in the OECD were enrolled in a course that was either partially or fully about the environment (CERI 1973). Early environmental courses in Australia tended to be offered in CAEs, designed to produce professionals who were federally supported and then bonded upon graduation to bodies like the Forests Commission or the Soil

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7 Examples of campaigns include oil exploration on the Great Barrier Reef, logging in NSW rainforests, the flooding of Lake Pedder, Uranium mining, sand mining on Fraser Island and the damming of the Franklin River in Tasmania for hydro-electric power (Hutton and Connors 1999; Macintyre 1999)
Conservation Service (Libby Robin pers. comm. 23 Nov 2005). Early university courses arose among the more recently founded universities, rather than the ‘sandstone’ institutions (Quigg 1973). It was not yet a prestigious undertaking academically. These university-based interdisciplinary courses on environment were more liberal than professional, and gained popularity after fees were abolished (Libby Robin pers. comm. 23 Nov 2005).

2.2.7 1980 to 2000 - Economic rationalism and globalisation

Macintyre (1999) describes business and the economy as dominating the public sphere of the last quarter century in Australia’s history, as visible in politics, the media and in the application of business planning and marketing to public institutions. Economic rationalism (elsewhere referred to as neo-liberalism) opened all enterprises up to market forces in order to cut costs, reinvigorate the economy and reduce inflation, but unemployment inevitably increased. The unions traded wage increases for job creation and increased social expenditure, and – other than protecting some key industries – everything from banks to the value of the Australian dollar was permitted to compete on the open market (Macintyre 1999). When foreign currency loan repayments skyrocketed with the falling dollar, the country appeared to be on its way to becoming a failed ‘banana republic’ colony. The chosen solution was less protection and more competition. As in the US and Britain, the New Right was eroding government control and allowing the market to set value; very little was assumed worthy of existence if it could not compete and the universities were certainly not exempt.

Unfortunately, the challenge of the post-industrial, globalised world called for more than the application of efficient business practices. In the information age, entirely different skills were needed, but Australia continued to import technology rather than invest in such development at home. School retention and university uptake rates were vastly improved, but in both cases, the education was focused on vocational ‘skills’ training rather than liberal studies. The reintroduction of tuition fees in 1989 cemented the idea that the university education was a benefit only to the learner in future money-making capacity, rather than contributing to the nation by being educated. Despite rising costs, higher education participation rates increased from 6.1% to 10.1% among school-leavers between 1984 and 1994 (Burke and Spaull 2001). Though communications improved in cities, service in rural areas lagged, and the partial privatisation of telecommunications during this period made further investment in sparsely inhabited areas unprofitable and unlikely.

The then Minister for Education, John Dawkins instituted enormous reforms of the Australian higher education sector in the late 1980s, flattening the binary higher education system and creating a Unified National System (UNS) (Dawkins 1988; 1989). Teaching institutions such as CAEs and Institutes of Technology became universities,

Some studies have shown that the reintroduction of fees at this time did not seem to affect equity (Anderson 1990; Marks and McMillan 1993), but after universities were permitted to increase fees by up to 25% in 2004, 2005 applications dropped by 5% (Maiden 2005).
occasionally merging with each other and/or established universities to reach the threshold of 8000 students required to achieve ‘university’ status. Between 1986 and 1994, 20 new universities were founded, thereby doubling the number again.\(^9\) Marginson (1999) provides a useful classification of the resulting institutions (Table 2.1) before the recent wave of private specialist providers were approved as HEPs. Universities were becoming big businesses, and structurally isomorphic. At the same time, however, the prominent role of public institutions, intellectuals and experts in public life seemed to be declining, perhaps as a function of the ‘positional’ nature of the education ‘product’ whereby value erodes with ubiquity (Hirsch 1977).

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*Some members do not share all characteristics of others in the group.

Gibbons et al. (1994; also Nowotny et al. 2001) describe a trend of increased research and development outside the universities, where it can be produced on demand without the burden of undergraduate teaching. In 1984-5, only 29% of federal environmental research expenditure went to the higher education sector, and most of this was spent on earth science, rather than pollution or energy conservation (Australian Science and Technology Council 1990). The Australian Research Council (ARC) dedicated a third of its budget to environmental research, but this was very broadly interpreted and often involved a development or industry focus. Of the 47 ARC Key and Special Research Centres established between 1984 and 1990, only one was purely environmental: the Centre for Antarctic and Southern Ocean Studies at the University of Tasmania (Australian Science and Technology Council 1990). Environmental studies was considered ‘core curriculum’ for primary and secondary education from 1980, but few higher education students studied in the area (Cowie 1995). In 2002, only 2.9% of people with non-school qualifications (all sectors) had specialised in ‘agriculture,

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\(^9\) A number of books discuss this period in detail, notably Marginson’s Educating Australia (1997), Marginson and Considine’s The Enterprise University: Power, Governance and Reinvention in Australia (2000), and Coady (Ed.) Why Universities Matter: A conversation about values, means and directions (2000).
environment or related’ degrees, and 2% of students currently in higher education were enrolled in such programs, the same as was reported for the OECD countries in 1971 (ABS 2004c).

The resumption of the arms race between the US and the Soviet Union led to the establishment of American communications installations on Australian soil, and later—when nuclear-powered ships from America wanted to use antipodean harbours, Australia happily conceded. New Zealand most emphatically did not and remains nuclear-free today. When the Cold War finally died after the collapse of European Communism in the late 1980s, the resulting unrest increased immigration pressure—for both humanitarian and economic reasons—on Australia (Macintyre 1999).

Social movements such as those for women, the environment, and Aboriginal rights were subsumed into (Labor) government-controlled bodies in the early 1990s. Paul Keating, then Prime Minister, supported these causes and promoted multiculturalism and an embrace of Asia in a big-picture manner, but lost to John Howard’s conservative Liberal-National coalition in the 1996 election. The ‘aspirational class’ has dominated politics ever since, and the elites—whether financial or intellectual (and this was broadened to include the social movements mentioned earlier)—suffered reduced visibility in political debates (Sawer 2004). Environmental concerns, the so-called ‘black armband’ view of history and activities deemed academic ‘navel-gazing’ were perceived as interfering with the business of running the economy. Aboriginal land rights were curtailed; multiculturalism policies disappeared despite over 20% of residents being born elsewhere. The citizens who delivered Pauline Hanson’s racially insular One Nation Party some moderate success in 1999 began to be targeted by more mainstream parties. This demographic group’s resentment of environmental and equal opportunity agendas was useful in achieving federal government budget cuts (Sawer 2004). The new adversaries of populists were elites that could be found largely in universities and public service; those whose salaries were maintained by public expenditure.

Aboriginal self-determination increased during this period, as did the number of people identifying as Aboriginal. Both traditional and modern Aboriginal cultures experienced an upsurge in cultural practice and recognition, as well as often being appropriated for use as a national identity. The High Court’s Mabo decision in 1992, and the subsequent Wik decision that British colonisation did not extinguish Aboriginal land rights, was exploited to promote alarm and social division between Indigenous Australians and industry, pastoralists and other rural residents. In reality, however, by requiring proof of continuous ties to the land, Wik and Mabo limited Aboriginal claimants to land the whites had not yet taken (Macintyre 1999).

The Commonwealth Government has acceded somewhat to environmental concerns by establishing better management policies and voicing support for sustainable

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10 The French government later bombed the Greenpeace ship the Rainbow Warrior in Auckland harbour in 1985, on its way to protest French nuclear tests in French Polynesia.
development, a recently coined term (WCED 1987). A combination of reduced viability of primary production, increased sensitivity to the impacts of primary activities on tourism and the new environmental policies created even more of a rift between country and city. The former perceived their interests as sacrificed for the sensibilities of the latter. This dichotomy is well demonstrated by the simultaneous debates around restoring flows to the Murray-Darling and Snowy rivers while Cooper Creek was slated for irrigation and Coongie Lakes (a Ramsar wetland) for oil exploration (Powell 2000). Debate became increasingly violent through the 1980s, particularly about native logging, and – with the interference of a confusing array of environmental organisations, industry mouthpieces, and public relations counter-movements (Hutton and Connors 1999) – the debate became irrevocably polarised (Rowell 1996). In 1999, environmental problems were the utmost social issue for only 9% of adults, well behind health, crime, education and unemployment, and it was even lower for the young (ABS 2002; also Dennis 2005). Only 7% of the 62% professing to be concerned with the environment in 2001 were members of an environmental group (ABS 2001). With the widespread availability of recycling services and the founding of the Natural Heritage Trust (NHT) federal funding base in 1997, environmentalism was ‘mainstreamed’; activism seemed less attractive or necessary because the government was perceived to be dealing with the problem (Pakulski et al. 1998).

2.3 Recent history of environmental education in detail

The previous section offers a broad-brush history of the context for sustainability in Australian higher education. This one focuses closely on the last several decades, the years since the ‘environmental revolution’ first began to influence university curricula. I have taken this recent history in episodes, beginning with a very brief outline of the environmental events that meshed with early curriculum initiatives. The environmental consciousness-raising of the 1960s spawned some early curriculum initiatives, but it was the 1970s when the truly ‘interdisciplinary’ studies of the environment emerged. The 1980s curricula were designed to meet some of the needs of a more policy-conscious environmental movement. In the 1990s, curricula were shaped by the increase in the number, reach and style of universities as they negotiated a transition from public-good funding to business models. By the end of the millennium, the task of meeting a market for sustainability education had become a noticeable element in curriculum design.

2.3.1 1960s and 1970s - Environmental concerns and curriculum responses

In Australia, the biologist-writer A. J. (Jock) Marshall pointed a finger at rapid and damaging anthropogenic changes in his popular and bombastically titled: *The Great Extermination: Anglo-Australian cupidity, wickedness and waste* (1966). Marshall was

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11 Unusually, Australia – alone among the 178 ‘Earth Summit’ signatory nations at Rio de Janeiro in 1992 – has chosen to use the term ESD (Robin 2007).
appointed in 1961 as the foundation professor of biology at the new Monash University. Marshall’s new Zoology department set out to redress the dearth of work in Australian mammalogy, especially the biology of marsupials. The ACF’s energetic secretary, Francis Ratcliffe, was also deeply concerned about the conservation of Australian wildlife. Ratcliffe, Marshall and others were outspoken advocates for national parks and reserves, and for more environmentally sensitive agricultural practices. One of the zoologists appointed to the Monash department was E. H. M. (Tim) Ealey, a marsupial specialist, conservation activist and environmental educator. He introduced a unit in conservation to undergraduate zoology courses in the 1960s with Marshall’s strong support, and involved senior scientifically trained public servants in teaching his honours students (Robin 1998, p. 56-7). In 1973, Ealey established a new, genuinely interdisciplinary Masters in Environmental Studies at Monash University (now administered through the School of Geography and Environmental Science).

Ideas about ‘humans in nature’ (or ‘human ecology’) also influenced proposals for an innovative Biological Centre for Canberra in 1965, which flowed on to the Pigott Report’s 1975 recommendation that the collections for the new National Museum of Australia should represent “the history of man and nature in this continent, their linked roles and their interactions” (Robin 2003, p. 278). A program in human ecology was first developed by Stephen Boyd at ANU in 1976 (Fenner 1994), who applied it to complex urban systems such as Hong Kong (Boyden 1972; 1981), and a major in the approach is still offered there today.

The year 1973 also saw the foundation of a new interdisciplinary university. Griffith University was Brisbane’s second university, and the first in the nation to do away with disciplinary faculties. One of the four foundation (undergraduate) degrees it offered (first taught in 1975) was Australian Environmental Studies. The same year on the west coast, Murdoch University (Perth’s second) mirrored Griffith. Murdoch had a foundation Chair in Environmental Science and School of Environmental and Life Sciences (WA’s first), teaching undergraduates from 1975. With core units in ecology and social sciences both programs were truly interdisciplinary and system-focused.

The other major initiative of 1973 was the establishment of the Centre for Resource and Environmental Studies (CRES) at the ANU. Under the foundation directorship of Frank Fenner, who was one of the activists for the Biological Centre for Canberra in the 1960s, the research school undertook broad research across a full span of environmental studies, not just natural resource management (which was what was originally mooted). Its Masters in Environmental Studies was complemented by research programs in resources, applied systems analysis, hydrology, land use management, environmental management and human ecology (Fenner 1994).

Environmental programs also emerged at Macquarie University (Diploma in Environmental Studies), and Flinders University of South Australia (Ecology of Man and Society course), universities that were founded in 1964 and 1966 respectively (Quigg 1973; CERI 1976). The early adopters of interdisciplinary environmental studies were clearly not the ‘sandstone universities’, but those established in the post war era or
later. Similar higher education institutions dominate the EFS field in Australia judging to contributions to a recent volume (Leal Filho and Carpenter 2006), and several have since launched academic schools named for sustainability (Murdoch, Monash, Bond).

An ideal ratio of environmental generalists to disciplinary specialists has never been articulated, but the total never comprised more than 2% of overall university enrolments at this time (CERI 1976). Where no specific environmental studies department existed, degree courses relied on the goodwill of other departments, resulting in little cohesion across the delivered content. Connecting teaching to research was problematic; the one environmental research school (at the ANU) taught only graduates. Undergraduate students would also have benefited from having lecturers active in interdisciplinary environmental studies, but research programs were not yet established elsewhere.

At this time, courses tended to have either a human-environment focus or a nature- ecology approach to their disciplinary mix, and often involved a ‘unifying’ theme such as energy or systems approaches (CERI 1976). It was deemed (and remains) important that students learn explicitly about the interdisciplinary nature of environmental studies, but pedagogical innovations such as team teaching, the use of educational media, engaging alternatives to lecture delivery (e.g. seminars), practical field work and group projects were, and remain, challenging to university administrative structures and traditional preferences for individual assessment.

2.3.2 1980s and 1990s - The arc of the market

During the next two decades, the issue of the environment took a parabolic path in society and in universities. As discussed in the previous section, the Franklin River campaign ushered in a new professional environmental movement in Australia that worked with government and the policy sector through established collective conservation/green lobby groups such as the ACF and state conservation lobby groups (Hutton and Connors 1999). Government was no longer the only employment opportunity for graduates (Libby Robin pers. comm. 23 Nov 2005). Throughout the 1980s, the environment held political weight and environmental lobby groups were courted by several parties. Increased environmental regulation created demand for qualified graduates, as did emerging programs in local and regional community-based organisations. In addition, public expenditure increased early in this period for other social issues as well, including gender equity, indigenous land claims, the environment and multiculturalism.

At the end of the period, however, economic rationalism came to dominate public policy, creating a climate that relied on the market to assign value. When Dawkins flattened the hierarchies in the higher education sector in the late 1980s, fees were also reintroduced, and performance management measures expanded. Concern for the

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12 Two chapters in the Centre for Educational Research and Innovation volume (1976) on ‘The Training of Generalists and Specialists’, the first by J. Hedegaard and the second by L. Emmelin (pp. 80-98), generalise the content given here from a series of international case studies, some of which are Australian.
environment was paradoxically decreasing, replaced in public debate by a return to concerns about the economy in isolation from environment and social justice. Equity and environmental issues were separated from each other and both were regarded as subservient to economic imperatives. Because Dawkins had presided over the creation of so many new universities, competition became fierce for students.

Griffith University dominated undergraduate environmental enrolments until 2003 (when Southern Cross University overtook it), with enrolments consistently between 600 and 700 students despite the fact that the number of programs in competition increased almost every year. Postgraduate student enrolments were more contested, with dominance traded between a handful of post-war, ‘red-brick’ universities throughout the 15-year period covered by DEST statistics. Monash led enrolments from 1989 to 1991, followed by the University of New England (1992-3 and 1998), Griffith (1994-97, 2001-2002), Macquarie (1999-2000) and RMIT (2003). It appears that undergraduate course development has been largely led (and fed) by the fee-paying postgraduate market (Figure 2.2). Over time, the number of postgraduate environmental courses on offer parallels its market share, levelling off after the decline in enrolments begins. The number of postgraduate programs is a step ahead of the number of undergraduate courses, too, the latter following with a short delay although their share of the market is much weaker. An overshoot and quick correction in the number of undergraduate programs on offer occurred around the new millennium.

![Figure 2.2 Supply and demand of environmental courses in Australia. Pre-2001, the discipline of environmental science is used, post-2001, environmental studies (data: custom DEST statistics).](image)

The human side of sustainability issues is logically captured in the discipline of geography, which has a social science-humanities focus in the classification system used by DEST. Not surprisingly, given the science focus evident in terminology and research incentives in Australia, this field has not experienced the same upsurge as ‘the environment’. In fact, geography has experienced fragmentation as a discipline during this period due to the large number of departmental amalgamations (largely with environmental studies) as a result of low student numbers and the broad interests and
abilities of academic geographers (see Section 1.2.8). Undergraduate and postgraduate supply and demand are very well matched over time (Figure 2.3).

Figure 2.3 Supply and demand of geography courses in Australia. Pre-2001, the discipline of geography is used, post-2001, human geography (data: custom DEST statistics).

Despite constantly increasing university enrolments, as environmental courses proliferate, their average enrolments flat line at best (Figure 2.4). Though undergraduate enrolments of both fields are higher than postgraduate, the postgraduate numbers make up a larger percentage of enrolments at that level than the undergraduate enrolments as a percentage of theirs (Figure 2.2 and Figure 2.3). The upswing evident in Figure 2.4 between 2001 and 2003 may be a statistical anomaly (the result of non-linear transfer between classification systems), or it may be the beginning of a new pattern. If the latter, there may be increased receptivity towards the kind of integrated programs needed for sustainability; if the former, this cannot be assumed. Given that economic rationalists continue to dominate the political sphere of universities in the 21st century, curriculum decisions around sustainability have to be made carefully to ensure viability.

Figure 2.4 The average market share based on enrolments in each discipline and level divided by the number of ‘active’ programs (those having one or more students enrolled per year) (data: custom DEST statistics).
2.3.3 Since 2000

The focus in recent elections on terrorism and interest rates has exacerbated the difficulty of pursuing environment, society, culture and economy holistically in the academy. Despite vocal support for sustainability, ‘quality of life’ tops the hierarchy of needs of the new millennium, and it is not permitted to do anything but improve. Wars are fought in defence of this; university funding is harnessed to it. The modern fetish for innovation and development in university research reflects a wider societal trend: techno-optimism, the belief that better technology will save society from having to change its behaviour in order to save itself and its environment. Intergenerational equity has become the focus of sustainability debates to the detriment of intragenerational, perhaps so that difficult decisions can be delayed until the next election cycle. Per-student public under-funding has created competition between universities, faculties and even schools for students and research money, rather than collegiality and collaboration. Disciplines must meet a measure of utility or vogue or be cut by accountants. Nothing is permitted to exist, much less thrive, without market affirmation.

Universities are still having trouble filling their environmental programs, and some lower intake standards to do so, contributing to a further decline in esteem for such degrees. The university sector is still undifferentiated, but it is being given incentives to diversify its offerings under recent government proposals; some universities may be ‘teaching only’, with some encouraged to focus on research (DEST 2005a). Though the proposals have been controversial, it is possible that increased diversification will remove some of the pressure from existing environmental and geography programs such that some innovative sustainability courses will be able to thrive. Meeting the market for sustainability education requires the capacity for universities to clearly target different parts of it.

Structural changes are also afoot. Unlike 1973, when environmental research was revolutionary, today most Australian universities have some research activities in the area. Out of 104 environmental schools and centres recorded during a 2005 audit (see Chapter Four), 11 are supra-faculty ‘umbrella’ structures. These are established to facilitate research into sustainability and encourage cross-cutting collaboration, which would otherwise be fragmented into a number of other, presumably more disciplinary, units. Undergraduates and coursework graduates, despite the importance of contact with research activity in the field for engaging with sustainability, rarely interact with such a group, although there are exceptions (Kaufman et al. 2006; Reid et al. 2006).

2.4 Looking back to look forward

This chapter serves to anchor later case-specific analyses of sustainability education into the larger national story. Environmental and social awareness were not born with the term ‘sustainable development’ and universities have a long history in Australia. The current states of both are logical extensions of historical patterns and decisions that are particular to this country, though informative elsewhere. Tertiary environmental education offerings over the past 30 years reflect waxing and waning social concern for
sustainability, especially in comparison with issues such as the economy and ‘national security’. The tertiary sector has become over dependent on overseas student fees, currently in a downswing, due to decreasing federal per-student support. Universities have become less able to take risks – such as developing new courses or curiosity-based research programs – for what they see as the public good.

Environmental attitudes have always varied in Australia, and can be seen at election time to split along the longstanding division between rural and urban dwellers. The resource-based nature of Australia’s economy causes a slow response to many of the challenging environmental issues we face as a society, despite the visible effects of climate change and drought. Social equity and justice still lag for Aboriginals, whose quality and length of life remains drastically below that of the rest of the country. Multiculturalism has suffered some setbacks, currently disadvantaging Muslim Australians or those appearing Middle Eastern in origin. Australia’s ethics have been questioned internally and externally (Singer and Gregg 2004). Regardless of the clear need for increased awareness about sustainability issues and better education to address it, enrolments in relevant tertiary programs have passed their peak.

The utilitarian tertiary sector of Australia has been expanded to perform social engineering around ‘skills gaps’ and to improve Australia’s performance in international league tables around education. 13 Early specialisation is the norm, despite modern career paths characterised by technological change and multiple parallel moves. The Australian character features an anti-elitism which is suspicious of education for personal growth or curiosity-driven research and encourages strong oversight of universities by governments. By marketising the sector, the capacity of universities to act in a proactive role – to avert crisis, rather than responding to it – is drastically diminished. Flexibility and autonomy have disappeared with funding.

That modern universities are an imperfect system there is no doubt, but as Foucault said, “since these things have been made, they can be unmade, as long as we know how it was that they were made” (Foucault 1988, p. 37, as cited in Marginson 1997, p. xiii). Universities have a powerful role to play in bringing humanity into a closer harmony with our environment through teaching, research and exemplification. They house disciplines, within and between which the complex solutions to our problems may be found. Universities educate the professionals that will manage the environment in the future, and are also big businesses that significantly affect the physical environment. Despite the current UN Decade in its honour, momentum towards higher education for sustainability in Australia has slowed, if the lack of new signatory universities for the Talloires Declaration over the past few years can be used as evidence. Knowing what should be done is one thing, and not unsubstantial; this chapter throws into perspective the task of those making the choice to do it.

13 Of course, in recent years, the wide availability of university education has impoverished the trades, resulting in incentives to undertake vocational training (Donnelly 2005).
CHAPTER THREE  KEY CURRICULAR CONCEPTS FOR SUSTAINABILITY

Stasis in the literature and a disconnection with practitioners as discussed in Sections 1.2.4 and 1.2.5 support the need to identify and reclaim key concepts for tertiary EFS. A thorough literature review and expert questionnaires are used here to identify key curricular concepts for a sustainability education. Chapter Four will later examine existing Australian environmental curricula for evidence of such relevant features.

Four guiding theoretical elements covering disciplinary content and pedagogy can be distilled from the EFS literature: liberal education, interdisciplinarity, cosmopolitanism and civics. A sustainability canon is proposed on that basis featuring integrated science, humanities and social science theory, engaging pedagogy and authentic external experiences. The chapter goes on to explore detailed disciplinary content for undergraduate programs in sustainability, based on a survey instrument employed at two international sustainability events in 2005. Undertaken to supplement the richness in the sustainability education literature on generic skills and pedagogical method, it seeks to assist curriculum developers plan disciplinary content. This survey is also used to test the guiding principles identified earlier. Findings indicate that a sustainability canon of sorts exists, if an imperfect one. A surprising amount of agreement exists between the two different specialist groups about core concepts, notably in ecology and – less unanimously – economics, policy, and ethics. Studies about society are preferred as elective content. A 10-subject core is nominated, supporting the need for broad foundational underpinnings in any such program.

3.1 The sustainability canon

The key messages of the EE and EFS literature over the past 30 years are notable for their emphasis on teaching and learning methodologies and the engendering of values or world views, as opposed to imparting specific disciplinary content. Four well-established concepts capture a large percentage of this agenda and reduce the complexity of the EFS curriculum debate: liberal education, cosmopolitanism, interdisciplinarity and civics (Table 3.1). Each of these terms is old, but they are not ‘mature’ in this context; several are contested in the literature, threatened by current educational trends, or both. These ideas are most often combined in the US, where many universities require common ‘general education’ content for all students. They are also mirrored in the UK TALESSI project (Teaching and Learning at the Environment-Science-Society Interface), which asserts the value of active learning, interdisciplinarity, values awareness and critical thinking in environmental higher education (Jones and Merritt 1999). The American LEAP project (Liberal Education and America’s Promise) of the Association of American Colleges and Universities (AAC&U) echoes the EFS agenda:

The demands of the twenty-first century require the colleges and universities…to strive towards the development of globally minded, fluid, analytical citizens able to effectively function in the context of an increasingly complex, pluralistic world order. (Myszewski 2006 p.39)
Canada has undertaken a similar encouragement of liberal, so-called ‘Arts and Science’ programs to create students with minds that can adapt to change and complexity (Association of Universities and Colleges of Canada (AUCC) 2001). The liberal education tradition coincides with many EFS goals.

Table 3.1 Summary of pedagogical and normative concepts underpinning sustainability education.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Key Elements</th>
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<tbody>
<tr>
<td>Liberal Education</td>
<td>• Broad philosophical, historical, spatial and cultural context.</td>
</tr>
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<td></td>
<td>• Dialogue and debate encouraging critical and creative thinking processes.</td>
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<tr>
<td></td>
<td>• Encouragement of life-long learning and personal development rather than simply skills acquisition.</td>
</tr>
<tr>
<td>Interdisciplinarity</td>
<td>• Knowledge of other disciplines, their world-views and methodologies.</td>
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<td></td>
<td>• Mutual respect for roles of disciplinarians and generalists.</td>
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<tr>
<td></td>
<td>• Ability to work together in teams with others, and use interdisciplinary frameworks to integrate knowledge.</td>
</tr>
<tr>
<td>Cosmopolitanism</td>
<td>• Provides a balance for future focus of debate, orienting it towards worldwide equity.</td>
</tr>
<tr>
<td></td>
<td>• Encourages empathy, and consideration of the ‘other’ (facilitated by broad context and systemic thinking from above).</td>
</tr>
<tr>
<td>Civics</td>
<td>• Deeper consideration of citizenship at various overlapping levels of allegiance and belonging via outreach.</td>
</tr>
<tr>
<td></td>
<td>• Knowledge of how to participate in public process and improve governance.</td>
</tr>
</tbody>
</table>

This chapter (re)introduces these ideas in order to anchor the EFS project to its fundamental concepts. It focuses on the human realm in order to balance the ‘future environment’ perspective that sustainability curricula have taken to date (explored in Chapter Four). It speaks of what to teach, as well as how, neither assuming that the right content will result in the best message, or that pedagogy without content can deliver a desirable end. Two major pedagogical concepts will be discussed to characterise the embedded ‘what’ and ‘how’ of the sustainability canon: breadth and citizenship.

### 3.1.1 A pedagogy of breadth

Architectural metaphors are frequently used to discuss educational design, starting from the German term *bildung*, which derives from ‘formation’ and refers to the foundational improvement of a student’s moral and intellectual capacity. Degree programs might be thought of as broad-based or narrow, either pyramids or obelisks (Wilkinson 2006). They are comprised of blocks or units and conclude with stabilising capstones or keystones. In sustainability education this analogy may extend to structural pillars. This type of language implies the need for a logical sequence of study in order for educational transformation to occur (Collier 2000). While developing expertise in a particular field or problem is a valuable outcome of undergraduate education, the acceleration of change in careers (Burchell 2004) and the complexity of modern problem-solving suggest such early specialisation is ill-advised (Thomas et al. 2007).

Breadth can be deliberately accumulated and integrated for curricular coherence (Boyer 1987; Holloway 2005), as compared with the ‘free choice’ model often implemented in the name of liberal and interdisciplinary education (see Section 6.3.1 for examples). These two conceptions of breadth include, the “integrated use of disciplines in problem...
solving, and a recognition of the scope and limits, the proper contribution and field of authority of each discipline so integrated” (Foster 1999, p. 359).

### 3.1.1.1 Liberal education

When Jeremy Bentham, the Scottish philosopher, developed the idea of the utilitarian education that would bring the greatest good to the greatest number, both good and bad resulted. Widespread secondary education was born of this movement, but ‘use’ came to be defined in tangible, practical terms. Liberal education was seen as decadent in comparison, and – in its unwavering focus on ‘the Classics’, Greek and Latin – anachronistic. Universities such as Oxford and Harvard modified the rigid classical program to include foundation subjects, specialisations and electives (Wilkinson 2006). The liberal characteristics were retained in the broad foundation and the dialogic, Socratic style of teaching. A ‘liberal education’ is said to lead to “the formation of habits of free inquiry, of reflection, of an unprejudiced search for truth in her many guises” (Bratchell 1966, p. 1). It is nonetheless perceived in Australia to be without ‘use’, designed for the edification of the high-born rather than relevant to a broad community (see Chapter Two).

Foundational (or general) studies serve many purposes in undergraduate education. From a pragmatic standpoint, where secondary education standards or content differs widely, foundation years provide an opportunity to normalise intake quality (Wilkinson 2006). It can also give students a chance to sample a range of fields to see where their talents lie. Newton (2000) identifies three types of general education: ‘great books’, ‘scholarly discipline’, and ‘effective citizen’. The first – the perennial ‘great books’ version – is similar to the rigid classical model as supported by Livingstone (1917) and Bloom (1994) but discredited by cultural relativism (Englund 2002; Kennan 1989). The second ‘scholarly discipline’ model values breadth as an introduction to the disciplines for the apprenticeship of new academics. This approach builds context for disciplines within the larger knowledge system, making it possible to compare assumptions, cultures, contributions and burdens of proof.

It is the third, the ‘effective citizen’ or *literae humaniores* model that prepares students to “live well and participate fully in the 21st century” (Newton 2000, p. 174; also Barnett and Brown 1981) and that we seek in EFS. It can prepare a student for a lifetime of learning and informed action in a range of life paths: to “bring powers of judgement to bear on a diversity of subjects” (Burche ll 1966, p. 6), not just those in which they make their living. Complex public decision-making in a “democracy … requires education beyond specialities” (Kennan 1989, p. 33). The term ‘fundamentals’ is often used to describe such core content, meaning knowledge and understanding that is general enough in its application to provide wide freedom in future choices and perspectives (Bailey 1984). A modern liberal education should buttress the singular

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1 As Scott (2004) puts it, “Allan Bloom … seems to believe that studying the classics produces wisdom as a sort of by-product” (p. 173).
talents of each student, enriching their choices with a sense of context and the capacity for self-reflection, rather than moulding them to a classical template.

Decisions about what areas of knowledge – and which subjects within those – to specify as core are laden with fiscal concerns in the modern, internally competitive university (Lattuca and Stark 1994; Moore 2005c). The conceptual neighbourhood can shrink to the boundaries of the budget unit offering the program, excluding entire academic cultures (Snow 1959). The more numerous and diverse the set of people talking about curriculum, the more likely the process will become ensnared, but the debate is too important to avoid (Awbrey 2001; Newton 2000). It is nothing less than a discussion of who we are as an academy and what it is to be educated (Holloway 2005). In 1974, British philosopher Paul Hirst identified a core schema containing “the physical sciences, logic and mathematics, the human sciences, ethics, aesthetics, religion and philosophy” (Corson 2000, p. 112). More recently, the Task Force on the Student Experience in the Faculty of Arts and Sciences at Rutgers University identified as generic qualities: higher-order cognitive skills; an active awareness of one’s natural environment and oneself; and, the capacity for action in one’s social and cultural environment (Gardiner et al. 1998). Harvard University’s Faculty of Arts and Science (2006) includes in the core curriculum of its most recent curriculum review: cultural traditions and cultural change; the ethical life; historical and global perspectives of the US and other societies of the world; reason and faith; and, the life and physical sciences. Kennan (1989) adds quantitative reasoning, which enables understanding of hypothesis testing, cost and risk analysis and decision theory, such that a student will “know when a thing is proved and when it is not” (Livingstone 1917, p. 23).

In addition to discovering a ‘neighbourhood’ of disciplines, foundational study also typically provides key skills on which the rest of the degree draws, such as academic research and communication. Most North American universities require a first year composition subject, for example. If such generic skills do not appear as core, and early in a program, later instructors cannot assume the skill nor are they likely to sacrifice ‘their’ time to ensure students get it. At Harvard (2006), so-called ‘critical skills’ are identified as written and oral communication, a foreign language, and analytical reasoning. Rutgers includes also the capacity for interpersonal interaction and leadership, which is valuable for research and action (Gardiner et al. 1998). Apart from the foreign language, these skills are largely generic in nature and highly transferable in a way that many technology-specific skills are not.

Liberal education often employs Socratic teaching methods, such as seminars featuring dialogue between lecturer/tutor and student, to create deep learning and powers of critical thinking and debate. Critical capacity is especially important in a climate where complexity is reduced to ‘common sense’ in sound-bite media (Corson 2000). Inquiry-, problem- or case-based teaching environments are increasingly common, as well as those in which lecturing staff merely facilitate student-led, collaborative seminars and research (see the Journal of General Education and Liberal Education for many examples). Despite the strength of opinion associating desirable graduate characteristics to the liberal structure, it is impossible to prove causality, even if outcomes could be
satisfyingly measured. Educators themselves are rarely aware of how much is lost in transmission (Barr and Tagg 1995; Edmunson 1997; Wilkinson 2006).

Some institutions stipulate that foundation subjects should be designed for a non-major audience, rather than reusing those that are meant to introduce a discipline to intending majors (Carnegie Foundation for the Advancement of Teaching 1977, cited in Wolfe 2001; also Harvard 2006). Such subjects are scarce in universities that lack a general education requirement. Internal competition renders them unlikely to receive adequate enrolment, because departments discourage their students from enrolling outside their own offerings. Common too are limitations on the number of subjects at an introductory level that can be taken for credit. Three-year programs like those found in Australia and Europe would require major structural revision, and incur some risk, in order to incorporate such foundational content. Students may interpret such ‘for your own good’ or ‘common good’ content as an imposition (Nesteruk 2005).

Support for liberal or general education is also support for a vision of higher education as a “progressive force for democratic change” (Newton 2000), or what Goodin (1996) would consider ‘institutional irritants’. Liberal education is, by definition, ‘liberating’ (Bailey 1984). Sorgner (2004) identifies two types of liberal education that lie on opposite ends of a spectrum. An education based on momentary freedom asserts a student’s right to find their own path, provided they are tolerant of the paths of others, leaving staff the role of simply exposing the options. Considering lifelong freedom requires universities to foster student virtues and awareness, so that graduates are not limited in how they are able to contribute as future citizens. The former allows market forces to determine the value of universities, while the latter depends on a collective belief that what the academy provides is valuable to understanding the world. Higher education is suffering a crisis in this regard, but it was not always thus (Grant 1975).

The tension was brought to life by Pierre Ryckmans in his 1996 Boyer Lectures:

One [outback farming] woman expressed concern for the education and future of her son, and commented on the boy’s choice of exclusively practical subjects for his courses at boarding school. She remarked: “I can’t say I blame his choice, as I too would prefer to be out in the bush driving a tractor or building cattle yards rather than sitting in a classroom learning about Shakespeare, which is something he’ll never need. But it worried me to think that if in a few years time he decides to do something else, but cannot qualify because he lacks the required school subjects, then it will be my fault, because I didn’t supply him with the education he needed …” (Ryckmans 1996, p. 22)

A liberal foundation of the ‘lifelong’ variant is relevant for EFS as a means of imparting values and capacities that will help today’s students to ameliorate society’s trajectory. In such a context, the sustainability debate is a valuable heuristic, rather than a normative reorientation of the educational process (Foster 2001). That said, sustainability ‘specialists’ may benefit from core elements that speak more specifically to what is now quite a robust policy literature on sustainability. Despite the oft-discussed flexibility of sustainable development as a term, frameworks do exist that help in grappling with the issue, including setting targets (UN 2000) or at least compass bearings (Barnett 1988). The Millennium Ecosystem Assessment (MEA) is one such framework, and while it is
still being theorised (Carpenter et al. 2006), its four dimensions suggest some gaps in the traditional liberal foundation as it is described above. First, the social sciences – such as economics, sociology, political science, geography, and international development – contribute to understanding indirect drivers of sustainability and the capacity for appropriate change in society and governance. Second, sustainability requires the integration of information between disciplines and scales for decision-making across jurisdictions and political units (van Kerkhoff and Lebel 2006), as well as collaborating with others in doing so (Metcalf et al. 2006). Finally, the humanities provide a valuable perspective on foundational issues of our history, our desires and our trajectory (Fischer et al. in review).

3.1.1.2 Interdisciplinarity

Integration of knowledge across domains is commonly mentioned as a prerequisite for solving complex problems such as those upon which our sustainability depends (Dovers 2005b; Foster 1999; Thomas 1992). Integration reaches across disciplinary fields to evaluate, for example, the impact of social change on ecosystems, how global trends percolate to local levels, or the capacity to extend any such understanding to policy development or economic instruments. Integrative skills require specific training that tends to occur later in a program, when the requisite problem- and discipline-specific content has been acquired, although Husic (2006, p. 16) suggests that “students can’t be thrown into this type of experience for the first time in their senior year of college”.

The experience of environmental studies is instructive to the exercise of interdisciplinarity in the pursuit of sustainability. As Klein said of the increase in environmental courses in the 1970s and thereafter: “their structural identity was not always clear… and [a] ‘syncretic assemblage’ rarely resulted in synthesis” (1990, p. 96). The tendency to build environmental curriculum from ‘environmentally tinged’ subjects in a range of disciplines creates an eclectic assortment with little depth, a lack of reflectivity about the normative nature of its content, and no explicit integration. Interdisciplinary universities were formed to knock down the barriers between disciplines via multi-subject schools and deeply integrative and thematic offerings (Klein 1996). A strong ‘centralising force’ moved many early experiments back towards traditional structures (e.g. Griffith in Australia, Green Bay in the USA) (Klein 1996).

Academic career progression is one of those pressures, if structures such as tenure, promotion, publication and peer review are de-emphasised. An interviewee from the Canadian cases in Chapter Six investigated a number of innovative structural models in designing his program, and found one such ‘experimental’ university to appear like,

an academic black hole. You go [there], and you’re not going anywhere else because you are not gonna get tenure and you’re not gonna be publishing in your field because there aren’t departments, and there isn’t the whole structure of tenure and promotion and publication and peer review and all of that stuff. So you damn well better be happy if you go there, because that’s where you are. And that, that’s a serious problem with academic change. (pers. comm. 12 Oct 2005)

Such risk applies equally to students. Their willingness to sign up for experiments decreases as the personal costs of study increase.
Interdisciplinarity describes here the integration of multiple theories and methods to form a research or problem-solving approach (see Section 1.2.7 for definitions). It is not an end in itself, but simply a necessary approach to tackle complex issues, and is ancillary to specialist expertise. This stage of advancing knowledge through integration is only the middle step in a sequence. Integrating for sustainability also requires the capacity to contribute to decision-making for complex issues, and thus is an iterative and adaptive exercise spanning theoretical synthesis, research, action and reflection (Table 3.2). Integration extends beyond the research stage (Step 5) where universities typically focus. In addition to a multidisciplinary foundation (Stage A), students need experience in synthesising material (alone or in teams) to build new theory and/or balance priorities in decisions (B), and an understanding of policy and implementation options and feedback loops in monitoring progress (C). Although this is difficult for any one subject to achieve, the sample curriculum provided in the Appendix makes an attempt. Klein (1999) and Moore (2005a) list a range of other models for integrating students and content.

Table 3.2 Eight key steps of integration for sustainability, broken into three stages of activity related to different kinds of integration work.

| A. | 1. What do various disciplines contribute to this sustainability issue? |
|    | 2. What are the assumptions, languages and methods that characterise these disciplines? |
|    | 3. How can differences in these contributing fields be resolved to form a common picture of the issue? |
|    | 4. What is an appropriate research question? |
|    | 5. How can a common investigation of the question be undertaken? |
| Integrating Disciplines (lateral, multidisciplinary) | Integrating Enquiry (converging, interdisciplinary) |
| B. | 6. How can a ‘good’ decision be discussed and reached? |
|    | 7. How can such a decision be implemented collaboratively with relevant parties? |
|    | 8. How can this decision be monitored and adapted for impacts and outcomes? |
| C. | Integrating Action (engagement, transdisciplinary) |

Interdisciplinarity can be made easier to achieve by creating space for synthesis in foundation requirements (Boyer 1987). Such lateral integration can occur by means of block (or clustered) programs, where the boundaries between individual subjects are broken down and material is team-delivered organically rather than in parallel (see also Section 6.3.1).² Students undertaking traditional subjects can also be linked in additional, integrating seminars. Such programs are most successful with a narrow

² Lattuca et al. (2004, drawing on Lattuca 2001) identify four types of interdisciplinary teaching that describe increasing degrees of disciplinary blurring: informed disciplinarity, synthetic interdisciplinarity, transdisciplinarity and conceptual interdisciplinarity. Such an axis could be placed perpendicular to the one described in Table 3.2 to define an interdisciplinary pedagogical ‘space’ comprising ‘disciplinarity’ and ‘application’.
scope, such as within a domain (like science) or problem (such as the environment). If fundamental disciplines such as ecology, sociology and economics are covered elsewhere, classes in the interstices where new disciplines have evolved, such as environmental economics or ecological anthropology (McNeill 1999), or the nature of knowledge itself (e.g. Science and Technology Studies) can train in lateral integration. Where little or no common content can be assumed, individual subjects must combine content, method and synthesis from a range of fields as a sort of capstone experience. Such subjects can benefit from student diversity, but too much variety can also handicap progression. Respect for how various disciplines construct their knowledge is paramount. For example, the humanities are often relegated to a service role in relation to more positivistic fields because they pose more questions than they answer, but generating the right research question is a non-trivial contribution to integrative work.

Even lateral, type A integration can be challenging in a modular environment. Applying a range of disciplines to a common problem often means that more than one member of staff will have to be dedicated to a subject, challenging workload calculations. Staff disagreements in class are wonderful learning opportunities, evidencing the sheer difficulty of grappling with ideas across disciplinary divides, but can unsettle students and make the staff themselves feel quite vulnerable (Husic 2006). Working with people with different expertise, disciplinary approaches and world views can simulate the challenges of working life, but group work is often challenged by students and staff (Moore 2005a). Combining students in unlike years or disciplines is difficult for lecturers and for those generating timetables. Simply increasing communication between staff members of different departmental ‘guilds or ‘tribes’ (Stanic 1975 and Becher 1989, respectively) may have an equivalent impact (Husic 2006).

The literature is rich with type A cases describing the process of improving integration in teaching and learning for sustainability (Table 3.2). The next two stages of problem-based interdisciplinarity – integrated research (B) and action or policy engagement (C) – are more forward-moving and press at the boundaries of university education (McNeill 1999; Taussik 1998). Capstone subjects featuring problem-based and collaborative inquiry can engender joint student research on topics that span disciplinary realms (Klein 1999; Leroy et al. 2001; Meehan and Thomas 2006). Some such cases also include elements of transdisciplinary stakeholder engagement (Wemmenhove and de Groot 2001) and decision-making based on real problems (e.g. Urban Sustainability at Vancouver’s multi-institutional Great Northern Way Campus). Authenticity is deeply engaging for students, but increases lecturer effort because projects cannot be recycled. The costs may also be higher, too, and more difficult to predict at the outset. Finally, teaching staff take on personal risk in liability as well as reputation when they set students to solve real, often ‘wicked’ problems that even specialists find difficult. More common of the type C subjects feature previously worked, ‘management’ cases.

Assuming that students are touching at least theoretically on all three stages of integration in their programs, as well as acquiring a broad base and expertise in one or more other fields to contribute to such integrative environments, degree space is a major issue. Three year, narrowly career-focused programs are particularly inadequate. More
time is required to create sustainability experts without missing entire stages of the process and limiting students’ future contributions to problem-solving. Like architects lacking structural engineering skills, what they build may not stand.

### 3.1.2 A pedagogy of citizenship

Ideas of citizenship were born with democracy, in 5th century BC Athens, in the Greek city-state. It can be challenging to apply these ideas to modern nations and global politics where: potential civic agents are further removed from the seat of power; citizenship is more universally available; and, those whose interests should be considered lack a shared sense of identity. There are many kinds of citizenship including “citizenship as a moral and political philosophical idea, citizenship as a formal legal status, and citizenship as an administrative category” (Hudson and Kane 2000, p. 5), as well as many ideas about democracy itself. Citizenship is a “complex conceptual field” (Dobson 2003, p. 4) that does not require a reciprocal relationship in order for duty to exist.

Figure 3.1 diagrams the unavoidable overlaps and fragmentations of human interests, and how they have increased in scale with globalisation. As the axes move away from the individual, ‘distance’ (not always in space) increases with an inverse effect on the power of influence. A person’s set of interests reside within the cube, implying connections between the three independent axes. A spatial and legal jurisdiction such as a town seeps into the other two dimensions: the ecosystems that reside therein occur elsewhere in the world and are linked systemically to others outside the town, and social activities and relations are similarly unbounded. Deeply asymmetrical impacts are embedded in these increasing spheres; some cultures, land use types or nations will come to dominate over others by uneven access to the engines of globalisation like currency, media, and transportation. ‘Degree of mobility’ thus stratifies our ‘interest’ space (Bauman 1998; Jelin 2000; Papastephanou 2005) in a way which Figure 3.1 does not make visible or explicit. This imbalance suggests that the ‘winners’ of globalisation are morally obligated to consider the others when making decisions.

Debates around the idea of citizenship have experienced a recent resurgence (Cohen 1996; Hudson and Kane 2000; Nussbaum 2002), and call for thinking ‘relationally’ as well as rationally (Massey 2004; Smith et al. 2007). If the three solidarity mechanisms of jurisdiction, identity and environment operate separately, then citizenship is a more complex entity than that embodied by democratic rights and duties. We can think and act at different scales in each case, as indicated by the familiar appeal to, ‘think global, act local’. Two ideas flesh out the axes neglected by the future-focused, natural science-based curricula that dominate EFS in universities, as described in the next chapter. Cosmopolitanism is the moral undertaking to consider other members of this generation in decisions, as well as those of future generations. Although an individual can not necessarily act politically at that same scale at which their moral concern operates, the globalisation of markets allows many local decisions to impact at a larger scale. Civics is ‘local’, by definition, and refers to the building of active citizens.
3.1.2.1 Cosmopolitanism

Cosmopolitanism translates from the Greek as ‘citizen of the world’ and was a key principle of the Stoic philosophers (Kleingeld and Brown 2002). It is a philosophy that extends into political science and international studies, but my interest here is in cosmopolitanism as a moral capacity to consider the ‘other’. Cosmopolitans focus on the commonalities of humanity, and view themselves in perspective with the rest of the world. The philosophy has been experiencing resurgence in debate since Nussbaum’s (1994) call in *Boston Review* for increased cosmopolitanism in American education, in order to counter attitudes of nationalism and exceptionalism. She argues that if students were educated about the way others live around the world, it would improve self knowledge, bring perspective to complex international problems, and assist in the making of ethical life choices. Her key messages support the inclusion in core curriculum of the humanities: philosophy to induce self reflection and train in analysing and building arguments; cultural and area studies to help discover the commonalities linking majority and minority and inspire curiosity about others; and, literature and arts to develop a sense of empathy and “narrative imagination” (Nussbaum 2002, p. 299), the capacity to envision the experience of other lives.

Nussbaum’s *Boston Review* piece received many negative responses. Some opponents assume she denies the importance of local and familial attachments at all (e.g. Michael Waltzer in Cohen 1996). A few debate the capacity of humans to realistically conceive of and consider the ‘other’ (Elaine Scarry in Cohen 1996) or feel that attempting to do so is inherently imperialist (Miller 2002) or paternalistic (Papastephanou 2002). Others assert that formal political and economic institutions must match the scale of morals (Held 2003), some struggling (not surprisingly) to imagine such global institutions coexisting with other jurisdictions and solidarities (Fine and Smith 2003; Manning and

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3 This diagram also provides good explanatory power for the discipline of geography, and its identity complications, and might be a useful addition to recent maps of the field (Skupin 2004).
Ryan 2004; Painter 2003). Finally, patriotism is defended as a virtue (Charles Taylor, Hilary Putnam in Cohen 1996; Rorty 1998). What is intended here is rather a cosmopolitanism of education that embodies humanitarianism, tolerance, democracy and empathy, accepting that all players possess a complex set of overlapping interests and identities. All such qualities can be recruited to inform local choices in elections, consumption or membership, what Parekh (2003, p. 3) calls a “globally oriented national citizenship”. The follow-on effect of such action can be global, changing the position of elected officials on international aid and environmental justice (Singer and Gregg 2004; Wood 2004), the negotiating position of non-government organisations, or the priorities of the consumer marketplace (perhaps one benefit of trade globalisation). As Stokes states, this “requires us to understand citizenship as an ethico-political practice and not just as a legal or administrative practice” (2000, p. 232).

A few elements of Nussbaum’s cosmopolitanism do give pause, but the core of her ideas hold fast. First, there are concerns from the point of view of sustainability that an education such as she promotes is human-centric. Caring for all humans – now and through time – will at least require better stewardship of the environment, however. Second, there is an unresolved tension between particularism and universalism that renders the idea perhaps overly simplistic (Cocks 2000), but values like democracy are also better conceived as archetypes. Papastephanou (2002) makes two additional effective criticisms. She argues that acting as an intragenerational proxy can be oppressive, depriving many of their unique voice based on what are assumed by the elite – who are privileged by the media – to be shared values. This can actually increase inequity, even if the intention is good, and it will not always be. As Ylva Boman asked Nussbaum,

> Are there limits to my ability to understand someone else? Is there not also an ethical responsibility to let someone … go beyond my understanding of him or her? (Boman et al. 2002, p. 308)

Papastephanou is also wary of a philosophy that forces a clean slate, “overlook[ing] the debt…conflicts create or have created, responsibilities and obligations that if not settled somehow and agreed upon will always impede world justice and reconciliation” (Papastephanou 2002, p. 79). “Cultural collision” is inevitable if the process of intercultural understanding is built on top of a hastily erected foundation, the levelling of which obscures a history of conflict (Tilbury and Henderson 2003; Vargas 2000).

A cosmopolitan world view, accepting the entire community of humans as equals, is essential for sustainability in a globalised world. Western democracies are increasingly multicultural, whether or not multicultural policies are in place (Nussbaum 2002; Rizvi 2005). Bauman (1998) rejects Paul Virilio’s suggestion that geography may be dead, even if History is not, and describes how distance has instead become a social construct,

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4 For an illuminating and relevant critique of Rorty’s political philosophy, see Turner (2004).
isolating some because they lack the money to overcome it. Globalisation has also been an uneven economic engine (Smith et al. 2007), flattening opportunity in some places, and increasing stratification between others, leading to a backlash of national protectionism amongst the ‘losers’ (Saul 2004). In the sustainability debate, the ethic of intergenerational equity has been given more prominence than the intragenerational. Cosmopolitanism has the potential to rebalance the sustainability canon, and it is easily adapted to liberal education. In fact, the Stoics argued that only liberal education “will develop each person’s capacity to be fully human, … self-aware, self-governing, and capable of recognising and respecting the humanity of all our fellow human beings” (Nussbaum 2002, p. 290).

Cosmopolitan education is education of the ‘other’ (Orr 1992; Ryckmans 1996), including the diversity of their spheres of interest. This, as Harvey (2000) recognises, is pure Kantian philosophy: “spatial ordering produces…regional and local truths and laws rather than universals” (May 1970, cited in Harvey 2000, p. 535), and the same can be said for behavioural norms through time. Cosmopolitanism is not an attempt to homogenise values and cultural behaviour, as critics assert, but to learn about more of the local (and temporal) truths than just one’s own. This is another call for social science fields in liberal content as well as the humanities that Nussbaum has already promoted. Geography, sociology, anthropology and history bring spatial, cultural and temporal context to complex social and environmental issues, ensuring cosmopolitanism is not a shibboleth.

Something more than the multidisciplinarity common in general education is required, however. Holloway (2005) describes how that students that were given a supplementary intervention that required examination of one’s own values, as well as those of other individuals and groups, improved more during their first two years of university on indicators of universalism, benevolence and security than those who simply did a traditional, discipline-based core curriculum. Experiences such as contact with those from other cultures are also important to include (Holloway 2005). Orr’s ‘ecological literacy’ accordingly includes global citizenship as a key concept (1992). The Socratic tradition of liberal education promotes dialogue, showing students that most issues worth discussing are “ongoing problems in human life that they will have to approach as best they can, rather than closed issues to which some knowing intellectual has found a solution” (Nussbaum 2002, p. 297). Cosmopolitan learning must also be directed inwardly, in an environment of free expression (Cornwell and Stoddard 2006), to investigate one’s own values as “relative to time and place” (Holloway 2005, p. 262). Like sustainability itself, cosmopolitanism is less a destination than a compass bearing; “an interconnected mosaic of arguments and discourses rather than predetermined

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5 This is in reference to Francis Fukuyama’s (1992) The End of History and the Last Man, which posited that after the end of the Cold War, western democracy could be said to have ‘won’ and the march of history’s search for an ideal system of government ceased.

6 This is not what Brundtland appears to have intended, as the landmark report stressed poverty to be the overwhelming priority (WCED 1987).
blueprints and plans” (Stevenson 2002, p. 251). Cosmopolitan university education aspires to produce a student body with a sense of moral obligation for the entire community of humans, the ability to imagine the reality of others, and the capacity to reflect critically on one’s own identity and traditions (Nussbaum 2002).

### 3.1.2.2 Civics

Civics is as nearly old as cosmopolitanism, originating in the Roman city-state, and has also experienced a resurgence of interest in the late 20th century. The OED describes it as ‘that part of political science which is concerned with the rights and duties of citizenship’. Civics in education is:

committed to the development of those social practices and forms of agency that promote an understanding of, and commitment to, republican and liberal democratic principles, strong but pluralistic forms of civic identity, and active and deliberative forms of civic agency. (Hogan 2000, p. 171)

The overlaps with cosmopolitanism are clear, but our interest is in the final part of that definition: how to avoid the “spirit of detached spectatorship” (Rorty 1998, p. 11) to which academia is prone. It builds on interdisciplinarity too: students must negotiate epistemological claims around knowledge, values, and options that may run counter to one another (Takacs et al. 2006). “All have a need to be sufficiently acquainted with science to discharge their obligations as citizens by making rational, environmentally sound decisions” (Nickerson 1994, quoted by Wolfe 2001, p. 302; also see Elam and Bertilsson 2003) and other disciplines provide similarly valuable context. Finally, civics is compatible with liberal education, as evidenced by the wide espousal of civic virtues as a desirable outcome of general education, and the prevalence of interesting cases of service learning and public engagement at American liberal arts colleges.

Civics is included separately in this sustainability canon because the capacity to become active citizens requires more than simply supportive values. There is no use in “sending young people into the world with heads full of ideas and ‘answers’ but little experience in producing more effective action” (Senge 2000, p. 276). John Dewey reminds us (via Saltmarsh 2005, p. 50) that “democracy is a learned activity”, so civics provides the how, and strengthens the why, in tackling change for sustainability. Such content is particularly important in universities because tertiary education imbalances social equity when imbuing graduands with more powerful networks. It is not only a freedom, but a moral obligation and duty to act on behalf of those with less of a voice (Hogan 2000) human and non-human (Bell 2004b). Discounting for the moment the risks associated with this position discussed in Section 3.1.2.1, universities in this image could be considered ‘Citizen Model’ rather than ‘Market Model’ (Scott 2004).

Hogan (2000) lists students’ civic interests as including, “a recognition of their rights, access to political information, and the provision of expansive opportunities to participate in the public life of their communities and the democratic process” (p. 164). He goes on to suggest that students should be “helped to develop a political understanding of their … interests as members of a political community” (p. 164), to understand how these interests differ from desires, and how they are affected by policy
Proposals. Additionally, they should learn how to pursue and protect these interests in a participatory democracy (Spezio 2002). Several disciplines provide the theoretical knowledge that buttress civil action, like those related to public institutions and their management such as law, political science, policy and public administration (Saltmarsh 2005). An appreciation of some fields already discussed, like history, also help to avoid “policy ad hocery and amnesia” (Dovers 1999, p. 11).

Appropriate pedagogy will also improve civic engagement. While students do need to know how political processes operate, they will learn how to function usefully in these processes through developing their critical, democratic negotiation and leadership skills via active (as opposed to passive) and outwardly engaging teaching methods. Such pedagogy has been seen to move students beyond empty statements of ‘tolerance’, for example, to practicing it (Spezio 2002). Participatory communities of learning, also known as ‘democratic classrooms’, embody civics more than hierarchical information dissemination, but can be challenging to negotiate authentically in crowded curricula (Moore 2005a; Spezio 2002). In a democratic classroom, students participate in deciding how and what to learn as well as how to be assessed for that learning. Some of the block programs discussed in Chapter Six use such collaborative learning approaches.

Civics also makes space for outreach activities in the sustainability curriculum. Service learning is a pedagogical method that uses off-campus placements or projects to build student interest, confidence and leadership skills in civic action (Kezar and Rhoads 2001; Spezio 2002). Students can also participate in action research (Saltmarsh 2005), observe deliberative dialogue processes or make submissions to government policy reviews. Community engagement projects are fruitful, too, even if students contribute from within the classroom (Booker 2006; Boyle-Baise et al. 2006; Reardon 1999). University campuses are valuable laboratories for real world student projects, and campus leadership roles are also instructive (Holloway 2005; Saltmarsh 2005). Wilhite and Silver (2005) insist that the choice of educating citizens or educating technicians is a “false dichotomy” (p. 46): both are possible and desirable.

A final curricular structure which has been shown to inspire active engagement in learning is the ‘learning community’, which dates back to the 1920s (Smith et al. 2004). Learning communities are increasingly popular in the US, and vary in their formality and the degree to which activities in them are undertaken for credit (Tinto 2000). Some universities are structured entirely on the concept, including co-residency in student accommodation. Others require that students enrol in a thematic learning community each semester to provide an empowering, socialising and integrating experience for students as an adjunct to their regular program. Some arrange blocks of courses with linked enrolments that explore common themes (Tinto 2000). Still others are informal, extra-curricular clubs that hold discussions or work on environmental or community outreach projects (McMillin in review). Learning communities have been shown to improve academic results, increase confidence, inspire knowledge integration, and encourage the application of academic learning to the real world, especially if undertaken from early in a program (Zhao and Kuh 2004).
3.2 Balancing the disciplines

A chaos of disciplinary foci (Cosgrove and Thomas 1996; Focht 2003) and naming conventions (see Section 4.5) are offered under the guise of environmental education. Guidance provided in the EFS literature is not communicating effectively with the practitioner audience responsible for designing the aggregate student experience in sustainability programs. The literature contains little discussion of relevant disciplinary content beyond ecological literacy (Orr 1992), and an implicit support for interdisciplinarity in order to balance and integrate the various elements of the concept (Foster 1999). This may be a backlash against early discussions on the topic which privileged the ‘what’ over the ‘how’, but the question of “what will be integrated?” is still often ignored. Without formal accreditation standards or expert guidance sustainability can become embodied in universities by unrestricted, cafeteria-style programs rather than those that proceed logically in building the capacity to respond to such issues. Easily perceived as ‘anything goes’, such programs exacerbate impressions about sustainability as the ‘soft’ option for study, rather than the biggest challenge of our continuing existence. Such low esteem attracts mediocre students in return, which often fuels further weakening in rigour.

Course planning committees in traditional universities first turn to the discipline areas; the pedagogy to be employed is usually up to the responsible academic. In such planning environments, competition for resources (read: student numbers) is highly fraught, and identifying subjects which all students should study can quickly create ‘winners’ and ‘losers’ around the table. Compromise in such settings can mean opting for all or nothing, to avoid entering into a time-consuming and divisive discussion of relevance (see Chapter Eight for two such examples). A consensus of expert views about relevant content can defuse and inform such discussions, but has largely been absent to date (Second Nature n.d.). Such guidance also lends support to academic members of planning committees whose primary training is likely not to be education, nor sustainability as a whole, but some contributing discipline. It can also combat the tendency of curriculum to evolve from the interests of those sitting around the planning table.

Where Section 3.1 proposes a curriculum for sustainability based on literature reviews, this one has elicited expert opinions directly to examine and flesh out those recommendations. Two strong caveats are required before continuing. First, the set of surveys employed comprises a response rate and sample size that is small by any standards. Those that did respond, however, share an interest and expertise in this issue and their aggregate response is illustrative and informative without attempting to be definitive. Second, no ‘perfect’ degree either exists or is desirable; each institution will and should build on its own strengths. What this chapter provides is a starting point for dialogue.

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7 Second Nature (n.d.) is a notable exception; it recommends content rather than concepts or heuristics.
3.2.1 Methods

A questionnaire was opportunistically delivered at two international sustainability conferences in 2005 to explore the issue of disciplinary mix in university sustainability education. Permission to distribute the survey was granted by the Ethics in Human Research process at the Australian National University, as well as from conference organisers at both events. The instrument was distributed in conference satchels and a collection box placed at the respective conference desks to receive them. Event attendees were reminded several times by organisers of the opportunity to participate, and the researcher was given time to explain the research during plenary sessions at each. The only difference between the first (visible in Figure 3.2) and the second questionnaire was in the header information. Despite an imperfect initial design, it was kept the same for the second application for consistency. An informative cover page was also attached to introduce the researcher, explain the research, and provide contact details should the respondent wish to withdraw consent or make later contact.

![Figure 3.2 Questionnaire used at two sustainability conferences to elicit ‘ideal’ sustainability curriculum content.](image)

Section A of the questionnaire (Figure 3.2) asked respondents to design a new, undergraduate sustainability degree program. The ARC’s hierarchical classification standard, RFCD (research field, course and discipline), was used to categorise the nominated disciplines. The hierarchical RFCD is comprised of 25 divisions subdivided into 163 disciplines and 1062 subjects. All survey data were recorded in a Microsoft Access database (see Figure 3.3). Responses on Section A were translated to two matrices, one for core curricula and one for elective. In these matrices, each respondent’s survey is a row comprising a string of numbers representing how many of
each RFCD they nominated. These rows are then easily compared with each other, and can be averaged to develop an aggregate or ‘ideal’ sustainability curriculum. The rest of the questionnaire contained open-ended questions about pedagogy, and personal information about disciplinary expertise, departmental affiliation (these two also coded to RFCD) and country of origin. Similar matrix comparison methods were used to investigate bias by comparing the disciplines in which a respondent was trained or worked, with those they nominated, to see if they appeared overly partial to the familiar. Most other tables were analysed qualitatively, using content analysis such as in the case of appropriate pedagogy.

Figure 3.3 Entity relationship diagram representing the survey database in Microsoft Access.

3.2.1.1 Survey cohorts

The survey was first distributed to attendees of the First International Conference on Ecological, Cultural, Economic and Social Sustainability, held in Hawaii at the end of February, 2005. Hawaii survey respondents numbered only 26, from a distribution of approximately 150 attendees of unknown national and disciplinary mix. As a result, the representativeness of the sample is unknown. However, the disciplinary expertise of this cohort of respondents was certainly diverse, covering all but six of the RFCD divisions. The wide disciplinary and geographical origins of attendees provided valuable depth around the range of definitions of sustainability. None were specialists in education, although many did teach within their respective institutions.

In late October of 2005, the questionnaire was distributed to attendees at the Halifax Consultation on Sustainability in Higher Education, an event funded by the Social Science Research Council of Canada. The EFS experts at this invited workshop were
participating in another research exercise involving the use of a Delphi process to develop a comprehensive research plan and strategy for the ‘field’ (Wright 2007). The 13 Halifax participants that responded (out of 34 attendees) had a larger proportion of doctorates, a narrower range of primary disciplines (largely education or environment), had earned their higher degree eight years earlier than the Hawaii cohort (1987 as compared with 1995) and were – unsurprisingly – more likely to volunteer contact details in order to be kept apprised of research findings resulting from the work. The difference in higher degree achievement may be accounted for by the fact that Halifax was largely attended by those who had achieved a high level of achievement in their field. The Hawaiian meeting was open, and included more early career researchers.

Together, the 39 respondents were from the so-called West (33), worked in universities (30), and had either Doctorate (21) or Masters (12) highest qualifications. Those qualifications were acquired over a 40 year period, from 1965 to 2005, but the average was 1992, indicating a peak of interest in sustainability. The breadth of the collective sample is shown in Figure 3.4, which identifies the RFCDs in which the total set of respondents had higher degrees, or which are housed in their current academic budget unit. The area of highest degree is more evenly dispersed than those representing departmental affiliations; those working in departments relevant to sustainability come from all over the disciplinary spectrum.

Figure 3.4 RFCD discipline coverage of Hawaii and Halifax survey respondents. Black bars denote the discipline is within the respondent’s academic unit (if they work in a university); gray bars indicate that the respondent’s highest degree is in that field. Multiple counts are possible for an individual in each category.

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*The geographic dispersion of respondents included the US (16), Canada (6), Australia (5), the United Kingdom (4) and the Netherlands (2). Two were from Africa, and several did not specify.*
Chapter 3: Key curricular concepts

3.2.1.2 Sources of bias

Disciplinary bias was only evident in the Hawaii curricula at the coarsest level of RFCD aggregation (Table 3.3). Bias was investigated by comparing the disciplines in which a respondent was trained or worked (summarised in Figure 3.4) with those he or she nominated, to see if they appeared partial to their own fields of expertise. Only six percent of subject area nominations were within the broadest area of expertise of Hawaii respondents, but they were twice as likely to nominate their own division as core than elective and 96.6% of respondents’ broad qualification areas were eventually chosen in their suggested curricula. The Halifax cohort also demonstrated minimal bias, but its narrower range of expertise made this unlikely to start with.

Table 3.3 Discipline bias demonstrated by the Hawaii cohort at each level of the RFCD classification system. Square brackets indicate that multiple subjects are chosen within the class, and contain a subject count.

<table>
<thead>
<tr>
<th>RFCD Classification Level:</th>
<th>Subject</th>
<th>Discipline</th>
<th>Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of RFCDs nominated</td>
<td>49 of 1062 (4.6%)</td>
<td>37 of 163 (4.9%)</td>
<td>21 of 25 (84%)</td>
</tr>
<tr>
<td>Number of qualifications (n=29) chosen as:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core</td>
<td>5</td>
<td>7</td>
<td>23 [24]</td>
</tr>
<tr>
<td>Elective</td>
<td>2</td>
<td>3</td>
<td>11 [14]</td>
</tr>
<tr>
<td>Either</td>
<td>7</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Both</td>
<td>0</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Neither</td>
<td>22</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Proportion of qualifications chosen:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.1%</td>
<td>31.0%</td>
<td>96.6%</td>
</tr>
<tr>
<td>Proportion of biased choices (n=467):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5%</td>
<td>1.9%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

Despite the fact that at each level of the RFCD classification there are only 15% as many classes as was in the previous level, the subject and division-level bias numbers are similar (1.5% and 1.9% respectively). Most of the nominated subjects were thus also in different disciplines, and these choices are shown at the highest division level to cover a wide range (84%) of possible areas.

Bias may also be evident by what is excluded as a result of the respondent profile. It was already stated that the respondent expertise did not cover the entire range of RFCD divisions, and some respondents did not volunteer their qualifications. Gaps in the Hawaii cohort existed in ‘Architecture and Urban Environment’, ‘Physical Sciences’, ‘Medical and Health Sciences’*, ‘Behavioural and Cognitive Science’*, ‘Law’, ‘Education’, and ‘History and Archaeology’*. Only the asterisked fields above are lacking in respondents’ highest degrees or departmental homes when the Halifax cohort is included (recall Figure 3.4). The highest ranking of these ‘gap’ divisions in nominated core curriculum was the first listed, at 10th most prevalent; the remainders were even less prominent.

Bias is also inevitably introduced by the survey design itself. By far the highest counts were for subject areas listed on the survey. The power of suggestion was very much
evident, and it must be recognised that the choice – and perhaps the phrasing and order – of these fields may impact the final results. For example, not presenting the entire range of RFCD codes, despite the opportunity provided to add to the list, may have disadvantaged fields such as behavioural sciences.

It should also be mentioned that the researcher presented material on this topic on the first day of the first conference at which the survey was conducted. This may have modified the established opinions of those responding to the survey, but is not considered to have unduly skewed findings.

Additional bias arises from the subjectivity of the researcher’s classification of the categories provided, as well as those refined and suggested by respondents. Not all researchers would have returned the same results, but because the same individual undertook both studies discussed here, the results are comparable.

With the consideration of the sources of bias addressed above, one is left with one very positive impact of the survey instrument design. The fact that the survey was undertaken outside of a real curriculum development process allowed participants to envision an ideal curriculum away from pragmatic concerns. Genuine processes are rarely able to be undertaken in such a ‘blue-sky’ environment due to disciplinary allegiances, interpersonal issues, and the burden of ensuring subjects, schools and courses can maintain viability through healthy enrolments. The avoidance of this bias must be recognised, as it is partly for the elimination of vested interests that these findings are valuable.

3.2.2 Content and structure

The part of the survey discussed here asked respondents to “[I]magine [they were] designing a new undergraduate degree in sustainability aimed at producing students with an interdisciplinary, generalist understanding of the issue” and mark a list of disciplines with a C (for core) or E (for elective) “according to [their] opinion on its role in such a course.” Respondents could refine the discipline categories provided, or add new ones. As there was no space on the questionnaire for the number of subjects per discipline to be volunteered, one subject per nominated discipline area was assumed. Results shed light on two issues around sustainability curriculum development in universities that assist at the strategic stage of planning: what might be an appropriate discipline mix, and the level of flexibility in subject choice. First, the aggregated results are given in full, including a sample curriculum which received broad agreement. Later, pedagogical recommendations and the difference between the two cohorts is discussed.

3.2.2.1 Program structure

The disciplinary component of the survey was completed by 39 respondents, who chose between three and 14 subject areas for core content, with a median and mode of ten, the same that the survey suggested would be an appropriate number to include. Electives were chosen over a wider range, with as many as 17 included in one program and three with none at all, but the mode was 13. There was no relationship between the number
nominated for core and that for elective. For example, a zero-sum equation was not apparent, where choosing a low number of core subjects left room for a large number of electives. The opposite did not occur, either, where that those that nominated many core subjects did the same for electives. The two cohorts did not differ in this respect.

The aggregate response suggests a desirable curriculum size of 19.4 subjects, exactly half core and half elective. In a three-year program such a sequence would leave room for a handful of non-specified electives. In a four-year program, fully half of the degree space would remain available for double majors or capstone graduation programs.

3.2.2.2 Disciplinary content

Only 53 different RFCD codes of various scales were suggested by the 39 respondents (39 for core, 43 for elective). Only occasionally were new fields added or the supplied ones refined although there was space for both actions. Aggregated, the popularity of the various RFCD divisions for core and elective use can be seen in Figure 3.5.

![Figure 3.5](image)

Figure 3.5 The popularity of various RFCD divisions in curricula nominated by respondents, listed in order of their nomination as core.

The ideal curriculum is compiled at an aggregated division level above, but the raw (as captured) level of subject or discipline code is also informative. Counts using the raw data show that the topics that were agreed by respondents to be important for core study do not overlap with those agreed to be valuable for elective study (Table 3.4). The lower portions of both lists (not shown), which lack consensus, do overlap. The respondents stipulated the same core content fields more frequently than electives, despite the anecdotal difficulty in real curriculum development processes of nominating those subjects which all students will do. The core areas listed in Table 3.4 were chosen in at least half of the designed programs, ecology and economics notably in over three-
quarters. Electives were more widely dispersed, with only two – human geography and anthropology – appearing in over half of the questionnaires. The sixteen areas identified in Table 3.4 provide guidance to program designers in deciding who to invite to sustainability curriculum planning processes, and what range of disciplinary ken they should be attempting to impart to undergraduate students. No obvious theoretical gaps exist if compared with common conceptions of sustainability (see Section 1.2.3).

Table 3.4 Subjects in which a high degree of agreement existed, by role, in order of priority. Percentages of consensus are given in brackets.

<table>
<thead>
<tr>
<th>Core subjects</th>
<th>Elective subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecology (82%)</td>
<td>Human geography (56%)</td>
</tr>
<tr>
<td>Economics (77%)</td>
<td>Anthropology (54%)</td>
</tr>
<tr>
<td>Applied ethics (72%)</td>
<td>History (49%)</td>
</tr>
<tr>
<td>Environmental sciences (67%)</td>
<td>Public health and epidemiology (46%)</td>
</tr>
<tr>
<td>Cultural studies (59%)</td>
<td>Sociology (46%)</td>
</tr>
<tr>
<td>Policy and political science (56%)</td>
<td>Law (46%)</td>
</tr>
<tr>
<td>Resource management (51%)</td>
<td>Philosophy (46%)</td>
</tr>
<tr>
<td>International relations or development studies (51%)</td>
<td>Business, management or accounting (44%)</td>
</tr>
</tbody>
</table>

That the most popular RFCD division nominated for elective study was ‘Studies in Human Society’ (Figure 3.5), suggests that human issues are seen as ‘optional’ and easily picked up. Methods or pure sciences made little appearance in this ‘generalist’ sustainability curriculum, but mapping was a popular elective area. Engineering was a distant second in electives (receiving 8.5% of nominations, compared with 16.5% for human society) and half of its ‘votes’ were due to geographic information systems (GIS) (captured as geomatic engineering). The other half related to the development of new technological solutions to sustainability problems. Design is certainly an important element of sustainability (Birkeland 2002), whether developing new social systems, technological tools or new uses for our by-products. A generalist in sustainability may not be expected to develop new technologies without a more quantitative background, but knowledge about the process of innovation may contribute as much to social entrepreneurship as technology research and development.

3.2.3 Appropriate pedagogy

To add to the literature-based picture of sustainability education in Section 3.1, the questionnaire also asked “What teaching methods or practical experiences should be found in such an undergraduate [generalist] sustainability program?”, and “Would these be different in a coursework graduate sustainability program?”. Respondents replied with a wide range of activities, skills, content and the desired teaching approaches; only ‘generic’ approaches are included here. Key words or themes arising in this section of the questionnaire are summarised for undergraduate education in Figure 3.6. Many of these messages are harmonious with the pedagogical characteristics of the ‘canon’ discussed earlier in the chapter.
Chapter 3: Key curricular concepts

Figure 3.6 Popularity of pedagogical methods for undergraduate sustainability education, derived from a content analysis of questionnaires.

Student experiences such as community-based outreach, field-based trips or case studies, hands-on and ‘discovery-based’ learning methods were considered valuable by the 35 who completed this section in full. Problem-based learning and research was promoted for individuals and teams, as well as the practice of dedicating considerable time to discussion and debate and hearing from experts. The idea of ‘service learning’ was mentioned most frequently (by 46% of respondents), meaning an environment where students engage in relevant public service (such as research into a policy change that affects a group of landowners), and reflect upon the experience in the classroom. This concept is analogous to the previous discussion of developing the capacity and desire for active civic engagement (see Section 3.1.2.2). Some indicated that international or intercultural experiences are desirable, even if only facilitated by information and communication technologies (ICTs). Such knowledge of and empathy for the ‘other’, whether in person or virtual, is of value.

Generic skills such as conflict resolution, cognition (e.g. critical thinking) and leadership were nominated once each, but communication skills were seen to be the most valuable of this subset. Interestingly, employers list such generic skills highly amongst desirable graduate outcomes (Brown and Clark 1997). Lectures and seminars by experts were perhaps surprisingly prevalent, but this is still the most dominant mode of study for undergraduate students by far and most of the respondents were not educationalists or self-identifying pedagogical innovators. The Socratic dialogue so characteristic of traditional liberal education appeared in five of the surveys.

Interdisciplinarity and integration received several mentions but not as many as might be expected considering the dominant rhetoric that emphasises the importance of being able to think holistically in order to solve complex problems. Teamwork was much more popular, perhaps demonstrating the sense that individual interdisciplinarians are not as valuable as disciplinary experts who are able to work with others (see Section 1.2.7). Certainly problem-based learning (as opposed to discipline-focused), team-based
student research and collaborative inquiry all support the concept of integration without calling it by name. They imply the value of integrating key disciplines and methods intentionally throughout a degree program, rather than forcing students to make the intellectual leap of integrating them afterwards. Team-teaching was not mentioned, but may be the easiest way to accomplish it.

There was no clear indication from the respondents of whether coursework graduate teaching methods should differ drastically from those used with undergraduates (54% believed it should), and – if so – how. Some of this appeared to be the result of unfamiliarity amongst informants with the (common Australian) phenomenon of graduate coursework degrees, as many assumed that such courses would be dominated by a thesis. The type of teaching to be done in graduate programs would also necessarily differ based on the undergraduate training assumed of incoming students. A slight preference was evident for more applied and solutions-oriented programs for graduates, such as policy relevance, but no pattern or agreement existed about pedagogical methods, degree of disciplinariness, independence (e.g. team work), or program flexibility.

3.2.4 Comparing two populations

The patterns are surprisingly similar between the two cohorts, considering their personal differences, but several variations in the undergraduate sustainability programs they designed are surprising. First, Halifax respondents – those who were all researchers in university EFS – nominated proportionally fewer core subjects and more electives than the multidisciplinary Hawaii cohort, resulting in a slightly larger overall program (Table 3.5). This slightly increased flexibility may be an expression of the more conceptual nature of the Halifax respondents’ field of interest. Neither formal nor informal discussions during the workshop concerned the role of individual disciplines in EFS, for example. Participants focused instead on higher level pedagogical theory and educational philosophy: it is not what you teach, but how. Hawaiian attendees were specialist in a range of sustainability approaches, theories or technologies, and by attendance at such a broadly defined sustainability conference could be assumed to have respect for the contribution that a range of disciplines make to the area.

Table 3.5 Differences in nominated program size between the Halifax and Hawaii respondent populations.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Average Core</th>
<th>Average Elective</th>
<th>Average Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawaii (2/3 of responses, n=26)</td>
<td>10</td>
<td>9.1</td>
<td>19.1</td>
</tr>
<tr>
<td>Halifax (1/3 of responses, n=13)</td>
<td>9.2</td>
<td>10.8</td>
<td>20</td>
</tr>
<tr>
<td>Both (n=39)</td>
<td>9.7</td>
<td>9.7</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Figure 3.7a compares the aggregate core programs, with solid lines representing the two cohorts. The Halifax cohort markedly emphasised the importance of philosophy (by 4.7%), and de-emphasised human society and chemistry by 3.7% and 3.5% respectively, in comparison with the Hawaii cohort. Also notable is the unanimity with
which the biological sciences are felt to be key content for sustainability graduates. Although Halifax respondents identified human society less frequently than the Hawaii cohort for core study, they promoted it as an elective subject 5.6% more than Hawaii respondents (Figure 3.7b). Both felt it was the most important elective area (recall Figure 3.5). Other differences in elective choice between the two cohorts were within two percent of each other, a margin that outstripped some fields’ aggregate scores.

**Figure 3.7** The Halifax and Hawaii a) core and b) elective programs in comparison, ordered by the difference between the two aggregates producedootnote{Line graphs are used in lieu of bar charts, although line graphs usually indicate a natural order or relationship between categories (e.g. time), for ease of comparison across a number of variables.}.
3.3 Summary of sustainability education characteristics

The future of EFS may lie in its history, and the history of EE. Looking back in order to look forward, EE and EFS have been unnecessarily handicapped by frequent changes in jargon. Four simple ideas enrich the messages of future focus and environmental literacy that have dominated the literature. They suggest that all that may be required to educate for sustainability is a structured liberal education which develops critical thinking skills, broad and integrated contextual knowledge and the desire and capacity to apply that knowledge. Adding specialist expertise in one or two fields will make the sustainability graduate an effective agent in a range of workplaces, and a valuable citizen.

This section also presents an expert-derived ‘canon’ of disciplinary content to inform the development of undergraduate curricula educating in the full breadth of sustainability. This canon includes in its core ecology, economics, applied ethics, environmental science, cultural studies, policy and political science, resource management, and international relations or development studies. Topics educating in the third key pillar of sustainability – society – are largely relegated to elective status by experts, as in existing Australian curricula (see Chapter Four). These include human geography, anthropology, history, public health and sociology. Half (9.7) of the subject nominations were for core subjects, and a majority of respondents agreed on the subject areas for the core, suggesting a broad foundation year to underpin any such program.

The value of the questionnaire is in how it gleaned the mechanics of appropriate program design from sustainability experts in an environment where they were not subject to resource pressures related to subject load and discipline viability. In fact, bias in curriculum design was only evident at broad disciplinary classes; at more detailed scales, respondents almost appeared to disfavour their own fields of expertise. The results are useful for those in fraught planning situations, but are not intended to be a template as much as a touchstone. The aggregate program is as unproven in its value as any such nascent curriculum before it is tested in the classroom.

Knowing what disciplines might best be recruited to educate for sustainability is still far from the end of the issue. Questions remain about how best to integrate recommended core disciplines with optional majors or streams. Undertaking narrow majors in combination with a broad core (such as that suggested here) may engender disciplinary experts with a sustainability ethic and a critical, integrative mindset. Custom-designed sustainability majors may be broader, likely addressing sustainability as it is understood and implemented within a larger set of disciplines (e.g. humanities), thus creating sustainability generalists. Appropriate pedagogy is also in question, although many scholars and practitioners are engaged in answering these questions, often through action research in their own classrooms (Tilbury 2004). However EFS is implemented, the spectre of indoctrination must be avoided (Hargrove 1994; Jickling 2001; Moore 2005a).

Scott (2004) paints a picture of a Citizen-Model University where “educating citizens is the primary goal” (p. 170), in sharp contrast with the market model dominant in
Australia. Not all university sectors are ready to espouse a set of fundamentals or a role in values education. Neo-liberalism seems almost daily to move Australia’s tertiary sector further from that possibility, still preferring to prepare students for specific careers from day one, despite the possibility of “deleterious effects on … a character of training … for the business of money making, and making this from the outset the object of its efforts” (Livingstone 1917, p. 22).

The context of the tertiary sector in question has to be considered in implementing curricula (Huisman 1997). The Australian sector, for example, lacks a liberal education tradition and rarely employs common foundation years in its programming. Humanist graduate characteristics – such as critical thinking, independent inquiry, problem-solving, creativity, sensitivity, empathy, foresight, self-expression, and broadened perspectives – are the same as those of EFS, and will likely result from a liberal, interdisciplinary, cosmopolitan, civic model such as described here. Of course, all truly innovative pedagogical methods hold risk for staff and students in workload, flexibility, equity and intellectual challenge (Kezar and Rhoads 2001; Tinto 2000). The biggest barrier is likely to be the nature of the modern tertiary sector in terms of its vulnerability to national funding priorities, and its culture of competition.
CHAPTER FOUR  TAKING UP SUSTAINABILITY IN AUSTRALIAN UNIVERSITIES

This chapter explores if and how four key curricular concepts for sustainability education are integrated into the Australian tertiary sector, employing a minimum of new jargon to ensure accessibility for practitioners. An comprehensive internet-based audit is undertaken to catalogue tertiary environmental and sustainability offerings and reflect upon concepts like interdisciplinarity, cosmopolitanism and civics that are associated with a liberal sustainability education. Sustainability is not found to be well integrated in coursework environmental programs in Australia. What is more, the emphasis of such programs is usually technological solutions and scientific ken, to the detriment of human cultures and behavioural change. Core curricula from existing Australian coursework programs are compared with the idealised curriculum developed from expert surveys to show that a slight rebalancing towards the human sphere may be necessary, and may indeed be already in train. The audit also reveals that program names are not always good indicators of the contents of undergraduate degree programs, as compared to postgraduate programs.

4.1 Where are we now?

Abbott (2001) describes how academic research has a repetitive nature, both laterally – between disciplines – and in time. Education can be similarly susceptible to cycles and vogues, but the degree and rate of actual change depends on how centrally a sector is managed and the effectiveness of communication. Universities are self-accrediting, develop their own curriculum, and are often competing externally and internally, diffusing the uptake of new ideas in teaching. Additionally, the language used to discuss EFS is constantly shifting, making the literature inaccessible to practitioners. Any collective choice to change our path-dependent, conservative tertiary institutions (Connor and Dovers 2003) is best informed by a snapshot of the status quo using as little new jargon as possible. Four key ideas behind much of the agreed agenda of EFS were identified in Chapter Three, as well as an aggregate ‘ideal’ disciplinary foundation. These touchstones provide structure to an evaluation of existing course offerings given here. Basic statistical clustering is then used to investigate the degree to which degree program names consistently indicate core curriculum content.

4.2 Audit methods

A detailed internet-based audit of all environmental or sustainability offerings at Australian universities was undertaken to reflect upon the uptake of key curricular concepts identified in Chapter Three. Information was collected on all universities and faculties, and any academic organisational units (AOUs) working in environment or sustainability. Attributes of relevant courses were captured, as were all their pertinent specialisations or majors. Core curricula were also collected and all subjects mentioning sustainability. The entity relationship diagram representing the structure of the Microsoft Access database used to store this information is shown in Figure 4.1.

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Over 20 days of internet research during December 2004 and January 2005, 255 relevant coursework programs were found (159 undergraduate and 96 postgraduate), and 40% of their advertising materials explicitly mentioned sustainability. Some of them were specialised (100), such as programs in sustainable engineering or business management, but the remaining 155 were what could be called ‘generalist’ (see Table 4.1). Of these, half (77) were selected for closer study of curriculum content (51 undergraduate, 26 postgraduate). The other half were not included because they were from the same institution and included very similar core (18) (e.g. Macquarie’s array of Masters programs) or because no core details could be found online (60). Only nine of the 77 audited in detail included ‘sustainability’ or ‘sustainable’ in the course name, but half of them were targeting sustainability according to their course marketing materials. The audited courses cover a wide range of names, including ‘Environmental Studies’, ‘Environmental Management’, ‘Environmental Science’, ‘Applied Science’, ‘Science’, ‘Social Science’, and ‘Development Studies’ (see Table 4.2).

**Table 4.1 Summary of audited environmental or sustainability courses, including the rationale for inclusion or culling.**

<table>
<thead>
<tr>
<th>All courses found during audit</th>
<th>255</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalist courses</td>
<td>155</td>
</tr>
<tr>
<td>Specialised courses</td>
<td>100</td>
</tr>
<tr>
<td>Generalist courses with core content</td>
<td>77 (listed in Table 4.2)</td>
</tr>
<tr>
<td>(comprising 792 core subjects)</td>
<td></td>
</tr>
<tr>
<td>Duplicate core</td>
<td>18</td>
</tr>
<tr>
<td>No core</td>
<td>60</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>51:</td>
</tr>
<tr>
<td>19 explicitly sustainability (1 by name)</td>
<td></td>
</tr>
<tr>
<td>32 not explicitly sustainability</td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>26:</td>
</tr>
<tr>
<td>19 explicitly sustainability (8 by name)</td>
<td>Total EFS</td>
</tr>
<tr>
<td>7 not explicitly sustainability</td>
<td>Total non-EFS</td>
</tr>
</tbody>
</table>

86
### Table 4.2 Australian environmental or sustainability degree programs whose core details were captured.

<table>
<thead>
<tr>
<th>University</th>
<th>Programs and Majors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Catholic University</td>
<td>B. Environmental Science</td>
</tr>
<tr>
<td>Australian National University</td>
<td>B. Science (Resource and Environmental Mgmt)</td>
</tr>
<tr>
<td>Central Queensland University</td>
<td>B. Environmental Science, M. Sustainable Development, M. Environmental Mgmt</td>
</tr>
<tr>
<td>Charles Darwin University</td>
<td>B. Environmental Science</td>
</tr>
<tr>
<td>Charles Sturt University</td>
<td>B. Environmental Science (Land and Water, Catchment Mgmt, or Mgmt), M. Environmental Mgmt and Restoration</td>
</tr>
<tr>
<td>Curtin University of Technology</td>
<td>M. Sustainability Mgmt</td>
</tr>
<tr>
<td>Deakin University</td>
<td>B. Environmental Science</td>
</tr>
<tr>
<td>Edith Cowan University</td>
<td>B/M. Science/Environmental Science (Environmental Mgmt)</td>
</tr>
<tr>
<td>Flinders University</td>
<td>B/M. Environmental Mgmt, B. Science (Environmental Science) and (Biodiversity and Conservation), M. Population and Human Resource</td>
</tr>
<tr>
<td>Griffith University</td>
<td>[Two different B. Environmental Science (two campuses), B. Arts (Environmental Mgmt and Policy), B. Environmental Planning]</td>
</tr>
<tr>
<td>James Cook University</td>
<td>B. Arts/Social Science (generic with geography major, among others), B. Social Science (Environmental Studies)</td>
</tr>
<tr>
<td>Latrobe University</td>
<td>B. Environmental Science, B. Applied Science (Environmental Science), Grad. Dip. Environmental Mgmt</td>
</tr>
<tr>
<td>Macquarie University</td>
<td>B. Environmental Mgmt, M. Environmental Education, M. Sustainable Development</td>
</tr>
<tr>
<td>Monash University</td>
<td>M. Environment and Sustainability, M. International Development and Sustainable Mgmt, B. Environmental Science, B. Science (Environmental Science)</td>
</tr>
<tr>
<td>Murdoch University</td>
<td>M. Arts (Environmentally Sustainable Development), B. Arts/Science (Sustainable Development), B. Science/Environmental Science (Environmental Science)</td>
</tr>
<tr>
<td>Queensland University of Technology</td>
<td>B. Applied Science (e.g. Environmental Science)</td>
</tr>
<tr>
<td>RMIT University</td>
<td>M. Social Science (Environment), B. Social Science (Environment), B. Environmental Science</td>
</tr>
<tr>
<td>Southern Cross University</td>
<td>B. Applied Science (Environment and Resource Mgmt)</td>
</tr>
<tr>
<td>University of Adelaide</td>
<td>B. Science (Sustainable Environments)</td>
</tr>
<tr>
<td>University of Ballarat</td>
<td>B. Applied Science (Environmental Mgmt)</td>
</tr>
<tr>
<td>University of Melbourne</td>
<td>M. of Environment (majors including Sustainable Cities, Sustainable Regions), B. Resource Mgmt</td>
</tr>
<tr>
<td>University of New England</td>
<td>B. of Environmental Science</td>
</tr>
<tr>
<td>University of New South Wales</td>
<td>M. Built Environment, B. Environmental Science, M. Environmental Mgmt</td>
</tr>
<tr>
<td>University of Notre Dame</td>
<td>Bachelor of Science (Environmental Mgmt) and (Environmental Biology)</td>
</tr>
<tr>
<td>University of Queensland</td>
<td>B. Applied Science (Sustainable Ecosystems), B. Environmental Mgmt (Sustainable Development), M. Environmental Mgmt (Sustainable Development)</td>
</tr>
<tr>
<td>University of South Australia</td>
<td>Bachelor of Applied Science (Biodiversity, Environmental and Park Mgmt)</td>
</tr>
<tr>
<td>University of Sydney</td>
<td>M. Applied Science (Environmental Science), B. Science (Environmental)</td>
</tr>
<tr>
<td>University of Tasmania</td>
<td>M. Environmental Mgmt, B. Environmental Science</td>
</tr>
<tr>
<td>University of the Sunshine Coast</td>
<td>B. Science (Environmental Science), B. Social Science</td>
</tr>
<tr>
<td>University of Western Australia</td>
<td>M. Regional Development, B. Science (Environmental Science)</td>
</tr>
<tr>
<td>University of Western Sydney</td>
<td>B/M. Social Ecology, B. Environmental Mgmt and Science</td>
</tr>
<tr>
<td>University of Wollongong</td>
<td>B/M. Environmental Science</td>
</tr>
<tr>
<td>Victoria University of Technology</td>
<td>B. Science (Ecology and Sustainability)</td>
</tr>
</tbody>
</table>

None were collected in detail at the Australian Defence Force Academy, the Australian Maritime College, Avondale College, Bond University, Swinburne University, University of Southern Queensland and the University of Technology, Sydney, because of the reasons listed earlier. Two relevant courses, at Newcastle and Canberra, were not captured because of reasons of availability; the former because the curriculum was in flux, the latter because the internet server was not operating during the period of the audit.
Sustainability bound?

For those courses captured which were of a ‘generalist’ type and had some core component distinct from other courses offered by the university (see Table 4.2), the core subject descriptions were captured and classified to RFCD, the same classification system used for Chapter Three’s questionnaires. Only one RFCD was captured per core subject, meaning a higher-level class was often used to capture the content of subjects that cover more than one lower-class element. These data were collated to form an aggregate picture of the core content and flexibility of Australian environment and sustainability degrees at both undergraduate and postgraduate levels. A snapshot of the raw core curriculum data is given in Figure 4.2 for reference. The requirements of optional strands or other non-core content was not captured. The pedagogical methods or targeted generic skills of individual subjects were not consistently available either.

![Figure 4.2 Raw counts of courses and subjects with core content in three levels of RFCD fields.](image)
using the query ‘sustainab*’, and omitting inappropriate uses of the term such as ‘sustainable competitive advantage’, common in commerce subjects. This dataset allows the institutional homes of sustainability in universities to be explored.

Despite varying search functionality and quality among university web sites, I am confident that the process was as comprehensive as possible and results are suitable for the present purpose. This methodology relies on thorough descriptions of course and subject contents on the part of universities, but the level of information captured is the same as that on which students make their enrolment decisions. Simple queries and content analysis on the lists of sustainability subjects, core curriculum subjects, and specialisations/majors can shed some light on the degree to which Australian higher education institutions are delivering EFS as described in Chapter Three.

4.3 Reflections on sustainability in university coursework programs

Kline (1995) and Carolan (2006) employ the naturalistic fallacy to explain why neither specialist nor generalist knowledge is paramount: “You cannot get ‘oughts’ from ‘izzes’” (Kline 1995, p. 9). One cannot generalise specialist scientific knowledge to develop structures for human behaviour and ethics, nor can you use big-picture knowledge of a system to solve problems without specific domain knowledge. A parallel debate between the usefulness of specialists and generalists in sustainability work (and therefore EFS) is active yet unresolved, so both modes are investigated here. There are thus two ways for sustainability to be incorporated into tertiary education: one is to ensure that all degree programs (however specialised) produce sustainability-literate graduates, the other is to produce some graduates specifically educated in the full breadth of sustainability (called ‘sustainability generalists’ here). This section begins with a brief investigation of how thoroughly sustainability is integrated across all Australian university faculties, including a discussion of the various ‘homes’ of the problem area in the academy, and then investigates the expression of the key ideas of the EFS agenda in a subset of environment and sustainability programs identified as generalist.

4.3.1 University-wide integration

In a plenary speech at the 2004 ACTS conference, Prof. John Fien envisioned a day when environmental degrees are no longer necessary because the ideals of sustainability

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1 The jellyfish is perhaps an appropriate analogy for this tension between the primacies of disciplinary versus interdisciplinary endeavour. Jellyfish move between two forms every other generation. The form most often associated with the animal is the medusa, the free-floating stage of the life cycle. The other stage is a polyp that is attached to the ocean substrate and filters passing matter like anemone, eventually maturing to release nascent medusae. The medusae cannot make more of themselves without going through the polyp stage, and vice versa. Translating to interdisciplinary endeavour, this suggests a symbiosis between the grounded disciplinary work which feeds integration; and the problem-based areas that inspire more disciplinary investigation.
are integrated into all professions. This integration has to date largely been assessed through the use of voluntary questionnaires (Bekessy and Burgman 2001; Thomas and Nicita 2002; Wolfe 2001). The list of 585 sustainability subjects offered from Australian universities compiled during this internet audit provides additional insight on the progress of this integration.

On the whole, it appears that sustainability is not thoroughly or uniformly integrated across Australian universities. The institutions vary widely in their commitment to the idea, evident by a range of 0 to 58 sustainability subjects per university (average of 14). In only five universities did all faculties have sustainability subjects, but it is important to view such coverage in relation to the diversity of university structures (Figure 4.3). The number of faculties in Australian universities ranges from three to 18, and a university that has sustainability subjects in each of three aggregated mega-faculties is not necessarily more committed to sustainability than one with relevant content in five of 18 narrowly focused faculties. What defines a faculty also differs between institutions. In older, more traditional structures the term still represents homogenous disciplinary divisions. As budgets have tightened in recent years, broad cultures of academic endeavour, or areas of application in the case of the ‘new universities’, are being increasingly consolidated in more diverse faculty units.

![Figure 4.3 Number of faculties with sustainability content mapped against the number of faculties in the university, as of 2005. Some university web sites were designed such that a comprehensive survey can not be guaranteed, so the results are separated accordingly.](image)

Thomas and Nicita’s (2002) survey of Australian universities asks whether environmentally sensitive education has been integrated across all disciplines, and finds sustainability is seen to be owned largely by one discipline or faculty. Consistent with that finding, this internet audit shows that subjects with sustainability content tend to be clustered in one faculty, with only half as many subjects in the next most dominant one (Figure 4.4). The faculty where the cluster occurs, however, differs between institutions. Of those universities whose web-search functionality meant that a comprehensive picture was acquired: science and technology faculties are the home of sustainability in 17 cases; architecture, planning or engineering in eight cases; arts, humanities or social
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Sustainability has no well-established home in academia, which is probably good news for integration, but presents a challenge for those researching in the field, especially where disciplinary categorisation is increasingly the basis of performance management.

![Figure 4.4](image)

**Figure 4.4** Integration of sustainability subjects across universities, as indicated by counts of sustainability subjects, stacked by faculty. Those shown in gray did not have comprehensive online search functionality.

The degree to which the usage of ‘sustainability’ is tokenistic might be revealed by looking at where key terms are mentioned (Figure 4.5). If the keyword appears in the subject name only, it could be there to fulfil the letter rather than the intent of some decree around integrating sustainability content. This occurred in only 39 subjects. If the term appears in the description and not in the title, its presence may be less notable and perhaps a deeper integration of the concepts at that institution can be assumed. This occurred in 236 cases. In a further 297 cases, it appeared in both name and description. This preliminary assessment suggests that tokenism is not a problem.

Also notable in this database is the fact that almost all subjects have an easily identifiable faculty home. The alternative would be a subject being a ‘university’ subject, or being delivered by an ‘umbrella’ organisation such as those often established

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2 In a further thirteen no description was available online, or the subject was found by accident and felt to be relevant, although the term may not have been present at all
to address cross-cutting problems like sustainability. Both of these options make budgeting complex: Who provides the resources? Where is the student enrolment credited? University-wide subjects do exist, particularly in universities established for a narrow niche – usually religious (e.g. the University of Notre Dame) – and are usually comprised of ethical or theological content or generic skills core to all students. ‘Umbrella’-based subjects are rare because the groupings are often virtual and dedicated largely to research; centre members come from other faculties and any subjects they offer are resourced by and credited to that home. An exception is the National Centre for Sustainability partnership led from Swinburne University of Technology, which offers graduate coursework and industry short courses in sustainability, but that centre is well staffed (neither virtual nor ‘umbrella’) and education is one of its primary interests. The barrier to interdisciplinary education arising from AOU budgets is further illustrated by Part B cases.

Figure 4.5 The location of the keyword ‘sustainab*’ in subject listings at Australian universities. The bottom half of the list may be incomplete as a result of online search functionality.

4.3.2 Educating sustainability generalists

Teaching ‘crisis’ has its limits, as seen by debates in environmental history and conservation biology about assuming a normative stance under uncertainty (Robin and Griffiths 2004; Soulé 1985). Such ill structured problems as sustainability are even
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difficult to describe thoroughly (Lattuca et al. 2004). Introductory ‘issues’ subjects are common introductions to environmental studies programs but can be negative in tone and inspire paralysis rather than action (Moore 2005a). Empowering students to respond productively calls for an education that transcends its individual components. Reprising Section 3.1, a handful of old ideas encompass a large component of the 30-plus year debate over EE and EFS. A critical, liberal education should meet the needs of sustainability, as long as it includes cosmopolitan philosophies and contexts, interdisciplinary and collaborative learning methods, and civics for the empowerment of change agents. The presence of these ideas in existing programs is explored below.

4.3.2.1 Liberal education

Able to independently form and debate opinions with peers and tutors, a liberally educated individual is also armed with knowledge of the historical, cultural and geographical contexts that should inform decision-making. In the Australian setting, liberal education has been interpreted as elasticity in course requirements. An increasingly consumer-minded student market wishes to decide for itself what subjects are worth studying, and this has resulted in increased flexibility in degree programs as well as earlier and narrower specialisation. ‘Foundation’ years do not appear in crowded, three-year programs, leaving students with neither guidance on potential paths nor a picture of how their chosen one connects with ‘neighbouring’ fields. Of the 155 generalist degrees found in the audit, 60 were so-called ‘generic’ Bachelors of Arts or Science with no core content common to all available majors or specialisations within them. Of the 77 with some core subjects (recall Table 4.2), undergraduate courses on average prescribe 12.5 subjects out of their usual 24 credit requirements. Graduate courses, in comparison, require 5.4 subjects out of a range of four to twelve subjects, depending on whether the program is Certificate, Diploma or Masters. Including the 60 without any core at all, the numbers are 6.9 and 3.2 respectively. Those explicitly educating for sustainability (according to marketing materials) have a similar core size (within 0.7 of a subject) to those that do not. A higher proportion (3/4) of relevant graduate programs found during the audit target a ‘sustainability’ market than undergraduate ones (3/8) (recall Table 4.1).³

Though the word ‘flexible’ may often be considered synonymous with liberal, flexible education often works at odds to such a goal. Without core subjects and prerequisite sequences, teaching staff cannot assume any knowledge beyond that which they themselves cover, and so knowledge is taught in chunks rather than being integrated as a degree progresses. Prerequisites are very important for areas with heavy reliance on the mastery of theory, but are just as useful for developing generic skills such as writing or team-work. In crowded programs, if there are no prerequisite subjects imparting these skills, every instructor has to include some of it, but little time can be dedicated in each

³ The differences in core size introduce some biases when aggregates for ‘EFS’ and ‘non-EFS’ are shown in Figure 4.7.
A benefit of low prerequisites is the richness that comes with having a diversity of subject area expertise in the classroom. The value in diversity is perhaps found at the end of programs, however, rather than the beginning, in so-called capstone or keystone courses that finish off a student’s intellectual development. The power of liberal education is found in the early years, where Australian students are instead specialising, or given free rein.

Querying core and sustainability subject titles and descriptions gives some preliminary insight on the balance between thinking and theory in subject content (Figure 4.6). ‘Critical’, ‘creative’, ‘problem-solving’ and ‘reflexive’ are all terms that describe some of the desirable attributes of the liberally educated person (Foster 2001). Whereas descriptions of core curriculum and sustainability subjects contained similar numbers (not percentages) of mentions of ‘creative’ and ‘reflexive’ (both low), core subjects emphasised ‘problem-solving’ more than sustainability subjects (which emphasised ‘critique’). This may indicate more pragmatic core content than in subjects offered under the guise of sustainability, but this is difficult to determine without access to the generic skills that the subjects attempt to engender, or to the teaching methods employed. In later years, however, undergraduate sustainability programs are slightly more likely than other audited programs to require real world experiences like practica.

![Figure 4.6 Content analysis showing the prevalence of keywords describing a liberal education in generalist core curriculum and sustainability subjects captured during the audit.](image)

Also indicating a lack of liberal tradition in environmental or sustainability education is the consistently strong bias towards biology and environmental science in core curriculum (Figure 4.7). The courses that explicitly mention sustainability in marketing feature more human society, economics, policy and culture and less pure science than those that do not. There appears to be some degree of transition afoot towards an education that addresses the human origins of sustainability problems, and solutions to these problems that derive from society as well as better technology and scientific understanding. Generalist environmental degrees emphasise education about the

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4 Students often complain of repetition when this happens in their programs, but the programmatic flexibility that causes it is believed by course designers to be what the student market most desires.
environment, and scientific and applied theory still dominate them. Sustainability programs are moving towards a holistic approach to educating about environment-society interactions. Despite promising trends, environmental and sustainability education in Australia is far from adopting a liberal model, however. Although disciplinary content indicates an increase of breadth – particularly in the human sphere – the increasing flexibility of programs handicaps the intentional development of expertise.

![Figure 4.7 Division level popularity by core subject count, dividing courses that explicitly mention sustainability in name or web marketing, from those that do not. RFCD divisions are ordered by the total times used by the full set of courses.](image)

4.3.2.2 Interdisciplinarity

EFS is inherently problem-based, and as such naturally requires an interdisciplinary approach in both teaching and research. As discussed in 3.1.1.2, this expertise is ancillary to disciplinary specialisation. The ARC classifies research grant applications as interdisciplinary if at least two of the 24 different RFCD division codes are involved (Lawrence Cram pers. comm. 1 Feb 2005). Using this metric, Australian environmental degrees are highly interdisciplinary. In fact, content is so broad that course interdisciplinarity is strongly correlated to the number of compulsory subjects (Figure 4.8a). Undergraduate courses contained 6.8 different RFCD divisions on average and graduate courses had four. Averaging this by the number of core subjects gives 1.7 subjects per division, but inflates program diversity. Most undergraduate courses are dominated by one division (usually biology, ecology or environmental science), with only two-thirds as many units in the second most popular division (Figure 4.8b).
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Figure 4.8 Scatterplots demonstrating the range of course structures and subject diversity in audited programs. The first graph (a) shows the relationship between core size and disciplinary breadth, using the incidence of RFCD divisions. The second (b) shows the number of subjects included in the most dominant division as mapped against the number in the second, showing the degree to which one division often dominates.

Recalling Table 3.2, interdisciplinarity is clearly more complex than undertaking subjects from a range of disciplines, which is really multidisciplinarity. Academic vogue has inflated the use of the term ‘interdisciplinarity’, giving the impression that crossing disciplines is easier to achieve than it is (Foster 1999). Terms describing integration are common in the course marketing materials and subject descriptions of Australian universities. Content analysis of core and sustainability subject descriptions can reveal if and how fields are being meaningfully combined (Figure 4.9). The various terms for cross-disciplinarity and holism occurred roughly the same number of times in core and sustainability subjects audited (the last least commonly), while ‘integration’ appeared more often in the sustainability subjects, and ‘team-work’ in the core subjects.

Figure 4.9 Content analysis of core and sustainability subject descriptions for various terms for cross-disciplinarity.

Interestingly, all the relevant key words present in core curriculum were concentrated in the first year subjects (as assumed to be indicated by the first digit of the subject number), whereas they were more evenly distributed across years in the sustainability subjects (Figure 4.10). There is often more freedom as a course progresses, and the above phenomenon may simply be reflecting the resulting bias in our core subject
dataset. But it is also possible that cross-disciplinarity, integration and teamwork are perceived to be best undertaken early in a degree, before students specialise. Alternatively, it could indicate integration as a result of large first year classes and finite university resources, such as sharing samples within groups in practicals and laboratories. As Moore (2005a) indicates, working in a group is not necessarily collaboration. Sustainability subjects deferred such activities until later years. Access to the teaching and assessment methods employed would paint a clearer picture of integration in generalist courses.

Figure 4.10 Content analysis of core and sustainability subject descriptions for various terms for cross-disciplinarity, mapped against the year of the subject as indicated by the subject number.

4.3.2.3 Cosmopolitanism

Cosmopolitanism is the ideal that all humans on earth are “equally objects of moral concern” (Miller 2002, p. 80), which originated with the Stoic philosophers of ancient Greece (when the known world was much smaller). This philosophical viewpoint and the arguments of its detractors are covered in detail in Section 3.1.2.1. The term embodies the intragenerational ethic of sustainable development that has fallen by the wayside while the world has become increasingly inequitable under globalisation. To paraphrase Aristotle, human compassion requires not only recognising that something bad has happened to someone who didn’t deserve it, but that we ourselves are (or have been) vulnerable in similar ways (Martha Nussbaum in Cohen 1996). Clearly, to see the commonalities between people throughout the world, the differences must also be studied in their spatial, historical and cultural contexts. If history, anthropology, sociology and geography are necessary cosmopolitan components of a liberal environmental education, the status quo is not good. In Australia’s universities there are optional specialisations or majors available in all four, but little core content in environmental programs that focuses on such context (Figure 4.11). Most core subjects from these disciplines were methods-oriented, again showing the primacy of ‘skills’ in utilitarian education. These areas are discussed briefly.
Figure 4.11 Prevalence of disciplines contributing to cosmopolitan world views in core subjects (description or classification area), sustainability subjects, or available major streams or specialisations.

Few core subjects were classified to the RFCD division of ‘History and Archaeology’ in either graduate or undergraduate courses (Figure 4.11). Keyword searching within core and sustainability subject descriptions shows that the mix of contexts in which ‘history’ is used is biased slightly towards environmental and scientific contexts in the core subjects, and towards social or political contexts in the sustainability subjects. Core and sustainability subjects both reflect a strong future focus (Figure 4.12). Such a perspective is reasonable considering students are best able to exact change in the future, but still calls into question their ability to consider the sequence of events which has led to status quo.

Figure 4.12 Prevalence of temporal scale keywords in core and sustainability subject titles and descriptions.

Only five anthropology subjects are found in core curricula, though some of the more numerous cultural studies subjects (15) are likely to contain some anthropological content. Sociology is more prevalent, at 22 core subjects, with most of those units sub-classified to qualitative research methods and social change.

Geography has suffered a remarkable decline in status and presence in Australian universities during the last quarter-century (Harvey et al. 2002), and is currently available as a major or strand in fewer than half (18). Stand-alone geography departments have almost disappeared, merged to maintain critical mass with other
departments. As a consequence, geography has lost its holism as the human, physical, economic, regional and quantitative branches are pulled into different units (Holmes 2002). Human geography is the most common discipline found in core from the ‘Studies in Human Society’ division (27 subjects), but it is still not required in most (73%) programs audited. Searching on the terms ‘geography’ or ‘spatial’ at a subject level, the skills of GIS and remote sensing inflate the results.

To assess cosmopolitanism in content, it may also be valuable to consider the spatial scope or sphere of interest apparent in available subjects. Figure 4.13 shows that a national focus is most dominant in core curriculum subjects, and sustainability subjects usually cut across two scales, one of which is international. That students have a national focus in their prescribed courses is not surprising given that most will work within that context. Australian universities attract a large number of international students, but few of them study the environment; business and information technology dominate (DEST 2005c). Disciplines may also have scales at which they work best, as Griffiths (2002) has observed of environmental history’s primary utility in understanding local and global issues.

![Figure 4.13 Geographical scale of curriculum content as a proxy for cosmopolitanism in all core curriculum and sustainability subjects audited.](image)

Australia may also have a national focus to its environmental education because of the dominant role of the federal government in university funding. Peter Singer and Tom Gregg (2004) recently evaluated the country’s record as a global citizen and argue that Australia – as an affluent nation – is behaving in a manner that would be considered unethical if embodied by an individual. Similarly, fewer than half of the courses surveyed (32) contain a mention of ethics, justice or equity in their core subjects. According to the Bekessy et al. (2003) discussion paper, Universities and Sustainability, published by the ACF, cultural inclusiveness is a blind spot in the sustainability ideals or implementations of any of the universities held up as delivering best practice.

Of course, cultural context need not be international in focus. In Australia, it should be remembered how Aristotle’s words were echoed in then-Prime Minister Paul Keating’s 1995 speech in Redfern, NSW, where he apologised to Aboriginal people for their treatment:
Aboriginal spirituality and cultural studies rank among the least-prevalent discipline areas in course cores (only two subjects), which may give some perspective to the ongoing societal and political conflicts experienced between Australia’s Indigenous citizens and its more recent arrivals.

The humanities are identified by Nussbaum (2002) and other proponents of liberal education (see Section 3.1.1.1) as valuable for the development of critical thinking and communication skills, as well as cosmopolitan empathy. Literature and art provide insight into other lives, but neither appears in the audit, save for two: an investigation of dystopian and utopian visions in science fiction in Murdoch University’s optional unit Futures Studies and Sustainability, and tracing environmental thought partially through Australian landscape art in the University of Western Sydney’s History of Ecological Ideas, once core to their Bachelor of Social Ecology (now defunct).

Philosophy fares better. Twenty-four core subjects are dedicated to environmental ethics and bioethics in a quarter of the 77 programs surveyed, although majors in this area are rare (recall Figure 4.11). Not surprisingly, although a quarter of audited programs require some ethics content, 42% more sustainability subjects as core subjects contain mentions of that field. Only one of each kind of subject use the term ‘philosophy’ and both of those usages imply applied content: Swinburne’s elective Philosophy and Practice of Public and Environmental Health, and the University of Queensland’s Bachelor of Applied Science core subject in Integrated Landscape Management. This language suggests a difference of content from what Nussbaum (2002) intended that is not purely academic, encouraging the uptake of rules over reasoning. Applied ethics may examine the idea of value, but whether it builds the critical capacity in logic and argument is questionable.

4.3.2.4 Civics

While governments in democratic and liberal societies such as ours aspire, through education, to create “self-managing citizens” who can then be used “as a vehicle of order and rule”, citizenship itself is socially constructed and constantly evolving (Marginson 1997, p. 6). In today’s multicultural Australia, civics must embrace difference as well as common identity; in economic rationalist Australia, civics must renew value (actual and perceived) in public institutions; in environmentally challenged Australia, civics must instruct people on how to participate in debate in their professional lives and their lives as citizens (Dovers 1999) to achieve a more sustainable society.

Civics requires concrete, historically contextualised knowledge in systems of government, law, and processes of policy-making and community engagement. The
goal of civics is not that laws and policies can be perpetuated and the students become lawful practitioners, but that these institutions can be changed for the better. As Kaufmann et al. (2006) show, one of the keys to sustainability is the training of change agents; those who can change organisations from within. Despite the agreed importance of civic education as established by the 1994 Civics Education Group, its concluding recommendations largely ignore universities (Marginson 1997).\footnote{Civics is compulsory until year 10 in Australian secondary schools.}

The idea of citizenship in Australia is amorphous. Until the 1984 amendment to the 1948 Nationality and Citizenship Act the idea of Australian citizenship was clearly grounded in what citizenship was not, with requisite debates around immigrant and Indigenous rights, rather than defining what it meant to be an Australian citizen (Hudson and Kane 2000; Marginson 1997). While national pride is healthy among Australians, especially in sporting arenas, the moral and political idea of citizenship is still lodged pre-1984. Debates in politics and the media still tend to use the blanket term ‘un-Australian’ without clarification. Australian high-schoolers are notably cynical about their (compulsory) duty to vote, too, preferring to focus on the freedoms rather than the obligations of citizenship (Print et al. 2004). Ironically, student representative government – often tokenistic and less than democratic – can help to encourage political apathy (Saha et al. 2005). Political apathy and ignorance amongst parents is also seen to contribute to such attitudes (Edwards et al. 2006; McAllister 1998). Environmental civics are not healthy either, according to the NSW government’s set of longitudinal surveys on environmental concern. When respondents are asked to list the top two concerns for the NSW government, the ‘environment’ (excepting the subclass on water and drought) has decreased from 14% to 6% since the surveys began in 1997. Other public goods such as health and education also declined since the 2003 survey, with the only significant increases found in public transport, railways, roads and traffic (NSW Department of Environmental Conservation 2006).

Civics in a university setting can be found in subjects and majors in political science, policy, or law, though the term is rarely mentioned by name in Australian higher education (Figure 4.14). Citizenship and governance, similarly, rarely appear; when they do it is often in a corporate context. Some novel core subjects in the area are being designed specifically for sustainability courses (e.g. Environmental Governance and Citizenship at Monash University). Whereas law usually appears as core subjects or individual electives, policy and political science are more often subcomponents of core and sustainability subjects, appearing as terms in the description but not the titles or RFCD classification. Though just over half of all generalist courses (40) had some relevant content in their degrees, the focus on law emphasises a static impression of citizenship.
Civics is also engendered by a mode of teaching that is engaging and democratic, ideally featuring real-life opportunities to participate in community-based projects or other service learning. These active and authentic methods also feature in responses to the expert survey discussed in Section 3.2.3. This internet-based audit could not capture pedagogical methods employed by subjects. Keyword searches turned up many case- or problem-based subjects, but no clear suggestion of the use of democratic, collaborative learning approaches, service learning or other real world engagement in either core or sustainability subjects. The barriers to such pedagogy are many, as discussed in Section 3.1.1.2 in relation to ‘type C’ interdisciplinarity.

4.4 Idealised vs. actual curriculum

Section 3.2 identified a number of desirable characteristics of undergraduate sustainability courses as gleaned from experts in the field. As both the results of that survey and this audit are classified in the same RFCD system, it is a relatively simple undertaking to compare them. Doing so does not imply that all courses should follow any such template, but supplies a sense of which fields are being emphasised in existing programs, perhaps to the detriment of others. Each university will and should have its own strengths and target particular student and job markets. In later, case-based stages of this research the experience of the broadly educated sustainability undergraduate was the focus, and for this purpose a template of this kind is useful.

The undergraduate course design aggregated from survey responses is shown by solid lined areas in Figure 4.15, itemised by core and elective. The aggregate program core derived from audited Australian undergraduate programs is shown in a bold line, and the dashed line shows the aggregate core from relevant postgraduate coursework degrees. This preliminary view shows not only that existing undergraduate and graduate

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6 For example, Baxter et al. (1999) feel that the dominance of science and technology in Australian wildlife management courses neglects human systems to their detriment (see also Giacomelli et al. 2003).
programs differ in discipline focus but that the aggregate, ‘idealised’ curriculum differs considerably from both of these.

![Graph showing percent of nominations for different subjects.](image)

**Figure 4.15 Aggregate survey curriculum as compared with aggregates generated from Australian environmental and sustainability programs.**

As mentioned in Section 3.2.2.1, respondents identified an average of 19.8 disciplines, out of which 10.3 were considered ‘core’. Assuming only one subject per discipline nominated by respondents (which is questionable), this translates to an ‘ideal’ program where 52% of subjects are compulsory. The same average was found amongst those relevant Australian undergraduate courses that specified their core content. Assuming a three-year, 24 subject course (as is typical in Australia) 52% translates to 12.5 core subjects and means that 8% of nominations in both surveys represents one full subject. This allows the content of the two ‘aggregate’ undergraduate courses to be compared as shown in Figure 4.16. Note that this figure is ordered by the degree of difference between the ideal and actual aggregate curricula, so the division names are in different positions to the previous one.

Figure 4.16 suggests some possible changes required in order to educate for sustainability in undergraduate programs, and shows that those courses explicitly educating for sustainability according to marketing materials are approaching the ‘ideal’ in all areas except policy and philosophy. In its ‘see-saw’ appearance, Figure 4.16 could be interpreted to say the balance of existing courses simply needs to be adjusted. Sciences like biology, chemistry, earth science and mathematics/statistics as well as

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7 This is almost halved (6.9) if all audited courses are included, including those without core.
applied fields such as environmental science – appearing on the right-hand side of the see-saw – are emphasised in Australian program cores. The traditional humanities (language and culture, philosophy, history) and more pragmatic disciplines such as policy and political science, economics, management, and the built environment – appearing on the left-hand side – appear to be underrepresented.

![Figure 4.16 Number of core subjects in each division in aggregates based on survey and actual Australian undergraduate courses. The eight percent gridlines demarcate ‘one subject’ thresholds.](image)

Consider the two different eight-subject ‘foundation years’ that could be derived from these two surveys (Table 4.3). The foundation year based on existing curriculum appears to emphasise the idea that the solution to sustainability lies in technology and science, rather than societal and individual behavioural change. The persistent Australian focus on science and innovation as a solution to future problems may be a reflection of language used in national debate. The fact that government at all levels in Australia uses the term ESD (Robin 2007) – qualifying sustainable development with ‘ecologically’, which is widely-accepted to exclude humans (Bowers 2001b) – may give primacy to nature over society.

The most pressing deficiency in existing programs is the RFCD ‘Policy and Political Science’, a proposition supported by the discussion in Chapter Three about the importance of these fields in creating active citizens. ‘Philosophy and Religion’, the next most unrepresented, tackles big questions around how humans should live, and as a discipline contributes to critical considerations of identity, values and the ‘other’. ‘Language and Culture’ supply necessary contextual knowledge for complex decision-making and help in identifying meaningful long-term societal goals (Fischer et al. in review). Literature, for example, provides immersive experiences of other lives and
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minds otherwise inaccessible. These disciplines all clearly contribute to education for sustainability, but are often overlooked in curriculum design.

Table 4.3 Sample nine-subject foundation developed from survey, and the aggregate from existing undergraduate programs. This calculation is based on a 12.5 subject core (the Australian average) but only areas that round up to at least a full subject are included in each.

<table>
<thead>
<tr>
<th>Survey-based ‘ideal’ core program</th>
<th>Existing programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological sciences (1.5, e.g. ecology)</td>
<td>Biological sciences (3)</td>
</tr>
<tr>
<td>Agricultural, veterinary and environmental sciences (1.5, e.g. natural resource management)</td>
<td>Agricultural, veterinary and environmental sciences (2)</td>
</tr>
<tr>
<td>Policy and political science (1.5, e.g. policy, international relations, development studies)</td>
<td>Earth sciences (1)</td>
</tr>
<tr>
<td>Philosophy and religion (1.5)</td>
<td>Chemical sciences (1)</td>
</tr>
<tr>
<td>Studies in human society (1, e.g. human geography)</td>
<td>Studies in human society (1)</td>
</tr>
<tr>
<td>Economics (1)</td>
<td>Mathematical sciences (1, usually statistics)</td>
</tr>
<tr>
<td>Language and culture (1, e.g. cultural studies)</td>
<td></td>
</tr>
</tbody>
</table>

The lowest surveyed field included ranked .76 of a subject; the next closest was .57. The lowest actual field included ranked .95; the next closest was .66.

4.5 What’s in a name?

While undertaking the audit that has been discussed in this chapter, it was not always obvious which course names should be included in my searches. How meaningfully are Australian environmental and sustainability courses named? Offerings like environmental studies, environmental science and environmental or resource management boomed in the 1970s when environmental impact statements became legislated, environmental agencies were established, and employment increased accordingly. Problem-based study around the environment is now available at most Australian universities, although its market share has been sagging (see Section 2.3). A voluntary questionnaire was used to produce Cosgrove and Thomas’ (1996) typology, which finds ‘Environmental Studies’ courses emphasising biophysical and social environments, ‘Environmental Science’ the biophysical environments only, and ‘Environmental Management’ (EM) or ‘Natural Resource Management’ (NRM) courses focusing on biophysical environments within a social context. Baxter et al. (1999) identify three similar types of training from the compulsory subjects of 12 undergraduate degrees related to wildlife management: managers of ecological systems, the environment, and human systems, respectively. Sustainability degrees are not explicitly discussed in either of those surveys, but are increasing in number.

This section uses a comprehensive internet-based audit undertaken of environmental and sustainability programs in early 2005 to examine past findings and extend them to include sustainability. As already discussed, the core curricula of 77 relevant programs were classified to the ARC’s RFCD standard (recall the list of courses in Table 4.2, page 87). This produced a 77 by 20 cell spreadsheet where every row is a program, and each column an RFCD division (the highest level). Each cell of that matrix holds the number of subjects of each discipline that were present in the core of each program.
Sustainability bound?

When the rows of undergraduate courses with similar names are averaged together, some differences in disciplinary content and core sizes are revealed (Figure 4.17). For example, those who study sustainability or the environment through an undergraduate ‘Arts’ or ‘Social Science’ degree will study subjects in human society, environmental science, philosophy, culture, policy, and economics, along with practical or academic skills, despite having the smallest core sizes (nine subjects). EM undergraduate degrees are more operationally focused, with subjects in environmental science, biology, engineering and design, economics, and ICT (where decision support systems are counted), and have the largest cores (15 subjects). ‘Science’ programs come in between, with 12.7, mostly science subjects.

Figure 4.17 Average undergraduate program core contents by course name, noting the number of such programs captured, and the mean number of subjects stipulated for each group.

Graduate coursework programs attract a sophisticated audience that targets specific skills in their often fee-paying higher study. It is here that ‘sustainability’ and ‘sustainable development’ showed up in degree names. The careful niches that graduate programs are designed to fill make it more difficult to average them by name, and the smaller cores mean that one or two fields often dominate. Clear differences in disciplinary content are still visible (Figure 4.18). Although environmental science subjects are most popular overall, social science programs stipulated human society, science degrees stipulated biology, and sustainable development programs stipulated business just as frequently. The same trend in core size is seen as in the undergraduate subjects: Students studying to become environmental managers and scientists take the largest number of core subjects, social and sustainability specialists the fewest.
Figure 4.18 Average graduate program core contents by course name, noting the number of such programs captured, and the mean number of subjects stipulated for each group.

But how much variance exists within such aggregates? Is there consistency in what courses of the same name contain at different universities? These are particularly interesting questions in a diffuse field that lacks external accreditation standards. A statistical clustering method called $k$-means is employed to attempt to answer these questions (using XLStat, Addinsoft 1995-2004). The goal is to determine whether the courses clustered in any way based on their disciplinary content, and if those clusters then mapped logically to course names.

$k$-means clustering is an algorithm that searches for clusters amongst observations. The searched ‘space’ has as many dimensions as there are variables. This ‘space’ has 20 dimensions, one for each of the RFCD divisions in which the 77 courses have subjects. This ‘space’ is much more complex than the three dimensions humans can assess visually. The analyst begins by specifying the number of classes to find, called the $k$, and the algorithm places that many centroids (or points around which to cluster) randomly in that ‘space’. Those nuclei have variables in all the same dimensions, so they can be pictured as randomly designed courses that act as hubs. Each real case is assigned to its ‘closest’ hub, which is the one it resembles the most, comparing all the variables. Each centroid is then moved to the centre of mass of those courses assigned to it, which changes its curriculum content to an average of those in its cluster. Subsequent iterations of that process should improve homogeneity within clusters. The algorithm stops when little improvement is made with each new cycle.

With the high dimensionality of these ‘spaces’ it is impossible to know if there are clusters to be found (the data may be random) or how many exist. If the data is not clustered, each run of the randomly seeded algorithm is likely to give a completely
different answer, even for the same $k$. Choosing the ideal $k$ is also difficult. The elbow criterion rule suggests that the ideal number of classes occurs where adding one more is not offset by a gain in performance that justifies the difficulty in interpretation that additional classes bring. Finding the elbow requires classifying the data for a range of $k$ values and graphing explained variance of each ‘solution’. The ‘elbows’ in Figure 4.19 suggest three classes exist for both datasets, but in reality neither the undergraduate or graduate sets were naturally clustered. Totally different solutions are produced by different runs using the same $k$, and very little (60%) of the variance in the data is explained even with many classes.

![Figure 4.19 Seeking the elbow criterion. The number of classes used in k-means clustering for the undergraduate and graduate courses, mapped against the percent of the variance in the data sets that exists between clusters. This is the inverse of that within clusters, in which a low value indicates higher homogeneity.](image)

Using one three-cluster classification of the undergraduate courses, the types isolated delineate distinct core sizes as well as subject content (Table 4.4). Each cluster is described by averaging core content across the rows representing its members, but there is plenty of variance within each class. The actual courses that lie closest to each cluster’s centroid are indicative of the curriculum mix represented by each cluster. The three undergraduate archetypes are informative of broad approaches to undergraduate curriculum, if not course naming; in all three cases, the course ‘closest’ to the centroid is called ‘Environmental Science’. These three groups also align broadly with the program classifications identified by others, although the course names so clustered are not indicative of those groups. A more detailed classification (of $k=7$) on the undergraduate database further shows that within the major sectors or ‘cultures’, course names are largely interchangeable. For example, ‘Applied Science’, ‘Environmental Science’ and ‘Science’ degrees are indistinguishable from one another based on their core content, though they are all strongly dominated by biological sciences and environmental sciences.
Table 4.4 Undergraduate program clusters found, matched with classifications from the literature.

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average or archetypical program</strong></td>
<td>19.8 core subjects, primarily biology and chemistry, with some maths and engineering</td>
<td>13.8 core subjects, primarily biology, environmental science and earth science</td>
</tr>
<tr>
<td><strong>Number of members</strong></td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td><strong>Closest course to centroid/archetype</strong></td>
<td>BEnvSci (Griffith)</td>
<td>BEnvSci (Central Queensland)</td>
</tr>
<tr>
<td><strong>Career direction</strong> (Baxter et al. 1999)</td>
<td>Environmental systems manager</td>
<td>Environment manager</td>
</tr>
<tr>
<td><strong>Environmental course type</strong> (Cosgrove and Thomas 1999)</td>
<td>Environmental science</td>
<td>Environmental or resource management</td>
</tr>
</tbody>
</table>

The graduate classification does not match the literature as much as the undergraduate one, but course names are clearly grouped better. The three clusters of graduate programs isolated four EM courses appropriately, as well as two small, exclusively social programs (see Table 4.5). Left over is a mix of 20 dissimilar courses averaging 4.7 core subjects including a range of relevant fields. Despite the ‘elbow’ at three, it appears more clusters may be present, and this is suggested also by the popularity in the market of niche-based graduate coursework qualifications. Another classification (of \( k=5 \)) of the graduate set showed a similar lack of structure, except again in EM. Two neighbouring classes held nine EM degrees and one social science program; outside those classes only two EM degrees were found. The good result here was likely because of the higher core sizes in EM programs; a lack of data cannot be clustered.

Table 4.5 Descriptions of graduate program classes found.

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average or archetypical program</strong></td>
<td>10 core subjects, primarily environmental science, biology, engineering and health</td>
<td>4.7 core subjects, including environmental science, human society, biology, law and business</td>
</tr>
<tr>
<td><strong>Number of members</strong></td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td><strong>Closest course to centroid</strong></td>
<td>MEnvMgmt (Central Queensland)</td>
<td>MEnv (Melbourne)</td>
</tr>
</tbody>
</table>

Although there are technical explanations mismatch between clusters and names, one is left with the sense that a degree name is just as likely to be a structural (named consistently with the faculty offering the program, for instance) or financial decision (one based on market surveys), as one representing the core curriculum involved. Once these other pressures provide course names, the curriculum is then developed via processes that are easily affected by the education, research interests and socialised belief structures of those designing it (Lattuca and Stark 1994) or institutional history (Harvey et al. 2002). Programs also vary widely in the number of subjects they
Sustainability bound?

stipulate. More paradigmatically defined or practical courses have a clearer set of skills to impart than those aimed at a wider path.

The ambiguity of sustainability and environment is belied by the diversity within programs named for them. A remarkably wide choice of content and flexibility is available depending on student interests and life circumstances, and career paths have adapted to this variety (see the end of Section 1.2.8). The Environment Institute of Australia and New Zealand has developed an accreditation program that does not require any specific academic requirements (EIANZ 2003). Instead, individual prerequisites include a ‘relevant’ environmental degree and work experience in the area of accreditation. Similarly, employers stipulate desirable qualities rather than specific degree names in job advertisements (Brown and Clarke 1997; Thomas and Nicita 2003). Such findings encourage thorough research on the part of prospective students when they are planning to undertake further study.

4.6 Status quo

Sustainability is currently not well integrated across universities, but where the idea is being adopted, it seems to be happening in a meaningful fashion. The diffuse nature of the area challenges the institutional structures of universities. Those universities that are building cross-campus structures are shying away from using them for teaching. From this survey it appears that coursework degrees remain more concerned with understanding the environment alone, than human interactions with it. In addition, demand for marketable skills; named, specialised degrees; and flexible program designs increases the modularity and utilitarianism of university offerings – a phenomenon that works against the needs of education for sustainability.

Sustainability courses should be more liberal, prescribed, educate the citizen as well as the practitioner, and give historical, cultural and spatial context to choices and actions. Liberal study – not flexible study – creates critical thinkers, and the lack of foundational years risks impoverishing graduate outcomes. More rigid structures allow prerequisites to be assumed, enabling lecturers to assess on cumulative and integrated – rather than module-based – learning. Interdisciplinarity can be achieved through the practice of integration methods, and by combining student cohorts or years for detailed study of a common theme or problem. Cosmopolitan philosophies can be imparted through core studies in anthropology, geography, sociology and history, and perhaps the neglected field of literature. The immersive experience of good fiction may be the best way to impart a real sense of the ‘other’. Similarly, civics content must be further developed, possibly through student outreach into real policy and political issues (so-called ‘service learning’). Policy is the most pressing deficit of existing programs. Finally, the perception that sciences, methodologies and technologies are the only justifiable core content must be dispelled. Humans are novel and complex and their beliefs, motivations, histories, and cultures can not just be ‘picked up’. It is, after all, through human acts that sustainability will be achieved. Generally, the balance of content should be shifted towards the humanities and social sciences and slightly away from its current...
science focus. Future work should attempt to better capture and assess pedagogical methods and generic skills in existing programs.

Peripherally, the course names under which the environment and sustainability are studied in Australia show that while practical programs such as EM cluster relatively logically, other programs (particularly the undergraduate ones) are interchangeable within broad disciplinary sectors such as science and social science. One explanation is that curriculum tends to ‘evolve’ from staff bias, but course names are also often chosen for market value or to match the branding of particular faculties. Such ‘environmental determinism’ results in confusion for the student and the job marketplace.
CHAPTER FIVE     THEORISING HIGHER EDUCATION

Curriculum is the abiding interest of Chapters Three and Four, but such selectively narrow studies of EFS may be one of the reasons for the impasse between literature and practice. While this chapter may appear at first glance to be an apology for inaction, the larger context of university, discipline and individual must be considered to understand the impacts of modifying any one element. This chapter reviews literature from sociology and institutional design to support the importance of a systemic, ‘new institutionalist’ approach to studying cases of sustainability education. Such an approach considers how policy implementation (such as that for EFS) is affected by the pressures of the corporate and academic enterprise, the concerns of individual career progression and the need for maintaining progress in disciplinary expertise.

5.1 Breaking the impasse

Universities in Australia have undoubtedly been slow to adopt sustainability education as a guiding principle.¹ It could even be said that universities in general take an ‘exceptionalist’ position within educational institutions on the matter, in the manner of refusing to acknowledge or participate in a practice or principle that is widely accepted.² ‘Exceptionalism’ generally holds a negative connotation, and is used most often to describe nations that perceive themselves as holding a special role or destiny denied to others and thus somehow not subject to the same laws and norms (OED). If universities are exceptional among institutes of learning around sustainability, however, they are also exceptional among industries in the same terms. Education as a whole consistently contributes 4.8% to Australia’s GDP (1990 to 2006 data, ABS 2006) and deep market forces are at play in the higher education sector in particular. The EFS literature to date has largely been produced from within more liberal educational systems, or by primary and secondary educators whose sectors are centrally directed and whose practitioners have the same field of training as its scholars. If universities are exceptional, it is partially because EFS has not produced a set of norms or implementation recommendations that take into account the diverse needs of universities, much less the historically instrumentalist Australian sector. The difficulty of matching fractious institutional (sub)cultures to narrow agendas (Gornitzka 1999;

¹ During the audit of sustainability offerings discussed in Chapter Four, university strategic plans were also searched for mentions of sustainability. Only four had a thorough sustainability ethic (not obviously connected to practice); seven did not discuss the concept as relevant to all university operations and activities; 14 considered it in purely financial terms, or directed outside of the university only (e.g. community outreach), and the rest either had no mention (13) or did not make the plans available (4). Talloires signatory universities were included in all categories.

² The principle is not as widely accepted as might be assumed if only action plans and policies were consulted (Fien 2000; Jickling 2001; Scott and Gough 2006; Wals and Jickling 2002).

Some EFS implementation documents seem to lack awareness of what makes universities different, or the complex realities of the sector. For example, the 2002 NSW CEE EFS action plan recommends that universities make more environmental subjects available despite downturns in enrolments for existing environmental offerings at a course and subject level.\(^3\) Radical structural and philosophical changes (Lautensach 2004; Moore 2005b; Verbitskaya et al. 2002) or new incentive schemes (Brennan and Pettit 1991; Dearn 2006; O’Meara 2006) are commonly suggested to create a more hospitable climate in universities for one kind of literacy or academic activity (Gough and Scott 2001) with little concern on the impact on others. Predicating progress on such “design de novo” (Goodin 1996, p. 30) can be unhelpful, polarising and unrealistic.

The problem is not in making ambitious recommendations, but in doing so without also presenting the reasons some of the barriers exist. History is expressed in institutions by “standard operating procedures, professional rules and…elementary rules of thumb” (March and Olsen 1984; see also Stein 1997). Institutions ‘learn’ to do certain things from experience, and the process of facilitating some activities over others is on the balance advantageous, despite presenting some barriers (Moore 2005c). Recommendations for university change should recognise those structures that are still meeting the needs for which they arose, and develop additive or compromise structures for EFS in consideration of maintaining their function. A rejection of such transformative or ‘obliterative’ change (Pollitt 2000) is reflected in this statement by environmental risk expert, Su Wild River:

> It’s funny, I started off with all my environmental work as a real change agent, and I feel like what I’ve become in my maturity is an agent of stability. Somebody says, “Let’s change everything”, and I go, “But, why? Let’s just fix the funny little things that are broken and leave everything else as it is because it’s working alright. (pers. comm. 17 Aug 2006)

Teaching and research are accepted by most as being the key elements of academic life, although administration and outreach tasks have also been increasingly common.\(^4\) Sporn (1996) identifies five characteristics of universities that render them particularly complex organisms from the point of view of management and change. First, the fragmentation of academic life into research, teaching, administration and outreach elements results in a confusing mixture of objectives (see also Lattuca 2002; Moore 2005c). Second, universities have a large number of “constituencies” (Sporn 1996, p. 42), even within cohorts of clients: for example, students can be school leavers or mature-aged, full time or part, coursework or research. Third, goals are defined differently by those cohorts and constituencies and so it is difficult to define a consistent

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\(^3\) For details of this downturn, see Section 3.3, 8.4.1.1, or such recent articles as Macnamara 2007.

\(^4\) The strong symbiotic connection often assumed to exist in universities between teaching and research may be a furphy. In Australia, their quality has a negative correlation for individuals and departmental aggregations, suggesting a ‘zero-sum game’ is at play (Moses 1990; Ramsden and Moses 1992).
standard of success, especially for human ‘products’. Fourth, academics generally value autonomy in their work over collective action. Finally, and most importantly for this chapter, higher education institutions are highly vulnerable to changes in their political and social environment. These characteristics are combined in a relatively flat structural arrangement of loosely coupled subunits. Such autonomy at the scale of units and individuals makes universities uneven policy instruments (Dovers 2005a); “when the policy is fuzzy in the first place, the problems are compounded” (McInnis 1996, p. 103).

This complex setting presents challenges to tinkering with structures and incentives to advance the sustainability agenda at the level of university, academy and individual academic. The following key questions provide a framework for exploring some bridging theory from the fields of sociology and institutional design:

- Are universities demonstrating an excessive resistance to the EFS agenda, or a healthy resilience against social engineering, indoctrination, and intellectual faddism?
- How do higher education managers respond to external pressures of this kind, and what is the impact on the sector as a whole?
- How does the complex environment affect how individuals can adapt to localised incentives or policy initiatives while maintaining successful academic careers?

Since this thesis is not about social theory, a critical treatment of the theories has been set aside in favour of applying them to the context of EFS. This chapter thus draws mostly on those individuals that have taken up the role of reviewing, synthesising and interpreting such foundational work for specific applications. Top-down (enterprise, discipline) and bottom-up (individual career) perspectives are covered, as well as some attempts to unify them. These perspectives are deeply interconnected. The various, overlapping theories act as lenses that shape perceptions and thus uptake of EFS. The goal is not to choose ‘which’ is at play, but to understand the composite picture (Gornitzka 1999), and to learn to read across the warp and weft of threads connecting micro and macro phenomena. Connecting to these theories help to make cases serve as exemplars of larger truths, as Fein (2002) states is necessary to make progress in EFS. A ‘new institutionalist’ approach to organisational studies enables a systemic view of higher education.

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5 This may be why so few league table systems for assessing university quality focus on output indicators, instead of inputs (Dill and Soo 2005).

6 For example, in the UK, there was a central government initiative for embedding Enterprise in Higher Education (EHE) through universities in the 1980s (Jones 1996). This work-focused program challenged academic isolation and freedom and faced many challenges in implementation.

7 Sustainability is also an issue for general staff on campuses, like those engaged in purchasing or facilities management, but this thesis is concerned with the academic staff in particular.
5.2 New institutionalism - linking macro and micro views

Every social actor knows a great deal about the conditions of reproduction of the society of which he or she is a member. (Giddens 1979, p. 5)

Balancing structure and individual agency has been a major theme throughout the history of the social sciences. Early structuralist theorists modelled individual desires as determined (and subsumed) by collective institutions, a position often criticised as promoting an ‘oversocialised’ conception of human behaviour. Later theorists focused on the role of individual choice in rejection of such structural determinism, presenting an ‘undersocialised’ archetype of action like the agency model used in neo-classical economics. New institutionalism (a.k.a. neo-institutionalism) attempts to rationalise the two by recognising that they occur simultaneously: individual desires and motivations are deeply embedded in a collective context that is subject to the tempering effect of institutions, and it is the combined incidence of individual actions that construct and validate the structures by which those actions are constrained and judged. Why educate your children? Why become a university-based intellectual? Why seek peer review? In risk management terms, doing so provides the opportunity for legitimacy and equity (pursuing norms) and elevation or advantage (exceeding them) (Fox 1992), although the benchmarks for achieving each inexorably ratchet upwards. The prevalence of choice makes it rational to design structures that reduce the transaction costs of making the most common ones, and renders them even easier to choose in future (North 1990). Although new institutionalism is not introduced here to serve as a rigid analytical construct, social network analysis methods are applied in Chapter Seven consistently with neo-institutionalist thinking: patterns of collaboration reveal institutional pressures, while perpetuating them. Goodin (1996) identifies seven propositions that delineate the theoretical tradition as it is embodied in social sciences like history, sociology, anthropology, economics and political science (see also Powell and DiMaggio 1991).

Table 5.1 Sequence of propositions delineating neo-institutionalism in the social sciences (Goodin 1996, p. 19-20).

1. Individual agents and groups pursue their respective projects in a context that is collectively constrained.
2. Those constraints take the form of institutions – organised patterns of socially constructed norms and roles, and the socially prescribed behaviours expected of occupants of those roles – that are created and re-created over time.
3. Constraining though they are, those constraints nonetheless are in various other respects advantageous to individuals and groups in the pursuit of their own more particular projects.
4. The same contextual factors that constrain individual and group actions also shape the desires, preferences, and motives of those individual and group agents.
5. Those constraints characteristically have historical roots, as artefactual residuals of past actions and choices.
6. Those constraints embody, preserve, and impart differential power resources with respect to various individuals and groups.8
7. Individual and group action, contextually constrained and socially shaped though it may be, is the engine that drives social life.

8 Goodin (1996, p. 16) cites Schattschneider accordingly, that “organisation is the mobilisation of bias”.

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Institutional structures enable action as well as limiting it, though it does not consistently do one or the other through time or in different contexts (Frumkin and Galaskiewicz 2004). There are variations in how neo-institutionalist thinking is applied in sociology, particularly around the degree to which structures are seen as ‘winning’ in the tug-of-war between individual and institution. Anthony Giddens is seen as radical by Goodin, but Giddens’ theory of structuration also describes a recursive relationship or duality between structures and systems (see Figure 5.1) that appears consistent with Goodin’s (DiMaggio and Powell 1983). While Giddens’ perspective is often negative, focusing on the “unintended consequences of action”, his work is useful to scholars of higher education “in so far as [those unintended consequences] are systematically incorporated within the process of reproduction of institutions” (1979, p. 59). The cases to come in Part B illustrate several good examples of such entrenched feed-back loops.

**Figure 5.1 The duality of structuration processes (adapted from Giddens 1979, pp. 66, 71).**

Individual choices dictate the viability of the institutional forms that exist for facilitating different life and career paths. The available institutional forms also limit the kinds of choices that can be made. Changing either means changing both, so it is not surprising it happens so rarely. Neo-institutionalist approaches to studying organisational change are unified by two key characteristics:

… a shared antagonism to the idea that efficiency and market competition are the driving forces behind all organizational change, and … a shared agreement that much organizational structure and change derives from efforts to create or conform to categories and practices that give classificatory meaning to the social world. (Brint and Karabel 1991, p. 342)

Institutions are thus vulnerable to all the same irrationalities as the humans that comprised them through repeated action and valuing of outcomes. Sharp (2002) identifies “the myth of the rational university” as a barrier to systemic transformations such as campus greening: “it propagates the assumption that universities have attained the highest possible levels of functionality and that whatever is lacking must be accepted as an inevitable limitation of the system” (p. 136). This is undoubtedly the case, but that embedded irrationality reflects the complexity of academic life, and the

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9 DiMaggio and Powell pithily parphrased Thomas Schelling’s 1978 book *Micromotives and Macrobehaviour* to summarise this phenomenon: “Organisations in a structured field respond to an environment that consists of other organisations responding to their environment, which consists of organisations responding to an environment of organisations’ responses” (1983, p. 149).
earlier attempts humans have made to reduce the uncertainty in that complex experience. It is valuable to identify the irrationalities that conflict with cognition and action of a particular kind, but neo-institutionalist theory encourages understanding of the whole system. In universities, such research provides insight into the human reasons why such ‘bounded rationality’ was entrenched in the first instance.

5.3 Resistance or resilience?

Insofar as the social world is accident-prone, we might want to design around the risk of accidents, seeking robust institutions that can withstand the various shocks that will inevitably befall them. Insofar as the social world is subject to evolutionary pressures, we might want to apply design principles to reshape the selection criteria and social reward structures according to which some innovations succeed and others fail. (Goodin 1996, p. 29)

In exploring the history of institutions, Edward Shils (1975, p. 28) recalls 17th century philosopher Thomas Hobbes’ idea of the “state of nature as a condition of scarcity”. Conflict will inevitably arise between individual interests, but identifying shared values (the ‘first principles’ of the collective) can allow those interests to be “harmonised, compromised, or fused” (Shils 1975, p. 28). Shils goes on to observe that valued institutions are the only way of “accounting for the existence of order in society, in the face of the permanently present possibility of conflicts over the allocation of scarce values” (1975, p. 28). Goodin (1996) notes that education is included as one of Schmuel Eisenstadt’s list of six foundational social institutions, along with family and kinship, economics, politics, cultural institutions and stratification. Education is a cultural institution, and is socially constructed in that it is only valuable insofar as everyone agrees to value it (Stein 1997). Education ‘socialises the young’ and transmits a society’s cultural heritage between generations. Higher education is different to primary, secondary, or technical tertiary training, because of its role in extending knowledge as well as transmitting it. The cultural institution of ‘academy’ refers to an assemblage of scholarly professionals and comprises sets of disciplinary peers.10 The built (or online) university enterprise is an organisational institution (Gough and Scott 2001) and is thus only partially coincident with the academy, comprising also students who may or may not aspire to academic careers, and a majority of non-academic staff members (around 57% in Australia) (DEST 2005b).11 The theories of institutional design and organisational learning covered here may operate for any such aggregates: academy, discipline, or corporate university entity.

10 Disciplines are also cherished institutions whose characteristics and traditions we have already discussed in Chapter One.

11 The lack of synchrony between academy and university is evident by the practice whereby scholarly output by general staff members is not accredited to the institution unless that member also has an affiliation with an academic unit (David Carpenter pers. comm. 10 Aug 2006).
5.3.1 Institutional design

Goodin (1996) says that lasting institutions have to balance flexibility, robustness and goodness of fit in the operating environment. Dovers and Handmer (1992) distinguish between institutional resilience in which the goal is consistency, even when that consistency no longer meets societal goals, and resilience that will enable institutions to adapt to changing conditions while continuing to meet the needs for which they were founded. They translate this spectrum to a typology of institutional change (Handmer and Dovers 1996), noting that change at the margins is the most common form (see Table 5.2). They also note that increasing flexibility in institutions carries a proportionally higher risk of maladaptation. Centrally controlled organisations, for example, can minimise the checks and balances that ensure balanced consideration of options and ramifications. Some such institutions change their structure frequently and sometimes symbolically to the detriment of corporate history, tacit institutional knowledge, staff morale, and stability (Pollitt 2000). As VCs take on more central control of university direction and policy, the risk of maladaptive change increases. An adaptable tertiary sector should be able to meet new imperatives while still supplying solutions to the old ones, supporting a more incremental approach to institutional change.

Table 5.2 A typology of institutional change adapted from the work of Stephen Dovers and John Handmer (Dovers and Handmer 1992; Handmer and Dovers 1996).

<table>
<thead>
<tr>
<th>Institutional Change Type</th>
<th>Description and examples</th>
<th>Concepts in Dovers and Handmer (1992); Handmer and Dovers (1996)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>Such institutions and their members value stability above all (e.g. religious order)</td>
<td>Resistance and maintenance; Reactive resilience, with status quo the goal</td>
</tr>
<tr>
<td>Superficial Change</td>
<td>Such institutions value symbolic change, often in response to public opinion (e.g. shamed company; government department)</td>
<td>Change at the margins, with the appearance of changing the goal (change as a message)</td>
</tr>
<tr>
<td>Adaptability</td>
<td>Such institutions value resilience along with responsiveness to changing contexts (e.g. the internet, and ideally, universities)</td>
<td>Openness and adaptation; Proactive resilience, with adaptability the goal</td>
</tr>
<tr>
<td>Flexibility/ Flux</td>
<td>Such institutions value obliterative change, especially in response to new leadership (e.g. government executive branches)</td>
<td>(Increasing risk of maladaptation)</td>
</tr>
</tbody>
</table>

12 He also noted that a good institution may sometimes be one that agitates for change or acts as a ‘devil’s advocate’ within an undesirable environment.

13 Symbolic adjustments can help to deal with mixed expectations in a university’s environment, but it “is hardly a tool for convincing those who work at the institution” (Stensaker and Norgård 2001 p.490).

14 Adaptive capacity can be fostered in institutions as well as wider society (Fazey et al. 2007; Staber and Sydow 2002).
Many institutional structures are the result of a lack of design or intention, and this too is evident in Australia’s tertiary sector. Goodin (1996) noted that many institutions are a reflection of error incrementing through systems which are bound by path dependency. Similar to how ‘groupthink’ in cohesive groups can bring about decisions with which no individual agrees (Hogg and Hains 1998), institutions can “be the product of intentional action, without…having been literally the intentional product of anyone’s action” (Goodin 1996, p. 28). Shades of this effect are reflected in the sector’s isomorphism, discussed further in Section 5.4.1. Some institutions also evolve via selection of the fittest options (and the subsequent death of the unfit). Although a ‘free market’ ideology is visible in much of the Australian federal government’s policy towards universities, that body has also buttressed some potentially ‘unfit’ members of the sector in the difficult years since the Dawkins reforms. Not one university – new or otherwise – has ‘failed’ since that remarkable exercise in social engineering, although that assessment depends on how the term ‘failure’ is defined (Murray and Dollery 2005). “Selection acts with great force only in the early years of an industry’s existence” (DiMaggio and Powell 1983, p. 149), however, so the regulatory environment may have caused the window for market selection to be missed. The sector that has been inherited has certainly been tested on the market in Australia, but without paying the greatest price of that test. Given the distribution of universities across federal electorates, and the benefits they bring in terms of employment and equity of access, a similar trend is likely to continue.

5.3.2 Organisational learning

The degree to which institutions can be designed from scratch, or comprehensively redesigned in a productive way, is minimal. In the absence of such transformative opportunities, it may be possible for institutions to instead ‘learn’ better ways of working (Garvin 1993; Huber 1991; Levitt and March 1988; Senge 2005). Organisational learning and learning organisations are not synonymous (Dill 1999). The latter are assumed to emerge from learning individuals, so scholars who take that position (e.g. Senge 2005) focus on individual practice and applied research. This perspective is analogous to the action research focus of those who are looking to advance the EFS agenda by developing professional development for academics (Reid and Petocz 2006). That pedagogical literature can seem too abstract for those managing the aggregate. Organisational learning, in comparison, focuses on conditions that allow the organisation to adapt, not just its individuals (Levitt and March 1988). Huber’s (1991) review of the field of organisational learning establishes key constructs (Table 5.3) that can be linked with specific activities and organisational cultures in universities. Chapter Eight uses these elements of organisational learning theory to evaluate the practice of curriculum design around sustainability in Australian universities.

‘Learning’ implies that new ideas should lead to changes in the way organisations or individuals operate (Garvin 1993). By this conception, universities are often seen to fail at learning even when they have adapted administratively to the increasingly competitive nature of their environment, as their core business activities remain static.
(Dill 1999). This definition of learning also puts individual academics and aggregates at risk of sacrificing academic freedoms for policy indoctrination. However, Huber (1991, p. 89) considers learning to be a success if “the range of [the target’s] potential behaviours is changed”. This overall ethic of broadening perspectives is a much more comfortable match with the modes of higher education.

Table 5.3 Facets of organisational learning from Garvin (1993), Huber (1991) and Dill (1999), including the relevance of each facet for higher education in Australia.

<table>
<thead>
<tr>
<th>Processes</th>
<th>Examples</th>
<th>Relevance for universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge acquisition and information interpretation</td>
<td>Learning from one’s own experience, others’ experiences and best practices, and experimentation</td>
<td>Searching for new knowledge, scientific method, and rigour are cornerstones of academic life, but are rarely applied reflexively.</td>
</tr>
<tr>
<td>Information distribution</td>
<td>Transferring knowledge within the organisation</td>
<td>Interdisciplinarity requires the transmission of knowledge between disciplines, and into new interstitial areas. Administrative innovations and institutional cultural change can be transferred by lateral and horizontal links.</td>
</tr>
<tr>
<td>Organisational memory</td>
<td>Information storage and retrieval</td>
<td>Academics are highly mobile; universities should capture more information than that mandated by reporting needs.</td>
</tr>
</tbody>
</table>

5.4 The view from the enterprise

Marginson and Considine visited 14 Australian universities in the 1990s and observe that the changes taking place in the sector “… are changes in common[…]… there is marked variation in the original character … yet a common organisational template is apparent” (2000, p. 11, italics in original). Two ideas from the management and organisation literature shed light on the homogenous and corporate sector we face today: isomorphism, and resource dependency. These are institutional responses to very real financial strictures in the sector that simultaneously reflect and reinforce a decline of public trust in universities.

5.4.1 Isomorphism

Why is there so little variety in institutional forms when market theory would support the value of diversity?15 It is true that the Dawkins reforms of the late 1980s (see Section 2.2.7) had a homogenising effect, and the federal education department has forced a ‘false bottom’ on the market ever since. However, the decline in per-student public funding in that time (Marginson 2001) would suggest the need for universities to pursue specific niches. It is common sense that such focus will help to distinguish a university from other providers and make for a more efficient use of the funds each receives. As with any ‘positional good’ (Hirsch 1977), such as higher education itself,

15 The American tertiary sector provides a good example of this diversity with two-year colleges (largely public, including vocational offerings); largely private baccalaureate institutions, masters colleges, doctoral-granting institutions, and research universities (Clark 1997). Some commentators warn against modelling Australia’s sector on that one, however, fearing a loss of equity (Moodie 2006; Rood 2005).
value deteriorates with ubiquity. Any innovation will fail if taken up by all universities, but paradoxically, such mimicking tactics are extremely common for sectors that are operating under uncertainties and interdependencies. Not only is it common, but it is rational at the level of individual university decision-making, if not at an aggregate level.

Isomorphism explains the dominance of such “government-inspired, management-driven convergence” (Marginson and Considine 2000, p. 12) even when it is a distinct disadvantage to efficiency (Dey et al. 1997). DiMaggio and Powell (1983) identify a range of mechanisms that produce isomorphism in any ‘organisational field’, the group of organisations that constitute an institutional sector (see Table 5.4). When they occur in combination, the mechanisms can “seem to interact and sometimes counteract each other in a rather dynamic way” (Stensaker and Norgård 2001, p. 489). Just such forces, as well as an associated strong resource dependency, have shaped the sector and will continue to shape it in the absence of another total sectoral reconstruction. The outcomes are such that – despite current rhetoric in the federal education portfolio about the value of diversifying the sector – the tail of the snake will inexorably continue to follow the path the head has taken. These isomorphic mechanisms are discussed individually below, including examples from the Australian tertiary sector, although other national sectors appear to be in similar straits regarding increasing student numbers and governmental oversight (Stensaker and Norgård 2001; Morgan et al. 2004; Vakkuri 2004, among many).

Table 5.4 Three mechanisms of isomorphism in organisational fields (adapted from DiMaggio and Powell 1973), and their relevance to the Australian higher education sector.

<table>
<thead>
<tr>
<th>Mechanisms</th>
<th>Description</th>
<th>Relevance for universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normative pressures</td>
<td>Professionalisation of producers is centrally controlled, and reproduces more of the same.</td>
<td>Universities are usually the only source of new academics.</td>
</tr>
<tr>
<td></td>
<td>Uniformity in management training result in similar responses to pressures, and the valuing and hiring of those socialised the same way</td>
<td>Increasing administrative load calls for control by managers (with management training), not senior academics (with collegial aspirations).</td>
</tr>
<tr>
<td></td>
<td>Recognition of key players legitimates and elevates them further.</td>
<td>Elite status self-perpetuates (e.g. the need for a ‘track record’ to win grants).</td>
</tr>
<tr>
<td>Mimetic processes</td>
<td>Uncertainty of task or position produces a standard response; one for which transaction costs and risk are lowest (e.g. existing, successful models).</td>
<td>Sector members had to adapt quickly to changed expectations after UNS, leading to a convergence of response.</td>
</tr>
<tr>
<td>Coercion or incentives</td>
<td>Dependency on other organisations for resources and legitimacy in the face of societal expectations.</td>
<td>Largely limited to dwindling federal funding and international student sources.</td>
</tr>
<tr>
<td></td>
<td>Organised less around their own “technical activities” than “rituals of conformity to wider institutions”, especially those on which the institutions are dependent for resources.</td>
<td>All universities are subject to the same accountability tasks because of shared funding sources, and reorganise themselves accordingly.</td>
</tr>
</tbody>
</table>

16 Pollitt (2000) noted the tendency of institutions to compare against competitors, rather than one’s own historical trends. Universities do both.
Chapter 5: Theorising higher education

The first of the mechanisms presented in Table 5.4 describes the *normative* pressures resulting from a narrow source of producers, managers and legitimation, and the reproduction of norms such closed systems naturally create. For example, the popularity of the Masters of Business Administration qualification has created a population of managers who have all learned the same set of business rules and principles. The complexity of university operations and reporting has necessitated an increase in administrative staff with such skills (Sheehan and Welch 1996). ‘Managerialism’ has come to describe the process by which managers apply such principles uniformly, regardless of the product or context. The practice certainly increases the likelihood of homogeneity in university responses to pressures from above (government) and below (student market). Recruiters are also likely to hire others socialised with the same outlook, just as disciplinary peers judge potential new entrants to their field using criteria by which they themselves would continue to pass muster. These criteria are likely to delineate a self-similar archetype, according to social identity theory (Hogg and Terry 2000). Preferential attachment, discussed in Chapter Seven, or ‘accumulative advantage’ also causes any stratification in individual or institutional positioning to self-perpetuate and even be exaggerated further (Cole and Cole 1972; Dey *et al.* 1997). The types so elevated are also likely to be similar in a homogenous sector.

Those who have acquired a relative *dis*advantage have little choice but to look to the strategies of the successful. *Mimetic* processes occur under uncertainty of resources, status or tasks/goals, such as the situation after the conversion of CAEs and Institutes of Technology into the UNS (see Adams 1998). Comprised of the same staff of educators they had under a different set of expectations, suddenly the ‘new universities’ were subject to research incentives and pressures (Sheehan and Welch 1996). The ‘sandstones’ were struggling with huge and ageing infrastructure along with a suddenly much more competitive market (Marginson 2001). All felt uncertainty, and chose remarkably similar strategies to relieve their discomfort. Marginson notes that by the 1990s the goal of universities has become short-term “fiscal relief” (2001, p. 214) over long-term national benefit, making it rational for all universities to “[give] priority to recruiting international students” in “courses where the apparent private benefits were greatest” (2001, p. 210). The number of overseas campuses of Australian universities is also indicative of the extent of convergence, as well as the risks (Armitage 2007; Marginson 2004). Section 8.4.4 discusses further how this ‘solution’ provided short-term relief to the detriment of sectoral or individual university resilience.

*Coercive* pressures arise when central bodies on whom institutions rely for resources or legitimacy (Gumport 1997) decide to use those necessary inputs as incentives to engineer particular social outcomes. This generally forces university development around a narrow band of encouraged activities. As the universities work to prove their alignment with the goals of central bodies, accountability tasks come to dominate over

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17 As Billie Holiday sings in *God Bless the Child* (1941, co-written with Arthur Herzog, Jr.), “them that’s got shall get, them that’s not shall lose”. 123
tasks previously considered core business. A decline in differentiation has resulted between not-for-profit, for-profit and government agencies from the combination of such homogenising influences (Frumkin and Galaskiewicz 2004).

Isomorphic mechanisms result in obvious inefficiencies, like the logical paradox of the ‘tragedy of the commons’, familiar to those interested in sustainability (Hardin 1968). In the case of joint management of a grazing area, individual advantage is gained from grazing one more animal on the land, but if everyone makes that choice, the resource is degraded beyond usefulness for anyone. Incentives or thresholds introduced to reduce or reverse the effect can have adverse impact elsewhere. An example in universities is the distribution of government funding based on academic productivity, a case of resource allocation as accountability (Vakkuri 2004). A pot of money is set aside by the government to fund universities based on their share of scholarly research ‘points’ that their staff members produce in a given year. This zero-sum problem means that the more points that are produced, the lower the ‘value’ of each becomes. The time and effort required to produce the same ‘dollar amount’ of knowledge increases, and the threshold between equity and advantage ratchets upwards. The process that was intended as a reward, a way of distinguishing oneself and one’s institution, has also become an essential source of funding and esteem, concreting the ‘caucus race’ into academic life.18 Senge (2005) calls this phenomenon ‘compensating feedback’, and there are many such examples in the academic sector.

5.4.2 Resource dependency

The coercive element of isomorphic behaviour by universities is largely the result of external control of their sources of funding and esteem. It is natural for universities to want to reduce their dependency on such oligarchies, but unfortunately, normative and mimetic processes work counter to the diversity such a tactic requires. Such ‘external control of organisations’ is the subject of Pfeffer and Salancik’s classic 1978 book, and the inspiration for the theory of resource dependency. Slaughter and Leslie’s (1997) Academic Capitalism demonstrates how resource dependency theory can explain trends in higher education management and positioning: “Universities will do whatever is necessary to maintain the flow of revenues, and to maximise institutional prestige” (Marginson and Considine 2000, p. 49). Dependent universities look ever outwards, “involved in a constant struggle for autonomy and discretion, confronted with constraint and external control” (Pfeffer and Salancik 1978, p. 257). In comparison, universities that are in a comfortable and stable operating position have the luxury of being inward-looking (Sporn 1996), and focused on key business. Dependency (to outside resources) and interdependency (to other organisations that compete for the same resources) clearly must be managed. Universities must also consider intradependency: the internal

18 The ‘caucus race’ in Alice in Wonderland was suggested by one commentator as a good analogy of neo-liberal university governance and control (“they began running when they liked, and left off when they liked, so that it was not easy to know when the race was over”), including its risk of declining standards (“everybody has won, and all must have prizes”) (Carroll 1946)
competition that arises in such devolved organisations when individual sub-units seek favourable outcomes to the detriment of other sub-units (Gornitzka 1999). Applying resource dependency theory alone may present an overly ‘environmentally deterministic’ model of such institutions, but behaviour at the ‘enterprise’ level of universities is a close match.

As this is being written, the federal government is voicing its intention to re-engineer a diverse tertiary sector, but the resource pressures and incentives to be employed in doing so are still unclear. One proposed development is the new Research Quality Framework (RQF), which is intended to move the emphasis from research quantity to quality as modelled on a discarded British system (MacLeod 2006). The draft RQF plans have unleashed a spate of positioning strategies by universities which reveal them as seeing their key clientele as moving from the student (once the key source of funding), to the academic. The Australian newspaper’s weekly Higher Education Supplement is full of tales of universities ‘poaching’ high quality academic staff from one another in preparation of the impending RQF implementation. Those staff will become the attraction for future students and research funding. This is consistent with Fennell’s (1980) analysis of hospitals, which are seen to be competing for staff, rather than patients, the latter of which have as incomplete an understanding of the market in which they are participating as undergraduate students (Fox 1992; James 2000; 2002). It remains unclear to observers whether this positioning frenzy is an unforseen or intended consequence of the diversification policy.

5.5 The view from academe

Managers in control of university enterprises have tended in recent years to view the disciplines and collegiality of academe as “obstacles to managerial rationalities” (Marginson and Considine 2000, p. 11). The collective and individual traditions of academe persist, demonstrating resistance to change which can be equally interpreted as institutional robustness. The economy of esteem is an important principle by which to understand this resilience, as well as the limitations of modifying behaviour via tinkering with individual incentives. The latter is complicated by the complexity and mobility of academic careers.

5.5.1 The economy of esteem

The persistence of academe, despite resource declines and managerialism, suggests that another economy is at play in parallel with the financial one. For example, the steep resource decline in Russian federal funding to universities could have resulted in the collapse of its higher education sector. Its adaptation, however, was moderated by the deep pro-education culture of the nation (Morgan et al. 2004). The sector has survived relatively intact because education has remained collectively valued, and because financial remuneration is not the primary motivation for an academic career. Brennan and Pettit (2004) have developed the concept of the ‘economy of esteem’ to fill this gap between neo-classically rational economic action and the motivations of academe. Academics are not homo economicus, with income-driven ambition followed by
minimum effort once they have reached a satisfying salary, but neither are they *homo heroicus*, motivated only by a “love of the life of the mind” (Brennan and Pettit 1991, p. 5). A ‘third way’ of *homo socialis* captures humanity’s desire for social esteem, even above monetary reward and a sense of individual virtue. Academics may not wish to appear to be motivated by esteem, but this is what practices and norms belie (e.g. peer review, paper authorship order, and staff taking on the prestige of their university) (Cole and Cole 1972; Crane 1965; 1970; Han 2003).

Dill (1982) exploits this third model of academe in his suggestion that leadership in ‘value rational’ entities like universities requires symbolic elements such as academic freedom that differ from that of purely corporate bodies. This includes managing ‘meaning’ and ‘social integration’, both of which create a strong common ideology. Managing meaning involves creating myths about the institution and its values, and recognising/elevating examples of those values with symbols and rituals. Managing social integration requires engineering collegial relations such that commonly held values are handed down during mentoring and passed laterally during collective activity such as curriculum review. Both of these are challenging in an interdisciplinary setting, but are no less important as a result. What is evident, and is demonstrated in Chapter Seven, is that peer groups operate best if chosen, rather than imposed. Then, commonly held cultures or value bases suffice the priorities of individual players, and are also reproduced by the choices they make (see Section 5.2). Goodin partially agrees: “what animating principles ‘animate’ is intentional agents who internalise them, and … implement them” (1996, p. 27).

Academic life requires a mixed model of motivation. There is a risk that the dominance of the economic model (and hence, economic incentives) “mobilis[es] self-interest [and] crowds out virtue (Brennan 2005, p. 3): academia thus ceases to be a “calling” (Clark 1997, p. 36). The dominance of esteem (and avoidance of disesteem) as a motivator for academic behaviour means that an appropriate mix of ‘reward currencies’ can help attract real scholars and dissuade the involvement of what Brennan (1996) refers to as ‘expedients’. Effective financial reward for scholars may be in resources they can access to advance their positioning (e.g. PhD scholarships, equipment, research assistance, conference attendance) but that are of no interest to expedients. According to Brennan (1996, p. 256, quoting American founding father James Madison in 1788), making “interest … co-incident with duty” can act like an ‘invisible hand’ to motivate the ‘right’ kind of activity. In universities, this might be the “form of scholarship most closely aligned with their institutional mission” (O’Meara 2006, p. 77, paraphrasing Ernest Boyer), although isomorphism in the Australian sector is not helpful. Finding an ideal ‘currency’ mix is difficult. What is relevant here is that self-interest is relevant to academics, but not purely as it is measured or expressed in monetary terms.

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19 Sheehan and Welch (1996) surveyed staff of eight Australian universities and to find that job satisfaction correlated with age, rank and income (the last two also implying sex, as tutors/associate lecturers were 64% female at that time).
5.5.2 Career progression

Giddens’ idea of ‘structuration’ (recalling Figure 5.1) is demonstrated in academic careers perhaps more than other professions. Institutions encode ‘career scripts’ useful to them that give individuals meaning, and by enacting those scripts (or not) career archetypes are modified and the institution itself is reconstituted (Barley 1989). The complexity of universities (Sporn 1996) translates to a complicated career path for individual academics as they simultaneously negotiate the partially overlapping interests and contexts of: discipline or “science system”; national sector and culture; and, organisational setting (Kaulisch and Enders 2005, p. 131). All of these are discussed in depth elsewhere. What is important here is to understand the range of contexts to which academics respond in negotiating their careers, and the opportunity costs of working against norms.

The nature of disciplines is discussed in some detail in Section 1.2.6 and the challenge of crossing them in academic careers in 1.2.7. That section introduces the cognitive, organisational and social barriers to working over wide areas, and the suitability of silos as a structure for making forward progress in narrow areas (many of which the interdisciplines and interdisciplinarians draw upon in their work). From a neo-institutionalist perspective, the clarity of identity and purpose that disciplinary categories provide are beneficial to individual academics, and to the progress of scholarship in those areas (Russell 2005). Work crossing those delineations – by individuals or teams – will operate in tension with peer mentoring, accepted research methods and comfortable division of labour to advance knowledge. Social identity theory suggests, in the view of Hogg and Terry (2000), that humans seek identity relations in order to reduce uncertainty in goals, status and roles. Social identity plays out by constant comparison with representative group archetypes, and the degree of match with these characteristics determines group fit. Those at the edges may withdraw to increase homogeneity and fit within groups, or simply go ‘un-preferred’ as “self-interested researchers … link together in search of rewards, reputation and resources” (Wagner and Leydesdorff 2005, p. 1610). Disciplines are thus institutions as Giddens (1979) conceives of them, like behavioural grooves worn where many tread. In interdisciplinary areas of study like sustainability the paths are bumpier, the economy of esteem may cease to function, and participating individuals may suffer.

The perception that the Australian university sector should be ‘useful’ has been examined in detail in Chapter Two. Academic careers are – and have always been – vulnerable to federal priorities in research and education, such as the vogue for ‘science and innovation’ in the former, and for ‘skills’ in the latter. On an individual level, however, the increasing accountability of universities results in performance management processes that may not align with disciplinary emphases, organisational requirements, or personal ambition. Current pressures at this level encourage research quantity over quality (discussed further in Chapter Seven), and maximising external funding and grants. The latter privileges expensive work over cheap (irrespective of value to knowledge), and commits individuals to the priorities of outside funding
agencies. Forcing academic faculty members to follow their ‘track records’ rather than forge new paths, means they can’t be viewed themselves as still learning: “works in progress” (Lattuca 2002, p. 735). Such external orientations, and the varying timeframes of the various grant cycles, make it increasingly difficult to build a core to interdisciplinary units. On the education side, increasing tuition costs create a consumer attitude among students. Disciplines lacking a clear job-focus can be seen as organisational ballast; academics in those areas may experience incremental starvation of funds, or dramatic cuts to entire teaching programs.

The organisational structure within which academic staff members operate is yet another dimension that affects activities and career progression. While academics feel a strong pull from their discipline group or subgroup – wherever that group may be located – responsibilities around research training and teaching align with organisational budget units (Klein 1999). This enforced loyalty is bounded by even smaller units in Australian universities with their devolved budgets, as seen in Chapter Eight, than the liberal models sampled in Canada and discussed in Chapter Six. Local cost and infrastructure issues dictate day-to-day issues such as contact hours with students, available resources for research or networking with disciplinary peers (e.g. conference travel), administrative burdens, the capacity to experiment with pedagogy, and expectations regarding community outreach (whether for public good or university marketing). Incentives can be engineered to match individual institutional (or even smaller scale) niches, and the varying forms of scholarship that those suggest:

…baccalaureate institutions with primary teaching missions [c]ould reward the scholarship of teaching in their promotion decisions and not hold faculty back because they [are] not engaged in the same type of work as research faculty. Doctoral institutions might acknowledge the scholarship of application … and the work of faculty … in developing interdisciplinary programs (the scholarship of integration) would not go unrecognized. (O’Meara 2006, p. 78)

In addition to the homogeneity of the sector overall, the high mobility of academic careers (Crane 1970; Hugo 2005; Saha and Klovdahl 1979; Sheehan and Welch 1996; Wooley and Turpin 2006) works at odds with forging a diversity of successful academic career models. Pressures towards isomorphism operate at the level of individual, too.

5.6 Learning to look sideways

Clearly, neither a macro nor micro perspective alone provides the entire picture. Setting out on research with a narrow, normative stance will produce many recommendations on how to adjust structures to facilitate that one concern, as seen in Chapter Four. Undergraduate curriculum is only part of the higher education system, however, and any such recommendations will have ramifications in other facets of its role, and in its overall financial viability. Institutions are by nature pragmatic structures systematising the greatest good of the greatest number. It may be inevitable that crossing their boundaries causes discomfort to some. A neo-institutionalist mindset helps to expose the interconnections between individual and aggregate behaviours in higher education.

This chapter forms a structural fulcrum, designed to support a turn from broad-scale survey work focused on one facet of academic life to more system-oriented case
investigations. The need for this content became clear after undertaking the Canadian case work in Chapter Six, and it provides a strong social and institutional basis for understanding the phenomena presented in Chapters Seven and Eight. While none of these three explicitly follows a neo-institutionalist framework, that lateral, holistic perspective is embedded throughout their design and discussion.\(^{20}\)

\(^{20}\) Although holistic in considering the employed members of universities, this thesis has not involved the student body. Here it is an externality to which academics, schools, faculties and universities respond.
PART B:
The entropy of sustainability in universities

“The danger of falling back into monodisciplinarity is not imaginary; it is the way of least resistance, the ‘entropy of science’” (Zonneveld 2000, as cited in Antrop 2003, p. 50).

The previous section explored the undertaking of sustainability education in (particularly Australian) universities using audits, literature reviews and surveys. It established a desirable ‘sustainability canon’ of concepts and contributing disciplines. However, course offerings can not be considered in isolation from the other pressures of the academic setting. Such a lack of context may be one of the factors constraining EFS from informing practice. This part of the thesis narrows the case focus but broadens the range of activities being considered. The case work in this part has been undertaken in parallel with the exploration of theory characteristic of an adaptive research process. Both activities reveal a centralising force in academic structures that discourages educational models divergent from the traditional model.

Chapter Six looks at the implementation of those ‘canonical’ ideas, illustrated with cases from Canadian universities. It discusses comparative work undertaken in Canada during the tail end of the participant observation phase of the Australian case work, and served to presage some of the issues to be investigated in greater detail during the Australian interviews. A version of this chapter was presented at the 2006 Australian Association for Research in Education conference in Adelaide, Australia. A single-authored, refined version is in press with the Canadian Journal of Higher Education.

Chapter Seven utilises social network methods to explore the collaborative structure of the emerging field of sustainability research. Sustainability networks within the university, and within interdisciplinary hubs oriented to the topic, reveal impediments to interdisciplinary collaborative behaviour. The first half of it was presented to the 2006 Australian Sociological Association meeting in Perth, Western Australia, and the second is in development for an international journal (to be decided), listing as coauthors Linda Butler, Stephen Dovers and Alden Klovdahl, all members of my panel.

Chapter Eight summarises insights gained during two Australian universities’ processes of curriculum development (and subsequent structural changes) around the environment. Participant observation and interview methods serve to triangulate the structural analyses of the same cases featured in Chapter Seven in light of the sociological explanations of Chapter Five and the comparative cases in Chapter Six. A manuscript based on this chapter is in development for an international journal.

Chapter Nine is a summary of the thesis, including: revisiting the original research questions; identifying methodological innovations; and, making recommendations for universities, academics and EFS researchers. A generalist summary of the thesis based strongly on this concluding chapter is also planned, co-authored with Stephen Dovers.
CHAPTER SIX  CANADA: INNOVATION UNDER TENSION

EFS literature emphasises elements of individual practice, but the aggregate student experience is engineered one level above, where barriers are institutional. In this part of the thesis, relevant innovations and processes above the level of individual subject are explored in conversation with those people involved in bringing them about. How were they husbanded into existence? What key factors were responsible for their success or failure? What elements of the disciplinary, structural, administrative or collegial life of the university served as barriers to the process, and what of pressures from without, such as the student market and government funding? Major themes such as university management, organisational design, collegiality, pedagogy and the student profile are affecting educational offerings at all cases.

Exposing the larger context reveals the friction burns where the EFS agenda can focus to improve outcomes. Though many of the findings will not surprise those who have worked in modern universities, the knowledge this chapter conveys is of the tacit variety that is rarely recognised as knowledge by those who hold it (or by those who do not). Such information is thus rarely passed on to the new or junior staff members who are often the progenitors of innovation in the academy, or is dismissed as negativity or resistance on the part of the ‘old guard’ if it is. The messages may be better received at arm’s length, and with a wider sample of supporting evidence than that which typically comes prefaced by, “We tried that 20 years ago …”.

6.1 Sector background

As Australian universities have embraced the instrumental view of higher education, ‘public good’ ideas, such as sustainable development, struggle in the resulting tertiary culture and structure. Canada provides an interesting counterpoint to Australia. It is similarly youthful as a federation, and has a high immigrant population, with large areas of sparsely inhabited land that fuel its national imagination more than its lifestyle. Both higher education sectors are under similar pressures (see Section 1.2.1) and responding comparably. Investigating the innovations in Canadian universities around sustainability can thus inform Australian practice. Differences exist, however, in how the two countries regulate, diversify and populate their higher education institutions, as well as how they handle environmental fields, and these variations affect EFS implementation.

Universities are under provincial or regional control in Canada, compared to the more federal approach in Australia (Donald 2006). Developments relating to increased managerialism, commercialism, internationalism and credentialism are common to both countries, with growth the major measure of success, but Canada has a stronger tradition of respect for the intrinsic value of liberal education. By comparison, Australia has always tended to value education pragmatically, emphasising more concrete outcomes such as fuelling economic growth (see Chapter Two).
Canada has also retained a broader conception of what it is to be a university, from two year university colleges and liberal arts schools to comprehensive universities with medicine and law programs.\(^1\),\(^2\) Australia’s focus on market equity (Kemmis et al. 2002) and on performance management has seen its public universities conform to a similar model: that of the large research institution that optimises returns from federal government funding formulae.\(^3\)

Australia’s universities moved faster from elite to mass educational models than Canada’s did, and gender balance is more even after that transition in Australia. There are approximately three universities for every million inhabitants in Canada, compared to two in Australia, yet Australia had seven percent more degree completions in 2003. Thirty-five percent of Australian students study part-time, compared with 25% in Canada (Association of Universities and Colleges of Canada (AUCC) 2005; DEST 2005c). Canadian universities are more dominated by females than Australian: there are 1.5 female students for every male on Canadian campuses and 1.25 in Australia.\(^4\)

Canada considers environmental fields to be largely a graduate pursuit, and the market in coursework graduate qualifications is not as developed in all fields as in Australia. Graduations in the broad area are lower in Canada than Australia but in both are less than the two percent reported by the OECD 30 years ago (CERI 1976) (Table 6.1).\(^5\) The share of the 2003 environmental completions that were postgraduate was similar in the two countries. In Canada that value was the highest for any field, but in Australia it fell near the mean. Some fields of study were as high as 45.6% postgraduate in Australia that year.

### Table 6.1 Statistics on 2003 program completions, focusing on those in a broadly environmental field (Data: DEST 2005c; Statistics Canada 2005).

<table>
<thead>
<tr>
<th>Environment as a % of all graduations:</th>
<th>All Undergraduate</th>
<th>Post-graduate</th>
<th>Of all environmental graduations, percent that were postgraduate</th>
<th>Average [range] of all fields’ graduations that were postgraduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1.7% 1.5%</td>
<td>2.9%</td>
<td>30.3%</td>
<td>17.6% [4.1-30.3%]</td>
</tr>
<tr>
<td>Australia</td>
<td>1.9% 1.5%</td>
<td>2.1%</td>
<td>27.8%</td>
<td>28.8% [14.7-45.6%]</td>
</tr>
</tbody>
</table>

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\(^1\) Canada has a separate community college system that offers many of the professions found in universities in Australia since the UNS was established. Statistics given in this chapter do not include community college enrolments.

\(^2\) A revolution in Australian higher education has recently occurred at the University of Melbourne, which is now offering students the experience of a generalist, liberal undergraduate education with the option of specialising later via professional masters degrees. This is a first in Australian public universities, but has been painted by some as an attempt to extract more fees as students have to attend university longer to acquire professional qualifications (Coaldrake 2005; Rood 2005).

\(^3\) Australia averages about 23,000 students per university compared with 12,000 in Canada.

\(^4\) The gender mix is more equivalent in environmental fields than the overall university population.

\(^5\) Statistics Canada uses ‘Agriculture, natural resources and conservation’, while Australia’s DEST uses ‘Agriculture, environmental and related fields’.
6.2 Interview methods

Seven Canadian universities were visited in September and October of 2005:

- The University of British Columbia (UBC) and Simon Fraser University (SFU) in Vancouver, British Columbia;
- Ryerson University and York University in Toronto, Ontario; and,
- The University of New Brunswick (UNB) and St. Thomas University (STU) in Fredericton, and Mount Allison University (MTA) in Sackville, New Brunswick.

The cases cover a wide range of niches in terms of student body size,\(^6\) the amount of research undertaken, rank\(^7\) and course profile (see Table 6.2). Between 0.6% and 0.8% of the population of each of these provinces graduates annually from its universities, although many students study outside of their home province (Statistics Canada 2005). Websites, informal inquiries and targeted research techniques were used to find relevant programs involving one or more of the following areas of interest:

- Attempts to unify cross-cutting sustainability environmental or sustainability activities using an ‘umbrella’ style organisational superstructure;
- Cross-disciplinary environmental or sustainability programs; or,
- Innovative curriculum design addressing the key elements of sustainability education as identified in Chapter Three, namely liberal education, interdisciplinarity, cosmopolitanism and civics.

Some discoveries were purely accidental or opportunistic, and it is inevitable that some good examples were missed. Detailed information on the specific courses visited, including the rationale for each choice (Table 6.4) and how each was used in theory-building (Table 6.5), can be found in Section 6.5. These matrices demonstrate how the sampling contains considerable replication on a feature level, although the institutions in question can clearly not be identical.

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\(^6\) Enrolment figures are for the 2003/2004 university year except Ontario, which is 2002/2003 and before the double-cohort entry in autumn 2003 as a result of abolishing grade 13 in the province.

\(^7\) *Macleans* magazine publishes annually a ‘Guide to Canadian Universities’. Those smaller than 1000 students are not included, neither are those with a specialised mandate (e.g. religious instruction). In 2005, 47 institutions were ranked (just over half) using a questionnaire-based methodology that is discussed further at http://www.macleans.ca/universities. It uses six groupings of evaluation: student body, classes, faculty, finances, library and reputation, and between 22 and 24 criteria depending on peer group (medical/doctoral, comprehensive or primarily undergraduate). It has been judged poorly against comparable magazine rankings (Dill and Soo 2005). For example, the fact that reputation is used (weighted 19%) in order to assign reputation has been criticised (Readings 1996). Many universities are ceasing to cooperate with the *Macleans* ranking process. The method or ranking outcome is not endorsed by this author, and use here is only intended to suggest the cross-section of the market captured in this research.
Table 6.2 Diversity of Canadian cases by location, year of establishment as a university (and precursor institutions), rank (thirds within type), type, percent graduate and number of students (Data: individual university web sites; Council of Ontario Universities 2004; Macleans 2005; Maritime Provinces Higher Education Commission 2006; University Presidents Council of British Columbia 2005).

<table>
<thead>
<tr>
<th>Name (abbreviation), location</th>
<th>Estab.</th>
<th>Rank</th>
<th>Type</th>
<th>%Grad</th>
<th># Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of British Columbia (UBC), Vancouver, BC</td>
<td>1908</td>
<td>High</td>
<td>Medical/Doctoral</td>
<td>18%</td>
<td>Very large: 40,910</td>
</tr>
<tr>
<td>Simon Fraser University (SFU), Vancouver BC</td>
<td>1964 (1903)</td>
<td>High</td>
<td>Comprehensive</td>
<td>15.7%</td>
<td>Large: 21,845</td>
</tr>
<tr>
<td>Ryerson University (Ryerson), Toronto, ON</td>
<td>1993 (1948)</td>
<td>Low</td>
<td>Primarily undergraduate, ex-polytechnic</td>
<td>1.6% (Masters only)</td>
<td>Large: 24,979 (50% part time)</td>
</tr>
<tr>
<td>York University (York), Toronto, ON</td>
<td>1959</td>
<td>Low</td>
<td>Comprehensive</td>
<td>11%</td>
<td>Very large: 43,635</td>
</tr>
<tr>
<td>University of New Brunswick (UNB), Fredericton, NB</td>
<td>1860 (1785)</td>
<td>Middle</td>
<td>Comprehensive</td>
<td>11%</td>
<td>Medium: 13,015</td>
</tr>
<tr>
<td>St. Thomas University (STU), Fredericton, NB</td>
<td>1910</td>
<td>High</td>
<td>Primarily undergraduate, liberal arts</td>
<td>0%</td>
<td>Small: 3,135</td>
</tr>
<tr>
<td>Mt. Allison University (MTA), Sackville, NB</td>
<td>1914 (1839)</td>
<td>High</td>
<td>Primarily undergraduate, liberal arts</td>
<td>0.25% (Masters only)</td>
<td>Small: 2,319</td>
</tr>
</tbody>
</table>

An average of two interviews was conducted with different informants at each case, varying between one and three in each instance. Respondents came from a wide range of disciplinary traditions, from microbiology to theology. Only three of the 21 were female. All bar one were native English speakers, and that individual was not a native French speaker (the other official national language) but Spanish. The 21 formal interviews that resulted were open-ended and lasted 47 minutes on average. Questions varied but focused on the academic, operational, marketing and structural issues associated with the creation and maintenance of the program in question (see Table 6.3, for indicative questions). The interviews were recorded using a laptop computer and Hi-Q Recorder (Roemer 2005), and the 16.3 hours of content was later transcribed using Microsoft Word and Express Scribe (NCH Swift Sound n.d.) and collated with the help of NVivo qualitative analysis software (QSR International Pty. Ltd. 1999-2002). The author also sat in on three classes in session, and had a handful of other relevant discussions in informal contexts.
Table 6.3 Indicative questions asked of Canadian interviewees

| Establishing questions | What is the nature of your employment at [University Name]?
| | What is your own background, academic or otherwise?
| | What is the background of [Academic Unit/Course Name]; how did it come to pass?
| Research (e.g. umbrella research structures, innovative research programs) | How is the membership of the group established?
| | How is [Group Name] funded?
| | How is [Group Name] managed and who sets its direction?
| | How was research around sustainability challenged before the inception of [Group Name]?
| | What has been the impact of [Group Name] on sustainability research at [University]?
| | Is [Group Name] at all involved in teaching activities?
| | What, if anything, still limits the ability of [Group Name] to make progress?
| | What will the future hold for [Group Name]?
| Teaching (e.g. curriculum change processes; innovative curriculum design) | What was the rationale for revising/developing [Course Name]?
| | How did the change process progress?
| | What external pressures affected curriculum design decisions for [Course Name]?
| | Did any internal pressures affect the final curriculum design?
| | What disciplines are considered ‘core’
| | What teaching methods do you employ in teaching [Course Name]?
| | What has been the response of the student market to [Course Name]?
| | Are any future changes to the curriculum planned?

6.3 Points of friction

Despite the diversity of innovations explored, many friction points were shared. Friction often occurs when groups are deciding which of several divergent paths an educational program will take. The barriers seem characteristic of universities more generally. I have been a participant observer in two recent Australian universities’ restructures around the environment and sustainability fields in which similar issues were discussed (see Chapter Eight). Similarly, the Boyer Commission’s (1998) list of recommendations to improve undergraduate education in America’s research universities includes many curriculum elements discussed here, including: inquiry-based freshman years, research-based learning, removing barriers to interdisciplinarity and culminating with capstone experiences. They also itemise the institutional barriers, such as faculty reward schemes and a lacking sense of community (Boyer Commission 1998). The loci of conflict explored in this chapter are: core curriculum structure and content, program selectivity, organisational design, and administrative concerns.

6.3.1 Core curriculum

One key decision in educational program design is how to embed core and optional course requirements. The amount of freedom that is included in degree programs speaks to the cohesiveness of the field (whether or not there is an established canon), and the degree of theoretical rigour that practitioners are perceived to require upon completion. Sustainability attempts to balance concepts of social justice, environmental citizenship, cultural diversity and economic viability with a scientifically informed view of the
natural world. Translating to the academy, the ‘diffuse’ (Whitley 1984) field of sustainability appears to be about ‘everything’ and ‘nothing’ all at once. This connotation makes it difficult to identify what is ‘core’ to educate for something as amorphous as sustainability (see Section 3.2 for a detailed discussion), and when this core should occur in a program. Some of the pressures are disciplinary, some structural, and some philosophical. This section explores various choices of structure and content made in Canadian cases, for a range of courses, along with their pros and cons.

6.3.1 Core structure

Seven archetypes for handling core content in degree programs are identifiable but do not appear to have been previously described. These are diagrammed in Figure 6.1, illustrated with examples from Canadian cases. Some represent extreme, pure cases at the ends of a spectrum. The ‘cafeteria’ degrees, for example, usually do have a few core subjects, and the ‘rigid’ ones often have a handful of elective spots kept free. They are often found in combination, such as a foundation year followed by additional course requirements in later years. None of the approaches is inherently better or worse than the others, and choices are often careful compromises under competing interests. These models are presented simply to show the variety of options that exist to serve as points of friction in program design processes. The debates at play in each choice are discussed below, drawing on examples from the cases studied.

<table>
<thead>
<tr>
<th>Core Structure</th>
<th>Example Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation year – parallel</td>
<td>New Ryerson programs in Arts and Contemporary Studies (ACS), Politics and Governance and Science</td>
</tr>
<tr>
<td></td>
<td>UBC Science 1 and Arts 1 (as well as their ‘coordinated’ alternatives);</td>
</tr>
<tr>
<td></td>
<td>STU ‘Aquinas’ program (although it is optional)</td>
</tr>
<tr>
<td>Longitudinal</td>
<td>UBC Global Resource Systems (GRS) core;</td>
</tr>
<tr>
<td></td>
<td>Ryerson ‘Ideas that changed the world’ subject series for ACS</td>
</tr>
<tr>
<td>Rigid</td>
<td>UBC B.Sc. (Natural Resources Conservation);</td>
</tr>
<tr>
<td></td>
<td>Old Ryerson programs (before common foundation developed)</td>
</tr>
<tr>
<td>Chequerboard (high prerequisites)</td>
<td>MTA Environmental Studies major option in B.Arts;</td>
</tr>
<tr>
<td></td>
<td>UNB Environmental Studies minor and secondary major for any degree</td>
</tr>
<tr>
<td>Cafeteria (low prerequisites)</td>
<td>Ryerson B. Arts and Contemporary Studies;</td>
</tr>
<tr>
<td></td>
<td>York B. Environmental Studies;</td>
</tr>
<tr>
<td>Capstone</td>
<td>SFU ‘Undergraduate Semester in Dialogue’;</td>
</tr>
<tr>
<td></td>
<td>UBC ‘Integrated Science’ grad program, and Forestry 4th year field course</td>
</tr>
</tbody>
</table>

Figure 6.1 Core curriculum structural types, supported by examples encountered in case work.

One common core structure is the foundation year (or years), during which students are inculcated to a common level of knowledge in a number of the essential fields, values or methods of their chosen area of study. Units are usually modular, of one or (more rarely now) two semesters in length. Foundation years often expose students to the various options that exist for more detailed study within their broad field, like majors or
specialisations. Where foundation years are diplomatically designed to provide introductions to each available path in a degree program, conflict in course design arises where potential paths outnum ber introductory spaces. Subjects following the core in such a degree program can assume a particular background in their students, which is increasingly important as students leave high school with fewer common competencies. Lengthy, common groundwork can also be evidence of a paternalistic attitude by “building in the institutional capacity [for students] to remain uncertain for as long as possible” (C113).

A subset of the foundation year approach are those subjects offered in integrated or block mode, where students enrol in a suite of common subjects that are taught organically rather than in parallel. Lecturers in block offerings combine their material in a fashion that communicates the connections between the fields, and often only one grade is given (Benbasat and Gass 2002). Designing and delivering such programs involves heavy collaboration on the part of the academics, who are often accustomed to working independently. Such offerings are labour-intensive for staff and challenge workload and funding formulae. The intensive and democratic pedagogical methods often employed also limit the class size to much smaller numbers than is typical in first year, and make such subjects most attractive to those studying without other commitments such as families and full-time jobs. With block offerings optional and selective in intake, traditional, ‘parallel’ foundation years are offered to the majority.

There are disadvantages to block mode offerings. First, if students of block mode offerings are taught “Aristotle instead of sociology” (E219) in first year, there is some concern that they may not recognise disciplinary elements enough to inform later decisions about majors. “Departmental imperialism” (E219) can resist such organic teaching on that basis. Second, students in block programs sometimes also experience a disjoint when they encounter the rest of their degree program, which is likely to be more traditionally structured. Third, prospective students can be concerned with how the non-traditional offering will affect later opportunities, especially if offered pass/fail rather than graded. Finally, economies of scale create sector-wide pressure for modularity and subject reuse, discouraging such models, instead. Compromise programs can link traditional subjects, themselves individually graded, via an integration seminar (Benbasat and Gass 2002).

Core content can also serve as a common thread, undertaken longitudinally throughout a degree program. In the Canadian cases this involves one or two team-taught subjects per year, bringing students together who are otherwise focusing on different themes within a cross-cutting course design. The Global Resource Systems longitudinal program at UBC creates even more of a bond by uniting students from all years of a program in online discussions and other activities, although this can be an administrative challenge.

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8 This is the ‘scholarly discipline’ model in Newton’s (2000) classification of liberal education.

9 At their request, interviewees have been given codes rather than names. Codes denote region (West, Central, East), university within region (1-3), and unique interview number.
Compulsory content can also be identified for completion anytime in the degree program or major. In such chequerboard programs, students may also be pursuing other majors, minors or certificates with similarly dispersed requirements, and core such as English requirements may also be stipulated by their faculty or program. In this model, choice increases as the course progresses, but flexibility may decrease as a result of prerequisite sequencing. Prerequisites indicate a maturity of the scholarly paradigm, and indicate that a logical sequence is required to develop knowledge (Huisman 1997). The onus is on students to map their own progression through prerequisites, or to take responsibility for their own transition where they have had the prerequisite waived.

This model works well in more liberal institutions, where a distinction is made between putting academics in silos, and putting students in them. Cross-cutting majors in liberal institutions draw on subjects from across the campus, rather than keeping all students within their home department. Enrolments in such majors may suffer because of the small number of offerings that appear dedicated to the area (i.e. few courses starting with ENV). Other than giving subjects multiple codes, there is little that can be done about this. To support such a liberal model internal accounting structures must focus on subject enrolments rather than declared majors; setting arbitrary thresholds of declared majors to determine departmental viability is counter productive (Scott 2004).

More rigid programs are typical of highly technical or applied fields with formal accreditation. Their inflexibility is evidence of cohesive, traditional disciplines with wide consensus on the desired characteristics of their practitioners (Whitley 1984). This model can make transferring between programs very difficult and result in university attrition. Such programs are rarely offered part-time or by distance education, as the sequencing is considered critical. Students in such programs are often kept within one faculty for all their work, but they are increasingly exerting pressure for more choice and external experiences like co-op work terms, study abroad or internships.

The opposite of this is the wide open, cafeteria-style degree – so-called by Boyer (1987, p. 90) – that is becoming more common as student fees increase. Many programs of this type offer creative, cross-cutting specialisations, usually under a generic degree name where the declared area does not appear on the testamur. In some cases these sequences act simply as guidance for students, rather than as firm course rules or stipulations. Students can often still graduate having taken a very different series of subjects than those suggested, although they may find that the lack of detailed designation on their degree is a barrier to employment or further study (e.g. ‘teachable’ subjects for teaching careers). Subjects in such programs have few prerequisites to increase flexibility for students, although students are often encouraged to take subjects within a particular faculty. Staff can find the onus on individualised advice in such programs quite trying.

As discussed in Section 1.2.6, some knowledge cultures value lateral or recursive learning as much as sequential, so this phenomenon differs appropriately by discipline (Donald 1986).

See Domask (2007) for a novel example of international experiential learning.
The final option is the *capstone* practice of putting all the core content at the end of the degree, rather than the beginning. By starting the requirements for a major in second year or later, it maximizes the number of students that can transfer in (or be ‘poached’ from elsewhere in the university) after their first year without incurring extra time. It also means that a common foundation is unlikely and so core must be either ‘introductory’ or ‘integrating’ in nature. The latter can capitalise on intake diversity. Capstone subjects without prerequisites may limit what can be achieved in them in the sense of disciplinary depth, but on the positive side ensures a rich variety of student perspectives and experience in the classroom. Senior seminars in more liberal programs serve a similar purpose. Capstones in rigid programs are felt to need a common background to maintain the “quality of debate and discourse” (W108).

Each of the seven core options involves assumptions about particular student markets, and serves a specific purpose in educating an undergraduate. Used in combination, these core options allow a powerful amount of degree customisation without leaving the novice student unsupported in their progression. The ‘space’ provided by four-year undergraduate degrees keeps Canadian program designers from having to choose only one option. Students have time to get an introduction to a broad field, acquire some disciplinary expertise, integration practice and with their remaining electives perhaps opt into a thematic or problem-based graduation program, study abroad, an internship or narrow research training. Each program can be individually managed, as well, at different levels of faculty, school, or interdisciplinary research group. Such ‘robust separation’ works as long as course ‘real estate’ exists, program requirements are kept transparent, and parties communicate to ensure minimal duplication, gaps or impossible prerequisite arrangements. Students can then develop their interests progressively through their undergraduate training, neither making big decisions too soon nor being left without guidance. At the same time, course coordinators do not have to offer and support custom-designed programs, something they are increasingly under pressure to do to enable students to pursue idiosyncratic paths.

### 6.3.1.2 Core content

Deciding what theory the core content should include can be more trying than deciding how it should be structured (see Chapter Three). Sustainability is a diffuse field with no formal accreditation processes, and little consensus on what theoretical knowledge or pedagogical method produces a good practitioner. Such discussions are easily affected by peripheral issues such as the internal accounting processes that assign credit for student load, and staff member education and values (Lattuca and Stark 1994).

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12 The ‘robust separation’ of goals, resources and control mechanisms has been employed for purposes such as water trading (Young and McColl 2002) to ensure a flexible yet carefully designed system. The analogy often provided to this theory is the operation of a car; each task it is to do has its own control; steering, speed, brakes, etc. You couldn’t tie all those functions to one mechanism without having it crash. Similarly, degree programs don’t need to program in all possible paths if they allow space for a diversity of individually engineered programs to be intelligently assembled by students.
Section 4.4 argued that more breadth in the human realm is required in Australian sustainability programs, to offset the existing science and technology focus. The US Council of Environmental Deans and Directors endorse core competencies for environment that include generic skills like analysis, synthesis, systems thinking, critical thinking, communication, research. Experience with the disciplines of biology, geology, chemistry, statistics, policy and ethics are also desirable (Blockstein 2003; Focht 2003; Focht & Vincent 2004). A comprehensive Canadian survey of environmental core curriculum was not available, but four environmental programs were sampled during this research (see Table 6.6 on page 153 for details):

- UBC’s Bachelor of Science (*Global Resource Systems*) offered from the new Faculty of Food and Land Systems (previously Agriculture);
- York’s Bachelor of Environmental Studies, from an eponymous faculty;
- MTA’s Environmental Studies major for Bachelor of Arts students, offered from Social Science but effectively cross-campus; and,
- UNB’s secondary major in Environmental Studies, offered by the umbrella-style, Environment and Sustainable Development Research Centre (ESDRC).

The chosen programs were all established in the last 15 years and are reasonably small (50-100 a year at UBC, York and UNB and fewer than 10 at MTA). Whether these programs are representative of the Canadian approach to environment and sustainability is unknown, but they do give a cross-section in at least three ways. First, they are delivered from different faculties, suggesting that the home of environment and sustainability in universities is variable in Canada as in Australia (Section 4.3.1). Second, they comprise a major, a minor and two degree programs. Third, each has different core structures according to the terminology introduced in the previous section.

As would be expected, each case also differs in the fields it emphasises, showing a lack of consensus around the ‘core’ concepts for sustainability which is certainly not unique to Canada (Figure 6.2). Only the UNB minor includes the kind of policy content that the survey of sustainability experts in Section 3.2 recommended, and none had the philosophy or ethics for which they called. Aggregated, the programs emphasise applied rather than pure sciences, and the human realm comes distant second. In fact, the high ranking of ‘Language and Culture’ comes largely from compulsory first year composition subjects. Later year social science and humanities subjects seem to have few prerequisites, compared with those in science, and this may be why they are so rarely core; it does not limit students’ future choices to make them optional. Curricular coherence and consensus is also more characteristic of the sciences (Lattuca and Stark 1994).

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13 Interestingly, philosophy and policy are two of the major foci of the UNB Bachelor of Philosophy in Interdisciplinary Leadership at Renaissance College (discussed in Section 6.3.2, as an example of selective programs).
Figure 6.2 Four Canadian environmental program cores, as classified using the Australian Research Council's RFCD (research field, courses and disciplines) system. Three credits equal one subject, one-fifth of a typical semester's load. (Source: individual university course materials, as of September/October 2005.)

Student choice is supported in all three programs, with varying levels of personal responsibility being assumed by students and guidance provided by staff. Interviewed course coordinators of all programs voiced support for breadth and interdisciplinarity, too. The integration of disparate fields was either engineered by the use of longitudinal or capstone core, or assumed to emerge from being taught by staff who are themselves interdisciplinary scholars. Each course development process dealt with the usual debates around disciplinary depth and rigour that come with interdisciplinarity, and its implications for student options following graduation. Understanding of the choices made in structuring each course seems to lie in each institution’s organisational context and history, and the staff involved in curriculum development.

Canning (2005) identifies two types of interdisciplinary programs from the perspective of area studies that are also relevant for sustainability: those which are run by cross-disciplinary departments and those which are a partnership between disciplinary departments. York is an example of the former, and MTA and UBC are examples of the latter. Cross-disciplinary departments are better able to engineer an integrated experience for their students, because they are in control of all the subject contents. Liberal programs emerge from the offerings of many departments and are vulnerable to staff changes and varying teaching philosophies. Without some longitudinal or capstone core, students will largely be left to their own devices to integrate what they have learned in the latter. Additionally, cross-disciplinary departments will reward their students for their breadth and ability to integrate. Students taught similar content by
disciplinary departments will be evaluated alongside students doing specialist majors in those fields, and may be found wanting, especially in upper years (Canning 2005).

The contents of core curricula may reveal the attitude of their offering departments towards the value of traditional disciplines. If disciplines are seen to be less relevant to sustainability than the capacity to integrate, one would expect to see no involvement of discipline-based departments, low prerequisites (to avoid specialisation) and a core curriculum empty of traditional fields (Cairns 2004). If disciplines are seen to contribute valuable tools and knowledge, a program might rely heavily on expertise found in traditional disciplinary groupings and include their subjects in the core curriculum. The only full course with no foundational core or majors in traditional disciplines is offered from the York Faculty of Environmental Studies, which has no structural subunits, disciplinary or otherwise. Students can pursue a major external to the faculty if they wish to specialise. The UNB minor is similar, and is not offered from a faculty at all. This means either that environmental study is felt to be ‘about’ breadth at these institutions, or that organisational structures impose themselves normatively on educational design. The courses at MTA and UBC are run from faculties with relatively traditional departments which value disciplines and use prerequisites to encourage a building of expertise in addition to breadth. The liberal arts organisational structure at MTA is comparatively more porous than at UBC, but both clearly support a ‘canon’ in environment other than interdisciplinarity itself.

6.3.2 Program selectivity

Student numbers must usually be limited in innovative teaching programs to control costs, workloads and retain the function of engaging pedagogical methods. Deciding how to winnow numbers belies the philosophy of the creator(s) about education as transformation. The cases that illustrate this section are not all seen by their originators as contributing to environment or sustainability, but they all meet at least some of the criteria established in the ‘canon’ and range in intake from 20 to 45 students at a time (for more detail, see Table 6.7 on page 154). Those cases that fill enrolment lists first-come, first-served include:

- The Learning City service and action learning subjects available at the inter-institutional Great Northern Way Campus, a collaborative initiative of UBC, SFU, The Emily Carr Institute of Art and Design, and the British Columbia Institute of Technology; and,

- The STU Aquinas Program, which is a team-taught, thematic block program utilising collaborative inquiry approaches.

Those cases selecting their intake based on grades, or more ephemeral qualities such as well-roundedness, or performance in an interview, included:

- The SFU Undergraduate Semester in Dialogue, a capstone, thematic, block offering with a collaborative learning ethic; and,
The Bachelor of Philosophy in Interdisciplinary Leadership Studies at UNB’s Renaissance College, a rigid yet liberal program developed with funding by a private foundation (Rehorick and Taylor 2001).

All of the above cases challenge the traditional model of higher education, and are unarguably more expensive to deliver. They cross disciplines, encourage communities of learners, and engage with the real world both to critique and improve it. Each one involves team teaching and intense immersion for students and staff. Because of the time involved, these offerings are most attractive to traditional student demographics. Some of the few mature-aged students who have undertaken the Aquinas Program, for instance, have been resistant to the creative pedagogical approach and its time demands, possibly as a result of other major life commitments they may be balancing with their education.

The transformative ethic is perhaps stronger among unselective programs which take students on a ‘first-come, first-served’ basis. It assumes that the desire is to convert and/or transform, fostering an informed and active citizenry, rather than take the converted to new heights. The Aquinas Program’s inventors, for example, had a “commitment…to making [it] not elitist and not triage … to have the same students [they had] all the time but give them this opportunity” (E219).

While choosing students based on academic standing or other less measurable qualities may be seen as creating a “silk purse recruiting and manufacturing facility” (E219) by some, a carefully engineered class composition can nurture creative, critical and cross-disciplinary leaders for the future, something that sustainability also deeply needs. Notably, such selectivity issues appear to have caused little conflict in the development processes of any of these cases. The creators’ choices felt obvious to them, based on the goals of the individual program, and none mentioned concerns about the inequitable opportunities available. The Canadian sector enables students to self-select within a diverse range of offerings.

In contrast, the Australian sector has an ‘equity’ imperative in access and experience (Kemmis et al. 2002). Mixed-modes of educational delivery or selective innovations like those discussed here can challenge that ideal. For example, it is often incumbent upon lecturers with distance education cohorts to ensure that a student doing a course in that mode has the same learning experience as those studying internally. Additionally, teaching staff must often ensure that students will not be disadvantaged by lack of funds, or by physical or emotional capacity to undertake required activities (such as international travel), or if the different real world experiences in which students are immersed for credit provide unequal challenges. As seen above, this admirable goal simply homogenises the experience to the lowest common denominator.

### 6.3.3 Organisational structures

Sustainability has no logical home in the academy, so many universities form superstructures to help academics collaborate on research across disciplinary ‘silos’. Governance of such superstructures can vary from the highly formal to loosely
collegial, depending on the source and amount of resources. The presence of ‘competing’ units in the same university affects the scope of such groups in outreach, collaborative research, research training and teaching. Three such organisations were visited in Canada (see Table 6.8 on page 155 for more detail):

- The Institute for Resource, Environment and Society (IRES) at UBC, in the Faculty of Graduate Studies;
- The Institute for Research and Innovation in Sustainability (IRIS) at York, led from the Schulich School of Business but funded by the Research and Innovation budget; and,
- The ESDRC (see Section 6.3.1.2) at UNB, housed in the Faculty of Forestry and Environmental Management but funded outside.

Structurally, each case comprises a small nucleus, which depends more or less on collegiality to form a larger network. This collegiality is easily corrupted by the competitive internal cultures of universities (Brett 2000). To succeed, managers of these umbrella structures felt the institutes must value-add, reduce transaction costs and be transparent to avoid inciting resource envy. Membership was often optional rather than imposed, and different modes of participation were possible. Rather than dragging people together against the ‘current’ of academic life, some of the institutional and career barriers to interdisciplinarity were simply softened. As one centre leader puts it,

I’m not sure that coordination is actually what’s needed. … People who want to do this kind of inherently problem-based, interdisciplinary, socially focused work just want to do it … it’s not because they did this kind of degree or that kind of degree, it is because somehow that’s the way they [are] inclined. (W109)

Another director describes his management approach accordingly as:

very much not to prescribe … but to let it grow organically. … It’s more rational to think about this as a network phenomenon, one that operates with high trust and goodwill in the institution. (C215)

Directors feel that the institutional home of such an umbrella group can limit its mandate. Centralisation in a common building is impractical and expensive, and location within one faculty can incite turf wars. It is both impossible and undesirable to “ghettoise” (W109) sustainability. It is valuable to have it spread throughout the institution, at least philosophically, perhaps using porous borders. One ex-director states the benefits of nonalignment as follows:

[I]f you are going to be able to look at emerging ideas…you have to have a certain amount of flexibility…in the structure that will allow it. As soon as you start putting up an institute or structure or department or faculty…people start looking at you with jaundiced eyes. (W107)

‘Umbrella’ institutes must clearly walk a careful line to find success in unifying sustainability research, but what of the relationship to undergraduate teaching? Although universities in Canada receive their provincial government funding only for teaching, there is a real disjoint between research and teaching when it comes to time, organisation and rewards (as in Australia). While the training of research students is often firmly within the purview of such ‘umbrella’ organisations, undergraduate
teaching is another world entirely. Undergraduate students can clearly benefit from the expertise and research in such organisations, so why the disconnection? Is it a message that undergraduate students should not be engaging in interdisciplinarity?

Disengagement of such institutions with teaching appears rather to be a budget issue. Any umbrella-based teaching program will become dependent on goodwill unless it has consistent funding, or can draw without penalty from offerings across the university. In the only program studied that was not successfully launched – the proposed UBC Interfaculty Program in Sustainability Studies (Spiegelman et al. n.d.) – recruiting and accounting hurdles proved insurmountable as a result of working outside of a faculty. Only one of the environmental programs investigated earlier was offered from outside a faculty. This was the Environmental Studies secondary major and minor at the ESDRC. The ESDRC was initiated by the 1994 (NB) Premier’s Round Table on Environment and Economy and remains funded from outside the academy. It uses short-term grants to establish coursework based on what it sees as a gap in offerings at UNB. It has found that teaching outside of a traditional faculty structure is a major disincentive:

[I]t’s like the ‘tragedy of the commons’. If it doesn’t belong to somebody, it doesn’t belong to anybody. (E117)

This dependence on goodwill and short-term funding is a recipe for burn-out, even amongst passionate environmental educators.

The other two ‘umbrella’ groups above are virtual institutes, comprised largely of academics that have permanent appointments elsewhere in the university. Many of the members teach undergraduates under that guise, and the students they attract contribute to funding those formal academic organisational units (AOUs). Governance of the ‘umbrella’ groups is loosely collegial, optional, and non-restrictive: the key to their success lies in value-adding for members, not increasing obligations, but they are rarely resourced to do either. “Networking … can bring together fragmented actors, but cannot meld them into one institution” (Rydin 2006, p. 214). The institutional, disciplinary and sectoral environment already involves a set of overlapping allegiances, incentives and barriers to individual staff activities. A research-based funding source limits the mandate. Such structures may provide a one-stop location for research on sustainability for those outside, but risk intellectual turf wars inside.

### 6.3.4 Administrative issues

Innovative curriculum structures are often unexpectedly hampered by the tools and structures that are intended to assist in their administration. If too many new things are proposed at one time, it can just as easily be the administrative ones as the pedagogical that will trip up the process. The lesson that comes out of some of the cases previously discussed is to make innovations administratively invisible whenever possible. Hurdles

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14 They also offer an MPhil in Policy Studies (Sustainable Development)
around student credit, workload calculations, and resources are advisedly minimised or subverted, particularly in the initial ‘proof of concept’ stages.

Student credit is usually delivered in regular sized chunks, and homogeneity in the value of subjects facilitates multi-mode delivery and exchange programs. Full-year subjects are decreasing in number for the same reasons. Block programs like *Aquinas* and the *Undergraduate Semester in Dialogue* use a number of standard credit units rather than one big one, and simply arrange to have the enrolments between them linked, even though the delivery is fully integrated. The innovative *Learning City* subject used open course numbers earmarked for independent study when it was in pilot mode at UBC. A successful offering later supported a submission to senate for a dedicated code. The recent move of *Learning City* to an inter-institutional campus presents a new challenge. Students enrol from up to four institutions to be taught collectively by instructors from up to four institutions; does the credit accrue to the academic units of the lecturers or the originating institution of the students? Such concerns call for a new kind of governance that is still under development.

Accounting for faculty workloads is often decentralised and thus difficult in innovative structures. Where the block programs and team teaching approaches have worked, as in *Global Resource Systems*, *Aquinas*, and *Undergraduate Semester in Dialogue*, participating staff members have been given credit for all the time they spend in the classroom, not just their ‘share’ as if it was a ‘tag-team’ joint subject delivery. Graduate co-supervision across faculties, such as that within the Resource Management and Environmental Studies masters program at UBC/IRES, must also be appropriately credited. In other cases like Environmental Science at UBC, innovative teaching models depend on the sense of duty of committed teaching staff, whose additional hours are essentially volunteered. If that staff member leaves, or burns out from effort, the program disappears. Funds for teaching assistants and a ready supply of postgraduate students can offset this burden, but all too often, innovative teaching programs depend on short-term teaching and learning grants. Without a guarantee of ongoing resources, many sensibly find the effort of developing new programs too big of a risk when it hampers their productivity in ways that are recognised and valued.

In addition to regular funding, other resources that can be taken for granted by academics can also become a stumbling block. Many of the innovators interviewed found that a permanent space allocation was important to developing a community of learners. Students in the SFU *Undergraduate Semester in Dialogue* found having the same room available for lectures, and for casual interaction outside of that time, to be extremely valuable. Such dedicated space is a luxury on most campuses. The UBC *Global Resource Systems* core programs need breakout spaces suitable for facilitating problem-based small group work and the lack of available rooms is what limits their enrolment size. The *Aquinas* program no longer has a dedicated room two days a week;

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15 In fact, the actual workload may be higher even than in a traditional subject taught alone, although staff members are certainly not credited for this.
other classes are interspersed around them. Some of the interaction that once occurred face-to-face has moved to an asynchronous forum environment; teaching staff report a commensurate loss of student engagement.

Some innovations using online environments can also challenge administrative processes. *Global Resource Systems* students participate in a cross-cultural subject throughout their degree that involves the interaction of students from all years, whether on site or on overseas exchange. This requires having four sections of each of the three subject numbers sharing one forum, which Registrars and the software alike are not easily able to handle. Such longitudinal or integrating subjects also challenge timetabling systems for class time and examinations.

### 6.4 Conclusions

This chapter has explored a number of common tensions in the development of innovative teaching programs relevant to sustainability. These conflicts have been illustrated with cases from seven Canadian universities. Developers of the teaching and research programs discussed had to make compromises during their design, but less than might be required to enact similar programs in Australia. This work was less a search for the ‘right’ model than for insights into the range of options available, and how best to marshal those appropriate to sustainability through the internal maze of modern tertiary institutions. The interconnecting pressures support the importance of systemic analysis around tertiary change.

Sustainability is clearly not the ‘soft option’ for students or researchers to tackle, and it would benefit outcomes if it ceased to be seen as ‘anything goes’. Teaching such a topic with rigour requires time and clear intentions (Collier 2000), which is difficult with tight budgets and with sustainability understood differently across the academy (Reid and Petocz 2006). Students need time and guidance to build expertise in a discipline (or two) and to learn to make connections between them and others. Core content and prerequisites acknowledge the importance of building on intellectual foundations. A lack of prerequisites in upper-year humanities and social science subjects may actually lead to their absence in course core, if core is used to make sure students do not burn their bridges, rather than instilling a ‘canon’. A diversity of designed programs provides choice without sacrificing guidance. University organisational, accounting and administrative structures often cement internal divisions and limit intellectual breadth in staff and students. Pragmatic concerns such as subject numbers, credit value, workload formulae and timetabling can become challenging when working outside the traditional university model. Innovators recommend making a program as ‘invisible’ as possible to these processes, at least in the pilot phases, to ensure the only hurdles are the important ones.

Three more general themes arose that resonate with higher education sectors other than the Canadian one.

- First is the strong centralising force extant in universities and disciplines alike. As Campbell (1969) notes, academic boundaries discourage activities at their edges.
Similarly, innovative programs seem to work at a tension from the traditional model and can easily be drawn back towards it if additional pressure is exerted.

- The second theme is the importance of collegiality and good academic (as opposed to corporate) leadership, especially when facing a somewhat tyrannical market. There must be some support for ‘for your own good’ in a world of choice. A diversity of well-designed offerings balances student support and responsibility.

- The final overarching theme is that tight university budgets are a major barrier to higher education for sustainability. Innovations require more effort, not less, and increased engagement with the real world means more friction occurs than in ‘controlled’ environments.

In this context, a program that successfully educates for sustainability is a rare but notable accomplishment.
6.5 Addendum

The following five tables contain detailed descriptions of the cases addressed in the chapter. The contents they hold are ancillary to the text, but provide evidence of rigour.

Table 6.4 Matrix showing Canadian cases, number of interviews, and the rationale for inclusion.

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<th>Number of Interviews (FormalIntl)</th>
<th>Block-linked programs</th>
<th>UG Sustainability education</th>
<th>Interesting core sequence</th>
<th>Problem-based investigation</th>
<th>Cosmopolitanism in curriculum</th>
<th>Civics/Outreach in curriculum</th>
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Table 6.5 Matrix showing Canadian cases and their uses in theory building in this chapter. Zeroes indicate key cases described in greater detail in Table 6.6, Table 6.7, and Table 6.8.

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<td>BA (Environmental Studies), Faculty of Social Science</td>
<td>X</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 6.6 Canadian cases expressing environment and sustainability core content issues.

<table>
<thead>
<tr>
<th>Cases:</th>
<th>UBC BSc (GlobalResSys)</th>
<th>York BEnvStudies</th>
<th>MTA BA (EnvStudies)</th>
<th>UNB (Env Stud secondary major)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>Food &amp; Land Systems (erstwhile Agriculture)</td>
<td>Environmental Studies (small, with no subunits)</td>
<td>Social Science</td>
<td>None (run by ‘umbrella’ ESDRC)</td>
</tr>
<tr>
<td>Established</td>
<td>2000, after a faculty-wide rejuvenation process to address market downturn.</td>
<td>Early 90s, after being a masters-only faculty since the 1970s.</td>
<td>Late 90s, as a result of discipline changes and student agitation.</td>
<td>Since 2000 due to personal interest by centre members.</td>
</tr>
<tr>
<td>Design &amp; control</td>
<td>Small committee on time release; run by staff of two.</td>
<td>Developed and maintained by faculty committees.</td>
<td>Individual interdisciplinarian coordinator.</td>
<td>ESDRC and contract staff.</td>
</tr>
<tr>
<td>University structure</td>
<td>Faculty autonomy but good support for external experiences like exchanges</td>
<td>Faculty autonomy encourages duplication and internal competition.</td>
<td>Traditional liberal arts model encourages breadth of experience.</td>
<td>Traditional departmental model.</td>
</tr>
<tr>
<td>Core Structure</td>
<td>Longitudinal with faculty-specific foundation year (tension between)</td>
<td>Cafeteria with small foundation</td>
<td>Chequerboard with capstone issues subject</td>
<td>Foundation with chequerboard elective structure.</td>
</tr>
<tr>
<td>Core content</td>
<td>Science-oriented faculty core; longitudinal focus on integration, cross-cultural sharing and PBL.</td>
<td>Intro to social action and change, environmental studies, one science and one humanities subject.</td>
<td>Environmental studies, economics, biology and earth sciences.</td>
<td>Environmental studies, applied problem-solving, stakeholder engagement.</td>
</tr>
<tr>
<td>Inter-disciplinarity</td>
<td>Highly individualised programs with the choice of a ‘resource’ and a ‘region’, which serve as double majors. Also language subjects if needed.</td>
<td>Four subjects in a faculty-based area of concentration like environmental management, urban and regional env., env. politics and env. and culture.</td>
<td>Choose-from-a-list requirements are grouped by broad discipline area to ensure breadth; draws from offerings across the campus.</td>
<td>Six electives, with minimum of one from each of four lists (science, applied science, humanities and social science).</td>
</tr>
<tr>
<td>% Core</td>
<td>31% of 40 subjects</td>
<td>30% of 30 subjects</td>
<td>42% of 24 subjects</td>
<td>40% of 10 subjects</td>
</tr>
<tr>
<td>% Prereq in year 2-4</td>
<td>- (upper year subjects can not be identified)</td>
<td>18%</td>
<td>78% (students map own progression)</td>
<td>48% (students map own progression)</td>
</tr>
<tr>
<td>Annual enrolment</td>
<td>55 in 2005 and growing.</td>
<td>Consistently 80-90 per year.</td>
<td>10 declared majors and increasing.</td>
<td>Approximately 100.</td>
</tr>
<tr>
<td>Challenges</td>
<td>- Invisibility of constituent parts of adisciplinary core for accreditors/employers. - Ensuring full credit for team teaching. - Onerous student advising for custom programs.</td>
<td>- Staff resist silos of any kind and prefer a customised course design like the individualised Masters program on offer.</td>
<td>- Low student awareness of option and low number of dedicated subjects. - ‘Two cultures’ divide in science prerequisites.</td>
<td>- Developing and running subjects on short-term grants. - History of unsuccessful environmental experiments elsewhere in the university.</td>
</tr>
</tbody>
</table>
Table 6.7 Summary of innovative Canadian cases illustrating equity and program selectivity issues.

<table>
<thead>
<tr>
<th>Cases:</th>
<th>GNWC Learning City subjects</th>
<th>SFU Dialogue Semester</th>
<th>UNB BPhils (Interdisc.Lead.)</th>
<th>STU Aquinas Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other affiliation</td>
<td>Interinstitutional: UBC, SFU, Emily Carr, BCIT</td>
<td>Morris J. Wosk Centre for Dialogue</td>
<td>Renaissence College</td>
<td>-</td>
</tr>
<tr>
<td>Origins</td>
<td>Origins in a proposal for a sustainability major at UBC which spawned a pilot subject (Spiegelman et al. n.d.). GNWC houses subjects since UBC declined the major. Plans to extend subjects to a Masters at GNWC.</td>
<td>Originated during Centre foundation in 2002, by a senior research biologist with broad interests; starting to become independent of this individual with new hires.</td>
<td>2000: College and course funded by a private foundation, developed by loose UNB committee with some externals (Rehorick and Taylor 2001).</td>
<td>Three staff all fascinated with an account of ‘false memory’ in early 90s, and discussing how to use it. Collegial course design followed and continues.</td>
</tr>
<tr>
<td>Format</td>
<td>Piloted as a summer semester offering, with immersive experiences of living off the land, with First Nations communities or urban bicycle commuting. Recent offerings longer but not summer only.</td>
<td>Themed, upper-year block offerings: sustainable communities, health care and ethics, art and community, etc. Intensive, with a dedicated space for class and work.</td>
<td>66% core: broad foundation year; integrating seminars throughout; internships in Canada and overseas, and room for an external minor. Immersive.</td>
<td>Themed block-offered program as optional 3/5 of first year. “Truth in society” was first and still exists; links English, psychology, and religious studies.</td>
</tr>
<tr>
<td>Pedagogy</td>
<td>The educational model is one of community service and action learning. Students form interdisciplinary and interinstitutional teams. Subjects start with intensive stake-holder engagement to develop applied urban sustainability projects. Student teams work with faculty to solve problems chosen by stakeholders.</td>
<td>Dialogic, self-driven learning on assigned theme. Practice in citizenship, critical thinking, experience of the ‘other’, interdisciplinarity and problem-solving, both alone and in teams. Students sometimes undertake volunteer tasks for credit.</td>
<td>Evaluation by learning portfolio, evaluating “effective citizenship, problem-solving, multi-literacy, personal well-being, social interaction, leadership skills and knowing oneself and others” (Renaissance College Council 2005)</td>
<td>Team-based collaborative inquiry with authentic experiences such as writing for a real audience. E.g. “inkshedding” is used for students to reflect on reading, and their required attendance at campus events, and is used by other students.</td>
</tr>
<tr>
<td>Size and selectivity</td>
<td>First offering 45 students from any program, any year.</td>
<td>20 per year: grades, diversity and interview</td>
<td>25 per year: on grades and well-roundedness</td>
<td>Limited to 36, but not selective.</td>
</tr>
<tr>
<td>Challenges</td>
<td>- Unites several knowledge cultures with trade and design institutions included. - Novel governance arrangements needed for accounting costs and workloads across institutions. - Surviving on short-term teaching grants.</td>
<td>- Full-time, internal status required of students, and schedule varies, perhaps making it difficult for those with other commitments. - Intensive weekly student advisory meetings.</td>
<td>- Resentment at UNB that new money heading to a new college r/t to help existing. - Attracts school-leavers as associated with a residential college with summer placements.</td>
<td>- Hard to get access to same room so pushed online. - Limits size of 1st year intro subjects. - Concerns about 2nd year readiness pulling towards a traditional model. - Attracts mostly school-leavers.</td>
</tr>
</tbody>
</table>
### Table 6.8 Summary of Canadian ‘umbrella’ institutes around sustainability.

<table>
<thead>
<tr>
<th>Cases</th>
<th>UBC IRES</th>
<th>York IRIS</th>
<th>UNB ESDRC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origins</strong></td>
<td>Agglomeration: An interdisciplinary graduate program from the 1970s has become the nucleus of IRES through a series of institutional amalgamations during the past decade. That program in resource management and environmental studies (RMES) allows students to assemble diverse supervisory teams from across the university.</td>
<td>Top-down design: Launched in 2004 as a result of a task force aimed at becoming more ‘strategic’ about sustainability, one of the university’s key research themes. It is somewhat ‘virtual’, and was loosely built on faculty-based initiatives that lacked critical mass. Still young, it currently houses mostly the work of the director and several active academic members.</td>
<td>External catalyst: The 1994 Premier’s Round Table on Environment and Economy, provided money for a chair and a centre on the topic at both UNB and the local french language university. The host university only provides space, so effort is directed mostly out of the institution to advocate for sustainability in the province.</td>
</tr>
<tr>
<td><strong>Faculty home</strong></td>
<td>Faculty of Graduate Studies (houses interdisciplinarity at UBC for the time being)</td>
<td>Schulich School of Business, funded 20% by Research and Innovation budget, 80% soft.</td>
<td>Faculty of Forestry and Environmental Management</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Originally just one staff member, with a changeable cast of faculty associated via their students, IRES is becoming formalised. It now has a building, and the first few dedicated appointments rather than joint.</td>
<td>Comprised of a director, with a bit of admin and research proposal support. There is an executive committee, which includes staff from operations, as well as an outer group of members less involved.</td>
<td>Comprised of a director and other staff funded through ‘soft money’ for largely external projects. There are neither additional memberships nor joint appointments.</td>
</tr>
<tr>
<td><strong>Activities</strong></td>
<td>There has not yet been an effort to use IRES as a way of drawing people together, i.e. no seminar series or networking opportunities, but these are planned. Adjunct members are affiliated through their students and projects. IRES also has no involvement with undergraduate students.</td>
<td>The goal is to provide assistance to get more sustain-ability research happening at York. Incentives do not yet exist to motivate those external to IRIS to funnel funds through the group. Occasional seminars are held for all members. No undergraduate involvement as yet.</td>
<td>The centre director sits on the round table as well as other government advisory boards and committees. There is no mandate to unify activities on campus, but ESDRC has developed a MPhil Policy Studies (Sust Dev) and a popular Environmental Studies minor.</td>
</tr>
<tr>
<td><strong>Challenges</strong></td>
<td>- Amalgamations were not entirely peaceful at first, and subdivisions are intact pending strategic planning. - Formalisation and assets could affect collegiality and student access to labs, etc. - Incentives for involvement “seduction” (W107) only</td>
<td>- Some initial scepticism about its ‘umbrella’ status and whether it is adding value. - A big challenge is to appear non-threatening to faculties while being an authoritative portal for those outside to access York sustainability research.</td>
<td>- Coursework depends on short-term teaching stipends, often taken up by ESDRC staff themselves. - The university does not value anything for which it does not pay, which leads to a lack of a mandate inside, despite credibility outside.</td>
</tr>
</tbody>
</table>
Universities are aggregations of units which reinforce boundaries via reward systems, administrative structures and disciplinary activities. Sustainability, by definition, considers social, cultural, economic and environmental ramifications simultaneously. Contributing to sustainability from within a university necessitates reaching across disciplinary or structural boundaries in research and teaching. Social network analysis (SNA) and bibliometrics have been frequently employed to investigate academic collaboration, and are applied to this diffuse field to investigate the academic research environment that sustainability researchers perceive. Evidence of collaboration is derived from Institute for Scientific Information Inc. (ISI)- and DEST-indexed co-authorships and research panel co-supervision affiliations captured by internal university databases. A multi-scaled analysis is undertaken because the context looks very different from the perspective of an individual academic than it does to a research group, budgetary unit or research policy or administrative position. The reasons for collaboration differ by scale, and the costs and benefits accrue differently at each level (Melin 2000). A bi-directional orientation is revealed that may be an optimum combination for research undertaken in a research training environment: cohesive, department-based supervisory clusters benefit from the sparse (hence non-redundant) and wide-ranging collaborative connections of each supervisor’s personal research activities. Even interdisciplinary units dedicated to sustainability fragment along disciplinary lines.

7.1 Studying sustainability research collaboration

Sustainable development is a higher-order social goal (Dovers 2005a) that challenges the growth ethic and increasing inequity of modern life. Education is a powerful policy instrument for social change, but the tertiary sector has been slow to react. This resistance or resilience (depending on your perspective) may indicate support for academic freedom, but organisational, funding and incentive structures can also motivate individual behaviours in academia. Academics must rationalise and prioritise loyalties to discipline, organisational unit, career, and public good, in a sector undergoing reinvention as a result of information technologies and neo-liberalism (Marginson and Considine 2000; Noam 1995). Although ‘an environmentally sustainable Australia’ is now a formal national research priority, interdisciplinary topics can be beset by challenges.

This chapter presents social network analyses of sustainability research and research training in two different units and at various levels of aggregation. First, collaborations at two case study universities are mapped using an indivisible ‘atomic’ unit of budget units or AOU. Incremental aggregations of those units along the organisational hierarchy help to examine the impacts of such boundaries. Second, recent collaborations inside and reaching out from the key organisational hubs at each case institution are mapped at the level of the individual to reveal the dynamics within interdisciplinary
Sustainability bound?

AOUs. Different datasets are used for each stage, and so the chapter concludes with a sizable discussion of methodology and data.

7.2 Social networks and social capital

Sociologists have spent considerable time looking at academia and the production of knowledge in traditional science (Bourdieu 1984; Cole 1983; Kuhn 1970; Latour 1987; Price 1965). The ‘Mode II’ research (Gibbons et al. 1994; Nowotny et al. 2001) or ‘post-normal’ science (Funtowicz and Ravetz 1993) perhaps typical of sustainability work involves more players and disciplines, and complicates sociological analyses and the research evaluation processes that feed government funding policies. SNA explores connections between individuals or organisations, and how linkages affect aggregate behaviour or information flows (Borgatti and Foster 2003; Klovdahl 1997; Wellman 1983). Actual interactions such as email exchanges or conversations can be mapped onto sociograms, or bibliometric evidence of influence like joint publications (Laudel 2002; Newman 2004), citation (Crane 1969) or co-citation (Van Raan 1990). Maps of the former illustrate social cohesion for use in understanding information flow or managing change in organisations (Frank 1996; Price 2003; Tichy et al. 1979). The latter has been used to visualise academic collaboration (Barabási et al. 2002; Newman 2001) or the diffusion of technology or new ideas (Davidson and Lamb 2000; Fujigaki 2002; Rinia et al. 2001; Sorenson et al. 2006) in organisations and disciplines. Collaborative networks have been found to be ‘scale-free’, meaning that they demonstrate similar degrees or patterns of clustering at various levels of aggregation although pressures and incentives differ at the level of individual and organisation (Newman 2001; 2004). This fractal characteristic is also visible in academic productivity. Price reconfirmed Lotka’s 1926 ‘inverse law’: “about one in five authors produces five papers or more, and one in ten produces at least ten” (Price 1963, p. 43). Fields with such differing sizes and publication traditions as chemistry and philosophy follow this pattern.

Social capital is conceived in different ways by theorists such as James Coleman and Ronald Burt (Borgatti and Foster 2003), and the union of their concepts combine to a model of collaboration that closely fits the evidence given here. Social capital in an academic setting comprises ‘scientific and technical human capital’ or “the sum of researchers’ professional networks and their technical skills and resources” (Bozeman and Corley 2004, p. 599). A lack of social capital is a real hurdle for collective action (Rydin 2006). Formal education and mentorship is a way of transferring that capital between generations. Collaboration helps to advance knowledge in a field by leveraging capital from a range of agents, but there is disagreement about what network structures best leverage such capital.

Coleman (1990) asserts that dense and relatively homogenous networks make it easiest for “an ego’s alters … to coordinate with each other to help ego” (Borgatti and Foster 2003, p. 994). These terms describe the agents of networks that are focused on one individual, the ego. The ‘alters’ are connected to that ego in some way, and may also be linked with one another in such ‘ego-based’ network analyses. If the ego is a research
student, Coleman’s statement supports the logic of selecting a panel from within one AOU or discipline area. The student is more likely to receive consistent advice, because the panel members likely already know one another (indeed, may already be collaborators), and may be operating under the same administrative or disciplinary norms. Such a bounded view can be reassuring for a research student who is apprenticing in a complex field. The risk of ‘groupthink’ or intellectual stagnation can arise in overly cohesive settings, however (Hogg and Hains 1998, see also Beaver 2001). Interdisciplinary areas in particular need to feed on new research in the disciplines (Rinia et al. 2002; also Section 1.2.7).

A dense network does not appear to be the best way to advance knowledge amongst the mentors themselves. Burt (1992) recommends instead a sparse network, where so-called ‘structural holes’ are bridged by individuals who link those who are not otherwise connected. Granovetter’s (1973) agrees, by distinguishing the incremental value of forming ‘weak ties’ and strong using graph theory (Chartrand 1985): the first few connections in a network improve performance – the transmission of new information – much more than the ones that complete its connectivity. A sparse structure reduces redundancy in the capital and information to which an individual has access (Mehra et al. 2001), and the more novel the connections to others, the more non-redundant information that link will likely provide. “Why work with someone nearby, or otherwise similar or familiar, when they probably already know the same things I do, or have access to the same set of resources? I might as well work alone (and not have to share kudos).” As visible later in Figure 7.4, a quarter of publications demonstrate such logic.

Like the dualism of light, which simultaneously behaves as a wave and as a particle, these two conceptions of social capital might operate together to produce an efficiently, two-faced academia. This is described by Granovetter (1973, p. 1378) as a “welcome” paradox:

Weak ties, often denounced as generative of alienation … are … indispensable to individuals’ opportunities and to their integration into communities; strong ties, breeding local cohesion, lead to overall fragmentation.

How can this bi-directional phenomenon be understood in the context of units designed to tackle diffuse and naturally interdisciplinary field like sustainability? Is pro-collaboration rhetoric supported by a union of theory and evidence?

Well-defined disciplines facilitate sociometric analyses, but some work on interdisciplinary research has been done, (Fujigaki 2002; Qin et al. 1997), albeit frequently in areas that involve the sharing of expensive research infrastructure such as neuroscience and experimental physics (Braun et al. 2001; Laudel 2006a, among many). Sustainability is a diffuse field (Whitley 1984), often mysterious even to its practitioners, each blindly holding a different part of the proverbial elephant. What motivations or career strategies are evident by choices made about collaboration? What operating dynamics affect those choices? Enriching standard bibliometric methods with social network analysis to map relevant activities at several case institutions reveals the forces at play on sustainability in universities.
7.2.1 Cases and disciplinary duplication

Two Australian universities are examined, both of which have unique structures featuring disciplinary duplication (i.e. several units covering economics). University A is a post-war, research-intensive university with a high ranking nationally and internationally. It comprises a research-intensive element which is budgeted separately to the teaching schools that mirror most of the research units. University B is a regional, multi-campus university formed in the late 1980s by the amalgamation of several vocational institutions. It is still building its research profile but its focus on rural society and natural resource management is relevant for sustainability. Disciplines are duplicated at B because schools on different campuses (once autonomous institutions) often deliver similar teaching content. Collaboration outside of units is thus not necessarily interdisciplinary at either university. Each institution has one unit that acts as a natural hub for sustainability research, although the dominance of this unit is more notable in B. Each institution also has a relatively new ‘umbrella’-style institute to coordinate education and research in sustainability. These universities are the same as those explored in Chapter Eight, where accounts of recent changes in environment and sustainability curricula at the same institutions are provided. That qualitative work draws on observations made here, and provides – in turn – the context with which to interpret these findings.

7.2.2 Social network methods

The institutional context for sustainability research in the case studies is mapped using records of research student co-supervision and journal article co-authorship (Table 7.1). These are not necessarily comprehensive “proxies for intellectual activity” (Lattuca 2002, p. 719). Co-authorship is not always evidence of genuine collaboration between actors (Bozeman and Corley 2004; Katz and Martin 1997; Laudel 2002). The assumption is a common one, however, and the data is readily available (Barabási et al. 2002). Whether the assumption overestimates or underestimates collaboration is unclear (Katz and Martin 1997; Melin and Persson 1996) but likely varies by discipline from the reality it seeks to model. Some fields acknowledge all contributing work by lab technicians, when others only acknowledge creative input (Laudel 2001). The panel members advising students who are undertaking higher degrees by research (co-supervisors) vary in their engagement, too. Some advisors may only be involved intermittently in the student’s work, or even less substantially engaged, but this variety is not captured here.

Other potential datasets capturing research collaboration activities include research grant applications (successful and not), paper acknowledgements and co-authorship in the gray literature such as government reports. None but research grants has a thoroughly indexed data source available, and permission was not granted to access unsuccessful grant applications at the universities studied because – although clearly the result of collaboration – that material was not in the public domain. The assumption is made here that successful collaborations around research grants also result in academic publications and will thus already be present in the journal article dataset.
Table 7.1 Data sources and periods used for analysis of two case study universities, and sustainability hubs within them. The header refers also to sections where the data is employed.

<table>
<thead>
<tr>
<th>Cases</th>
<th>Supervision</th>
<th>Publication</th>
</tr>
</thead>
</table>

7.3 Collaboration within universities

The first analysis of sustainability collaboration uses AOUs (basically budget units) as ‘atomic units’, to understand the dynamics between different components of the university.

7.3.1 Compiling and modelling data

Co-publication data is derived from the Australian National Citation Report as prepared by the ISI and address-linked by the Research Evaluation and Policy Project at the ANU. The ISI was chosen because of its wide acceptance in bibliometric studies and long history of record-keeping. Reaching back to 1980, ISI easily covers the period since ‘sustainable development’ was coined (WCED 1987), and thus perhaps also the “birth of the discipline” (Barabási et al. 2002, p. 591). ISI does not systematically index book chapters, creative works, or the gray literature. Applied science, social science, and humanities citations are under-represented (see Section 7.5.1). There is also a bias towards the issues and outputs of rich nations (Lorrae van Kerkhoff pers. comm. 27 Apr 2007). Other biases introduced via this approach are discussed in Section 0. All publications were extracted that had at least one author from the case institutions and contained in the article title or the journal name one of five keywords and their derivatives: sustainable, conservation, ecology, resource and environment.

The number of times each address was used on each paper was determined manually, because ISI only lists each address once per paper, regardless of how many authors are from that affiliation (Melin and Persson 1996). Correspondence addresses different from those otherwise listed were deleted to isolate the affiliations to locations where the collaboration in question actually occurred. The date of publication was taken as the year the collaboration occurred, as time lags between work and publication may differ widely.

Individual university research student databases were mined to identify supervisory teams overseeing higher degree students working in sustainability. Details were
extracted of theses where titles or ‘field of study’ classifications contained the keywords mentioned above. Theses that were discontinued in some way were not included, other than the work of students on leave. Each thesis was linked to the year the student commenced, and all names were deleted for privacy; scholarly contributions were instead aggregated to the smallest discernible scale of AOU. Research into organisational change was occasionally required to track AOU name changes, closures and mergers, but for the most part the structure of both universities remained consistent during the study period.

Many uses of the keywords do not relate to sustainability work, necessitating a culling process. A three-dimensional criteria system identifies the intended audience, immediate purpose, and values implied in the work. Theses and papers were removed if they were classed with any category ‘starred’ in Table 7.2, which puts it in the white (filtered out) area of Figure 7.1. In the case of theses, whose titles are often creative and harder to classify, 10% of the borderline titles were checked for consistency by two colleagues. Where disagreement existed, theses were retained. University A, being a research-intensive institution, does a much larger proportion of sub-disciplinary, pure academic research than University B, and thus had more papers culled during this stage. The remaining set of papers and theses left after filtering are denoted as ‘sustainability’ throughout the rest of this section.

Table 7.2 Classes and rationales used for filtering papers and theses once extracted using keywords. Those classed with any categories marked with asterixes were removed from the analysis.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audience</td>
<td>General</td>
<td>Intended for those outside the discipline; a broad audience.</td>
</tr>
<tr>
<td></td>
<td>Discipline</td>
<td>Intended for an audience of fellow disciplinarians.</td>
</tr>
<tr>
<td></td>
<td>Sub-Discipline*</td>
<td>Intended for a narrow subset of specialists</td>
</tr>
<tr>
<td>Purpose</td>
<td>Application</td>
<td>Focused on usage, usually testing the impact of behaviours or decisions on environment, society or other.</td>
</tr>
<tr>
<td></td>
<td>Methods/Context</td>
<td>Developing and testing methodologies that will aid future researchers, but not yet suitable for application, or contributing background context to understanding, such as environmental history.</td>
</tr>
<tr>
<td></td>
<td>Pure Research*</td>
<td>Extending knowledge in a sub-discipline or discipline, often in isolation of human behaviours or actions.</td>
</tr>
<tr>
<td>Value System</td>
<td>Social</td>
<td>Concerned with social sustainability only (including health, cultures, communities, etc).</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td>Concerned with environmental sustainability only.</td>
</tr>
<tr>
<td></td>
<td>Financial*</td>
<td>Concerned with economic sustainability only.</td>
</tr>
<tr>
<td></td>
<td>Integrated</td>
<td>Combining two or more of economic, social and environmental.</td>
</tr>
<tr>
<td></td>
<td>Academic*</td>
<td>Values-neutral, usually also pure, sub-disciplinary work.</td>
</tr>
</tbody>
</table>
Figure 7.1 Graphical representation of the culling rationale explained in Table 7.2. Those theses and publications classified with the combinations represented in gray were retained.

Figure 7.2 shows the ‘sustainability’ research output about for each university included in this section’s mapping exercise. It suggests that sustainability research is more prevalent at A than B, which is not surprising given their respective histories and niches. Trends of publishing in sustainability also appears to be increasing at A while flat-lining at B, the latter surprising considering incentives for increased production. In addition to having more ISI-indexed publications overall, University A publishes in a wider range of journals. The most prevalent journal for both cases was Biological Conservation, and Ecological Economics and the Journal of Environmental Management also ranked highly. University A data reveals the presence of a prolific research group in conservation biology that includes all but one of the most dominant nine authors at that institution. University B’s most prolific authors were more active in rural sociology, policy and agricultural or catchment management.

Figure 7.2 Number of research activities used in this analysis, over time and by case, as extracted from ISI databases and internal university graduate student records, and filtered for relevance to sustainability.

The two academic activities were modelled differently in converting them to sociograms in SNA. All of the authors listed on a journal article were modelled as fully and mutually connected via the work (Figure 7.3). This calculation uses Equation 1. As the focus of this initial analysis is the amount of collaboration, papers with many authors and theses with many supervisors are justifiably valued higher for being more
interactive. Each collaborator/activity pair is thus valued in this section as ‘one’, rather than as a fraction of the ‘one’ activity. Interdisciplinary research students, who are creating something new between the diverse expertise of their supervisors, rather than a subset of any of them, anecdotally interact more with their panel members individually than as a team. Collaborations on theses are thus modelled as radiating between the student and their supervisors (Figure 7.3), and this is where later collaboration often occurs too (Katz and Martin 1997). White (1999) uses a similar approach to explore collegiality in a university communications department, although he keeps the data in two-mode tables, and clusters staff based on their common involvement on student panels rather than mapping interactions between units or disciplines, as done here.

![Figure 7.3](image)

**Figure 7.3** The relationship between the number of people involved in an academic product and the number of mutual links, using fully connected and radial or ego-based approaches.

\[
\frac{n^* (n-1)}{2} = \# \text{links} \quad \text{where } n=\text{number of actors}
\]

**Equation 1** calculates the number of mutual links between \( n \) paper co-authors.\(^2\)

Data was captured in *Microsoft Access* databases and moved into social network programs *Ucinet* (Borgatti et al. 2002) and *Netdraw* (Borgatti 2002). Publication data was entered as ‘two-mode’ datasets, which are pairwise lists of unlike things such as authors (or author AOU)s and the papers to which they have contributed. The ‘affiliation’ function in *Ucinet* then computes connections between authors (or AOU)s based on the sum of papers they have co-authored. This produces a one-mode dataset that links like things: authors (or AOU)s to one another. Supervision data are automatically in the form of one-mode data, being pairwise lists of student and supervisor AOU affiliations. *Microsoft Excel* was used to calculate bibliometrics and check for errors. The combination of quantitative statistics and qualitative sociograms reveals interesting patterns that relate to the institutional environment for sustainability research. The results from both cases are presented in an integrated fashion.

---

1 The fully connected method was trialled for linking co-supervisory teams, and these results are given in square brackets in Table 7.3 and Table 7.8. These alternate calculations show the lack of difference that the modelling approach made on the overall pattern.

2 This equation is more commonly referred to by mathematicians as \(^5C_2\).
Chapter 7: Mapping an interdiscipline

7.3.2 Quantitative analysis

Social networks can be viewed many ways, and the following observations were developed using a tabular visualisation of the above affiliation computations. The sections explore the orientation of sustainability work, the degree to which sustainability work differs in orientation, and the team size and composition involved.

7.3.2.1 Bidirectional orientation

Past choices reveal how academics value various types of collaborations, and in both cases, supervision is oriented inside AOU, and research publication outside universities. Beyond that broad pattern, however, each university has emphases depending on the task involved (Table 7.3, with an alternative visualisation in Figure 7.4). After AOU, academics at University A looked next for supervisors among other units within the university, while those at B augmented the university’s nascent research capacity with external collaborators. In publication, external co-authorships were clearly favoured, and a similar number of papers were solo authored in each case. Next were links internal to AOU, although University A also had nearly as many elsewhere in the university whereas collaboration was largely kept within AOU boundaries at B.

Table 7.3 Percent of collaborations of each orientation, by case and activity. Square brackets contain the results of preliminary analyses where supervision was modelled as fully connected. The entire datasets of each institution are compared, 1981-2004 for A and 1993-2004 for B.

<table>
<thead>
<tr>
<th></th>
<th>Publication</th>
<th>Supervision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Solo (only one address)</td>
<td>28.1%</td>
<td>23.2%</td>
</tr>
<tr>
<td>Links inside AOU</td>
<td>20.3%</td>
<td>32.6%</td>
</tr>
<tr>
<td>Links to University</td>
<td>16.1%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Links outside University</td>
<td>63.6%</td>
<td>60.9%</td>
</tr>
</tbody>
</table>

Figure 7.4 Percent of ‘links’ of each type, by case and activity (as in Table 7.3), but counting solo publications as links. Note that supervision always involves at least one supervisor, so no solo links are present in that category.
Since both institutions have disciplinary duplication, the relative impermeability of AOU boundaries at B (save for outside links) compared to A suggests that multi-campus geography or competition limits collaboration, or that it lacks critical mass in the range of fields necessary to encourage intra-university collaboration. The Vice-Chancellor (VC) at University A has also explicitly encouraged collaboration across academic units. There is an increase in ‘internal’ collaboration metrics at A as the data is aggregated incrementally ‘up’ the hierarchy of the organisational structure.

An alternative explanation relates to Granovetter’s (1973) ‘welcome paradox’ of network density and sparseness presented in Section 7.2. The bidirectional nature of collaborative activities may be providing the best of both worlds to students: consistent advice from supervisors housed in a similar organisational culture, but with access to a wide range of resources via those supervisors’ non-overlapping research networks. This is the only hypothesis that unifies the divergent literature on the topic as presented in Section 7.2. More research is required to confirm whether this self-organised phenomenon is optimum (see Section 9.3.3.2) for research advancement and training, but it also shows up in individual activities within the sustainability hubs in Section 7.4.2.

7.3.2.2 Is sustainability research different?

Is sustainability research measurably different in collaborative orientation than other research? Data collection for this study was not designed to answer this question, but a brief comparison is possible using existing resources. The mapping of research panels using SNA is unusual, and no comparative datasets are available for that activity. ISI databases can easily be mined for papers demonstrating collaborations of various kinds in all its humanities, social science and science indices, however. Table 7.4 compares the ‘orientation’ of scholarly outputs in the sustainability set, and the full ISI database, for each case university over two 11-year time periods. Its numbers are not based on counting linkages, as is done in Table 7.3, as that would be too time-consuming for comparative purposes. Instead it classes indexed publications in one of four groups, those that contain: only one address (solo); a collaboration within AOU (even if other types are present); a collaboration outside of AOUs but within the university (even if some external links are also present); and, those that have no collaborations inside the university, but some outside of it. Papers are thus not counted twice (except where small overlaps exist between ISI indices, as shown in Table 7.5), and internal connections are privileged over outside. The sustainability sets are re-counted here to match this new logic. Comparing the two reveals some differences with the patterns discussed earlier, and reveal the different modes of collaboration with which each institution tackles sustainability in comparison with the rest of their academic output.
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Table 7.4 A comparison of co-authorship patterns between raw (All) and sustainability (Sust) ISI publications, using the percentage of papers demonstrating collaborations of various types, rather than the proportion of linkages from those papers that cross each type of boundary. The categories are exclusive (save for overlaps between the composite indices), prioritising local engagement.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>University A</td>
<td>University B</td>
<td>University A</td>
</tr>
<tr>
<td>Solo</td>
<td>Sust 35.3% All 31.3%</td>
<td>-</td>
<td>47.9% All 25.0%</td>
</tr>
<tr>
<td>AOU</td>
<td>41.4% All 40.1%</td>
<td>-</td>
<td>20.7% All 33.8%</td>
</tr>
<tr>
<td>University</td>
<td>4.3% All 2.5%</td>
<td>-</td>
<td>0.9% All 9.9%</td>
</tr>
<tr>
<td>External</td>
<td>19.0% All 26.1%</td>
<td>-</td>
<td>30.4% All 31.3%</td>
</tr>
</tbody>
</table>

n 116 13829^ | - | 217^ | 285 | 17659^ | 56 | 913^

* Note that University B was only formed in 1989 and appeared as a valid affiliation on few outputs during this period.

^ These totals are based on the un-normalised sums from the three composite indices; see Table 7.5 for overlaps.

University B was only established in 1989, so it appeared in few papers (none sustainability-focused as defined here) during the first period of interest. During that first period, its ISI output is characteristic of a new university formed of amalgamated institutions. Most of its papers are solo publications or feature external collaborations (perhaps from prior appointments), with very few extensions across university AOU's. AOU-only collaborations increased by 19% and solo publications decreased by 26% as cohesion developed. University-only collaborations remained low between the first and the second 11-year period under investigation, probably due to multi-campus geography. University B’s sustainability output in that second period of interest, however, has fewer AOU-only collaborations in evidence than in the overall ISI set, and much more external-only collaboration, perhaps typical of the applied nature of sustainability research in such a vocationally oriented institution. B’s staff members are publishing in more journals that are classified as belonging to more than one of the ISI indices (see Table 7.5), implying more integration of knowledge cultures. A larger proportion of University B’s ISI-indexed output (6.6%) is considered ‘sustainability’-focused than University A’s (0.9% and 1.7% for the two periods in question, derived from Table 7.4).

Table 7.5 Share of scholarly outputs from the case universities indexed by the ISI’s three databases, over the two time periods of interest.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>University A</td>
<td>University B</td>
</tr>
<tr>
<td>Arts/Humanities</td>
<td>530</td>
<td>9</td>
</tr>
<tr>
<td>Science</td>
<td>11294</td>
<td>99</td>
</tr>
<tr>
<td>Social Science</td>
<td>2005</td>
<td>109</td>
</tr>
<tr>
<td>All ISI (unique papers, without overlaps)</td>
<td>13373</td>
<td>213</td>
</tr>
<tr>
<td>% overlap in indices</td>
<td>3.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>% of Science</td>
<td>84.4%</td>
<td>46.5%</td>
</tr>
</tbody>
</table>

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University A has a longer history of publication from which to consider the question of whether sustainability research is different. Its sustainability output in both time periods features more solo papers (perhaps by interdisciplinarians) and fewer with external-only collaborations than the ISI set, as well as slightly more university-level collaborations. The pattern of collaboration differs with University B’s, which seems closer to reflecting the Kates et al. (2001) opinion that ‘sustainability science’ will require increasing integration of disciplines and non-academic stakeholders, against the personal incentives towards solo authorship. The difference may be institutional, reflecting the diversity of staff expertise and equipment available on site, or the dominance of University A’s output by the Science ISI index, compared to B (see Table 7.5).

The data comparison in Table 7.6 suggests that sustainability work is different, but not consistently so; it varies based on institutional research niches. At B, sustainability has involved more outside collaboration, often with agencies, leading to more interdisciplinary publication based on applied work. At B more collaboration inside universities is evident, but also more work by individual ‘sustainabilists’, possibly interdisciplinarians. The only characteristic present in both cases over the time periods investigated is a slightly higher prevalence of intra-university collaboration in sustainability work.

Table 7.6 How sustainability and all ISI collaborative orientations differ, based on Table 7.4. If the number is positive, sustainability work features it more than the entire ISI set.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Solo</td>
<td>+4.0%</td>
<td>+6.1%</td>
<td>+0.9%</td>
</tr>
<tr>
<td>AOU</td>
<td>+1.3%</td>
<td>-0.1%</td>
<td>-16.3%</td>
</tr>
<tr>
<td>University</td>
<td>+1.8%</td>
<td>+4.5%</td>
<td>+3.3%</td>
</tr>
<tr>
<td>External</td>
<td>-7.1%</td>
<td>-10.5%</td>
<td>+12.1%</td>
</tr>
</tbody>
</table>

7.3.2.3 Team size and composition

While the number of internal and external authors per sustainability paper is similar, the number of supervisors per relevant research panel differs between institutions (Table 7.7). One cause of this difference may be university policy. University A prescribes at least three supervisors per thesis panel and its average of four may reflect the impacts of such a policy, although, as discussed later, panel sizes (or the full reporting of them) appear to have dropped in recent years. University B had no policy on panel size at the time of this analysis and has consistently smaller panels. Staff workloads may be a contributing factor to the difference. University A has many research-only staff, and a much smaller student/staff ratio than B among those who do teach, theoretically leaving more time for staff to take on mentoring roles. University A’s longer history allows some trends to be explored in team size and composition.
There has been an increase from two to three authors per paper on average at University A during the period studied. A small decline in intra-AOU collaboration since 1981 can be linked with a commensurate increase in collaboration across AOU.s. Disaggregated network visualisations not shown here expose a surprising lack of collaboration between the AOU.s that comprise larger groupings like faculties, whether those larger groupings are disciplinary or interdisciplinary (i.e. problem- or area-focused) in nature. Academics clearly exercise the right to choose their collaborators, if not their colleagues. Many linkages in collaborative diagrams around sustainability work appear to be well-worn ‘grooves’: working together once makes later collaboration more likely than new links being formed. Such social reasoning (including previous collaboration or mentorship) is responsible for 32% of collaborative choices, according to Melin (2000), and a quarter of collaborations are undertaken to expand social networks.

Within the last ten years at University A, the proportion of sustainability papers with outside authors has increased. External addresses appear on 18% of such papers between 1995 and 1999, compared with 37% since then. There were only half as many outside authors as those from University A on papers between 1995 and 1999, compared with one-to-one later (acknowledging a small skew resulting from one 42-author paper in 2002). The analysis in Section 7.3.2.2 suggests this external orientation in publication is even more characteristic of sustainability research at applied universities like B, where stakeholders are increasingly involved in both problem-framing and research. Incentives for collaborating with industry on research grants may also be a cause. It may also attest to the decreasing impact of geographical proximity on research collaboration, discussed later.

The ‘hoarding’ of student supervision within AOU.s at University A was common through the 1990s, peaking at 83% of reported supervisors in 1999 coming from the same unit as the student. Funding and workload incentives may have motivated this insular practice. Outside supervisors are making up increasing shares of sustainability panels, but membership numbers from within the AOU have simply dropped rather than

---

3 The elite are often able to turn collaborators into colleagues, attracting students and staff from elsewhere into their group. This reduces uncertainty, transaction costs and cognitive tasks involved in arranging the division of labour vertically (Laudel 2001) and allocating resources and credit (Landry and Amara 1998). Such clusters can operate almost as an assembly line to increase research productivity for all members (Beaver 2001).
both converging. In fact, the size of sustainability supervisory panels has plummeted
from six supervisors per thesis in 1995 to 3.2 in 2004, much closer to those at
University B. External collaborations declined so dramatically as to suggest that it may
be an artefact of the student database; external advisors may simply be less rigorously
reported and recorded as there is no operational reason to capture them. If not, there
may be some systemic pressure from outside the sector, or research bureaucracy
(Chompalov et al. 2002) and high transaction costs (Landry and Amara 1998) are
discouraging the formation of new linkages, ad hoc or otherwise.

7.3.3 Structural analysis

The aforementioned affiliation computations can be aggregated at various levels to
depict the institutional structure of sustainability research and research training. Such
diagrams (called sociograms) and their associated structural metrics help to
conceptualise where the incentives and barriers lie in such practices.

7.3.3.1 Intra-university networks

Since the mid-70s, when environmental concern was becoming institutionalised,
research on sustainability has involved increasing numbers of agencies and parts of
universities. The four so-called ‘pillars’ of sustainability are economic viability,
environmental responsibility, social justice and cultural vitality (Hawkes 2001). Most
units at any university could potentially contribute to at least one of these elements.

Engagement in the topic varies widely across the sector, however, in research as well as
education (recall Section 4.3.1). Biophysical units are dominant in the research activities
captured at both cases (Figure 7.5 for A, Figure 7.6 for B), resembling the way
biophysical topics dominate coursework degrees in sustainability (see Section 4.4). In
addition to the difficulties of capturing work in the humanities discussed earlier (Section
7.2.2), the engagement of health units appears low at both institutions (but particularly
B) considering the unarguable physical and mental public health impacts of
unsustainable practices. Neither university had a medical school during this period, but
they did have relevant research and teaching units in the topic at A and B, respectively.

Collaboration outside of AOUs into the rest of the university was the least popular of
the possible collaborative alignments in Sections 7.3.2. Intra-university density is lower
for co-authorship than co-supervision. Each university has about the same number of
units active in sustainability publication and research, but the density of connections
(the proportion of possible links that actually exist) between those AOUs is much higher
for co-supervision (27.5% and 22.2% respectively for A and B). The density of
publication links is 11.1% and 2.8% respectively for A and B. It is likely that B’s
publication density is underestimated, because of the fact that so many of the
publications are credited to that university’s cross-campus umbrella institute on
sustainability. The members of that hub (‘Sustainability’ in Figure 7.6a) are mostly
based at one school (‘C3-Environment/IT’ in Figure 7.6b), it there are members at other
AOUs whose work is credited there. If this diversity was captured, B’s publication
density would probably resemble that of A.
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Figure 7.5 Internal collaborative relationships at University A represented by discipline areas rather than identifiable unit names: a) Co-authorships in sustainability ISI papers, 1980-2004, scaled by the number of time each AOU appeared on a paper, with link weights representing the frequency with which the two nodes appeared together; and, b) Co-supervisory relationships, 1976-2005, with nodes weighted by the number of students or supervisors from that AOU named on a relevant culled thesis, and links demonstrating the frequency of the pair.

The influence of physical proximity on collaboration feasibility and success has been much discussed (Adams et al. 2005; Katz 1994; Rhoten 2004; Younglove-Webb et al. 1999). Laudel (2001, p. 778) observes of German research institutions that, “social interaction is a crucial condition for the emergence of creativity”. Lattuca suggests that co-location creates collaboration across fields because the co-located individuals “[learn together] in interaction and in situ” (2002, p. 720). Testing this premise by mapping collaborations geographically (rather than diagrammatically) at University A (a single-campus institution) did not show any clustering, even though the campus itself is roughly zoned along disciplinary lines (graphic not shown). At that scale, proximity appears to have little impact on the choice of collaborator. At University B, a multi-campus institution that is spread across several hundred kilometres, campus boundaries
are visible barriers, either physically or emotionally. Both universities are the product of mergers between formerly independent institutions, but the merger at B is within the memory of most of the staff members (late 1980s), unlike that at A (early 1960s). Progress in institutional identity and cohesion occasionally requires generational change (Connor and Dovers 2003).

Figure 7.6 Internal collaborative relationships at University B represented by campus and discipline areas rather than identifiable unit names: a) Co-authorships in culled ISI papers, 1993-2004, scaled by the number of time each AOU appeared on a paper, with link weights representing the frequency with which the two AOU appeared together; and, b) Co-supervisory relationships, 1990-2005, with nodes weighted by the number of students or supervisors from that AOU named on a relevant culled thesis, and links demonstrating the frequency of the pair.

7.3.3.2 Core and periphery

A core/periphery structure of sustainability research emerged in both cases, although these forms were detected visually rather than statistically (in contrast with the work of Borgatti and Everett 1999). Figure 7.7 presents AOU and linkages that are present in both scholarly activities (thus, those where relations are ‘multiplex’). The cohesive core of each is centred on the member units of topical umbrella institutes (shown in black in Figure 7.7), and it is surrounded by a changeable periphery. At A, periphery members are connected to the core but not to one another. Collaboration of one sort does not seem to result in the other outside of the core at A, where a weak relationship is demonstrated between collaboration around supervision and paper co-authorship. Activity around sustainability is more clustered at University B, but is also less structurally complex. The apparent lack of cohesion at B in Figure 7.7b is a data artefact resulting from the presence of the umbrella institute in publication data only; academic staff names were not available in the supervisory data, so they could not be cross-referenced for membership.
**Figure 7.7** Multiplex nodes and links (those which are present for both co-authorship and co-supervision) for each case university, scaled and weighted by the number of total activities and links. Black nodes are members of that university’s ‘umbrella’ organisation: a) In the case of A, all umbrella units have multiplex involvement and thus are represented here; b) for B, the two relevant umbrella groups (Sustainability, Rural Society) are not formalised to the degree that they are valid AOU’s for supervisors. Formal budget units are credited for supervisory activities instead at B, which largely align with C3-Environment/IT and C1-Arts/Social Sci respectively.

Sustainability work is more widespread at University A than B. Although more units are involved in sustainability publication than in co-supervision at each, networks are denser for the latter whether aggregated by faculty or viewed by AOU. At University A, 89% of faculty-level units or centres have contributed to a sustainability thesis or paper captured by this methodology, compared to only 37.5% of analogously sized units at B. Many of the units in the latter have an industrial focus, such as food science or agriculture, which serves to direct or focus the research interests of staff members.

**Table 7.8** Statistics on shared faculty-level nodes and links (collaboration paths), as well as those only present for one of the two activities. Results in square brackets contain sums if supervision was modelled as fully connected rather than radial.

<table>
<thead>
<tr>
<th></th>
<th>University A</th>
<th>University B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Publication</td>
<td>Supervision</td>
</tr>
<tr>
<td>Nodes shared by both activities</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Nodes unique to one activity</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Links shared by both activities</td>
<td>9 [10]</td>
<td>0 [0]</td>
</tr>
</tbody>
</table>

This table provides statistics from a higher level of organisational aggregation than that used in the sociograms shown earlier.
Another interesting structure is the difference in the pattern of involvement by year, and in neither case is the progression consistently upwards. At University A, there are always twice as many AOUs involved as there are theses, but half as many AOUs as there are papers (Figure 7.8a). University B is closer to one-to-one for both activities, with a plateau at five AOUs (Figure 7.8b). These patterns further support the idea of a periphery of AOUs engaged in sustainability work at A that shifts through time due to staff interests or incentive changes. This is appropriate as a breadth of expertise and advice is needed for students working across disciplines, but only a few AOUs or individuals at either institution could survive by considering sustainability their core business. At B, the sustainability units are more clearly identified, and they are the obvious home of sustainability work within the university.

Figure 7.8 A scatterplot indicating the number of AOUs involved in publications and research panels on sustainability each year, at a) University A, and b) University B.

More types of external agencies are becoming involved in collaboration with universities, and – in sustainability at least – many of these are not other research organisations. External publication collaborations are still dominated by research organisations like the CSIRO and Cooperative Research Centres (CRCs) and other universities, but the set of actors has expanded to include: hospitals, industry, and state and federal governments, and even local councils at University B. The expansion in players maps to CSIRO’s declining share of Australian publications between 1983 (15%) and 1999 (8%) (Butler 2001).

The geographical dispersion of collaborators can be an indicator of the intended audience for research outputs. An international authorship will likely benefit publication success in international journals and citation rates (essential for performance management), even if it does not inspire on-ground change like locally focused work might. Of University A’s so-called ‘external’ collaborations in sustainability, international co-authors have outnumbered Australian ones in the past, but they are now on par, which is opposite to the Australia-wide trend (Butler 2001). University B’s external co-authors are largely Australian, consistent with its local mission.
Although the percolation of sustainability throughout universities could threaten the rationale for interdisciplinary units, this does not appear to be happening. Looking at University A, publications and graduate student enrolments in sustainability are increasing for both interdisciplinary and disciplinary units. Only supervisory relationships from interdisciplinary units have decreased. This could map to the decline in supervisory team sizes and the increased interest in sustainability across disciplines. Alternately, it could show a backlash against interdisciplinary, sustainability research supervision by those who have suffered as a result of disciplinary- or AOU-focused performance management exercises. In comparison, the market position of sustainability hubs at University B is clear, although that university has not yet experienced widespread interest in sustainability.

7.4 Collaboration within sustainability hubs

It is a common finding that co-location improves collaboration in academic or other research settings (Adams et al. 2005; Katz 1994; Lattuca 2002; Laudel 2001; Melin 2000; Rhoten 2004; Younglove-Webb et al. 1999). The increased use of ICTs like the internet and email, the mobility of academic careers and the decreased cost of travel have somewhat reduced the importance of proximity (Beaver 2001; Davidson and Lamb 2000; Marceau 2000; Noam 1995; Van Alstyne and Brynjolfsson 1996). Nonetheless, having offices close to one another or sharing a tea room certainly increases the number of casual interactions academics have. Such interaction has been noted to result in felicitous conversations that occasionally ignite research collaboration relationships, even among those from differing disciplinary traditions (Lattuca 2002; Melin 2000). In the early 1970s, interdisciplinary research centres began to be established on the subject of environment and sustainability at Australian universities and overseas (see Section 2.3). Such institutions are often problem-based, and are staffed by a wide range of disciplines with little duplication. For example, there may be only one economist, one historian, and one biologist on the permanent academic payroll; research students, field staff or visiting collaborators are used to create critical mass in any field. Rhoten (2004) notes that centres staffed ‘nominally’ – to contribute a discipline rather than undertake a specific role – tend to suffer from a lack of common direction and waste the benefits of co-location. Brennan and Pettit observe similarly that:

…any such ‘artificial’ determination of peer groups is no easy matter: peer groups are either chosen by people for themselves or are determined by virtue of earlier disciplinary training. (1991, p. 7)

Rhoten (2004) also notes that interdisciplinary centres fail less because of a lack of intrinsic motivation by faculty or students, or a lack of support by funding agencies or other external pressures, than as a result of maladaptation at the level of management and leadership. University structures and incentives have “tended to approach interdisciplinarity as a trend rather than a real transition” (Rhoten 2004, p. 6) and have

---

4 Rarely is it ‘two-by-two’ here, as on Noah’s Ark, to assure the ‘reproduction’ of each species.
failed to establish systemic support for the undertaking. Strong cultures have been shown to be beneficial in adapting to changes such as increased opportunity or financial stricture (Sporn 1996). Ambiguity in internal organisational culture, comparatively, presents many opportunities for manipulation. If a hub or program can fill an apparent niche by *appearing* to be interdisciplinary while continuing to play a more traditional game that allows it to maintain its status, it is difficult to challenge this tactic (Landry and Amara 1998). External funding pressures may make disciplinarity a much more pragmatic choice than tackling the structural and intellectual barriers involved in actually doing interdisciplinary work.

To understand what is happening inside these interdisciplinary hubs it would be useful to know whether they have academic cultures that differ from that of the disciplines that comprise them, or priorities other than those of corporate university managers. For example, are there any incentives provided, financial or in esteem, to offset transaction costs and encourage joint ventures? Does performance management consider more than just a staff member’s ‘share’ of DEST-approved publications, which otherwise discourages collaboration? Is sharing information between disciplines encouraged beyond seminars and mingling, informally or otherwise? Is a particular kind of research encouraged, or mandated, or is hiring done for specific projects or tasks rather than to fill disciplinary niches? The answers to these questions are not known empirically, but the patterns that arise in this analysis suggest the answer is largely no, except in the training of research students, and the recruiting of project-specific post-docs. Academics in such interdisciplinary groupings are still largely looking outward to the culture and peers of their original disciplines for collaborators and signals about esteem. Status acquired from the disciplines, and the concomitant accrual of resources and networks, is what makes such individuals able to continue working to foster research students (interdisciplinary or otherwise), while setting up a cycle that simultaneously, and perhaps ironically, is keeping them from being able to model it (recall Section 5.2).

The analysis in Section 7.1 focuses on inter-organisational collaborations within case universities by aggregating all authors to their budget unit. It reveals that interdisciplinary centres or schools exist at each institution that are clear hubs for sustainability work. The approach does not reveal the dynamics within those hubs, such as the degree to which disciplinary divides persist. In this section, the internal relationships of the key hubs in both cases are investigated using an individual level of analysis, to:

- Detect individual strategies for collaboration, comparing disciplinary tradition with institutional culture;
- Explore internal divisions at these chosen organisational ‘egos’;
- Weight collaborative work so the sum of each output adds up to ‘one’;\(^5\),

\(^5\) This element will balance the ‘elephants’ with the ‘rabbits’, meaning those who publish books or monographs (large dumps of knowledge) infrequently with those who constantly publish smaller units.
• Remove the confounding effect of joint appointments on collaboration patterns;
• Understand the limitations of ISI-indexing on the assessment of fields like sustainability which span the sciences, social sciences and humanities; and,
• Capture research panels from Honours study and coursework Masters major projects, as well as Masters and Doctorate research theses.

A different set of databases and analytical methods are employed in this section to meet some of the above goals. First, the DEST point ‘share’ allocated to individuals is used in order to remove the bias towards outputs with large numbers of authors. Second, annual reports and internal records from sustainability hubs are mined to provide a more thorough source of co-supervisory panels to that provided in Section 7.1. Finally, all DEST-eligible research outputs with at least one author from the University A and B sustainability hubs for the years 2000 to 2004 inclusive are included. This information is gleaned from internal university databases. No filtering is done on this set; a decision analogous to the common bibliometric assumption that the content in a journal classified by ISI as ‘interdisciplinary’ is interdisciplinary. These internal databases have different pros and cons compared to the ISI datasets previously utilised.

7.4.1 Publication databases

Some of the limitations and biases inherent to ISI indexing have already been discussed, and more detail is given in Section 0. This analysis uses the internal databases kept since DEST introduced transfer payments to universities on the basis of the number of peer-reviewed publications they produce meeting certain criteria. As suggested by the adage “what gets measured, gets done” (attributed to Mason Haire by Behn 2003, p. 599), measures of academic productivity have become an end in themselves, encouraging particular kinds of work above others. DEST metrics determine a key source of funding for universities, and are based on books, book chapters, refereed conference papers and journal publications. All outputs are worth one so-called ‘DEST point’, save books (not edited volumes), which are worth five. Information on such academic output is collected by departments, who store it for their annual reports, and pass it on to institutional research offices. These research offices use their databases (after some post-processing and deliberation with the budget unit involved) to develop reports for DEST’s Higher Education Research Data Collection (HERDC) process on research productivity. The value of a ‘point’ is currently around AUD$960 but varies (generally declining) year to year, as it is a percentage share of a stable set of funds, drawn on to reward an increasing amount of research output (David Rofe pers. comm).

(kernels or pellets, if you will), using the digestive patterns of the elephant and the rabbit as an analogy. Such differences can disadvantage certain fields in bibliometrics (Moses 1990; Najman and Hewitt 2003).

6 Valuing publications according to how they are valued by DEST is not meant to validate their approach. Indeed this approach has encouraged volume over quality (Butler 2003).

7 It is worth noting that textbooks are often not considered to contribute to scholarship, resulting in a decline of motivation to produce them.
The resultant funding universities receive from DEST may be disseminated pro-rata back to the producing areas or individuals via calculations using the same internal database, although some hold the funds centrally (Butler 2003). This reporting process is common to all universities, and there are several off-the-shelf software programs available to prepare the submissions, but the case universities have developed their own programs (or hired in the skill). Neither of these databases is designed to answer questions related to social network analysis, and they differ from one another. Different caveats must thus be applied.

University A has used an internal database, $P_1$, for years. $P_1$ was not designed to capture information regarding how members of the university do or do not work together, or those organisations with which outside collaborations occur. In $P_1$, the first AOU to ‘claim’ an academic publication had all its authors captured in detail. Other authors from the same university were attached to that record as ‘other Uni A’ and those from outside were noted as such, without further detail. When the other AOUs from University A involved in that publication submitted it, the publication was given a new identifier, and the same data was captured from that AOU’s perspective. Due to rigorous cross-checking, this did not affect reporting to DEST. But still, two versions existed of the same published work, with the side effect of making it difficult to recognise that the two AOUs were linked by the work. Collaboration internal to the university was rendered invisible.

$P_1$ has been recently superseded by $P_2$, a normalised but highly complex database system, and the migration to this new system is still in train. It captures a myriad of budgetary and informal affiliations and joint-appointments for each individual, and research outputs are uniquely identified as objects (unlike $P_1$). The data request for this project was made during the transition period, when $P_2$ had a temporary reporting flaw of grabbing human resources affiliations when linking authors to papers. Four errors occurred. First, authors whose reported affiliation on a paper differed from their current one with the university had the current one reported instead. Second, a person who is jointly appointed within University A appears to be linked to the ‘first’ (alphabetically rather than chronologically) of their identities. Third, less formal affiliations like CRCs were temporarily invisible if they did not have a budget code at the university. Finally, a small number of other errors occurred due to mistaken identity. For example, some researchers who had left the university since the migration began had their records initially attributed to someone with a similar name. A later stage of migration will clean up these mismatches so that this data can form the new basis for DEST reports, although this task may be rendered partially obsolete by the upcoming Research Quality Framework (RQF), which will allocate funding based on the impact and quality of research, rather than amount.

Table 7.9 shows the University A sustainability hub’s DEST points according to the range of datasets trialled (including the $P_2$ eventually used), and in comparison with those actually reported to HERDC. The first column shows the sustainability ISI publications captured in the analysis in Section 7.3 (15% of actual returns), the second an unfiltered set of ISI-indexed publications for the hub (42%), and the third gives those
extracted by P2 during this migration period (84%). In most years, P2 ran short (by an average of 6.5 points), but occasionally it produced more points than were reported by the hub because of some of the aforementioned errors. This analysis thus did not capture all the DEST-eligible work that the sustainability hub at University A produced, and some that is included was actually produced by other AOUs, so it is used with all the caveats such errors suggest. Many corrections were also made based on anecdotal information. The P2 data has captured 60% more authors than the raw ISI, and almost twice as many budget units, correcting many biases in the ISI analysis.

Table 7.9 Comparison of actual DEST-reported points for University A’s sustainability hub, 2000-2004, with those captured by various datasets used here; 1) the culled ISI, 2) raw ISI (both approximate), and 3) University A’s P2 database, by year. Note that computations were reached differently in each case, and are shown here as purely indicative of trajectory. The number of research outputs, budget units and authors found in each dataset are also given for comparison.

<table>
<thead>
<tr>
<th>Year</th>
<th>1) Sustainability ISI records</th>
<th>2) All ISI records (unculled)</th>
<th>3) Internal P2 database</th>
<th>Actual HERDC returns</th>
<th>Difference Actual-P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5.63</td>
<td>18.58</td>
<td>20.69</td>
<td>25.58</td>
<td>4.89</td>
</tr>
<tr>
<td>2001</td>
<td>5.37</td>
<td>18.31</td>
<td>34.12</td>
<td>52.62</td>
<td>18.50</td>
</tr>
<tr>
<td>2002</td>
<td>6.92</td>
<td>17.75</td>
<td>35.36</td>
<td>34.48</td>
<td>-0.88</td>
</tr>
<tr>
<td>2003</td>
<td>5.08</td>
<td>15.45</td>
<td>38.73</td>
<td>52.29</td>
<td>13.56</td>
</tr>
<tr>
<td>2004</td>
<td>7.52</td>
<td>18.39</td>
<td>46.85</td>
<td>43.18</td>
<td>-3.67</td>
</tr>
<tr>
<td>Total</td>
<td>30.53 [15% of returns]</td>
<td>86.47 [42% of returns]</td>
<td>175.75 [84% of returns]</td>
<td>208.15</td>
<td>32.4</td>
</tr>
</tbody>
</table>

# Output 56 164 348  # Units 6 11 20  # Author 38 [33 hub] 85 [66 hub] 136 [79 hub]

University B’s internal database is much more task-oriented than that of A. At that institution, a new database is established each year specifically to produce the HERDC report. It does not capture information other than that HERDC requires. As each year is held in a separately archived file, the database structure can be simpler: it is less likely that a person will hold multiple identities during a single year. This does make it difficult for the institution to perform longitudinal analysis, especially as an individual’s name may be recorded differently through time. In this case it did not take long to massage the five years under study here into a common structure for analysis purposes. Some data inconsistencies remain because each publication’s data is input by its ‘lead author’ (as decided between the co-authors, not necessarily the first named), rather than a central agency. An example is where a co-author is nominated as ‘non-University B’ by their collaborator, yet the default (alphabetical first) faculty and school affiliation is left present in other fields for those external collaborators. As a result of such inconsistent data input, it was difficult at times to identify who was internal and who external to the institution. The assumption was made that if ‘non-B’ appeared in any of the columns, the author was external.
The internal database at B includes all DEST-eligible publications and shows an even larger improvement than A in representing the sustainability hub’s output over the ISI data used earlier (see Table 7.10). It also captures a valuable piece of information unavailable earlier: the AOU of each author and the umbrella centre to which the individual belongs. This makes it easier to identify the AOU affiliations of those previously allocated to the umbrella institute. The difficulty is that the AOU of interest contains individuals who self-identify as members of a range of different umbrella groups – primarily rural society and sustainability, but also complex systems and professional educational practice – as well as those who are ‘unaligned’. Only by looking at this additional detail can we fully understand their collaborative patterns.

Table 7.10 Comparison of DEST points for University B’s sustainability hub included in; 1) the sustainability ISI, and 2) University B’s internal database, by year. Computations were reached differently in each case, and are shown here as purely indicative of trajectory. The number of research outputs, budget units and authors found in each dataset are also given for comparison.

<table>
<thead>
<tr>
<th>Year</th>
<th>1) Filtered and culled ISI records</th>
<th>2) Internal database</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2.5</td>
<td>24</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
<td>19.2</td>
</tr>
<tr>
<td>2002</td>
<td>3.9</td>
<td>48*</td>
</tr>
<tr>
<td>2003</td>
<td>2</td>
<td>25.4</td>
</tr>
<tr>
<td>2004</td>
<td>2.7</td>
<td>43.6</td>
</tr>
<tr>
<td>Total</td>
<td>16.12 [10.1% of internal]</td>
<td>160.2</td>
</tr>
</tbody>
</table>

# Output  | 26     | 189  |
# Units   | 5      | 8    |
# Author  | 24 [13 hub] | 78 [64 hub] |

*One individual earned 16.67 points in this period, and was thus responsible for a large proportion of the skew during this year. Spikes like this can be the result of a local conference, which many staff and students are encouraged to participate in, and for which local staff members edit proceedings.

7.4.2 Networks between individuals

Earlier analyses show that ISI-based publications are centred within one or two ‘hubs’ at each case university. These hubs are the subject of this more detailed, individually based analysis of collaboration. At University A, the apparent hub (labelled ‘Sustainability’ in Figure 7.5) is one of Australia’s pioneer interdisciplinary research institutions in sustainability with over three decades of practice. The faculty unit labelled ‘Science’ is also a major player in sustainability according to the ISI, and within that unit, one of the dominant AOU’s specialises in the environmental and social impacts of NRM. Although the sustainability hub is research-only, most of those in the centre that do teach to undergraduates do so via guest lectures or team teaching in this ‘Resource Management’ AOU, and the units have recently merged. At University B, the

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8 Actual HERDC returns are not available, and raw ISI was not extracted for this subunit when its low performance was discovered for University A’s sustainability hub.
hubs appear to differ drastically between the two activities of publication and research supervision in Figure 7.6. This is an artefact of using umbrella research centres for HERDC but not supervisory affiliations; the individuals involved are likely the same. The node called ‘Sustainability’ in Figure 7.6a is just such an umbrella centre, and is largely coincident with ‘C3-Environment/IT’ in Figure 7.6b. It is this latter AOU that forms the sustainability hub at University B studied here.

Interdisciplinary departmental arrangements allow for formal (e.g. co-teaching) and informal interactions that increase the probability of discovering common research interests. Case hub co-authorship networks are mapped as ‘egos’ in Figure 7.9 (at a lower level of aggregation than that given in Figure 7.5a and Figure 7.6a). The hubs appear to engage with a more diverse range of budget units in undertaking collaborative research than was revealed in the sustainability ISI method. Public health units are involved, for example. Discounting the impact of ISI indexing practices, much of the work occurring within such nodes might not be ‘sustainability’-oriented as defined in Section 7.3.1: integrated in ethic, intended for application (or directly enabling the same), and written for a broader audience from that whence it came.

Figure 7.9 Aggregated ego collaborative maps of a) University A and b) University B, 2000-2004, scaled by DEST point contribution to hub publications. Nodes are scaled by the number of DEST points that other departments contributed to hub publications, ranging up to 6.8 for A and 3.3 for B. The hubs themselves are not scaled because their large size would make the rest so small as to make it hard to distinguish between contributions. Line weights indicate the DEST value shared between the nodes on those same hub publications. ‘Unknown’ in B contains statistical consultants.
Sustainability bound?

Many of those collaborative links radiating outwards from the hubs in Figure 7.9 are transient, occurring only once. Although individuals in 20 AOU's co-published with members of the A hub during the five-year period, only between six and 11 are present per year and only three (including the hub) exist in all five. University B’s hub demonstrates less reach into the rest of the university, consistent with the findings of Section 7.3.3, and only ‘Other’ – which holds non-academic support staff – was present in more than two of those years. Even if linkages to other units in the university are numerous, their frequency is not necessarily matched by shared DEST value. Published work featuring hub authors during the five years of study earned those units 176 and 160 DEST points at A and B respectively; the largest contributing units earned 6.8 and 3.3 points respectively on those same publications. As described in Section 7.3.2.1, linkages external to the university are often more popular as staff members exercise their right to choose collaborators; in interdisciplinary units this is as much the case as academics develop their own research programs in the absence of a collective one.

A more interesting question is, “What is happening inside the hubs?” Is interdisciplinary work occurring within that draws together the collected skills, or are they internally fragmented and aiming effort outward to disciplinary peers in other budget units or institutions? Rhoten (2004) has argued that unless recruitment is carried out to fill specific roles in a research program, rather than fill nominal, disciplinary identities, the former is an unlikely outcome. Collaborations within the case hubs are explored using qualitative and quantitative methods appropriate to each (accepting that the same data was not always available), and jointly synthesised. A detailed critique of method and data resources follows, and conclusions and suggestions for additional analyses conclude the chapter.

7.4.2.1 University A hub

University A’s sustainability hub is similar to others in that there is no one discipline with a so-called ‘critical mass’ of permanent staff. It spans the humanities, social sciences and sciences, and individuals largely follow the different publication and collaboration traditions of those originating disciplines (Qin et al. 1997). Solo or pair publication is common amongst the first two broad academic sectors – humanities and social science – and teams (large or small) in the third, science. It is not part of the teaching faculties but does train a large number of students undertaking higher degrees by research, and that mentorship role extends to students in other AOU's (Figure 7.5b).

Only ten individuals appeared in all of the five years under study here and have continuing appointments. A further ten were visible in most or played interesting

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9 Personality types seem to be good predictors of the centrality of players in such sociograms. Mehra et al. (2001) discuss the relationship between personality and work performance, using the characteristic of ‘self-monitoring’ behaviour. High self-monitors constantly modify their behaviour to suit the social environment, while low-self monitors are more consistently ‘themselves’. The former appear to emerge as group leaders because they are socially adapt and good at compromise, and they are also good boundary-spanners, meaning they can negotiate heterogeneous networks (Mehra et al. 2001). Low self-monitors are
structural roles via their more temporary positions like post-doctoral research, visiting fellowships or emeritus relationships (columns two and three in Table 7.11). These closely agree with the four network roles identified by Derek de Solla Price and Suha Gürsey in 1976 on which Braun et al. (2001) based their neuroscience network research. ‘Continuants’ are those who are productive in the years preceding and following the analysis, and are identified here as ‘key’. These 20 key players are identifiable as forming the nucleus of co-authorship ‘stars’ (Stokes and Hartley 1989). ‘Newcomers’ are at the beginning of their career, and ‘terminants’ at the end, both included as ‘secondary’ nodes. These three groups largely form the core discussed later in Section 7.4.3, and the periphery in that section is coincident with the ‘transients’, who publish only once in an area, and may be from another field entirely. Considering that the internal database counts 79 different authors from the hub having published in that five year span, there is a sizable periphery of ‘transients’ like PhD students. Only 3.6% of the possible linkages formed by those 79 nodes were actually present during the five years in question.

Table 7.11 Description of clusters within University A’s sustainability hub, 2000-2004. Key nodes are present in most years and hold continuing appointments; secondary hold more temporary appointments. Individual node ID numbers correlate with those in Figure 7.10.

<table>
<thead>
<tr>
<th>Areas of work</th>
<th>Key nodes</th>
<th>Secondary nodes</th>
<th>Linkages inside AOU</th>
<th>Linkages outside AOU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental philosophy (EP)</td>
<td>1 (234)</td>
<td></td>
<td></td>
<td>Anthropology</td>
</tr>
<tr>
<td>Environmental history (EH)</td>
<td>1 (231)</td>
<td>1 (64)</td>
<td></td>
<td>History, resource management</td>
</tr>
<tr>
<td>Environmental economics (Ec)</td>
<td>1 (219)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy and institutions (P/I)</td>
<td>1 (77)</td>
<td></td>
<td></td>
<td>Conservation biology</td>
</tr>
<tr>
<td>Water quality/ earth science (W/E)</td>
<td>2 (287, 298)</td>
<td>1 (21)</td>
<td>Catchment management</td>
<td>Earth science, resource mgmt</td>
</tr>
<tr>
<td>Catchment management (CM)</td>
<td>1 (150)</td>
<td>3 (176, 108, both prev PhD, and 60)</td>
<td>Water quality/ earth science</td>
<td>Intl. development, resource mgmt</td>
</tr>
<tr>
<td>Conservation biology (CB)</td>
<td>1 (178)</td>
<td>3 (99, 190, both prev PhD, and 282)</td>
<td>Spatio-temporal, Policy, Conservation genetics</td>
<td>Statistics, maths, resource mgmt, biology</td>
</tr>
<tr>
<td>Conservation genetics (CG)</td>
<td>1 (138)</td>
<td></td>
<td></td>
<td>Conservation biology</td>
</tr>
<tr>
<td>Spatio-temporal analysis (ST)</td>
<td>1 (147)</td>
<td>1 (211)</td>
<td></td>
<td>Conservation biology</td>
</tr>
</tbody>
</table>

*Another key node in this cluster is not included because of the P2 database error described earlier.

more comfortable with homogeneous settings and form strong bonds with fewer individuals. These categories may align with integrators and disciplinarians, respectively.
This sparse network of individuals does not consist of evenly dispersed links, however. Clusters have formed around the ‘continuant’ key players in a range of concentration areas (Table 7.11), each demonstrating publication traditions similar to their discipline, rather than of a particularly interdisciplinary mode of work.\textsuperscript{10} In the one area that has two key players and a collaborative disciplinary tradition – water quality/earth science – the key players did not collaborate with one another (Figure 7.10). ‘Keys’ collaborate with visitors they have attracted, post-docs (usually previous PhD students of the key player) and other early career researchers (ECRs), and disciplinary peers (and students) from outside the hub. Other studies have also shown that continuants act as hubs, and mediate communications (such as publication) between the others, as a result of “preferential attachment based on reputations and rewards” (Wagner and Leydesdorff 2005, p. 1611) locally and internationally (Barabási \textit{et al.} 2002).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure7.10.png}
\caption{Co-publication collaborations within the University A sustainability hub, 2000-2004, grouped into disciplinary or problem clusters. Colouring is by sex (men are gray, women black); squares indicate key or secondary nodes; size indicates the share of DEST points produced by the author, and links are weighted by the proportion of DEST work shared by the nodes. Note that some individuals (often departmental visitors) have not participated in research clusters.}
\end{figure}

When more than one key player from the hub engages with the same outside AOU (e.g. resource management [four key players], zoology [two], or international development [two]), they usually do not engage with the same people at those sites. Only two out of the 57 external individuals named on DEST-eligible publications are collaborators of

\textsuperscript{10} “Eagerness and need to collaborate” differs by discipline, and these traditions should not be viewed as undesirable (Melin 2000, p. 38).
two of the clusters shown. Within the hub, only a few research outputs tenuously linked clusters during this period, and such connections were as likely to be caused by protégés as they were by key nodes (Figure 7.10). ECR author 21 has worked with the water quality/earth science group and the catchment management cluster, for example. ECRs and key players in conservation biology also use and help to refine the software programs developed by the spatio-temporal group, and participate in investigating the policy implications of their findings.

Section 7.3 demonstrated the bifurcated nature of academic collaborative priorities, and this dichotomy is equally visible inside sustainability hub A. As discussed in Section 1.2.7, research students in such a group may be encouraged to undertake integrated research projects, even if this is not modelled to them as a route to research excellence (Rhoten and Parker 2004). Despite their large networks, Laudel (2006a) notes that key researchers possess a much more rigid career path compared with ECRs, because of the pressure of research leaders to acquire the funding that “keep[s] the group together” (Laudel 2006a, p. 498). When continuing funding is sparse, it falls to key players to develop the consistent track record that ensures success in winning external grants. It is unsurprising that it is the terminators and newcomers that play many of the bridging roles in interdisciplinary contexts.

The extremely sparse internal co-publication network shown in Figure 7.10 rarely spans disciplinary clusters, but the key players that lead those clusters frequently collaborate on the panels of research students enrolled within the hub (as well as outside). The matrix in Table 7.12 shows that 34 instances of internal boundary crossing occur in the supervisory teams of the 51 research students that started between 2000 and 2004. External supervisors were more common, whether from inside or outside the university, but the internal density is notably higher than in co-authorship. Many such interconnections are invisible to the publication record as a result of differing traditions in how disciplines acknowledge supervisory guidance. The social sciences (environmental history, economics, and policy and institutions) are called on most frequently by other areas in the hub, and the last of these calls on the most other fields in turn. Water quality and earth sciences have the most external supervisors (as well as frequently calling on others within the unit), and the conservation fields (conservation biology and conservation genetics) also aim outward. Catchment management is the most insular (or self-sufficient, depending on your perspective). Spatio-temporal analysis and environmental philosophy are the least connected but behave consistently with the mathematics and humanities traditions of those that comprise them.

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11 At University A, student supervisory panels were seen as subject to student record privacy policies. As a result, a neutral interlocutor used a provided list of these clusters and indicative supervisor names to create this matrix of supervisory teams. Individual names were not provided to the author, thus a visualisation or measure of the degree of cluster was not possible here.
Table 7.12 Matrix showing the number of student supervisory panels chaired from within each cluster that included at least one member from another cluster. The diagonal is empty because connections within cluster were not captured. A directed – possibly unreciprocated – link is assumed from the chair to other supervisors.

<table>
<thead>
<tr>
<th>Clusters chaired from:</th>
<th>Involve peers from other clusters:</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EP</td>
<td>EH</td>
</tr>
<tr>
<td>Environmental philosophy (EP)</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Environmental history (EH)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Environmental economics (Ec)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Policy/institutions (P/I)</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Water/earth science (W/E)</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Catchment mgmt (CM)</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Conservation biology (CB)</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Conservation genetics (CG)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Spatio-temp analysis (ST)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Other (Oth)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>51</td>
</tr>
</tbody>
</table>

* - Internal cluster collaborative links were not captured by this data source.

7.4.2.2 University B hub

University B has a multi-campus structure, as well as a focus on applied rather than pure research and teaching. During the five year period under study, its hub was quite stable in membership and research focus. A notable number of staff members are currently or once were research students of the same group, also. Its key research activities during the years of interest align well with the degree programs in environmental management, recreation and heritage, and information technology that it offers. The first two groups largely affiliate with the sustainability umbrella organisation previously discussed, and the third to a centre interested in complex systems research, including applications in environment, public health and other areas relevant to sustainability. Another handful of individuals proved difficult to classify because they were involved in a range of different topics in the five year span. Some of these appear to be shared support staff members in statistics and/or GIS, and others have a primary or secondary interest in EFS or facilities management as a result of the eco-friendly design of the campus on which the hub is located. The research profile and structure of the hub is described in Table 7.13.
Table 7.13 Description of clusters within University B’s sustainability hub, 2000-2004. using individual node ID numbers identified in Figure 7.11. Key players are divided into two groups: those acting as key nodes, and those with lower ‘degree’, often playing connecting roles. The nodes given in italics are female; the rest are male.

<table>
<thead>
<tr>
<th>Areas of concentration</th>
<th>Key nodes</th>
<th>Secondary nodes</th>
<th>Linkages inside hub</th>
<th>Linkages outside AOU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied ecology (wildlife, vegetation, landscape) (AE)</td>
<td>4 (26, 31, 55, 60)</td>
<td></td>
<td>Methods, policy &amp; inst.</td>
<td></td>
</tr>
<tr>
<td>Recreation (parks, tourism and cultural management) (R/P)</td>
<td>3 (9, 28, 51)</td>
<td>1 (4)</td>
<td>Environmental management</td>
<td>C1-Arts/Social science, C1-Agriculture</td>
</tr>
<tr>
<td>Policy, sociology and institutions for NRM (P/S)</td>
<td>1 (17)</td>
<td>2 (1, 29)</td>
<td>Methods, applied ecology</td>
<td>C1-Arts/Social science</td>
</tr>
<tr>
<td>Complex systems* (CS)</td>
<td>3 (14, 19, 37)</td>
<td>2 (25, 53)</td>
<td>Methods</td>
<td>C2-IT, C1-Science, C3-Health</td>
</tr>
<tr>
<td>Environmental management and education (e.g. campus) (EM)</td>
<td>2 (22, 36)</td>
<td></td>
<td>Recreation, applied ecology</td>
<td>Facilities management</td>
</tr>
<tr>
<td>Methods (statistics, GIS) (Meth)</td>
<td>1 (45)</td>
<td></td>
<td>Complex systems, Applied ecology, policy</td>
<td></td>
</tr>
</tbody>
</table>

*This group is no longer a part of the AOU in question, following a recent restructure.

Between 19 and 33 authors from the hub were named each year between 2000 and 2004 in DEST-eligible published work. The trend is upwards, showing an increase in staffing or research success, both possible for a university new to research. Overall, 63 names appeared, sparsely linked with 3.2% of the possible collaborative links present. Key players are those present in a majority of the five years of interest, and with above average DEST productivity (a number already skewed upwards because of one large producer). The applied focus and financial resources associated with tuition fees have allowed a critical mass to exist in each area of interest. The co-publication structure in the unit is sparse but highly clustered, with most activity radiating from one of the key players identified by squares in Figure 7.11. Where there is more than one key player in an area of study, such as with applied ecology and recreation, the key players often do not co-publish together, and have few links elsewhere in the university. Fields where key players do collaborate via co-authorship include complex systems and policy/sociology, and the smaller group of environmental management. The first of these is most active elsewhere in the university with links to the widest number of other AOU's (as well as the most diverse range) in searching out its areas of application. The internal methods group is the most active internally, likely for similar reasons.
As with University A, this pattern becomes much denser when co-supervision of research theses is involved. Twenty-one internal staff members chaired or were on the panels of the 53 students completing Honours (35), Masters (2) or Doctorates (20) between 2000 and 2004, and 10% of the possible links between them existed (see Table 7.14). Co-supervisory links inside and between the clusters delineated above are structurally important: only six of the 21 linkages existed via co-authorship and they knit together previously disconnected key nodes. Membership delineations are clarified somewhat, too. Individual 63 is revealed as an active mentor of honours students in environmental management as well as applied ecology. The applied ecology group reaches out to other clusters quite frequently for co-supervisors, in comparison with the other major groups around recreation and parks heritage and complex systems, which are more insular. The two smaller groups of environmental management and policy/sociology are also quite insular. The methods cluster is largely just a ‘service’ field to applied ecology in terms of co-supervisory teams.
Table 7.14 Matrix containing numbers of supervisors from the same and other clusters, as well as from outside the AOU, for research student theses chaired at the hub AOU that were completed between 2000 and 2004, inclusive.\(^{12}\) A directed – possibly unreciprocated – link is assumed from the chair to other supervisors.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>#Staff</th>
<th>#Thes</th>
<th>AE</th>
<th>R/P</th>
<th>P/S</th>
<th>CS</th>
<th>EM</th>
<th>Meth</th>
<th>Int</th>
<th>Ext</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Ecology (AE)</td>
<td>6</td>
<td>23</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Recreation/Parks (R/P)</td>
<td>6</td>
<td>19</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy/Sociology (P/S)</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Complex Systems (CS)</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Enviro Mgmt (EM)</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Methods (Meth)</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>53</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

7.4.3 Synthesis across cases

The ego-based analysis presented in this section provides a more balanced picture of the contributions of the humanities and social science areas within the sustainability hubs than was visible using ISI-indexed publications alone. By normalising co-authorship by ‘share’ of the DEST-points that each publication earned, these fields are shown to be very active, if less collaborative in tradition than the sciences. By mapping on individuals, confounding effects of joint appointments at University A are removed, decreasing the amount of collaboration apparent between the hub and the science (especially resource management) nodes in the ISI analysis. The culling methodology applied to that ISI data may also be flawed, causing fields such as health to erroneously appear disengaged with the topic of sustainability. They are co-authoring scholarly work with members of sustainability hubs, at least, although this is not necessarily sustainability work.\(^{13}\) It is perhaps surprising that the aggregate picture of involvement in sustainability at the two universities is so similar in the two analyses, considering the first approach contains only 10% (B) or 15% (A) of the total amount of academic work produced by each hub as portrayed in the second.

Table 7.15 presents a summary of the collegial networks inside each case hub that allows similarities and differences to be identified and discussed. The two sustainability hubs are very different in organisational niche and structure, so the degree of similarity

\(^{12}\) Note that this is a different measure than that used earlier, where doctoral starts between those dates were used. Annual reports of the University B hub did list thesis completions and panel members, except for 2003 honours, where this information was missing. The previous co-supervisory analysis did not include honours students at all, because they are considered to be undergraduates and their information is not held by any central office.

\(^{13}\) A content analysis of paper titles would have to be undertaken to consider the relevance of all such possible involvement in sustainability that did not appear in the sustainability set, and refine the methodology.
between the two nodes is notable. Individuals in each hub earned a similar number of DEST points over the five year period, on average (2.6 for A, 2.5 for B). The co-authorship networks are similarly sparse and clustered, with comparable numbers of nodes presenting as core and periphery. Although the theses were selected using different criteria, they are similar in number, and involve the same number of supervisors (largely those identified as ‘core’ nodes). The structure of co-supervisory relationships within the hubs demonstrates the ‘inside-outside’ paradox noted earlier, in firmly linking together the key nodes who rarely publish together, resulting in a denser arrangement of a smaller set of the key mentors that inhabit the core. It is possible that the bidirectional nature of the sector’s collaborative activity optimises the research training experience for students and academics. Dense internal links on panels provides local support and consistent messages for students. Sparse publication networks require less maintenance, minimise redundancy with the networks of local peers, and provide diversity to students in the individuals outside the hub with whom supervisors can facilitate contact.

Table 7.15 Summary and comparison of collaborative relationships inside sustainability hubs at both case universities, 2000 to 2004, based on analyses performed in Section 7.4.2.

<table>
<thead>
<tr>
<th></th>
<th>DEST points</th>
<th>Unique authors</th>
<th>% links present</th>
<th>Num of theses</th>
<th>% links present</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-authorship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>175.7*</td>
<td>79</td>
<td>3.6</td>
<td>51</td>
<td>3.6</td>
<td>20</td>
<td>59</td>
</tr>
<tr>
<td>B</td>
<td>160.2</td>
<td>64</td>
<td>3.2</td>
<td>53</td>
<td>3.2</td>
<td>19</td>
<td>45</td>
</tr>
<tr>
<td>Co-supervision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>n/a</td>
<td>23</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>19</td>
<td>21</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Recall that the database provided by University A did not include all of the 208.15 points reported to DEST.

University A includes those theses started between 2000 and 2004 (mostly PhDs), while B includes those completed during those years, primarily honours.

University A co-supervisory data was aggregated to cluster, rather than name, so density can not be calculated.

Rhoten (2004) studied six interdisciplinary centres to find that two types of key player balance research needs: the ‘stars’ and the ‘connectors’. Although one person can play both roles – and a handful of senior staff doing this are identifiable at each case – they are effectively two different strategies. The ‘stars’ work on disciplinary excellence, which enables them to earn the funding that keeps others employed, and the ‘connectors’ are attracted to the intellectual challenges and opportunities of linking diverse fields. These are often “younger researchers – driven to the edges of their fields by a shift in their epistemological values and intellectual interests” (Rhoten 2004, p. 8-9) despite the acknowledged risks of doing so. This is suggestive of a ‘vicarious interdisciplinarity’, consistent with Laudel’s (2006a) observations about the need for key researchers to follow traditional disciplinary patterns in order to fund research programs that support others who may be working interdisciplinarily. This analysis also shows that the ECRs are often the ones integrating the hubs, and that this tendency in the ECRs has often been fostered by doing PhDs in the same unit. Perhaps those who are mentored by a diverse panel, drawn locally, are more likely to pursue that type of research when they complete. What might this mean for the survival of the hubs?
Chapter 7: Mapping an interdiscipline

It was observed earlier that individuals in interdisciplinary units follow the traditions of the outside disciplinary community if an interdisciplinary academic culture is not actively fostered. This appears to be the case in University A, where the hub is comprised largely of pure disciplines or environmental sub-disciplines. University B’s clusters are more problem-based or applied and its individual members more interconnected, perhaps as a result of cohesion resulting from the teaching programs they deliver together.

There is some overlap between the areas of study covered at the two institutions around ecology and policy/institutional work. Other areas in the humanities (philosophy), social sciences (economics, history) and problem-based fields (recreation, catchment management, methods) are not comparable in the same way. Of those present in both hubs, an interesting difference presents itself. Applied ecology is quite an isolated cluster in hub B’s publication network, but it reaches out to other clusters the most for expertise on its research students’ supervisory panels (as well as externally). At A, the conservation biology group is responsible for most of the cross-cluster publication collaborations, but is insular within the hub in its supervision. The policy group at B has a handful of external linkages, but recruits no one from other clusters in its supervision, while the corollary at A draws on the most other clusters of any (six). These differences may simply be based on the personalities of the key individuals involved.

A final difference relates to the degree to which women are present in key roles at sustainability hubs (see Table 7.16). At University A, the proportion of those in core roles that are female is very similar to the proportion in peripheral ones (one fifth to one quarter, respectively). University B’s proportions are one tenth and two-fifths, respectively, showing that females play much less dominant roles there. This is consistent with equity statistics published by the universities themselves, and indicative of the cumulative disadvantage that women experience in academic careers (Hugo 2005; Long and Fox 1995). Women made up almost two-fifths of the academic staff at University B in 2003, but were less than half as prevalent in appointments at the level of Associate Professor or Professor (level D and E, respectively). University A’s numbers are about 16% for overall appointments and those above level C (see Table 7.16).

Table 7.16 Gender equity in sustainability hubs, 2000-2004, and case universities overall in 2003 (source for latter: internal university statistics).

<table>
<thead>
<tr>
<th>Females in structural positions at hub:</th>
<th>Female employment at case universities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>All academic positions</td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>20.0%</td>
<td>16.0%</td>
</tr>
<tr>
<td>23.7%</td>
<td>16.6%</td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>10.5%</td>
<td>17.4%</td>
</tr>
<tr>
<td>42.2%</td>
<td>38.3%</td>
</tr>
</tbody>
</table>

7.5 Methodological reflections

Bibliometric and social network approaches such as those used here are limited in several ways, some of which have already been discussed. This section will detail the challenges to using such approaches to answer questions about collegial environments.
that result from: ISI indexing practices and database structures; the record-keeping undertaken in universities; the modelling of affiliations; and, the challenges of comparing such different practices as research and research training. These handicaps were dealt with in this chapter by using a range of data sources and modelling approaches, and integrating tacit knowledge acquired as a result of a personal history with each case. Later in Chapter Eight, a degree of triangulation (Jick 1979) is added to these observations through the use of qualitative interviews and participant observation around curriculum development.

7.5.1 ISI databases

The ISI databases themselves are considerable sources of bias and inaccuracy, and their use in university league tables is starting to be questioned (Bond 2007; Butler 2007). Science disciplines whose main mode of knowledge transfer is refereed journals have over half of their DEST-eligible scholarly output indexed by ISI (Butler and Visser 2006). ISI is also biased towards elite, and typically more collaborative, publications (Beaver 2001). Fields relevant to sustainability from the social sciences and humanities have only 18-32% of DEST-eligible work included (see Figure 7.12). This bias was exacerbated in the first analysis by the keywords chosen to set a boundary to the set of activities defined as ‘sustainability’-oriented (Kossinets 2006), and by the penchant for creative paper and thesis titling in the non-science fields.

![Figure 7.12 ISI coverage of DEST output, by field, adapted from Butler and Visser (2006, p. 329). Human society includes sociology, social work, anthropology, human geography and demography.](image)

The ISI-sourced data was challenging also in its ‘many-to-many’ structure of relationships between addresses and authors. An author could have more than one affiliation, and each affiliation could be applied to more than one individual on the paper. These relationships are not made clear in the database, which does capture the order of authors, but does not use that order number to link to affiliations in another
Instead, each affiliation is listed only once, with a possible additional listing if it is also the corresponding address. In the aggregated work in Section 7.1, linkages internal to AOU were important to capture, so the addresses had to be linked manually with individuals. If only one address was listed, it was assumed that all authors were from that site. If not, the original papers were sourced to view the affiliations, online curricula vitae were viewed to determine where individuals worked at the time of publication, or emails were sent out to discover these affiliations from those with whom they published. It was a time-consuming process which could easily be captured by ISI during its indexing of the raw data. However, most bibliographic work is less spatially explicit than this study, and defines collaborative work based on the number of different addresses involved, or identifies interdisciplinary work based on the ISI categorisation of journals in which authors publish or the diversity of journals papers cite. The second analysis was analogous to this approach, by bounding the data to the outputs of dedicated sustainability units.

### 7.5.2 Internal university databases

The detailed study of internal collaboration at sustainability hubs at each case university featured in Section 7.4, and the co-supervisory mapping in Section 7.1 was undertaken using databases held by the universities themselves. Given the limitations of publicly available sources like ISI for such work, it bears mentioning the ways in which internal database design and maintenance affects the ability to seek insights of this type.

Co-supervisory data was first accessed via the central graduate research organisation of each university. These units are concerned with managing federal funding for research training via tuition and so-called research quantum (what the university receives upon the completion of a thesis, a non-trivial amount in direct and indirect funding that varies by university (Butler 2003)). Primary concerns are: tracking attrition/non-completion (which affects a university’s ‘credit record’ of sorts where a bad trend may see its allotment of funded graduate places decline); monitoring the supervisory load of academic staff; and, reporting on the disciplinary areas in which research is being undertaken. As such, some valuable information is ignored or less rigorously captured, such as the affiliations of external supervisors. Varying perception of risk meant that comparable information was not available at both universities, making it impossible to undertake more detailed comparisons.

Central university graduate research divisions do not hold information about theses involved in Honours or coursework Masters projects, and so this information is only available through the individual units at which those students are enrolled. This more complete data source was thus pursued for the hub-based analysis. At University B, this information was available on a public website listing all the theses coordinated from within the hub and their full supervisory teams (affiliations had to be determined by hand). At University A, the equivalent information was only held in spreadsheets (not databases) which also held sensitive information related to progression, personal funding circumstances and special dispensations. As a result, an approved interlocutor
had to mine the data and present it in an anonymous format (see Table 7.12). This individual was familiar with the study but validity checking was not possible.

The most challenging databases to reconcile were those holding internal publications for reporting to the HERDC process used to evaluate university contributions to knowledge. A central unit manages the information at each case, but neither has purchased any of the off-the-shelf solutions available that facilitate this task. The structures and assumptions of each database result in highly idiosyncratic data as detailed in Section 7.4.1.

In almost every example of internal record-keeping discussed here, limitations in design, or bare-bones maintenance funding, has limited the kinds of questions that the data can answer. Good databases are an important resource of institutional memory (Pollitt 2000). Once the infrastructure is established, a small amount of extra data collection can enable improved institutional research and self-awareness. Performance management is a compelling reason to establish databases, but the funding structures and strictures that they serve are subject to change. The HERDC will be superseded by the Research Quality Framework (RQF) in 2008/2009 for example.

7.5.3 Modelling affiliations

There is some dispute about the validity of computing affiliations between aggregated units, given the ‘social’ assumption of such work (Malcolm Alexander pers. comm. 5 Dec 2006). It seems acceptable to do so as long as the interactions being mapped originated between individuals rather than between organisations more generally. Melin (2000) identifies two modes of collaboration which form opposite ends of a spectrum: projects with one leader and clear division of labour, and projects with joint setting of goals and integrated work. Laudel (2001) differentiates these as vertical (led) and horizontal (peer) specialisation, which produce collaboration of varying kinds. These and other conceptions of collaboration make it difficult to decide how to model affiliations in such work. As a result, a combination of approaches has been used at various times, and these choices bear some discussion.

In co-publication, all authors were assumed to be fully and mutually connected by the work. This is a common assumption, despite its many limitations. For example, there are different disciplinary norms regarding who is listed as co-authors on scholarly work. Much valid collaboration may only be cited in acknowledgements in the social sciences and humanities, and left to the ‘invisible colleges’ identified by Crane (1972). The sciences are likely to have many ‘honorary’ authors based on mentorship alone, such as the tradition of placing supervisor names on all doctoral student publications coming out of a thesis (and following on from that work), and to name technical assistants or field staff as co-authors. That said, Biology is anecdotally also more likely to have the first author listed as the genuine ‘lead’ author, coordinating the contributions of others as per Melin’s (2000) first kind of collaboration (Joern Fischer pers.comm. 2 Apr 2007; also Beveridge and Morris 2007). Mapping ‘radially’ with this assumption (rather than the assumption of mutuality) would reveal the disciplines ‘serving’ other fields and
identify the instigators of integration as separate to the ‘recruited’. Other disciplinary traditions may assume more equivalent contributions in order for co-authorship to be acknowledged, however, and such a modelling approach would not represent that reality. Such differences are irrelevant when only studying one broad or narrow sector using bibliometrics, but sustainability crosses them all. The empirical establishment of a set of disciplinary norms would enable a more realistic modelling of collaboration in future analyses.

The assumption of mutuality in authorship created a model that was extremely sensitive to papers with a large number of collaborators. One such 2002 paper had 42 authors, two of whom were from University A, creating 126 links radiating out from its sustainability hub, and only one linked pair inside. The reality of the collaborative relationships in such a large group is unknown, but it is undoubtedly true that assuming full connection is likely to have overestimated the phenomenon. The paper-counting approach employed in Table 7.4 certainly demonstrated a much smaller, although still significant, external orientation than is suggested by the link-counting approach in Table 7.3. Such analytical sensitivity illustrates the difficulty of analysing collaboration in such a fashion. Such metrics must always be ‘ground-truthed’ interpretively and qualitatively.

Co-supervision was modelled in two different ways in this work, both assuming a radial model. In Section 7.1 the collaboration was assumed to occur between the students and their supervisors (both aggregated to AOU), as indicated by continuing collaborations in that direction after the student’s graduation (Katz and Martin 1997). In Section 7.4 links were made from the chair of the panel outward to the other members of the panel; the student’s affiliation was considered irrelevant because only theses chaired from within the hub were investigated. Each approach provided a different perspective on the dynamics at play and still other approaches exist (e.g. assuming mutuality between supervisors). A useful extension of this work would be to determine which of these co-supervisory models is most realistic and/or beneficial for sustainability work.

7.5.4 Computing affiliations

Software computations of affiliation proved another challenge in Section 7.1. The Ucinet (Borgatti et al. 2002) software’s affiliation function converts two-mode data (linking authors and publications, or supervisors and student) to one-mode (linking individuals based on common activities). Such algorithms automatically result in a loss of visibility of “the duality of people and events” (Field et al. 2006, p. 97; also Brieger 1974), but other side effects were not anticipated and required considerably more data handling than expected. As with any specialist program, it is easy to produce the wrong answer.

Affiliation computations do not allow for easy capture of collaborations internal to a node/AOU or solo publications. For example, the diagonal in the one-mode matrices generated by Ucinet does not hold the number of collaborations to ‘self’ or within the organisation. To circumvent this, the original two-mode matrix was used to tabulate the
number of links directed internally, to other AOU’s, and outside the university at various scales of aggregation as well as solo efforts. The affiliation function was then applied to develop the sociograms used for visualisation in Netdraw (Borgatti 2002). The summary data created from the two-mode files was linked to the sociogram as an external attribute file to customise the visualisations. The nodes and lines were scaled and weighted based on information generated externally to the SNA software.

A different approach had to be used in Section 7.4 in order to handle non-integer (fractional) weightings of DEST point value. In the previous analysis, each linkage between individuals was valued the same – one – which meant that those publications with lots of authors were worth more much than those with few. For the purpose of investigating incidences of collaboration alone, this is appropriate and computationally simple. The affiliation function works very well in Boolean (presence/absence) situations, or when integers larger than one are involved. Its ‘cross-product’ calculation to two-mode matrix structure outputs a simple count of the number of times each pair (of authors or AOU’s) appeared. This was used to weight the lines in the resulting sociograms, further biasing towards many-authored science papers.

Correcting this bias required all the link weights between individual authors on a paper to sum to the DEST value of the output. A conversion table such as the one shown in Table 7.17 can be created by dividing the DEST value by the number of links resulting from the mutual connection of all authors involved (recall Equation 1 on page 164). The proper value of a DEST output will result if: 1) the ‘minimum’ affiliation function is selected, rather than ‘cross-products’; and, 2) the (admittedly inelegant) ‘points per link’ value from Table 7.17 is used in the two-mode input file. The resulting matrices and sociograms allow this analysis to focus on the contribution of various fields to the academic productivity of interdisciplinary units (as defined by DEST), rather than simple frequency of relationships. Nodes are also scaled by summed DEST value accrued per author, rather than a count of outputs, as in the previous analysis.

Table 7.17 Conversion table for ensuring sociogram publication links sum to the DEST-value. Totals of ‘points per author’ are shown in scaled node sizes; ‘points per link’ by weighted lines.

<table>
<thead>
<tr>
<th># Authors</th>
<th># Links</th>
<th>Papers, Conference Papers, Chapters</th>
<th>Books</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Points per author</td>
<td>Points per link</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>.50</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>.33</td>
<td>.33</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>.25</td>
<td>.17</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>.20</td>
<td>.10</td>
</tr>
<tr>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td>10</td>
<td>45</td>
<td>.1</td>
<td>.022</td>
</tr>
</tbody>
</table>

* Conveyed by node size only

14 The latter occurred when data was aggregated to AOU in Section 7.3 because more than one author from an AOU might be involved in a paper.
7.5.5 Multiplicity

A final methodological issue relates to the validity of comparing affiliations arising from co-authorship and co-supervision because of the varying time frames involved. It is hard to know just when collaboration has taken place (Melin 2000). There are varying lag times between research collaboration, co-authorship and the appearance of work based on those interactions, and even this is strongly correlated with discipline. The sciences tend to have a shorter delay than other fields, perhaps due to the time-sensitive nature of such knowledge and the clear delineation of what constitutes ‘progress’ in well-defined fields (Whitley 1984). In this work, the date of publication is taken as the date of the collaboration. While this is clearly not the case, the real collaboration period cannot be determined without more primary data collection. Time lags can be arbitrarily applied, but will not necessarily be more universally realistic.

Similar challenges of timing exist with co-supervisory data. Research supervision by members of panels other than the chair can be quite periodic, or limited to just one chapter of a thesis, and the theses themselves can be pending for many years. In section 7.1, the date the thesis was started was employed, but the final panel line-up captured.\(^{15}\) Such complexities make ‘multiplex relationships’ difficult to interpret, but nonetheless patterns emerge that are revealing (see Figure 7.7), provided they are understood in a nuanced context.

7.6 Conclusions

This chapter analyses the structure and vigour of sustainability research interactions at two universities and finds cause for optimism. More academic units are becoming involved in sustainability work, no longer just the ‘usual suspects’, and collaboration within universities is increasing, provided individuals are sufficiently co-located. The fact that the market position of problem-based units appears secure could indicate that the performance metrics so rife in the sector are no longer hostile to interdisciplinary work, or that upper level management are offsetting such pressures with supportive cultures. However, a look inside relevant interdisciplinary units suggests that their success may lie partially in the degree to which their members continue to seek esteem in disciplinary practice. Their internal dynamics are much more fragmented along disciplinary lines than might be expected given the assumptions that support the formation of such groups. This analysis also shows those assumptions may be false. Fragmentation may simply be “an intractable aspect” of institutions grappling with broad issues like sustainability (Rydin 2006, p. 214).

Academics at the two institutions have responded in remarkably similar ways in their collaborative choices to pressures within and without, despite very different research niches. Such choices are logical responses to incentive structures like promotions and

\(^{15}\) The same logic was used in section 7.4.2.1, for University A’s sustainability hub panels, whereas University B’s hub panels were derived from a website of thesis completions and only indicated the date the thesis was finished (Section 7.4.2.2), but multiplicity was not thoroughly computed in section 7.4.
workloads which are themselves expressions of external funding formulae. A university will often apply the “same stimuli internally...to avoid sending conflicting signals to its employees” (Gläser and Laudel 2005, p. 5). Of course, universities may also be unaware of alternatives, or unwilling to demonstrate the collegial leadership required to offset such corporate pressures (this is discussed more in Chapter Eight).

SNA methods have been used to explore university structures for “discernible patterns … produced by constraints, opportunities and dependencies in actors’ interests” (Field et al. 2006, p. 99). Having access to two data sources for each activity made it possible to gain better insight on the real patterns than one alone could provide. For example, where the ISI data created collaborative links wherever individuals were jointly appointed, the internal databases made it possible to see which of those connections really exist and thrive.

Key sustainability hubs were investigated in detail and the collaborative relationships show that external disciplinary norms are dominating in the absence of a clear interdisciplinary climate or task at which staff members are recruited to fill. Where delivering teaching programs build a common identity amongst staff, collaboration is improved, but divisions still exist. The core groups are comprised of the academic ‘stars’, whose productivity fuels the temporary ‘connectors’, and the stars are much more connected to one another via supervision than publication. Women comprise a similar proportion of core and periphery at each university hub as they do in the overall academic staff, if appointments above level C are compared to all academic roles.

A bi-directional collaborative orientation was revealed at both scales that reflects different explanations of network behaviour in supervision and authorship. Co-publication is directed outside of the institution, while co-supervision is clustered largely within budgetary units. The theories and evidence taken together suggest that the bi-directional orientation optimises both the furthering of academic knowledge and the fostering of new researchers. Internal connections are sparse in publication, providing a diverse and non-redundant range of potential contacts to the supervised students. Sparse networks also increase the likelihood of combining diverse information and expertise in new ways to advance collective knowledge, rather than getting ‘inbred’. When supervisory teams are drawn from within interdisciplinary units, students get consistent messages about expectations, despite potentially differing disciplinary traditions at play. This self-organised, bi-directional orientation may be the best of both worlds, rather than something that needs fixing.

The network structures vary in density but include a core, aligned with umbrella institutes, and a shifting periphery of actors. Umbrella institutes have been discussed throughout this chapter as a means of overcoming disciplinary, organisational or geographic boundaries of other kinds. Such informal sustainability centres do appear to build some cohesion if comprised of individuals rather than AOU's. Curriculum change for sustainability is likely to benefit from the cross-cutting institutional arrangements and networks of collegial relationships they foster. Considering the increased research cohesion along the lines of course offerings at B, the inverse may also occur.
CHAPTER EIGHT AUSTRALIA: FALLIBILITY IN THE IVORY TOWER

As spaces for reflection [universities] have the opportunity to provide for sustained periods of contemplation of issues in an age in which there is a frenetic search for adaptation to new demands which are taken as self-evident, rather than subjected to sustained scrutiny. As places of expectation, they are constituted according to the demands of the environment and this drives the idea of relevance as being of service to the economy. These are not compatible, but...produce tensions that are played out in different contexts with different consequences. (May 2006, p. 333-4)

Two Australian curriculum development case processes reflect positive and negative aspects of adaptation to sustainability principles, just like wider society. Each case studied had its own internal logic, and produced reasonable programs, but contradictions arose in four key areas: privileging the financial; incomplete engagement; failing to learn; and, treating the symptoms.

Chapters Seven and Eight combine to present an interesting perspective on the university sector’s academic response to sustainability. Notable is how universities do not resist change itself, but are limited in their adaptations by resource dependence and the economy of esteem (see Chapter Five). The fallibilities identified above are discussed individually following a brief introduction to curriculum change and a discussion of method. The chapter concludes with an epilogue explaining how the fates of sustainability and environment improved at the institutions after each formal study.

8.1 Curriculum change in an interdiscipline

How does curriculum change differ from the research and research training activities discussed in Chapter Seven? Curriculum development is a social process in which participating individuals rationalise cognitive models of the issue under study with environmental pressures and administrative strictures (Huisman 1997). It is necessarily a collaborative experience. Curricula expose “what counts as valid knowledge” (Gumport 1988, p. 50), and there has been a dearth of work on how academic cultures “construct, evaluate and revise curricula” (Huisman 1997, p. 405; also Lattuca and Stark 1995). Those who wish to educate for sustainability in tertiary curricula in Australia face many challenges. These include the diffuse, crisis nature of the field; its subsequent lack of academic community; its structural misfit in university structures; and, the culture of the tertiary sector at all scales.

Chapter Three developed a set of desirable elements for sustainability curriculum design. The meandering literature was mined for core concepts, and experts were surveyed outside the practical constraints of a real process. Even so, definite conclusions about the most suitable training for meeting the sustainability challenge can not yet be made. This hypothetically ‘ideal’ curriculum remains untested in the classroom, and differs from the aggregate Australian experience (see Section 4.4) and selected Canadian programs (see Section 6.3.1.2). One of the cognitive challenges of sustainability is not just its ‘diffuse’ nature – intellectually, methodologically, socially...
and organisationally – but the fact that evidence of success or otherwise is difficult to define. Proving the value of pedagogical innovations is complex enough in such interdependent socio-economic systems (Ernst and Monroe 2004). Determining causality between research or education activities and actual progress on sustainability is even more difficult. Sustainability is, like conservation biology, a ‘crisis’ field of study in that “one must act before knowing all the facts” (Soulé 1985, p. 727). There is a very real risk that by the time we find out exactly what kind of education will contribute towards making society sustainable, it might be via the impotent clarity of hindsight. Curriculum development processes for sustainability clearly operate in a situation of higher uncertainty than fields with more developed intellectual paradigms.

A diffuse identity also means that self-identified members of the problem area share little other than a general normative stance. Chapter Seven demonstrated that the field is comprised of work in a range of disciplines and interdisciplines that are individually more or less cohesive and largely disconnected from one another. Dill (1999, p. 136) suggests that in “faculties characterised by less structured subject fields and curricula, improvement of teaching and learning often suffers from poor skills in collective problem solving and team work among faculty members”. The social diversity and interconnected environment of an issue like ‘sustainability’ are likely to present distinct challenges to curriculum development in its image. Such a demonstrated “inability to coalesce” can be catastrophic for winning internal and external resources (Gumport 1993, p. 297). Organisational structures pose inevitable barriers internally, despite increasing efforts in some universities to network academics with similar problem-based interests across such boundaries.

Internal organisational culture determines much about how individual academics prioritise their various activities, but so does societal context. Australia’s universities have always been dominated by a utilitarian ethic, and as more private providers are entering the market, competition in the sector becomes ever more corporate. The argument that universities are for anything but training is rarely ventured. Academic careers are also increasingly mobile. The resulting climate is largely devoid of interest in building or valuing collective identity. Without collective identity, whether as a corporate enterprise, an academic profession or a discipline, there is little impetus to identify and pursue common goals.

8.2 Case-study methods

This chapter reflects on the case-study approach used to research curriculum change processes around environment and sustainability at two Australian universities in 2005 and 2006. The study of universities and their response to the sustainability challenge meets both of Yin’s (2000) criteria for case study research: 1) the possible variables far outweigh the number of cases (thus making statistics and more deterministic methods useless), and 2) the context within which each of them operates is itself part of the issue. Courses and policies cannot be isolated from each other. During the sector-wide research in Part A of this thesis that was designed to facilitate an intelligent selection of cases, relevant change processes began at two institutions in which I was actively
embedded: one as a postgraduate student and the other as a lecturer. The decision was made to undertake participant research, with the concomitant benefit of evaluating process and content in real time as well as reflectively. The cases were thus not randomly chosen in a way that mimics the sampling regimes of the biophysical sciences, nor were they selected to comprise a cross-section, or a homogenous set (Yin 2000). They do provide a cross-section of sorts, one being a post-war ‘redbrick’ institution, and the other a ‘new university’ (using Marginson’s 1999 classification, recall Table 2.1 on p. 48). In retrospect, the observation of real processes provided essential to understanding the complexity of such curriculum developments.

The universities investigated here had their research collaboration around sustainability mapped in Chapter Seven (see Section 7.2.1 for brief descriptions). That mapping is combined in this chapter with case-specific enrolment statistics, internal document analysis and participant observation and interviews, forming a rich picture of the processes of curriculum change. Such ‘triangulation’ helps to ensure rigour in case-based, qualitative methods (Jick 1979), where consistency, reliability and repeatability are inappropriate measures of evaluation. Each university within Australia is unique in structure and history and therefore cannot easily be considered a case of any larger phenomenon (Stake 2000), but integrated discussion of findings is offered to highlight similarities where they exist. Points of agreement and common themes are elicited to demonstrate the shared context for sustainability curriculum development (Corcoran et al. 2004, Fien 2002).

8.2.1 Participant observation and embeddedness

I was embedded in both cases in ways that made my presence at each process natural and logical to other participants. Ethics approval was thus not sought to observe either one, unlike the ensuing interviews. A collegial approach was more appropriate in a context where no recordings were made and research notes did not include personal details nor direct quotes. Permission to undertake the study was instead granted by those running both processes, and other stakeholders consented to the arrangement. The participant observation phase simply provided an overall narrative to inform the later interview stage. My embeddedness meant that I had a comfort level with each of the disciplinary areas involved in discussions. I was a ‘native’ rather than a ‘naïve observer’ of the field of study in anthropological terms (Laudel and Gläser 2004). Being differently (in rank and history) embedded at each meant I had to carefully negotiate and reflect upon my position as a researcher.

University A’s process coordinator invited me to provide a perspective on the literature around sustainability education based on findings from earlier stages of this research, so at times I was an active participant somewhat more than a neutral observer. This role was not appreciated by all, particularly staff members who were themselves active in researching around sustainability education and who possessed the tacit information around teaching at the institution that I – a student – lacked. For some, “there [was] an
argument of whether the neutrality element over[r]ode the naïveté element” (AP1). Other interviewees suggested in contrast that the role of an ‘unaligned’, ‘good officer’ had been valuable.

In the University B case, I was not appointed to the committee, nor was I invited to participate as a result of my research. Instead I requested was granted access from the Dean overseeing the process and the process coordinator. I contributed relevant information to this process regarding trends in enrolment and EFS literature. Otherwise, I observed meetings, followed email correspondence, and collected relevant public documents. Such imposed observation was not greeted with uniform enthusiasm at B either. Complicating factors included an uneven past working relationship with one of the key participants, and wider concern that a critical evaluation could negatively affect enrolments or employer opinions of environmental offerings at the university. Both universities have been kept anonymous throughout the thesis to address these concerns.

As an embedded researcher, personal conflict arose between wanting to observe from outside, and the practitioner’s desire to help each process develop the best possible course based on evidence gained to date. Although both processes were real, the research design was not one of action research, so this necessitated walking a careful line. If asked, I always presented my opinion, but I did not argue for it in ensuing debates, which were simply observed. This seemed the best possible compromise between contributing to a good cause and not contaminating the local cultures at play.

8.2.2 Interviews

Both processes largely began and completed under observation during 2005 and 2006 (Table 8.1), a lucky accident that perhaps reflects a growing interest in revisiting environmental offerings in Australia at this time. In the University A case, the process coordinator and I alternately captured and circulated detailed minutes of each informal meeting and pending tasks. No paperwork was filed formally until the end. In the University B case, the committee was an official body, with appointed members. A general staff member was assigned to document the process according to internal university protocols, and minutes were circulated. These official minutes rarely reflected the richness of the discussion, and I was not able to attend all meetings because of the distances involved, so interviews in the latter case involved more detailed coverage of process as well as personal reflections.

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1 Interviewees are uniquely identified by codes that indicate only the university (A or B), individual’s role in the process (Management, Chair/coordinator, or Participant), and interview number within institution.

2 This general staff member was unable to be interviewed.

3 Such terse reporting requirements may be one of the causes of institutional amnesia (Pollitt 2000), and the inability to learn from past processes as needed for organisational learning (recall Table 5.3). Organisational memory is ill provided for by the reporting needs of groups like academic senate. A current AUQA audit of University A has chosen to investigate the course whose design is reported on here. My records of the process have been supplied to the audit, to complement the e-mail-based ‘paper’ trail, to explain the basis for decisions neglected in formal record-keeping.
Table 8.1 Overview of the Australian case processes.

<table>
<thead>
<tr>
<th>Case</th>
<th>Process duration and participation</th>
<th>Interview cross-section</th>
<th>Chronology of interviews</th>
<th>Interview statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Researcher was approached on the 30/3/05, and attended all but one group meeting (about 10) until 29/07/05. Observed and assisted with implementation until mid-2007.</td>
<td>Bottom-heavy; three managers to 12 participants, biased towards males and the social sciences.</td>
<td>Spread across 8-11, 16-18, 22-23 August, and the 29th of September, 2006. Interviewees from seven AOU's, management and general staff included.</td>
<td>15 in all. 38.7 minutes average (19-64). 54,956 words transcribed.</td>
</tr>
<tr>
<td>B</td>
<td>Became aware of environment review (begun December 2004) and requested access on 15/02/05. Followed (attending half of meetings) until faculty and university restructure began in mid-2006.</td>
<td>Top-heavy; six managers to four participants, biased towards males and the sciences</td>
<td>Visited all three campuses involved, 4-5 Sept. and 5 Oct., 2006. Interviewees from four AOU's and management echelons included.</td>
<td>10 in all. 36.5 minutes average (27-52). 37,432 words transcribed.</td>
</tr>
<tr>
<td>Both</td>
<td>B met every three months for 18 months; A took four months. Both reflected processes</td>
<td>8 August to 5 October, 2006, inclusive</td>
<td></td>
<td>25; 15.8 hours; 92,388 words transcribed.</td>
</tr>
</tbody>
</table>

The interview stage was undertaken and analysed much more systematically than the participant-observation stage, although my lack of prior experience with both methods, and the different contexts undoubtedly resulted in some inconsistencies. The process observations and personal reflections in my ‘field notes’ helped me to sketch a timeline for the process. A much richer and complete picture was formed once the 25 interviews were undertaken. A list of indicative questions is shown in Table 8.2, but the interviews did not rigidly follow them. Not all were used for each interviewee, and the sequence varied. Some questions were also abandoned as the interviewing continued because they did not seem to ‘work’. Interesting asides were pursued where they seemed fruitful or put the interviewee at ease. The analysis was largely a descriptive undertaking, using inductive rather than hypothesis-testing methods (Silverman 2001). As in Chapter Six, interviews were recorded (Roemer 2005) and transcribed (NCH Swift Sound n.d.). Neither tone nor pacing was captured in the transcription. NVivo software (QSR International 1999-2002) was trialled for use in imposing some analytical structure, but despite training to an intermediate level, it was found to hamper, rather than assist, the analysis. Each coding structure developed seemed to interfere with the inductive process, and the coding process was time-consuming without being revealing. Instead, the transcripts were repeatedly read, notated, and summarised to extract and illustrate key emergent themes.

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4 The psychology literature would likely have much to say about the risks of self-fulfilling prophecy in the use of NVivo to classify text-based data; I feel that one probably finds what one looks for, especially after investing the time to generate a schema.
Sustainability bound?

Table 8.2 Guiding questions for the interview process. M indicates the question was only asked of managers overseeing the process, P indicates it was asked only of participants, M/P indicates it was asked of both. Not all questions were asked of all interviewees, and phrasing varied by subject.

<table>
<thead>
<tr>
<th>Question</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your philosophy regarding the role in sustainability education and research of interdisciplinarity, creativity, and science?</td>
<td>M</td>
</tr>
<tr>
<td>Do your feelings on the above differ for undergraduate versus graduate education?</td>
<td>M</td>
</tr>
<tr>
<td>Do they differ for early career versus established researchers?</td>
<td>M</td>
</tr>
<tr>
<td>What has influenced these opinions?</td>
<td>M</td>
</tr>
<tr>
<td>How are your philosophies around sustainability transformed by other concerns before implementation?</td>
<td>M</td>
</tr>
<tr>
<td>What is the source of your interest in the environment or sustainability?</td>
<td>P</td>
</tr>
<tr>
<td>Are you currently active in researching, teaching or supervising in the field?</td>
<td>P</td>
</tr>
<tr>
<td>What motivated these activities (or lack thereof)?</td>
<td>P</td>
</tr>
<tr>
<td>How do you choose collaborators?</td>
<td>P</td>
</tr>
<tr>
<td>What do you think undergraduate education is for?</td>
<td>P</td>
</tr>
<tr>
<td>What impediments to or opportunities for cross-cutting work exist in the broader operating environment of universities/this university?</td>
<td>M/P</td>
</tr>
<tr>
<td>What is the role of the umbrella institute in sustainability education, research training and research?</td>
<td>M/P</td>
</tr>
<tr>
<td>How do you think recent structural changes will affect environmental education?</td>
<td>M/P</td>
</tr>
<tr>
<td>Why did the curriculum change process happen?</td>
<td>M/P</td>
</tr>
<tr>
<td>How involved were you/How did you come to be involved in the curriculum change process?</td>
<td>M/P</td>
</tr>
<tr>
<td>What did you think of its terms of reference?</td>
<td>P</td>
</tr>
<tr>
<td>How did you feel during the process?</td>
<td>P</td>
</tr>
<tr>
<td>How did financial or pragmatic (non-educational) concerns affect outcomes?</td>
<td>P</td>
</tr>
<tr>
<td>How did the membership and interpersonal relations affect outcomes?</td>
<td>P</td>
</tr>
<tr>
<td>How did you feel about its outcomes?</td>
<td>M/P</td>
</tr>
</tbody>
</table>

8.3 Case narratives and outputs

A brief narrative of the two cases follows, key elements of which are summarised in Table 8.3. These narratives draw on considerable internal documents and published literature, but these are not cited to avoid identifying the cases.

Table 8.3 Summary of case processes followed.

<table>
<thead>
<tr>
<th>Task</th>
<th>University A - Expansion</th>
<th>University B - Contraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a new undergraduate program in sustainability.</td>
<td>Rationalise subject offerings in environment sensibly across campuses and budget units.</td>
<td></td>
</tr>
<tr>
<td>Target a new student market to increase enrolments in existing subjects. Increase interdisciplinary offerings in areas of research strength, streamlining entry to honours study. Honour Talloires Declaration commitments.</td>
<td>More efficient servicing of existing enrolments. Reduce the number of (redundant) subject offerings to increase enrolments in remaining. Decrease subject coordination duties to leave more time for research and publishing.</td>
<td></td>
</tr>
<tr>
<td>Repetition of disciplines across teaching and research units, linked by a new college system. Umbrella institute (virtual, networking only)</td>
<td>Repetition of disciplines across campuses. Campus-specific, autonomous schools. Umbrella institute (resourced, value adding)</td>
<td></td>
</tr>
<tr>
<td>Research excellence, and research-driven teaching.</td>
<td>Regional, para-professional education; aspiring to research excellence</td>
<td></td>
</tr>
<tr>
<td>Bottom up, voluntary, additive</td>
<td>Top-down, imposed, contracting</td>
<td></td>
</tr>
<tr>
<td>Four months, with weekly meetings</td>
<td>18 months, with quarterly meetings</td>
<td></td>
</tr>
</tbody>
</table>
8.3.1 University A

University A was a research-only institution until a fraught 1960 amalgamation with a nearby undergraduate college. The two halves persist within the new institution as both funding and staff appointment processes clearly differentiate research-only from research-teaching staff. Staff members report that an internal hierarchy places the research-only side ‘above’ the other, despite the teaching side undertaking increasing amounts of research, and rhetoric in a 2005 structural working group report in support of “parity of scholarly esteem across research, teaching and creative activities”. Most disciplines have a presence in each side (some more than one). In mid-2005, a new superstructure was applied on top of the existing bifurcations to unify activities in discipline areas, or at least broad academic cultures. The location of environment and sustainability academics within this model was hotly debated, not least because the topic’s dispersion across AOUs was felt to be one of the key causes of its poor performance in a 2004 internal quality audit. The ‘sustainability hub’ and ‘resource management’ nodes featured in Section 7.4 were eventually placed in ‘Science’, which has had some repercussions for humanities and social science academics and students housed in those AOUs. A simultaneous administrative decentralisation made the new super-structural boundaries form more restrictive barriers than ever existed between the teaching and research sides of the institution. For example, and importantly for this analysis, linkages between AOUs/disciplines in the teaching half became more discouraged, although an umbrella institute around environment networks researchers.

University A self-identifies as an international research university, and is recognised as a leader in that activity by national and international ranking systems. This ‘creation myth’ dates back to its founding, and has served it well during recent government enthusiasm for ‘science and innovation’. Research suffuses its teaching ethic, with the relatively small number of undergraduates highly valued for their potential as future graduate students. One corporate vision active at University A at the time of the curriculum redesign process in question was an ethic of ‘education-intensive research’, working towards an elite intake where the majority of students continue on to honours study, if not higher. Towards this end, the VC was encouraging contact between research-only staff and undergraduate students. Despite this high-end niche, A also pursues more career-focused student markets, especially where enrolments are low.

The Talloires Declaration, which commits signatory universities to pursuing sustainability in all their activities (recall Table 1.3 on p. 12), was signed by University A in 2002. The university has been extremely active in campus sustainability, including initiating international efforts in this area, but academic efforts have been uncoordinated and uneven. In April 2005, the Head of School of the ‘Resource Management’ teaching unit invited staff who had demonstrated some interest in environmental education to help design a sustainability undergraduate program. It was driven by concern about low

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5 In identifying corporate ‘myths’ of the case universities, it is clear that “aspirations move in the direction of past performance” (March and Olsen 1984, p. 746).
enrolments at that school and a search for new niches, but it also aligned with the corporate interests mentioned above, and the university’s Talloires commitments. The basic structure was decided within the first few weekly meetings: it would include a longitudinal core, with ‘choose-from-a-list’ foundational breadth, and two complementary, ‘cafeteria’ majors. Figure 8.1a shows the curriculum that the process produced. The lack of a visible ‘canon’ in the final curriculum beyond methods, breadth, and sustainability itself is notable. For ease of management, breadth is delineated in the course by the organisational structure of the university, despite the fact that one of the categories – regional studies – cuts across the other two.

<table>
<thead>
<tr>
<th>Direct entry honours year for those with high intake score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Integrative Methods</strong></td>
</tr>
<tr>
<td><strong>Sustainability</strong></td>
</tr>
<tr>
<td><strong>Human/Environment</strong></td>
</tr>
</tbody>
</table>

a) New sustainability undergraduate course at University A

<table>
<thead>
<tr>
<th>Course requirements for specific degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemistry</strong></td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
</tr>
</tbody>
</table>

b) New common foundation year for four environmentally oriented programs at University B

Figure 8.1 Schematic of core curriculum designed by, a) University A, and b) University B. The bottom row represents first year, the middle, second, and the third, the final year before honours. Subject choice is available in light gray areas (with the number of options in brackets); darker gray represents optional content.

### 8.3.2 University B

University B was formed in 1989 from a number of para-professional colleges, although it has acquired additional specialised units since then. It is a national leader in distance education, and also delivers its popular business and ICT subjects via partner institutions overseas. The university is structured with five faculties and a number of administrative divisions that span campuses (e.g. Human Resources, Finance).

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6 While a few sustainability courses had appeared at the graduate level of the Australian sector, only one undergraduate program existed in name that was not limited to one facet of the concept. This was Murdoch University’s BA/BSc (Sustainable Development) in Western Australia.

7 This terminology is explained in Section 6.3.1.1.

8 The final year ‘integrative methods’ subject was written under contract by this researcher in early 2007 based on the theory in Chapter Three, and has been included as an Appendix to this thesis.
Marketing), but with separate schools on each campus even where similar content is taught. The schools are not exact duplicates on different campuses, as they originated and developed independently in terms of specialisations. At University B, the key overarching philosophy is the ethic of ensuring the institution operates as ‘one university’ despite its many campuses. It is not the only multi-campus, ‘new’ university created during the shift to the UNS (see Section 2.2.7 for details), and not all of them hold such an ethic: some opted to federate rather than amalgamate (Curri 2002).

University B’s mission is to train for skills required in regional Australia. It prides itself on flexibility in its teaching modes, and educating those who do not have a family history of higher education. Its research also concentrates on regional issues.

University B is somewhat active in campus sustainability, particularly on one campus which was designed to be ‘low footprint’, but the university is not a Talloires signatory, and the idea has not infiltrated curriculum at that institution. At the time of this case work environmental or agricultural programs were offered from four different schools, on three different campuses, one of which was a recent acquisition. The two key schools in this process had evolved to a position of direct competition for environmental students in courses which had no subject overlap yet were not clearly differentiable by either the student market or management. In the words of one interviewee:

> What was environmental management and what was environmental science? We ended up with a bit of a dog’s breakfast in terms of nomenclature for courses. (BM1)

Environmental programs at the two key schools had ceased to ‘pay their own way’ in terms of enrolments, but both schools offered other courses in different fields, too. The most recently acquired campus offered a course that had the strongest overt association with sustainability, but with an agricultural focus, and a fourth school overlapped with that new campus’ agricultural offerings. Each campus of University B was once autonomous, and so campus-based cultures persist, further exacerbated by internal competition and long distances. This process mandated the rationalisation of subject offerings in this field of study, with the incentive of increasing research time.

The University B environmental review process was imposed by the Dean of the faculty in which environmental and agricultural programs were based but the Deputy Vice Chancellor in charge of academic programs (DVC(A)) exercised considerable additional influence. In November 2004, the Dean established a committee, including identifying a coordinator and the courses and schools that would need representation. The full terms of reference (TOR) were broader than curriculum issues, and included topics that are not addressed here, such as: increasing uptake of educational delivery technology; coordinating marketing approaches; improving enrolments; and, balancing teaching and research loads. The review proceeded hierarchically, with nominated players representing their respective subjects, courses and campuses at formal quarterly meetings and occasional, less formal communications. In the end, the multiplicity of specialisations was retained, but with a common foundation year (Figure 8.1b). After 18 months, the recommendations were overtaken by resource issues, and the launch of a series of structural and strategic reviews of the faculty and university as a whole.
8.3.3 Curriculum comparison

Each process demonstrated firm internal logic in the curriculum they developed. Outputs reflected the goals of each process, as well as the limitations under which they operated, and indicate real progress in developing cross-campus programs. Before spending the rest of this chapter focusing on the process, it is relevant to briefly assess the curricula developed: first from the standpoint of the sustainability canon developed in Chapter Three of this thesis, and then in the words of the participants themselves. The latter reflects upon the outcomes using interviews undertaken a year after the processes finished. While University A is now in the second intake year of its sustainability studies course, University B’s new program never saw a student. As a result, only University A interviews tended to focus on the curriculum outcomes, while those at B focused more heavily on the process undertaken to develop them. The University A program received a mixed evaluation, with satisfaction generally increasing with position classification or rank (see Table 8.4).

The untested sustainability canon presented in Chapter Three is only entirely relevant to University A’s program goals. That curriculum lacks many elements in comparison. The core only contains methods and ‘issues’ (Figure 8.1a), although there is potential for service learning in later subjects. The flexibility is such that there is no guarantee that students will acquire theoretical grounding in all the ‘pillars’ of sustainability, much less make any progress towards integrating their disparate choices of major. The curriculum sends no particular message about sustainability, and imposes so few requirements on students that some have been attracted to the degree simply because it allows them more freedom in their selection of majors than any other. This is not necessarily a bad thing if the desire is to ‘convert’, but it is unclear whether the content imposed has the strength to do this. The fraught University B process did succeed in negotiating a set of key concepts for environmental study, but it is unclear how much of that decision was intellectually driven and how much a negotiation of student load. The nominated foundation subjects (shown in Figure 8.1b) were certainly science-heavy beyond what would be expected to prepare for the diversity of specialisations into which the foundation was intended to feed.

A final, rather lengthy, quote, gives some perspective to the importance of balancing pedagogical rigour, intellectual validity and community building in such processes.

More and more as I see students, I get that feeling that they get the depth from being part of a community and knowing there is depth there if they want. The structure is only part of it. It’s only scaffolding and within the degree structure the students will move in and out of that scaffolding as they want. In my undergraduate degree in Sociology I became fascinated with 19th century Russian peasants, believe it or not. There was never any course, but I was able in most of my courses of finding a way of doing more research into 19th century Russian peasants. It was probably a fascination with Dostoyevsky, Chekhov and 19th century Russian literature. Nobody would have sat down when they were reviewing the structure of the Sociology degree and thought, “We need more 19th century Russian peasantry, what happens if someone wants to do that?” We’ve just got to have that openness and flexibility and a community that if someone wants to do it, someone tells them they should go see [me]. That’s what it is all about. (AP4)
It is thus perhaps not the curriculum that is most important, but what the process of building it fosters in the intellectual community engaged in the collective action. The rest of this paper explores these case processes using characteristics frequently associated with sustainability decision-making.

8.4 Four contradictions of the academy under sustainability

Proponents of EFS often note the value of universities as microcosms of larger society for the testing of sustainability initiatives and practices. The Australian case studies further illustrate the suitability of that comparison by demonstrating the same
Sustainability bound?

weaknesses as wider society in adapting to the sustainability challenge. Finances motivate change, as well as bounding the process of implementing it. Universities undertake incomplete engagement processes, despite rhetoric in favour of consultation, and those processes undertaken often do not demonstrate learning. Finally, some of the key causes of stasis are intractable, forcing project-based committees to ‘treat the symptoms’ using short-term perspectives. These fallibilities are treated separately below, using data from both cases, to reveal how these two experiences reflect upon undertaking sustainability in universities in general, not to isolate them negatively.

8.4.1 Privileging the financial

Universities are sites of intellectual activity in every possible realm, including advancing industry, society and government policy toward sustainability. Most academic commentators would agree about the importance of taking a triple-bottom-line, long-term approach to sustainability decision-making, where the best decision is not always the one that is the most immediately financially beneficial. The case universities tackling curriculum change around environment and sustainability, however, were strongly motivated by financial costs and benefits in why each process began and what each was able to achieve. Observations and interviews reveal the importance of resource pressures and corporate vision in the change processes, although individual case responses to those pressures differed.

8.4.1.1 Resource uncertainty

Curriculum change is a non-trivial activity. At institutions that require some element of general or liberal study by all students, such undertakings involve long, campus-wide deliberations about what knowledge really ‘matters’ (Boyer 1987; Harvard University Faculty of Arts and Sciences 2006; Newton 2000). Australian universities rarely require a common foundation, so curriculum change occurs on a local level, responding to more narrowly targeted pressures or opportunities within and without. Huisman (1997) noted that new study programs and specialisations are most likely to emerge in fields experiencing an uncertain supply of resources. He defined resource uncertainty as present in fields showing a decline in enrolments over time, or experiencing highly oscillating enrolments. As more universities have entered the market of offering undergraduate environmental qualifications (recall Figure 2.2 on page 53), the average market share available to each has trended downward (see the black, dotted line in Figure 8.2b). There were enough undergraduates for each university active in environmental fields to teach 220 in 1990, and while there has been a slight recovery since 2000 (up to 180), in that year it dropped to 150.\(^9\) Of course those students are not

\(^9\) Graduate program market share – comparatively – oscillates between 52 and 78, with a very small upward trend, despite new entrants to the market (Figure 8.2a). The lower enrolment is acceptable to universities participating in the market because most of those students pay full fees, and the courses employ many undergraduate subjects. Such re-badging of content is supported because such coursework degrees are not intended for graduates of undergraduate programs in the same field, but those looking to acquire skills and knowledge in new areas.
Environmental enrolments for the 15 years to 2003 at the case universities suggest that they were reasonably healthy in their graduate enrolments, but that the undergraduate situation was declining. Overall enrolments for A and B also declined by 9% and 8.3% respectively between 2004 and 2005 (DEST 2005c). University B was also struggling with attrition more generally, according to its recent (2004) AUQA audit.

**Figure 8.2** Enrolments in environmental programs, 1989-2003, as reported to DEST, for a) postgraduate (including by research), and b) undergraduate study. University B’s internal numbers (black dashed line) differed from those reported to DEST (solid black line), so both are given. Between 2000 and 2001, DEST changed classification systems; numbers given are for Environmental Science until 2000; environmental studies afterwards.

Those in senior positions were more likely to stress decreasing enrolments in environmental courses as a reason for change (Table 8.5). It is a sector-wide problem, as concern towards the environment in the broader Australian population decreases (ABS 2004b). Labour shortages can also provide impetus to curriculum change initiatives,

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10 The largest enrolment at a single university is shown in gray dashed lines in Figure 8.2 for comparison, although the key player is not always the same one through time (see Section 2.3.2).

11 These statistics do not include the last year or two, however, in which most western governments have come to accept the reality of global climate trends, its human cause (and solutions) and its potential...
but despite decreasing enrolments and increasing demand (Thomas and Nicita 2003), the environment/sustainability field has not been able to capitalise on the disparity. Environmental studies do not lead to clear career paths (Mitchell 2007), and students in a consumer educational culture are largely opting to buy jobs (Thomas et al. 2007). This lack of perceived paths to careers and future salaries could explain why University A, the higher-ranked institution of the two cases, has lower enrolments than B, which educates for ‘the professions’. Another cause may be the tendency for students to consider minimum intake scores as a proxy of “quality and personal relevance” (James 2002, p. 3; also e.g. Ferrari 2007). University A’s increasing intake standards may have ‘left behind’ most students willing to enter fields like the environment and those with higher scores may feel they are ‘wasting’ them without a clear and financially rewarding career paths or the status of a high entry score.

Table 8.5 Comments from interviewees about declining resources as a rationale for change.

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<td>[Resource management] has a problem with student numbers and [the new course] is part of the response to that. Again I can’t prove all of this but I think that generally it is accepted in the science faculty that University A has moved up the food chain of students that a smaller percentage of the students at [an intake score of] 85-100 are interested in doing resource management... than in the group between 70 and 85. ... What has happened is that they’ve been left behind. ... The way the faculty is funded is that we have a certain target of undergraduate student numbers and provided we can meet that target, we’d expect to get the same operating grant next year. I rolled the same kind of thing out inside the faculty, so each area inside [the school] has a target [and] they are well below their target in percentage terms and they’ve got to do something about it. (AM2)</td>
</tr>
<tr>
<td>The enrolments in the degrees [resource management] has traditionally offered have been declining and we were actively searching for ways to offer new degree programs. (AC3)</td>
</tr>
<tr>
<td>[Resource management] was at a time of needing to create new programs, in order to maintain or increase enrolments, to strengthen its offerings. (AP8)</td>
</tr>
<tr>
<td>The enrolments for environmental science [were] poor and the viability of environmental sciences was really under question in terms of its ability to sustain itself through the income it generated. (BM2)</td>
</tr>
<tr>
<td>One [cause] was that there was concern about the ongoing sustainability of the faculty [involved], financially. Because the demise in environmental student numbers came at the same time as with a dropoff in [other courses]. So there was probably a, not probably, there WAS a concern about the downturn in all three at the same time, all in the same faculty. And that faculty also being a major research faculty in the university and the university saw that it was not a good position for the research-intensive faculty to be unsustainable in student numbers. Because the student numbers were dropping, so was the funding available to the faculty. (BM1)</td>
</tr>
<tr>
<td>It was fairly clear that the main drivers were from those that perceive a fall in numbers demonstrates a need to review. There was certainly a fall in numbers in all courses, … definitely. That always triggers in the minds of managers the need to do something. And so the review was deemed to be the thing that would make people think that something was happening. I think that was the main driver. (BP7)</td>
</tr>
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Resource dependency is also played out inside the universities, whose budgets are decentralised and are thus internally competitive. Internal agendas are usually set by VCs, and DVCs, often referred to in the aggregate by ‘Chancelry’, commonly the buildings that house these top university managers. Taking conditions of growth as

impacts. The sharp increase of coverage of these issues in print and broadcast media has provided an opportunity for sustainable development in universities that could echo that provided to forensic science with the ubiquity of procedural crime dramas on television. Sustainability has not received a commensurate rebound in enrolments as yet.

12 The change of VC at one EFS-active Australian university anecdotally led to the cancellation of that campus’ sustainability initiatives; it had been an initiative of the previous VC (David Carpenter pers. communications, pers. communic. 2012).
the norm “administrators define [declining] conditions as resource allocation problems or problems of efficiency, and they respond conservatively rather than innovatively” (Cameron 1983, p. 362). Many strategies at that level simply mirror the stimuli the institution experiences from outside, such as pressures regarding publication volume, attracting external funds, graduate experiences or attrition rates (Gläser and Laudel 2005). At University B, this strategy was explicit:

The DVC came down to the school numerous times and laid out what he wanted and spoke to [us]. And he was pretty forceful in what he wanted. What he wanted was to serve the pressure that was being placed on him from government sources in relation to funding and proving that we were cutting courses and rationalising courses and cutting subjects, because there was a financial carrot there to demonstrate that that was happening. (BC4)

As discussed in Chapter Five, similar responses to external pressures exacerbate isomorphism in the sector. Internal planning offices keep track of student numbers in various combinations and cohorts: by subject, by course, by gender. Areas that drop beneath performance indicators may be subjected to strict improvement goals under threat of ‘the axe’ (for two compelling examples, see Gumport 1993). Arbitrary goals can be set, such as reducing 15% of all subject offerings, as happened at University B. Some pressures imposed by University A’s Chancery were ideological rather than financial (Table 8.6). Individuals and AOUs try to align with management agendas in the hopes of being favourably regarded in the competition for internal resources.

Table 8.6 Comments from University A interviewees about meeting management expectations as a rationale for change

<table>
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<td>The faculty’s standing, and mine of course too, is dependent on the VC’s evaluation of how we’re going about doing what he sees as the vision for [the University]. (AM2)</td>
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<td>I felt there was support from the top and therefore should push on even if some people were a bit reluctant. I suppose also I felt that I was expected to do it. [DVC(A)] thought it was a good idea, and from my point of view, I’m interested in making sure that what the school does is viewed favourably by the Chancery. (AC3)</td>
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<tr>
<td>The DVC(A) has obviously previously thought about this stuff and had it on his mind. He got straight to the point and said it was something we should do. He gave a sort of directive [and resource management] ran with it. (AP7)</td>
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<tr>
<td>The motivator was DVC(A). It came from on high. As I understand it, I never talked to him directly about it, he wanted to have a degree that allowed students to take things from across campus, not be limited to one particular faculty or discipline. (AP10)</td>
</tr>
<tr>
<td>The ‘working together’ mantra of the Chancelry was also a spur but also a justification to take that forward. …. The VC in a few years can say, “what have you done?”, [and] tick boxes. Educationally the [new] degree, if it succeeds, is a large box to tick because it’s the only expressly interdisciplinary degree that involves a number of colleges. (AP8)</td>
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</table>

Change can be symbolic of corporate commitment to certain ideals, despite decreasing enrolments (Gumport and Snydman 2002). Such symbolism can partially explain both curriculum initiatives. While the EFS agenda has been advanced by the UN Decade in its honour, it has not become a sector-wide norm or a metric by which university quality is established. Individual University A staff have an intellectual and philosophical

commitment to the principles of their Talloires commitment, but actual change was initiated by an international visitor who could speak for the international EFS agenda:

I think eventually [we] would have suggested something but we’re not the director of such-and-such and couldn’t get the DVC[(A)] to come to a meeting. It’s interesting whether [the course] would have happened without this guy from away telling us we should do something. [Although others] had clearly thought about these things, and we’d all been talking about it. (AP7)

The environment is also central to University B because of its commitment to serving drought-affected regional Australia:

The only reason for [University B] having environmental sciences would be if it addresses [catchment] land and water issues. I don’t see any reason for [us] trying to have any other sort of environmental sciences course. They are done very well in other universities. I think there are lots of very good environmental science courses. If it was any other course we’d have gotten rid of them ages ago, because they have poor enrolments, not very good quality students, but I think the university has a strategic commitment to try to support the communities in the [region] and the environmental issues around land and water, sustainable agriculture, irrigation, all that kind of thing, [is an] absolute priority in the university. So we’ll keep teaching and researching in those areas. But I think the challenge for the environmental science group is to ensure that the course is aligned with that priority because they’ll not get the support from the university to be some other kind of environmental science degree. (BM2)

8.4.1.2 Anticipating the market

Financial imperatives not only inspire change, but limit how the curriculum is designed. There are two relevant drivers here. First, there are no resources to do anything but reassemble what already exists in new ways. This is especially the case in University A, where the home of the innovation was only guaranteed funds from four of the 24 subjects the enrolled students would undertake. Although such a cross-campus initiative was desired by Chancery, its breadth was its weakness: it was not a valuable enough program to any one AOU budget to inspire the commitment of new resources. University B also had no freedom to innovate, even when discussions uncovered gaps in its offerings, because adding one more thing meant it would have more to delete, and that task was already proving divisive enough.

The second example of market focus was the need for curriculum design processes to develop a curriculum to maximise student numbers. Potential students exercise only ‘bounded rationality’ in their choices of higher education course and institution (Baldwin and James 2000), but their choices are increasingly evidence of a ‘consumer’ attitude. Explicitly defining what a course is about has the downside of clarifying what it isn’t about, which risks putting some students off. Course marketing initiatives thus walk a careful line between innovation and ambiguity.

In University A’s process the main assumption was that students sought flexibility. It was assumed that prospective students liked to be able to transfer into new programs in second year without having to add a year to their program, for example, making foundation years impossible to impose. Instead, students are permitted to take incredibly

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13 The term ‘sustainability’ was only used in reference to enrolment numbers within my earshot.
narrow first years, and – while many academics acknowledge that this might not be ideal for the student, any school those students have enriched by doing so is unlikely to want to limit the practice. They can also take extremely broad first years. Students reportedly also want the freedom to take courses from across the campus without restriction, and the sustainability curriculum at A was able to break down some arbitrary boundaries that existed around faculties:

The faculty rules are designed so that you can do things in two faculties, but not three faculties. So if you want to do something in a third faculty, if you’re doing Science and Arts, you can do an Arts language, but not an Asian language. (AP5)

The call for more direct entry honours students in support of ‘education-intensive research’ was one of the reasons for University A’s sustainability course being developed, but this also ran the risk of limiting intake. Both pass (three-year) and honours (four-year) options were eventually created.

At University B, job-focused students do not balk at prescriptive, career-driven degree programs. The challenge there is that the university’s student market – often with a lower intake score than A, a long delay between secondary and higher education, or perhaps work experience qualifying them for higher study rather than a higher school certificate – is less willing or able to handle hard science. Any reasonably sized student market will be served. Without the ability to require such subjects, however, pure science (often service teaching) departments atrophy for fear of frightening a potential market away. Uptake of the enabling or basic sciences has declined overall (Dobson 2006; Gabler and Frank 2005).

I’d imagine there would be a group of students who look at Parks and their experience with being involved in the environment and think, “I love this, this is what I want to do with my life. How can I do that even though I don’t like maths? Look, here is a program.” So there is a group of students there, there is a market, so you have to work out how to tap into that market. (BM3)

8.4.2 Incomplete engagement

“The pleasures are often in the process. Potential participants seem to care as much for the right to participate as for the fact of participation; participants recall features of the process more easily and vividly than they do its outcomes; heated argument leads to decisions without concern about their implementation; information relevant to a decision is requested but not considered; authority is demanded but not exercised.” (March and Olsen 1984, p. 741)

Dill (1982) noted in the early 1980s how universities appeared to be moving towards a governance model which businesses were discarding. This is the ‘Total Quality Management’ approach that, according to Senge, includes “management by measurement; compliance-based cultures; managing outcomes; uniformity; control; excessive competitiveness”, and the subsequent “loss of the whole” (2005, p. xiv-xv). This management regime, which would sound familiar to any academic staff member of a Western university in the last few decades, reveals universities as corporate entities, encouraging self-interest at all scales of its components. Jones (1977) recognised three decades ago that university governance was no longer collegial and consensus-based, especially as universities become increasingly atomised with little at their core. Nor, Jones observed, was it divided clearly between the academic realm (that faculty owned)
and the administrative (where managers ruled). Administrative control has instead bled down into the academic realm (as suggested by Section 8.4.1.1) (Gumport 1997; Jones 1977). Marginson and Considine (2000) paint the following picture of the Australian sector:

Not only have older participative structures lost authority in governance, the collaborative (‘collegial’) networks in teaching and research are being hedged by budget systems, and crowded out by more centralised modes of decision-making and performance control, albeit centralised modes that are administered through devolved structures (p. 12).

Yet there is still a myth of ‘academic democracy’, as the following quote shows:

As a university we’re not implementing my views, we’re not implementing the VCs views, we’re implementing the consensus of views. (AM12)

This myth survives even to the point of risking token consultation:

It would have been easier just to say, “this is what is going to happen, let’s get on with it.” But in an academic democracy you try to get people to have ownership in the way it goes. (BM1)

Both processes were operating under democratic precepts, variously conceived and bounded, so how well did those processes pursue due process, and how did that limit what they were able to accomplish?

Any academic working in researching fraught, resource-based disputes in the wider world will emphasise the importance of good process. In community engagement, this is said to involve early engagement (even in the determination of the problems and TOR); representation from all stakeholders; time for dialogue and the building of trust and mutual understanding; skilled, neutral facilitation; and a real management mandate (Aslin and Brown 2004). Unsustainable decisions can be made under good process, but “the main point of a decision-making process may not be the decision” (March and Olsen 1984, p. 78). More important is the community that develops, and becomes capable of fostering future improvement. Palerm (2000) agrees, and identifies two components by which to evaluate public participation that can be extended to academic settings: legal provisions, and actor’s attitudes and capacities.14 In the following sections, these are covered by looking at process governance, and membership and leadership.

8.4.2.1 Process governance

University A’s process was voluntary, and additive in nature, so the process design was not as crucial as might have been the case if there was the potential for ‘losers’ around the table. The lack of time for shared dialogue was identified as the primary weakness. As with any project, the characteristics of time, scope, cost and quality expand and contract together: if you have more time, you can be more ambitious on the others. From an informal TOR provided by the coordinator, shared assumptions were

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14 These elements broadly echo Habermas’ system and lifeworld concepts, and while this literature was not explored in this thesis, additional work similar to Palerm’s (2000) on this overlap in academic decision-making may be productive.
developed iteratively that clarified political and marketing concerns more than content or theory. The University A process only took four months from the first meeting to approval of the new program. Weekly meetings were interspersed by directed processes of information gathering or discussion comprising fewer members. As such there was little opportunity to build a common understanding between the changing set of disparate individuals about best practice sustainability education and desirable graduate characteristics. All existing conceptions were simultaneously accepted, and thus the lowest-common denominator or intersection of those ideas survived to the final curriculum design. The process was not a quest for consensus, but an opportunity to feed ideas to the small set of individuals who would take responsibility for the course.

In University B, where the process was imposed from above, time was not the limiting factor. Governance issues limited the curriculum rationalisation process. First, there were two sets of TOR applied to the committee, one from the Dean and one from the DVC(Academic), neither of them making transparent the enrolment or salary cost numbers on which they were based. The basis for the lack of coordination between the two managers was not apparent to those receiving their conflicting instructions. Participants adhered to one or the other set of instructions, according to personal preferences, allegiances or pragmatism (see Table 8.7).

Table 8.7 Comments from University B interviewees demonstrating a lack of consistency resulting from diverse sets of instructions.

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<tr>
<td>I think most of that politics came in the first six to 12 months. But the way I stayed out of it was I kept referring back to the direct emails from the DVC[(A)] as to what we were trying to achieve. And if we got bogged down in the process about money and loads and those sorts of things I tried to steer away from that and get back to rationalising this from the university’s perspective. (BP5)</td>
</tr>
<tr>
<td>So [the DVC(A)] had his own agenda that he was overlaying on the top of the Dean’s agenda, and …[t]here were aspects of what he wanted that was conflicting with what the Dean wanted. So in all of that I simply made the decision that this was a faculty-constituted committee and that I’m serving the Dean, I’m not serving the DVC. (BC4)</td>
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The alternative TORs at B set out desired outcomes, including a reduction of ten undergraduate subjects and a consolidated set of programs across the campuses with the strong suggestion of a common first year. It was unclear which courses were to be included, because of only partial overlap between schools and the complication of subject uptake by other courses (e.g. supporting ‘teachable’ majors). One TOR added the burden of financial analyses to justify the group’s continued existence, although a large cross-university division existed to undertake just such work. Such tasks appeared to the committee as punitive, paternalistic make-work, and fostered a culture of ‘compliance’ rather than real transformation. When the committee appeared to be undertaking the ‘minimum change possible’, Chancellry threatened possible drastic changes. When the group presented their hard-fought common core and subject

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15 This lack of foundational agreement about theory is discussed further in Section 8.4.3.3.

16 The difficulty of obtaining clear numbers of this kind later also confounded an external reviewer of the Faculty.
rationalisations, they quickly found they had no real power. What had taken over a year to build was rolled back almost to status quo by simultaneous pressures at all levels:

- The Head of the school with the most students vehemently protested the impact of the science-heavy compromise core on their school’s typical cohort;
- The Dean stopped the proposal from going through higher channels because of the prohibitive cost (in salaries, labs and/or travel) of delivering the common core on both of the primary campuses, an issue the committee had been instructed to assume would be solved; and,
- The executive level launched two overlapping reviews of faculty and university that encouraged process members to stall progress and claw back any sacrifices made in order to maximise school bargaining powers under the new conditions.

8.4.2.2 Membership and leadership

The University A process had no set ‘membership’. An open invitation was issued to 30 to 40 academics (most members of the university’s umbrella institute) to help in the development of a new undergraduate sustainability program. Participation, either in person or via the email list, was entirely voluntary, and even those with a clear interest were permitted to opt out. There weren’t formal ‘delegates’ representing defined interests, and “people [c]ould miss one meeting and therefore their idea would just fall away” (AP8). Those attending could be considered ‘the usual suspects’ based on previous involvement in the issue on campus, and they met frequently (with widely varying attendance) over the following months, driven by the Head of the school that was to coordinate the cross-campus program. Any academic group struggles to work as a team (Eckel 1998), but one that is project-based has even less common ground (e.g. Heck 2005 on institutionalising sustainability). Because A was an additive program that held few risks for participants, trust was high; if it had been otherwise, given the speed of the process, the outcome would likely have been very different.

With the facilitator providing crisp boundaries to the undertaking, five participant types were identifiable during the process at A (see Table 8.8 for detailed descriptions): idealists, schematists, pragmatists, targeted monitors, and rejectors. The groups were not static. Some individuals moved from idealist and schematist roles to rejectors, perhaps defensively or to exert power by passive aggression. Others moved from schematists to targeted participants after the preliminary design was established and their interests in the program were clarified. Given the tendency for curriculum to emerge from the preferences of those at the table, such withdrawals can limit outcomes. Only pragmatists (the most powerful group, including the coordinator) and the targeted monitors expressed full satisfaction with the course and the process to create it. The second group likely had low expectations to start with. The first cohort is sandwiched between the staff for whom they are responsible and the executive administrators to whom they report (Gumport 1993), and are thus accustomed to compromise.

Few participants came from the research ‘half’ of the university save for a handful from the interdisciplinary hub that mirrors the resource management teaching department
heading the initiative. The process was also dominated by the social realm, partially perhaps because of the internal competition and mistrust that had arisen within the Science faculty for students: for example, “Biology keep trying to get our students to do their courses and not encourage or allow for people to do ours.” (AP5)

Table 8.8 Participant types in University A curriculum change process.

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<thead>
<tr>
<th>Name</th>
<th>Perspective</th>
<th>Description</th>
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<tr>
<td>Idealists</td>
<td>Top-down, or ‘blue sky’; highly normative and seeking transformation</td>
<td>Focused on transforming the learning experience, favouring engendering generic skills and attitudes over disciplinary expertise. These participants largely felt that the structures of the university were anathema to EFS. They tended to be in positions of little power, with little experience in administration or teaching, and demonstrated some naïveté about the financial burden of their suggestions. They attended persistently with little impact, and often had negative feelings about its outcomes. Some reported feeling personally devalued by the process.</td>
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<tr>
<td>Schematists</td>
<td>Balancing top-down and bottom-up; seeking intellectual defensibility</td>
<td>Focused on ensuring a defensible intellectual framework to the program. These participants were less concerned with ensuring individual subjects organised to an overarching logic were each suffused by a sustainability ethic. They tended to have strong ideas about what sustainability meant, and translated their definitions into discipline-based areas of breadth over which students of the field should have working knowledge. They also expressed negative feelings about the resulting curriculum as theoretically null, but were not personally affected.</td>
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<tr>
<td>Pragmatists</td>
<td>Bottom-up; seeking minimal expenditure and low maintenance needs</td>
<td>Focused on keeping resource demands low, student numbers high, meeting bureaucratic demands and using existing structures wherever possible so as to ensure a robust, self-governing program. These participants were loathe to waste time on thought-experiments that they knew, from their experience in administration and teaching, could not be easily implemented. They immediately began discussing individual subjects, rather than the rationale for their inclusion. As the most powerful players, these participants were most likely to be pleased by the outcomes and feel that social capital was built in the process.</td>
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<tr>
<td>Targeted monitors</td>
<td>Self-interested, directed or selective participation</td>
<td>Focused on the outcomes of the process for their specific discipline or subject, these participants attended rarely in person and largely monitored the process via the emailed meeting minutes. They are genuinely concerned about sustainability, but – being from separate colleges – did not see the course as their bailiwick. They responded to direct questions asked of them during the process, and felt positively about how it was undertaken, but were unlikely to be fully aware of the final outcome, outside of its direct impact on their interests.</td>
</tr>
<tr>
<td>Rejectors</td>
<td>Opting out or withdrawing</td>
<td>Because of the voluntary nature of the process, some of those whose work was most relevant did not participate. Some such individuals were what Eckel (1998) would call ‘historians’, who brought a wisdom of experience when they participated, but also could be seen as ‘roadblocks’ because of their backward focus. Because they were so deeply embedded in the topic at hand, their non-participation was occasionally a calculated protest against the undertaking, or how it was being conducted.</td>
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</table>

University B’s process included hand-picked representatives of all the courses potentially affected by subject rationalisation around the environment. A narrower band of participants was thus involved at B than A, as no one relevant was permitted to ‘opt out’, and neither was anyone appointed to the task-focused committee that could be considered idealist by the typology developed in Table 8.8. A newly promoted Associate Professor was given leadership of the process, against his wishes. Kotter (2007) would say that that choice did not create an adequately powerful guiding coalition for the task at hand, marking it for failure. First, the anointed staff member
coordinated one of the courses initially included in the review, but then managed to have it removed from the process to avoid disturbing its valuable articulation with TAFE programs. Despite that decision’s defensibility, some on the committee still saw this as an expression of a conflict of interest. Second, he also disputed the need for the review and spent its initial stages formulating arguments for status quo. Finally, initially the only member appointed to the committee from the school with the most enrolments, he was also perceived to prioritise his own (social science) field when negotiating compromises with the other major campus, only offering science subjects.

I know that the chair of the committee … must have pushed … the social side of things, so we had in that core two subjects from here. … And as far as I could see that was fine, except it seemed to me that then what people were saying was, “Okay, we’ve got these social science subjects, so now let us have the chemistry and maths. You’ve got your subjects; we’re going to have ours.” (BP7)

This last imbalance was later rectified, but not after some sacrifices were made that compromised inter-school relations. As an assemblage of competitive units, trust was an ongoing issue, especially at the outset. The duration of the process allowed for some development of collegiality, although the dramatic roll-back of the merged program design back to independent courses suggests that the concessions were built on unstable foundations. As will be discussed in Section 8.5, the process’ key members finally ended up in the same school, and some of the divisions fostered by the flawed process may linger on.

8.4.3 Learning difficulties

The greatest irony evident from the cases was the fact that the processes failed to work as ‘learning organisations’, although this is certainly not an original observation about the nature of universities (Dill 1999; Garvin 1993; Senge 2000). Learning organisations (and societies) that try to adapt together to change, and take time to reflect on the experience, have their capacity to deal with further change deepened and strengthened (Gough and Scott 2001). Again, the crucial outcome of a decision-making process may not be the decision itself, but how the organisation has learned to operate as a result.

The outcome of the ritual – the curriculum defined – is relatively meaningless. It is the ritual of discipline-wide discussion of a symbolic idea which creates meaning and commitment. … By the same token, the emerging sense of cynicism about this ritual, the perception of departmental politicking to sustain enrolments necessary for their budget base, also suggests the loss of meaning, [a] decline in the power … to create a common system of belief. (Dill 1982, p. 314)

The very process of curriculum design can buttress the foundations of new disciplines or collective identities. This is more important in emerging fields that lack external auditing or accreditation standards. The activities that characterise organisational learning include: “exploring for new knowledge; … experimenting with new processes; transferring knowledge within the organisation, and measuring learning” (Dill 1999, p. 132). These principles resonate in three cherished pillars of academia – rigour, experimentation and research – but they were not mustered to their full power in either process, to the detriment of developing sustainability as a mature field of education in universities. The following sections map the two case processes against these three pillars of academic activity.
8.4.3.1 Research

Exploring for new knowledge is a common activity for research-active academics, but in tertiary teaching a ‘culture of evidence’ is lacking. Instead,

... groups of scholars, who would not make a decision about the shape of a leaf or the derivation of a word … without painstakingly assembling the evidence, make decisions about admissions policy, … staff-student ratios, content of courses, and similar issues, based on dubious assumptions, scrappy data, and mere hunch. (Ashby 1963, as quoted in Dill 1999, p. 149)

Neither curriculum design process involved primary data collection, whether from undergraduate students, potential employers, or experts in pedagogy from education departments or common, in-house ‘teaching and learning’ divisions. The information employed to make curriculum decisions is instead drawn from the experience of those around the planning table (or the email list), who report anecdotes about past programs, conversations with students and potential employers. This material may not be selectively reported to further specific arguments, but an element of bias is likely assumed by listeners. The quotes in Table 8.9 indicate this propensity:

<table>
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<tr>
<th>I don’t think … many people have a really well-thought position on what the student market was. It was more an informed hunch, and there had been feedback from students that more than resource and environmental management was what they wanted to tag themselves as, and there was some more anecdotal stuff that some had heard from government agencies and so on that there was a market but it hadn’t been looked at very closely. (AP8)</th>
</tr>
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<tbody>
<tr>
<td>[W]hat would our graduates need to have to be great environmental scientists? Now the huge problem with that is that those decisions were made by four people with no external review, no consultation, nothing whatsoever. (BP7)</td>
</tr>
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</table>

Participants in such higher education curriculum processes are typically not trained educationalists, although they are educators, so may simply be unaware that there is a relevant literature upon which to draw. They may also have made unproductive forays into such literature in the past. Similarly, because they are not entrepreneurs, they may be unfamiliar with the principles of marketing and market research. Other explanations are contextual, relating to high academic workloads, short time frames, and the small amount of room to innovate as a result of pragmatic process management.

The beginning of the University A curriculum design involved a period of sharing ideas amongst the participants, although later decisions rarely drew on that learning. Many staff members contributed to debates at that time, drawing on sustainability literature in doing so (e.g. global documents like the MEA) more so than educational. My own expertise and outputs of ARIES were occasionally mentioned as touchstones of what was happening in the rest of the EFS literature or the rest of the sector. Relevant internal data was made transparent to all participants. University A also had access to some marketing research that had been undertaken for another course under development in the same faculty. ¹⁷ That marketing research provided guidance for attracting high-

¹⁷ This parallel curriculum design process could hardly have been more different. It originated with a joint proposal to the VC by several schools for funding to enter a new field of science study that was gaining profile in the media. The generous funding included full-time staff positions to help link curriculum
achieving, non-local students by appealing to the ambitious career goals of such an intake. Early on in the process, one member learned about an interdisciplinary program idea under development by a new member of staff in the language school via the minutes of the University’s Committee on Educational Policy. This model was quite influential upon the final structural design, demonstrating the value of transferring knowledge within an organisation and between disciplines, and creating a linkage between two previously unconnected areas of the university.

The governance arrangements and lack of transparency in the accounting processes at University B delayed the intellectual discussions of that curriculum process. When those discussions began, the group drew on ‘unaligned’ professoriate (who sit above schools) to negotiate subject-level winners and losers within discipline areas. The selection of these interlocutors involved a careful and democratic negotiation of interests and expertise to ensure the committee would trust their recommendations. This process was not concerned with sustainability as a broader concept, and the transferability of pedagogical ideas from sustainability (or even less neighbouring fields) to environment was not discussed. Guidance was thus not sought from the EFS literature, further confirming the disjoint between that ‘field’ and those tackling relevant education in universities.  

8.4.3.2 Experimentation

Scientific research processes often experiment to determine what is true, or what ‘works’. Experiments always involve risk, even when adapting an approach that ‘worked’ elsewhere, as environments differ. Chapter Six describes a number of innovations relevant to sustainability education (as defined in this thesis) that were undertaken at Canadian universities, along with the barriers that limited their design or operational efficacy. Along with the commonly discussed barriers to academic innovation like organisational design, disciplinary chauvinism or bureaucratic processes, there is also an ‘opportunity cost’ in working outside the traditional model (Dill 1999). Time spent innovating, building something new, is time you don’t spend doing something else (perhaps something more career-focused). One of the recommendations that arose from the Canadian cases was the imperative of making innovations invisible until there is a success with which to leverage additional resources. Of course, this is a conundrum: if it is done cheaply to start with, the innovation may not be the success it needs to be to win more support. A willingness to experiment is an indicator of organisational learning, but the case processes were clearly

deviation to research emphasis. This investment was rendered more likely by the fact that it only involved one faculty, so any students the resulting program brought in would benefit the source of the start-up funds. The sustainability course students were only guaranteed to do four subjects in the faculty that ‘owns’ it. Enrolments in both programs are similar (10-20) two years in.

18 In fact, a state-based report on EFS covering primary, secondary and tertiary education was dismissed as entirely irrelevant during the B process. Information I volunteered was also selectively, and in one case, misleadingly, used, during the ‘make work’ reporting tasks described earlier.

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limited by many of the same barriers experienced in Canada. Since University B was in a period of contraction, which limited its innovation, only University A is explored here.19

A number of innovative ideas were proposed in the University A process, largely by the ‘idealists’ and ‘schematists’ described in Table 8.8. These individuals were concerned with ensuring that the sustainability cohort – entirely enrolled in subjects open to other students – develop a common identity, and a solid understanding of the breadth and policy history of sustainability. Suggestions included: making it a four-year undergraduate program (thus reducing pressure on ‘real estate’); requiring students to engage (even lead) in the nascent (and otherwise voluntary) Sustainability Learning Community on the campus; holding cohort-specific retreats or integrating tutorials; and, creating a low credit-sized, seminar-based subject for all years of the program to form a common, thematic thread. None of these was able to be implemented because of a lack of new funds, the pressures to reduce staff teaching load, and an imposed homogeneity in subject credit sizes.20 Alternatives like social events must be optional and can be poorly attended, increasing the opportunity cost perceived by the staff arranging them. One interviewee described this tension well:

They really are very driven and time poor, increasingly so. [Since] I’ve been here, there is less and less time to do things which aren’t assessed. Once upon a time you could get students to do things because it might be interesting, but now it is very hard to do something unless there are marks associated with it, which is disappointing [but] totally understandable when students are paying for it. That’s changing the teaching. You can’t create the opportunities and situations if students don’t have time for it. Increasingly students just come for a lecture and then go. They’re not hanging around afterwards and having a chat with other students. (AP5)

Most of the University A participants – the satisfied and unsatisfied – felt that the curriculum model they developed was just the first step, and not a bad achievement for a short process. Most hoped it was not the final outcome. As foreshadowed earlier in this section, however, the minimal innovation it involved may produce low interest or low satisfaction in those it attracts, resulting in fewer resources in future, rather than more. If it proves a success, resources will follow, but little incentive and some risk exists in changing a model both successful and cheap. Any new money the unit receives because of the success might be best used for leverage elsewhere. Status quo is a likely expectation either way, supporting the value of early experimentation in such curriculum processes where budgets allow, followed with measured monitoring and adaptation.

19 While the foundation year for environmental courses at University B is a considerable innovation in comparison with practices in other Australian universities, it was an imposed solution.

20 If all subjects are the same credit size, they can be more easily recombined for various purposes, resulting in economies of scale.
8.4.3.3 Rigour

Both cases illustrate how “low-paradigm or multi-paradigm fields … are loosely knit communities with diverging values and beliefs and internal disagreement on techniques and methodologies” (Huisman 1997, p. 405). Even without research or experimentation, rigorous academic debate amongst diverse experts can help advance emerging fields. Such discussions can give rise to unpleasant conflict between members, but their avoidance handicaps curriculum design processes because individuals are aiming at different goals. Any short-term gain from such delicacy is offset by long-term intellectual stagnation. The debates in the case processes favoured student preferences over intellectual validity, and a form of hyper-inclusive ‘academic correctness’ over paradigmatic development. The latter is an unsurprising backlash against past complaints of disciplinary chauvinism in academia, but is completely at odds with the rigorous questioning so valued by universities in other settings. Gough and Scott (2001) argue that competition and liberty must be valued as much as collaboration and equality in organisations tackling sustainability: the freedom to question certain practices or assumptions strengthens the entire undertaking, and increases the likelihood of social learning. Such timid academic behaviour conflicts with discussions during each process lauding how important it is that students of the resulting interdisciplinary curricula experience and work through such conceptual clashes openly with one another. The behaviour does, however, agree with Hogg and Terry’s observation from social identity theory: “where there is no clear category defining ‘in-group’, group dynamics rely much more on “personal relationships and idiosyncratic preferences” (2000, p. 126).

Protecting that hospitable climate should ideally not require a slackening of rigour. Section 8.3.1 described how University A’s new sustainability curriculum reflected the intersection, rather than the union, of the many conceptions held around the planning table. The short time-frame of this process likely influenced the lack of examination and debate of these conceptions, but politeness and mutual respect also played a part (see Table 8.10 for indicative comments from University A). While these are laudable characteristics of any engagement process, they also create ambiguity and ambivalence, especially combined with the pressures of individual or school self-interest. Individuals around the table appeared to be saying, “as long as the course contains my discipline/subject, or at least doesn’t favour any one else’s, I am happy.” As one interviewee put it, there were “lots of competing discipline areas vying for a seat at the core table” (AP6), and all that everyone could agree on was the importance of method. No common context other than human/environment ‘issues’ was required in the final model, despite broad agreement about the relevance of the ‘three pillars’ model of sustainability. This lack of concern with the aggregate experience means that students can depart the resulting course without a basis in all three pillars, much less the whole set of fields and approaches in Chapter Three’s recommended canon. The resulting program perpetuates the impression that sustainability is ‘anything’, which can only harm the undertaking in the ‘economy of esteem’ (see Section 5.5.1 for an explanation of this concept).
Chapter 8: Australia in depth

Table 8.10 Comments from University A interviewees about the degree of rigorous debate involved in the case processes.

<table>
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<td>Some of those [decisions], such as not cutting off or deleting options for majors from other colleges or parts of the university, courses that, I think that if you had a sustained argument about their relevance they might have been deleted, were left in to keep other areas happy and involved. And that’s not ideal course construction, but it was the practicalities of wanting to make it happen. And not creating disappointed people who then withhold their students from it. (AP8)</td>
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<tr>
<td>People had really strongly held views which weren’t properly exposed. One, because of the speed in which it was done, but also because of the niceties. So there were things stated which were never fully explained, and there were claims made about what certain terms mean that never got sorted out. (AP8)</td>
</tr>
<tr>
<td>There wasn’t really a full and open airing of what people’s pros and cons arguments were. That was partially to do with the speed of it, but partially because there was no communicative history to the discussion. So people were coming in assuming they knew all about something, then realising that someone else had a completely different view, and they never really reconciled those before. So in a short process, they never really reconciled them. So maybe that’s just the nature of compromise and negotiations. (AP8)</td>
</tr>
<tr>
<td>One of the reasons that we got through in the way we did was that we didn’t push that point [of agreement about sustainability] too much and just let it [be]. (AC3)</td>
</tr>
<tr>
<td>Yes I think we had a shared vision, but not a shared starting point. … I think the thing we really didn’t grapple with is the nature of disciplines and their relevance. I think that was put in the ‘too hard’ basket. Maybe it would have never happened if we had. … The fact that we were able to interact so quickly and see potential was that we had some shared understanding of [sustainability]. But it wasn’t deeply developed and we didn’t have the capacity to explain it to anyone else. (AP5)</td>
</tr>
<tr>
<td>I think most of the participants appeared as though they weren’t going to listen to each other. They were there to push their own courses, or see what was in it for them. Committees are formed and people come to see if there is anything in it for them, and if not they’ll leave. I got this impression partly because there was no real expression of interest in the course content. (AP13)</td>
</tr>
<tr>
<td>I didn’t think there was [much in the way of common understanding]. But look around the table. You had a forestry genetics person, institutional policy person, human ecologist, … a marine geologist or something. Post-structural, feminist geographer! … And everybody had different ideas about what sustainability is, if you look at disciplinary backgrounds. (AP7)</td>
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University B’s environmental curriculum rationalisation process was much more career-focused, but the challenge was that each school’s program claimed to produce students for a slightly different career market. After their independent origins and evolution, and years of being forced to differentiate the programs for the purposes of personal identity and student marketing, it is not surprising that such divisions remained. Most participants did believe that their respective courses shared many concepts, and that rationalisation of overlapping subjects was a reasonable request. Organisational myths formed barriers that remained unexamined with any rigour or independent data. Identity issues of this type are examined further in Section 8.4.4.3.

8.4.4 Foregoing causes for symptoms

The last way in which universities mimic the world outside them in adapting to sustainability is the tendency to focus on the symptoms rather than the causes of undesirable behaviour. In universities, as is the case outside them, “you almost need to modify everything at once, rather than incrementally” (Gough and Scott 2001, p.143). Complexity is one of the reasons that universities tend towards short-term thinking although it often leads to maladaptation (Cameron 1983). One such ‘solution’ recently devised saw universities marketing their offerings more heavily to the fee-paying, international student market to make up for reduced domestic funding (Marginson 2002;
That sector-wide, isomorphic ‘innovation’ has resulted in heavy reliance on the international (as well as domestic fee-paying) market. Huge financial investment has been made by these universities in the fields to which such students typically flocked (business and IT) to the detriment of disciplines less attractive to that market but essential to Australia’s capacity. Today, the countries that were once a source of students are building up their own tertiary sectors. Australia’s quick sectoral adaptation to this temporary niche shows its capacity for change. Unfortunately, it is less resilient now than if it had taken a long-term view on those budget short-falls. There is always an intoxicating “time lag between the short-term benefit and the long-term disbenefit” (Senge 2005, p. 60).

Management guru Peter Senge calls such escalating cycles, ‘compensating feedback’:

Many companies experience compensating feedback when one of their products suddenly starts to lose its attractiveness in the market. They push for more aggressive marketing; that’s what always worked in the past, isn’t it? They spend more on advertising, and drop the price; these methods may bring customers back temporarily, but they also draw money away from the company, so it cuts corners to compensate. The quality of its service … starts to decline. In the long run, the more fervently the company markets, the more customers it loses. (Senge 2005, p.59)

Senge goes on to say something else which will be very familiar to those observing the declining sector from within: “[a]s individuals and organisations, we not only get drawn into compensating feedback, we often glorify the suffering that ensues” (2005, p. 59). Running to stand still under incrementing demands is the nature of modern academic careers.

The short-term thinking that causes such feedback cycles is symptomatic of project-based teams, and corporate management rather than specifically academic leadership (Dill 1982). The latter recognises the ‘value rational’ nature of academia, whose members need to believe in something commonly held, and the resulting importance of managing meaning instead of just outputs. Believing in a common goal other than the dollar – increasingly rare in the ‘entrepreneurial university’ (Martin and Etzkowitz 2000) – is essential when academic communities face financial stricture and strain (Sporn 1996). In comparison, corporate management passes performance metrics valued by external agencies down through internal bureaucratic processes to send a consistent message to academics and ensure the best performance of the university on external priorities (Dill 1999; Gläser and Laudel 2005). The difference can be one between fostering a culture of ‘compliance’ and one of real improvement. The cases considered could not address several points of ‘high leverage’, despite their position at the root of many of the problems encountered: structural duplication, the low esteem of teaching, and interdisciplinary insecurity.

21 Operations research provides an interesting analogy to short-term management horizons. It comprises a range of methods that are used to navigate the complex ‘solution spaces’ of intractable problems for an optimal decision. One of the trickiest things to do is design a program that will find a global maxima (the best possible solution) rather than a local maxima (the closest one), because the program will have to abandon the local maxima it has found and temporarily accept a worse solution to find the best one.
8.4.4.1 Structural duplication

Gumport and Snydman (2002) note how academic change is normally ‘additive’, in the manner of University A’s process. Essential to its success was the fact that it was seen not to replace anything already existing. This is consistent with the frequently noted path dependency of institutions of higher education. Process committees typically ask, “Given that we have this, what else do we need?” instead of “Do we still need this?”. Environmental studies departments multiplied in such an additive way, unabashedly overlapping with other areas (Klein 1990) and having their terrain appropriated by others in return. It is not surprising that financial stricture inspires the rationalisation of such overlaps, as seen at University B.

Administrative barriers are not trivial in either expanding or contracting situations, and the case universities are atypical in that each features duplication as a normal state of affairs. Such bifurcation of efforts hampers progress in cross-cutting curriculum design just as it affects collaboration in research and research training (see Chapter Seven). Structural boundaries (and their concomitant, one-line budgets) limit the scale at which individuals can think in problem-solving processes. Linkages spanning boundaries were in severe tension during the processes, but neither set of players was in the position to negotiate or change them. At University A, there was a long history of aborted discussions about the merger of the research-only and teaching-research units around sustainability, but funding and elitist attitudes were a persistent barrier. As a result, the research side of the university failed to engage in the undergraduate initiative.22 At University B, school barriers were the clear problem, but were a taboo topic of discussion as each participant around the table recognised the sensitivities involved. No participants could be seen to be lobbying for a loss of power for another (which is what a merger would entail): that was up to Chancellery to ‘impose’ and staff to ‘resist’. To inspire progress at one stage, there was just such a threat from above, not for a merger, but for one campus to be given rights over undergraduate programs in the field and one offering only a major. This failed to inspire the desired behaviour because it emphasised structural division rather than alleviating it.

Bureaucratic processes and reporting requirements also seem to be cumulative. Attempted solutions have persistently built on top of these unstable foundations because those in power (who make structural divisions) are unwilling to forfeit any. University A’s new super-structure, established in 2005 to unify disciplines across the teaching and research bifurcations, left that structure in place and simply added another layer of bureaucracy. At the time of the change processes both cases also had virtual institutes around environment and sustainability that attempted to network interested individuals from across the fragmented structures. Each was comprised of a director (also a member of staff with a professorial appointment elsewhere in the university), and some minimal

22 It does not help that interest from the research side is usually limited to third year subjects, and is thus construed by the teaching side (perhaps correctly) as motivated by a desire to poach the best students away for postgraduate study.
administrative staff to manage websites, newsletters and collate research funding opportunities. Members self-nominate as such from across the university, although most members come from the sustainability hubs identified in Chapter Seven. University B’s institute provides value-adding such as travel grants paid from the quantum the institute receives from DEST based on publication activity. University A’s institute is not a valid affiliation for the HERDC, so few resources of that type are available to its members. Neither institute is formally involved in teaching activities such as curriculum initiatives, existing purely to maximise research outputs in the cross-cutting field of study. Universities have placed research instead of teaching at the centre of their self-image, much to Boyer’s (1987) dismay.

8.4.4.2 Disesteem of teaching

Academics receive conflicting messages about the ‘value’ of teaching work. Despite lip service paid to multiple forms of scholarship, the teaching, integration and application of knowledge is still less highly esteemed than the discovery of it (O’Meara 2006). It is not an original observation that incentives towards quality teaching must be increased to make effort in that area a rational choice (e.g. Moore 2005b), although they need not be based on economic gain. Academic cultures are produced by the management of meaning and interaction, not finances (Dill 1982). Meaning comes from the myths that define an institution’s values and the symbols and rituals that are used to recognise exemplars of that myth in order to reinforce and reproduce it. In both case universities, for an individual’s work to be recognised as emblematic of university goals or values generally requires self-nomination, and usually onerous application processes. Productive researchers are elevated with promotions, grants and media publicity, and the preferential attachment that such recognition brings. Good teachers are given awards that do not bring esteem commensurate to those of research success, but may involve financial remuneration as a consolation (Dill 1982). University A has initiated an honorary lecture in 2006, in which the speaker is nominated and elected by students, but it was not active at the time of the case work. The pending RQF may unfortunately degrade esteem for teaching further.

Collegiality around collective educational targets cannot be assumed in such fragmented systems, either. Vision is often lacking in the Chancellry, unlike ‘branding’, so the ‘management of meaning’ is decentralised to boundaries coincident with budgeting processes, if it happens at all. This thesis has previously posited that the Australian sector is unaware of just what – if anything – it should aspire to do other than research and ‘train’ for economic gain at the level of GNI and AOU. Until teaching becomes a basis for genuine respect, curriculum design processes that reach beyond budget boundaries – that is, those that rely on collegiality – will remain a fool’s errand. This is consistent with the loosely coupled nature of university enterprises. Cultural change is difficult under such institutional isolation, but a strong academy can knit a university together. Desirable behaviour can be consciously managed via interactions like mentoring (vertically or diagonally), collaboration, and bridging structures (Dill 1982). The umbrella institutes only partially fill this role if they ignore teaching.
8.4.4.3 Interdisciplinary insecurity

A final blind spot in the case processes was the problem of managing contentious academic turf, as separate to that of student numbers. Interdisciplinarians are sometimes assumed to be more naturally integrative and less defensive than those from crisper disciplines. In the two ways that matter here, interdisciplinarians and disciplinarians behave very similarly. First, academics of all stripes tend to define themselves along lines of difference rather than similarity, and defend themselves most against their closest intellectual neighbours. It is easier to understand how a neighbour’s world view differs (or not) from yours, than that of someone more intellectually distant, so a higher risk of invasion is often perceived. Second, despite the primacy of individual scholarship in the atomised university, identity and membership is important. The social networks in Chapter Seven suggest that disciplinary cultures are strong, with good “fit between cultural values, structural arrangements and strategic plans” (Sporn 1996, p. 46) while corporate and academic cultures are weak. Interdisciplines feel that same need for clarity and group momentum. There are many personal and scholarly incentives for interdisciplinarians, or individuals working in interdisciplines, to draw crisp boundaries around their problem area, methods, assumptions or traditions: basically to become ‘disciplined’ in their practice if not their content (Huisman 1997). When this happens in universities with structural duplication, the same interdisciplinary niche can be filled in several different ways. Sustainability provides a zone where these disparate nodes of interdisciplinarity research can shine. Processes like those at the case institutions bring these cultures together and potentially into conflict over ownership of, or leadership rights around, the shared areas. Scarce resources or opportunities make competition for validation quite fierce (Hogg and Terry 2000).

At University A, battles arose around the ownership of ‘interdisciplinarity for sustainability’. Several groups on campus claim expertise on this topic, ranging in their paradigmatic development from rough logical or analytical frameworks to detailed ‘mythologies’ of practice. The individual approaches are not necessarily compatible, differing in scale or methodology or normative bent, and there was not the time to engineer one common to the process (as previously discussed), nor the desire to elevate one above the others. As a result, individuals from some such relevant areas withdrew from the process, convinced that their insights were being disrespected, ignored, and compromised. The paradox is that many of these groups are quasi-evangelical about the importance to collaborate across fields, while they defend the right to do so as precious turf, and the means to do it as bounded to their own approach.

University B’s identity battle raged between the ownership of environmental science, emphasis on the science. The two key schools evolved their expertise separately, and the one whose role was as a pure science, ‘service teaching’ school named its programs Environmental Science.23 The other key school, University B’s sustainability hub,

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23 Service teaching units deliver core content to degrees in other schools that do not have the in-house expertise. This is increasingly uncommon as schools are loath to give up any of their student-based funds.
includes a number of social scientists, and they were able to carve a wider niche including environmental management and tourism although they had a very strong research output in science (particularly conservation biology). The first group still saw the school as ‘softer’ and their social content as less important for ‘core’ study. Relevant content such as indigenous studies or environmental ethics did not make it into a core program intended to feed into tourism, management and science, but chemistry and mathematics did. These organisational myths were also occasionally used to allow one AOU ‘ownership’ over particular content in discussions, or to make unsupported claims about the nature of the ‘other’ student body to emphasise the importance of retaining separate programs. An independent external reviewer could not see the difference that these groups so vehemently defended.

8.5 Epilogue

As a researcher embedded and personally invested in both case processes, I could not avoid (or resist) following developments after the cases themselves had ceased. After the critical assessment given here, some of the subsequent good news should be shared, even if only anecdotally. Both cases were closely followed by major structural and bureaucratic changes that should serve environment and sustainability education well. Most dramatically, mergers of key players at both campuses have occurred. These structural changes must be carefully handled through collegial means (the management of meaning) as well as administrative means to build common ground. Hogg and Terry (2000) describe the relevant risks from the perspective of psychological theory:

“When two organisations merge … the postmerger entity embraces premerger intergroup relations between the merger ‘partners’. These relations are often competitive and sometimes bitter and antagonistic. Indeed, negative responses and feelings toward the employees of the other organisation may jeopardise the success of the merger. (Hogg and Terry 2000, p. 133)

At University A, the key units have been merged into a common school that spans the bifurcated university structure. Although two budgets are being retained, and the new entity will remain scattered across a few buildings, its internal processes are being merged as this is written. Directives are pending on expectations about undergraduate student exposure to research-only staff, and are expected to increase. A recently announced program institutionalised a process for staff from the two halves of the institution to trade roles for a semester, although uptake of this opportunity has been slow. In addition, the loosely assembled committee that formed the sustainability course has become a regular group, tasked with monitoring coursework matters in resources and environmental studies for the entire university. Cross-campus majors are now possible, for example, due to agitation from this group. Despite varying attendance, this is likely to build capital and common ground among its participants. This will improve the likelihood of better outcomes in similar processes in future, as well as providing the capacity to monitor and improve the course described in this case. Early enrolments in

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24 One of the components is itself the product of a relatively recent merger.
the new program are promising (10-15), although some of those students transferred in from other courses in the university so not all represent ‘new’ resources.

The major barrier at University B was the cross-school nature of the undertaking. The unanimous opinion after a faculty-level review and an overlapping university-wide review was that the two competing units should be merged. This was achieved on January 1, 2007, as part of a large restructure across the university. The science service-teaching school was dissolved, with staff going to four different units and three different faculties, largely to serve their ‘biggest clients’ from before the merger. Nine teaching academics merged with the sustainability hub to form a cross-campus school, and the curriculum design process began again in earnest. This time it was driven by one Head of School, starting with a survey of 50 experts and employers on their opinions about desirable graduate characteristics. Responses from the experts included a number of elements that support the canon proposed in Chapter Three:

 Lots of global, international stuff. All the global warming, the influence of global politics and changes in the global environment on national agendas; treaties, that kind of stuff. … Australian environmental graduates don’t have that international vision. … The second thing is critical thinking … Probably half the responses have been “you need students that really can think outside the square, can have lateral thoughts, can be really rational and can devolve themselves from emotive issues.” The cross-discipline has come out a lot. You need students that have the science but understand the culture, the social, the economics, the politics, that sort of stuff. Policy and planning integration, that has come through a lot. Mostly from the people who work from the government, they’re saying, “the graduates are really great but they have no idea how the political process works.” So they’ve got to understand the difference between knowing the answers and coming up with a policy that will be pragmatic and do-able. (BM8)

All members of the new school divided themselves into rough, overlapping areas of interest and held fully transparent discussions about content, not subjects. The new curriculum will be available for intake in 2008 and comprises a 13-subject core, three possible majors, and professional Masters specialisations (see Figure 8.3). Service teaching has become even rarer as school budgets have been tied directly to student numbers and cross-subsidisation practices, “once taken for granted” in many universities (Gumport 1997, p. 129), have been discontinued. For example, the core elements in chemistry, mathematics and statistics for which the service-teaching school fought in the previous model do not appear in the new one. That the individuals offering this content are now in different schools is unlikely to be a coincidence.

| Five optional Masters specialisations: Environmental Management, Water, NRM, Tourism and GIS |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| NRM Practice | Aquatic Ecology | Landscape Evolution | NRM Practice |
| NRM Admin | Animal Systematics | Ecosystem Analysis | Ecology |
| GIS | Biology | Local Environments | Social Science |
| | | | Earth Systems |
| | | | Data Visualisation |
| | | | Natural Systems Science, Conservation, or Catchment Management |

Figure 8.3 A schematic model of University B’s new, post-case Environmental Science program.
8.6 Conclusions

Two very different cases of curriculum change around environment and sustainability observed in 2005 and 2006 demonstrate some very similar responses to the challenge that may be characteristic of the larger sector. Curriculum outputs were largely appropriate to local needs and pressures, but propagate a limited or vague impression of what constituted sustainability because of the breadth and flexibility of content. It could be said that incremental pragmatism was the consistent winner, perhaps a necessary bedfellow to the abstract ideal of sustainability in conservative, resilient institutions. This highest institution of learning demonstrates the same fallibility in dealing with issues of change for sustainability to which the larger society is susceptible: short-term, finance-focused solutions; incomplete, occasionally tokenistic, engagement; and, extreme learning difficulties. Universities hold an idealistic self-image despite their entrepreneurial climate, and avert their eyes from the problems that climate causes for processes like those followed here.

Case universities were largely motivated by finances at the levels of the Chancelry and the individual school. The former’s concerns about decreasing course viability are based on internal metrics (enrolments per subject, course, or staff member). Schools respond to that pressure as well as other signals (e.g. corporate vision or ideals) that they feel will put them in the best position when internal resources are distributed. When developing new programs, fiscal concerns dominate curriculum discussions, with staff reacting to what the market is seen to want, and management emphasising low-cost options.

‘Academic democracy’ does not thrive in entrepreneurial universities, and pretending that it does can create tokenism, make-work, and a bureaucratic culture of compliance that hides deep divisions and resistance. Although curricula tend to emerge from the membership of design committees, there is less room to innovate in universities than participatory rhetoric suggests. Unless the limiting factors are made explicit to all members, or the process is designed to genuinely remove them, disappointment and division can result rather than the building of collegiality.

Tertiary teaching has a much less developed culture of evidence than its research corollary, and few of the inquiry-based strengths of universities were mustered in the case processes. The collected personal experiences of participants are instead used to make enormous decisions affecting student outcomes. It is partially the fault of educationalist literature, the jargon and theory of which has failed to speak to this potential practitioner audience (see Chapter Three). This audience may also be unlikely to listen to any such expertise, however it is presented. Process time and academic sensitivities also limit learning together to advance the field, or build common ground.

The collegial outcomes of curriculum design processes may be more important than carefully engineered student outcomes (recalling AP4’s quote at the end of Section 8.3.3). Regardless of what students are looking for when they come to university, what they should find is an academic community. The curricula are adequate, but the opportunity was missed to apply the collected intellects to the problem of sustainability.
in toto, and to integrate education with research aspirations. A culture of debate and experimentation should be encouraged in the pursuit of sustainability curriculum, although a financial buffer is clearly required to offset risk.

Finally, most of the processes were derailed by matters of structure or human nature that were outside the power of such temporary, project-based committees to challenge. Schools need students, and academics need career paths, and neither of those is negotiable. What is negotiable is how the academy decides to constitute itself. As discussed in Chapter Five, if a collective identity of scholars can be encouraged, and decoupled from ‘the university’ and that institution’s bureaucratic or administrative functions, such a group can serve a useful counter pressure to entrepreneurial priorities.
CHAPTER NINE SUMMARY AND SYNTHESIS

This thesis has explored multiple aspects of the adoption of sustainability in higher education, using a range of lenses to provide breadth and theoretical rigour as well as empirical, case-based depth. Four characteristics make this a unique picture of the problem at hand.

- First, the project was not externally funded or attached to an existing research program; not having a ‘client’ meant that a normative position was not imposed.
- Second, the research followed an adaptive and exploratory path, informed by my own interdisciplinary background and a range of theories and qualitative and quantitative methods.
- Third, as a recent migrant to Australia, I was uniquely positioned as an ‘outsider’, and I could use my nation of birth as a valuable point of comparison.
- Finally, my strong affiliation with the two key Australian universities of my case studies gave me an internal, comparative perspective on curriculum and structural change around sustainability while it happened.

This section summarises the key contributions and methodological innovations of the thesis, but because of the diversity of threads it covers, the concluding sections of each chapter are essential sources of additional detail. Despite the broadly descriptive nature of the thesis, some recommendations are offered for universities and individuals looking to educate for sustainability and for those interested in researching this area further.

9.1 Revisiting the research questions

The implementation of the EFS agenda via university curriculum processes is occurring largely in isolation from the sustainability education literature itself. Educationalists do not speak the language of tertiary educators trained in other fields, and the literature is often either highly theoretical or singularly case-based and therefore difficult to apply. The normative tone, cyclical nature, and narrow focus of that literature can also act as barriers to uptake. For its part, academia has asserted a position on change for sustainability that reflects its wider responsibilities to society, and the importance of academic freedom in occupying those roles. Australia’s higher education sector has a history of being utilitarian but has become increasingly entrepreneurial and explicitly careers-focused, attracting ‘clients’ rather than students. Disciplines with diffuse and reputedly less lucrative job paths, like environmental studies, have struggled for students and have often been the target of amalgamations and cutbacks. Academic careers in such diffuse fields are also a challenge, in the face of incentives towards narrow, well-bounded research interests. Just what should universities’ responses to the EFS agenda entail, given increasing need for societal sustainability? Revisiting the original research questions at this stage helps to draw out some tentative recommendations for those tackling that bigger issue.
9.1.1 What does it mean to be educated for sustainability?

While higher education is not blameless in the problems we now face as a society, neither can it be ignored as a source of amelioration. There is no magic solution to sustainability education, nor is there a definitive ‘way forward’. The sector cannot seek to indoctrinate, and will always be subject to noisy transmission, fallible and singular agents, and the diversity of approaches that such non-centralised institutions allow. Cognitive difficulties in grappling with the breadth of sustainability mean paradigmatically crisp fields like science are often privileged over essential humanistic elements in core curricula. Progress may require revisiting the past with the knowledge our current situation provides, and recharging some old ideas and institutions with new purpose. A sort of sustainability canon was developed here with both philosophical and disciplinary bases. It illustrates how universities can mitigate problems of global excess by aspiring to provide tempering influences. The conceptual side of the canon resembles early discussions of environmental education, including elements neglected in the Australian sector’s corporate setting and its fragmented approaches to sustainability. Rich context, critical thinking, and active, empathetic citizenship identities – combined with disciplinary and interdisciplinary expertise – should combine to produce sustainability even if the term is never mentioned to the students in question.

9.1.2 What is the sociology of the context for university EFS?

Idealistic EFS proponents and pragmatic corporate managers have set up extreme bargaining positions that have resulted in impasse. The diffuse nature of sustainability is a barrier to its rigorous adoption by the tertiary sector in teaching or research. The two tasks are typically interconnected in the individual academic life, but very different forces are at play across them. Collaborative choices made by the staff of two Australian case universities active in sustainability demonstrate that the focus is inside individual organisational units for curriculum design (at least in core subjects as service teaching is disappearing) and research training. From the publication data, however, we can see that co-authorships aim outward from the unit, most frequently outside the university or internationally rather than to elsewhere in the university. The teaching and training pattern demonstrates an economy of student numbers; the research picture reveals an economy of esteem. While startling in its two-facedness, this self-organised phenomenon may actually be optimal.

Ironically, for those who feel bounded but unsatisfied by the traditional model, every choice they make strengthens that model’s dominance in the institution. The mobility of individual academic careers makes many alternative choices unlikely, even in interdisciplinary units that purport to encourage integration. Internal fragmentation along disciplinary lines results, with staff looking to their disciplines for signals about appropriate behaviours and choices. This is not in itself a problem, as such clustering accelerates the disciplinary advances that fuel interdisciplinary work, but internal competition creates opportunities for chauvinism rather than collegiality. Collective activity around sustainability is hobbled in this context, and without rigorous academic interaction the problem area remains weak.
9.1.3 How do universities address sustainability in that context?

Sustainability indisputably stretches the university system, but the resistance of the system is also to be valued. Studies of two higher education sectors’ approaches to sustainability – one undertaken with a broad-brush approach and one in a more detailed fashion – demonstrate systemic pressures in particular instances. Innovations relevant to sustainability in Canadian case universities are clearly working in tension with low-cost educational and research models preferred by corporate management. There is still a diversity in the Canadian sector, however, that is not present in Australia. The devolution of budgets and course ownership in Australia creates a brittle system, where pedagogy may be sacrificed to financial viability and self-interest. Such a financial imperative in universities echoes the tendency of wider society towards ‘wallet watching’ when it comes to deciding if and how to adapt to sustainability. Universities also fail to engage and empower staff meaningfully, despite rhetoric about democracy, or to exercise their capacities for research, experimentation and debate. The curricula of two detailed Australian cases of curriculum development demonstrated consistency with local goals, strengths and internal limitations, but neither approached the canon.

9.2 Methodological innovations

Numerous methods were employed to answer the above questions, some of which were novel applications, or combinations of applications (Table 9.1). In the absence of a developed sustainability paradigm or external accreditation standards, key content and the current state of play needed to be established. A ‘wide-angle’ survey was undertaken comprising two phases. First, a thorough internet audit of relevant tertiary offerings supplied a picture of core content and sustainability electives. Next, a questionnaire about sustainability curriculum was administered to elicit expert opinions outside of the complications of real processes. A common classification method and comparable database design for the two phases provided the infrastructure for rich qualitative and quantitative examinations of curriculum. Core curricula were also clustered statistically using \( k \)-means approaches, which revealed several curricular approaches, but a lack of meaningful course naming in relation to those, especially in undergraduate programs.

Table 9.1 Methods employed in the thesis in relation to the research questions they answered, and the chapters in which the relevant work is discussed.

<table>
<thead>
<tr>
<th>Method</th>
<th>What does it mean to be educated for sustainability?</th>
<th>What is the sociology of the context and agents involved?</th>
<th>How do universities address sustainability in that context?</th>
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<tbody>
<tr>
<td>Literature synthesis</td>
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<td>Peer review</td>
<td>1-4</td>
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<td>Questionnaire</td>
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<td>Internet audit</td>
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<tr>
<td>Content analysis</td>
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<td>Clustering</td>
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<td>Bibliometrics</td>
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<td>Social network analysis</td>
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<td>Interview</td>
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In the second half of the thesis, a ‘new institutionalist’ philosophy was employed to consider the academic system of universities in toto, rather than isolating one activity or academic goal as is commonly the procedure in the literature. I have taken Fien’s (2002) call for ‘generalisable case work’ to heart. The cross section of Canadian cases in Chapter Six was chosen to replicate a few key pedagogical and structural features of sustainability education across different institutional contexts. Such an approach provided depth and rigour to this social science research and enabled general and particular phenomena to be discerned and described.

In Australia, social networks were employed to explore research and research training around sustainability at two case universities. Supervisory teams have rarely been included in sociometric studies (possibly because not all universities use a team approach to supervision), and the interdisciplinary focus and multi-scaled perspective was also novel. These maps informed the study of two simultaneous curriculum design processes at the same cases via participant observation and interview, providing richness and data triangulation rare in EFS studies. My spatial science background provided a facility with quantitative data and a natural aptitude for visualisation and graphical interpretation. The more language-focused qualitative work was a comparative challenge. Integrating the two has illustrated a more thorough picture of the undertaking of sustainability in universities than has previously been possible.

9.3 Recommendations

This alternately broad and deep, exploratory thesis has raised as many questions as it has answered. The following recommendations emerge from the learning it represents, although further research (see Section 9.3.3) is needed to strengthen or clarify each.

9.3.1 For academics

Academics often encounter obstructions to activities that they feel should be encouraged, but many such barriers have been established by the sum of individual choices and values over time. The act of changing institutions must then rely partly on changes at the level of the individual, and this thesis uncovered several ways that this can be initiated.

- Offer additive alternatives, not obliterative ones. Individuals who feel badly served by current systems and institutions are best qualified to develop improvements. The caveat is that such changes will only be accepted by those in power if they also improve or maintain utility for those who are well supported by the status quo. For example, barriers to interdisciplinary research will dissolve if quality can be assured, but this requires a new way of undertaking peer review. Any alternative process must not disadvantage research within crisp disciplines. Similarly, careers in university teaching and pedagogical research will be facilitated if innovative performance management schemes are devised that draw on the appropriate ‘currency’, and retain esteem for researchers also. Both are tricky problems but essential to making faculty rewards match the diversity of skills needed for EFS.
• Act to build a community of scholars across the institution. Collective activity could incrementally revive the identity of academe, and the collegial environment that it fosters. Collegiality should be the most cherished aspect of university work because so many of its key activities fail to function without it. The idea has become uncommon as spheres of interest have narrowed to budget divisions, however. Participating in activity across disciplines and universities emphasises the things held in common, and supports academic governance over the purely corporate.

• Wield to the fullest the freedom in the classroom and any opportunities to reflect that university teaching careers allow. Since individual academics have the most power in their own classrooms, but this thesis does not speak much to that audience, some of the pedagogical or case-based literature on EFS is highly recommended for those looking to experiment. Such Acknowledging the opportunity costs associated with innovative teaching, some of the more systemic barriers can be subverted with local support. Pedagogical research and teaching committees should not be left to the educationalists either; all teaching academics should share successes and failures with peers inside and outside their institutions.

• Continue to debate ideas with passion. Acceptance of varying modes of scholarship – and the mutual respect that has resulted – is an improvement on disciplinary chauvinism, but has indirectly led to an ‘academic correctness’ that privileges shallow agreement over rigorous debate. Avoiding that friction arrests paradigmatic development, and can encourage interdisciplinary chauvinism. Genuine intellectual conflict is as important as collaboration, perhaps more so, if work in the interstices of firm disciplines is to be done with similar rigour to that within them.

### 9.3.2 For universities

Separating academics and universities here is a false dichotomy; recommendations for universities are clearly for individuals to enact rather than institutions. Universities are set apart because there are some changes that have to start at the top (Heck 2005). Institutions that are interested in facilitating academic work in sustainability, perhaps as part of a commitment to Talloires, may wish to:

• Establish a clear identity for the university that differs from the generic ‘excellence’ model imposed by centralised funding bodies. Developing such a vision requires academic, rather than just corporate, leadership. Implementing it may involve setting internal targets that differ from those outside, thus managing meaning for value-rational agents, and wearing the friction between the two systems.

• Establish firm foundations based on that particular vision for students to build upon, including core theory and generic skills. If students are to develop their abilities progressively as well as laterally, prerequisites and intake standards must be

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1 These comments are likely to apply also to some other integrative domains.
specified and supported, even though the profit formulae that currently dominate academic decision-making may not be maximised as a result.

- Take a proactive view of course review and development, and facilitate experimentation in those settings. For students, a diversity of expertly designed educational experiences allows supported degree customisation, but some of the innovations may challenge administrative systems. For staff, curriculum design is an opportunity to build intellectual paradigms and develop collegiality. Harnessing such processes to routine administrative tasks and standard templates limits their scope. Keep a rich record of the processes, rationales, outcomes, and future plans for institutional memory.

- Foster interdisciplinary units in a different way than disciplinary ones, which is likely to require additional resources to develop core, collective projects and infrastructure. Such units need to be populated and managed differently if they are to behave differently, but incentives and expectations should be based on evidence rather than rhetoric or vogue.

- Establish and recognise equivalence across a range of successful academic career archetypes within disciplinary and interdisciplinary units, and assist staff to find the right place for themselves. Research quality is not a proxy for teaching success, or vice versa, and universities must manage meaning in a way that conveys the importance of both.

9.3.3 For EFS researchers

Not surprisingly, the most definitive advice to come from this thesis is about the best direction for further research in this area. The second and fourth phases of the research (as shown in Figure 1.2) were most fruitful in this respect.

9.3.3.1 Refining the sustainability canon

Phase two of the thesis involved the development of some baseline concepts around which sustainability education should evolve, and the status quo of the Australian university sector. There are two key possibilities for extending this work.

First, the sustainability canon is based on expert surveys and broad literature reviews, and was informed by the Canadian case work, but it is as yet untested. A number of the individual proposed elements could form the basis for entire research projects using case study or participatory action research. Can the study of literature impart cosmopolitan ideals? How can civics pedagogy be authentic and effective without putting staff at risk? Can integration be taught without a management mandate, such as the use of meta-research (see Appendix)? How is the new ‘liberal education’ curriculum model at the University of Melbourne structured and what will be its impact on student outcomes, equity and university finance after it begins in 2008? How do other universities respond to Melbourne’s experiment with liberal education? Such questions will help to test and refine the canon. Of course the new environmental/sustainability
curricula followed at these Australian cases should also continue to be evaluated and adapted, as well as the trajectory of the Canadian innovations.

Second, actual students were largely externalised in this study. For example, the aggregate student experience around environment and sustainability was captured by looking only at the core curriculum imposed, although the flexibility of such programs has been shown to be high. Large scale access to actual student transcripts could reveal what subject combinations students are actually choosing: is there a common core in practice even though it’s not imposed? Individual students from that sample could be interviewed to understand their choices, experiences, and intended career plans, as well as the kinds of influence or guidance they have received. Without such understanding, academics in planning processes are left only with uneven anecdotes or market research.

### 9.3.3.2 Understanding collaboration for sustainability

Phase four of the research encompassed the Australian case work, which endeavoured to take a systemic view of the academic uptake of sustainability. An even clearer picture is possible if work is undertaken in the following two areas, using a research design that tests throughout whether sustainability work differs in these respects.

First, an inside-outside duality was identified in terms of collaboration for sustainability, with staff looking inside AOU’s for co-supervisors for their research students, and outside to the disciplines for collaborators for their own research. Sociological theory suggests this might actually be optimum, but this proposition needs more research. What are the impacts of supervisory panel diversity or homogeneity for the students, and for the staff themselves? How do student careers progress in either case, and does this differ by discipline or problem area? Empirical information about these relationships can serve to counter or support rhetoric in favour of collaboration.

Second, the use of affiliation calculations to flatten two-mode to one-mode data had a number of undesirable side effects. The initial decision to aggregate to the AOU exacerbated this data flattening. It became impossible to tell the difference in the derived one-mode aggregated matrices between a strong relationship that derives from two people publishing together frequently, or a range of different linkages between members. Many researchers are engaged in the statistical development of SNA methods that retain this duality during activities such as clustering (Borgatti and Everett 1997; Field et al. 2006) that are not employed here, and simple $k$-means algorithms (see Section 4.5) can also be applied to raw two-mode matrices (Eckel 1998). While this analysis noted how collaborative traditions within the case hubs differed by disciplinary or problem-based cluster, such algorithms may be able to detect more subtle patterns than those found here.

### 9.3.3.3 Modelling interdisciplinarity

This fourth phase also presents many opportunities for investigating interdisciplinarity more generally, although sustainability remains a valuable heuristic.
First, rules should be further developed to delineate and model sustainability scholarship. The SNA analysis was hampered by the lack of a robust definition of ‘sustainability research’ that works across knowledge cultures. Defining this will also provide an identity for ‘sustainability’ in field-based quality assessment practices, and cross-campus networking. Such methods would also be facilitated by developing rules for modelling collaborative activity based on various authorship practices. For example, how does first authorship vary in implication in various fields; what does it say about how that work was undertaken?

Second, the social network methods employed have a blind spot in the cognitive activities of individual interdisciplinarians; those who integrate a range of fields in one mind. There are approaches in fields like cognitive science and psychology that could be extended to better understand the processes such integrators undertake in their research. This might draw upon the range of vocabulary (Porac et al. 2004) or cited sources employed (Rinia et al. 2002) – thus mapping networks between fields or terms rather than individuals – or look at individual self-monitoring behaviours (Mehra et al. 2001) or personality types more clinically.

Third, it would also be valuable to understand the life span of interdisciplinary work (for example, the ‘half life’) in comparison with disciplinary work. Who cites it? Is there a symbiotic relationship between the disciplines and interdisciplines as is suggested here, or is it one-way and parasitic? What does any difference mean for citation-based performance management and interdisciplinary careers (e.g. extending Beaver’s 2004 on collaboration in general)? Scientometrics tend to favour crisp fields, but – assuming a satisfying way of bounding ‘sustainability research’ can be found – applying the methods to such an interdiscipline could illuminate pro-integration rhetoric and anecdote with empirical data.

Finally, both detailed Australian cases concluded with the birth of new academic organisational units. Longitudinal social network mapping and ethnographic work could compare pre- to post-merger collaborations at these groups to explore the impact on interdisciplinary units of institutional culture and specific management approaches. Such insight is all the more essential as the units are planned to occupy different buildings and campuses in the short term: can such geography be overcome?

9.4 Sustainability bound?

The question stated in the thesis title remains unresolved. Universities are not singularly oriented towards sustainability in their academic work, but neither are they unduly constricted from taking such a journey, as the alternate reading of the phrase suggests. Rather than dictating a clear path, this thesis may best be thought of as mediating between parties who have little common ground from which to understand each other’s perspective. Like the undertaking of sustainability itself, it is easier to generate a compass bearing for EFS than a clear picture of the eventual goal. During the trip, the pressures that cause compass drift are rooted in human nature itself: the desire for prestige, to belong, to be unique, to be part of a team, to survive. If we can recognise
that we made the barriers and the conduits alike, we can also modify either or both. Students, academics, and the public also need to see universities as more than the sum of their parts. One of the conclusions from the Australian cases can be reiterated to broaden its meaning: regardless of what people come to a university looking for, what they should find is an academic community. Such collegiality nurtures a hospitable climate for the kind of EFS described here. The process of building such a community is conveniently familiar to those in academe: continuing to learn while we teach and research, vigorously debating ideas and values, and making choices with passion, reason and responsibility.


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Sustainability bound?


References


Sustainability bound?


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Appendix:

Integrative research methods curriculum

The following curriculum was developed under contract in early 2007, after a consultation process undertaken in person and by email with relevant staff, and engagement with the local educational development unit. It is included here in a condensed form as an example of the extension of theories from Chapters Three and Four into curriculum. Lengthy lists of readings and candidate guest lecturers have been removed.
Course overview

The problem of sustainability – including our sustainability as peoples and cultures, and the capacity of the earth to sustain us – cannot be solved from within any discipline. Solutions must draw on diverse expertise. This subject explores integrative methods and project planning for combining knowledge in teams for sustainability decision-making.

Aims

- Develop informed, critical and respectful attitudes about the contribution of various disciplines to sustainability issues;
- Increase awareness of the range of methods that exist for integrating knowledge and making decisions in complex settings, and develop detailed knowledge of a handful of techniques;
- Plan how to employ such methods in the solving of a sustainability problem in an integrative manner; and,
- Foster interdisciplinary teamwork skills, including negotiation, task division, and communication.

Structure

The program starts by drawing on theory learned in individual students’ major streams to understand the complexity of sustainability issues, and the contributions that various disciplines and players can have (weeks 1-3) in solving those problems. The following three weeks give an overview of a broad classification of integrative methods according to primary utility: 1) to understand a system, 2) to elicit or choose among options, or 3) to implement decisions and assess success. In fact, many of the methods are used in more than one of these steps. (e.g. those used to assess success are also often used to understand a system.) The three steps are – in fact – parts of an adaptive cycle. Students will form groups to share reading load in this first half.

Students will then undertake a week of team training, where they will formulate teams and guiding principles, as well as deciding a general research direction to investigate independently over the study break. Upon the students’ return, they will learn about project management approaches and research paradigms, and then will begin several weeks of team-based research planning, including a final week of lectures on individual interdisciplinarity. Individual and team-based reflections are assessed in the examination period.

Case

The problem domain to which integrative methods will be applied in the second half of the subject is the decision of the lecturer, but needs to suit the following criteria:

- Contain the potential for a range of research questions;
- Be current and engaging;
- Take advantage of the expertise of a wide range of student skill sets;
- Be adequately local that students can arrange their own research outings; and,
- Able to provide a challenge without overwhelming with complexity. (e.g. small victories rather than wicked problems.)
Candidate Texts


Team-based structure

Teams can be used for several reasons, and two of them are employed in this course.

Teams to share labour

During the first half, students will be grouped (or group themselves) into cohorts for collaborative learning. The method for doing so should be negotiated with the students, but similar sized groups are best. There is too much to cover and too many potential readings for all students to do each of them, so the readings groups (about 4 in each) will divide up the papers and an hour of each week’s tutorial time will be dedicated to allow the students to discuss the papers amongst themselves. They will establish their own group rules (although a default set will be available to use) and will self-govern with the oversight and advice of the lecturer and any tutorial staff/mentors identified. The only assessment on this phase will be the mid-term(s), for which it behoves them to advise one another with rigour. While this will be encouraged, the midterms will be written with options so that students who have done their own share of the reading will not be disadvantaged. The following elements are examples of key issues students should be imparting to their peers from that considerable literature (not given here for brevity):

- What is the research question? Who set this question?
- Who was undertaking the research? (individual, cohesive group, other)
- What key methods (those discussed in class) were employed? Why?
- How did the methods perform? Can you identify pros and cons?
- How did the investigator/team perform? Did interpersonal issues arise?
- How did the research progress? Were other methods also used? Why?

Teams to share expertise

For the second half, students will decide whether or not to remain in their existing groups or reformulate for the meta-research component. The second group will also negotiate a set of group rules, which will have to be more rigorous in the risk analysis and labour division as they will be producing a common research plan from the collaboration. Team crises are likely and will be negotiated by team and lecturer together.
Appendix: Integrative curriculum

Assessment

In the manner of democratic classrooms and working to students’ strengths, assessment task values should be negotiable within ranges. A preliminary scheme follows:

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**Forum engagement – 20%** – undertake throughout course

Forum postings on 10 topics of the 26 options presented, posted in the week following the relevant lecture (one per week, ~200 words). Boolean marking system (done/not done) – 10%

A thoughtful reply to someone else’s forum posting (~200 words), one mark per submission (5% for the first half of term, 5% for the second) – 10%

**Midterm exam – 30%** (One in week 7, or two tests, week 4 [10%] and week 7 [20%])

Covers the theory on integration from the first half of the course, but designed not to disadvantage students whose work-sharing teams have been dysfunctional.

**Personal reflection and peer evaluation – 15%** – submit during exam week

Assessment of personal learning experience – 10%

- How did I perform as a team member, both at setting team norms/goals and reaching them? (Students can and should draw upon forum-based discussions in this task.)
- What did I learn about my potential contribution to sustainability?
- What did I learn about teamwork that I will take into future similar settings?

Evaluation of peers in team (an aggregation of this mark will weight team grade above) – 5%

- What percentage of the team-based work did each do? (This number MAY be averaged with those from others to formulate a modifier for team report.)
- What kind of team member was each colleague? (These comments MAY be provided – unedited but anonymous - as feedback to each student in question.)

**Research plan – 35%** (all students get same, optionally modified by peer evaluation) – submit during exam week

Group presentation, evaluated by peers and lecturer – 10%

Research plan:

- Research question
- Proposed methodology (and rationale)
- Researched data/process requirements
- Division of labour (and additional expertise required)
- Comments on methodology (pros, cons, key resources/literature)

Team reflection:

- The experience of integration (pros, cons, advice)
- Assessment of team performance (in light of goals set)
- What would we do differently if we were to do it again?

Group submission of research report, details same as above, including – 25%

Narrative of process:

- How the team was chosen
- How the research question was settled upon
- How the method(s) was/were chosen
- Negotiation processes and reflections

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## Rough outline

<table>
<thead>
<tr>
<th>W</th>
<th>Topic</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What is integration and why do it?</td>
<td>What is a method? What is research? Why integrate for sustainability? Why is it difficult? Decision-making under uncertainty, with examples.</td>
</tr>
<tr>
<td>2</td>
<td>Thinking about disciplines.</td>
<td>What do I bring to sustainability? What assumptions is my discipline built on? Where are there gaps? Who fills mine? Post-normal or Mode II science.</td>
</tr>
<tr>
<td>3</td>
<td>Looking outside the academy.</td>
<td>Identifying other perspectives or stakes. Differences in knowledge cultures. Frameworks for wide engagement. Social learning as a research outcome.</td>
</tr>
<tr>
<td>4</td>
<td>Integration to understand a system e.g. area-based/ethnography, integrated modelling</td>
<td>For next three weeks: Introduce methods for various (main) purposes (note process is a cycle)</td>
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<tr>
<td>5</td>
<td>To elicit, generate or choose among options e.g. game theory/agent modelling, MCDM, meta-analysis</td>
<td>Note how they draw on existing knowledges, Discuss pros, cons, assumptions, gaps, resource needs, barriers to use,</td>
</tr>
<tr>
<td>6</td>
<td>To implement and assess decisions e.g. policy analysis, criteria and indicators</td>
<td>Ideally illustrated by a guest lecturer/expert (turn into public seminar?)</td>
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<tr>
<td>7</td>
<td>Teamwork across disciplines in situ of area or problem in question</td>
<td>Translating between 'languages', team skills, choosing methods/teams, setting research direction.</td>
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<td></td>
<td>BREAK (Field trip?)</td>
<td>Students expected to do preparatory research</td>
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<tr>
<td>8</td>
<td>Project management and frameworks</td>
<td>The research process itself and the range of frameworks and paradigms possible.</td>
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<tr>
<td>9</td>
<td>Meta-research (research about research) in self-directed teams</td>
<td>Refining a research question together and choosing methods (groups of 4-6 with student mentorship).</td>
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<tr>
<td>10</td>
<td></td>
<td>Understanding and 'feeding' the methodology.</td>
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<tr>
<td>11</td>
<td></td>
<td>Negotiating the division of labour/skill recruitment</td>
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<tr>
<td>12</td>
<td>The individual integrator</td>
<td>Challenges, perceptions, roles, personal aptitude.</td>
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<tr>
<td>13</td>
<td></td>
<td>Developing a research plan/process.</td>
</tr>
<tr>
<td>E</td>
<td>Group presentations during examination week</td>
<td>Discuss methods’ pros, cons, etc, diversity of outcomes; Reflections on experience</td>
</tr>
</tbody>
</table>
Weekly schedule

Week 1: What is integration and why do it?

Goal
Establish an awareness among students about the importance of integrating knowledge and perspectives for solving complex, even ‘wicked’ sustainability problems, and that integration already happens in order to come up with decisions in situations where not all information is known. Map the set of tasks implied under integration, and set the specific trajectory of subject, showing how it relates to others on offer.

Lecture content
- Why integrate? What is a method? What is research?
- Why is it difficult? Guests from one successful and one unsuccessful case including post-mortem of each.
- Thinking as integration: people have been combining information from various sources to make decisions for aeons: government ministers, legal judges and juries, colonial and coronial enquiries (e.g. US Office of Technology Assessment)
- Types of integration (in space, in time, of discipline and policy sectors, across social systems, of knowledge systems).
- Demystifying qualitative and quantitative work; it’s not just words versus numbers.
- Defining terms: multidisciplinarity, interdisciplinarity, transdisciplinarity, integration.
- State focus of this subject: decision-making around society-environment relations.

Tutorial
Hour 1 - Perform personality testing (Briggs-Myers, Kolb) and run an exercise where students gather first in groups with ‘like’ people to discuss how they would approach a task (e.g. organizing an inter-house competition), and then in ‘unlike’ groups. Discuss in relation to the difficulty of team-based integration, esp. leadership role or high and low self-monitoring characteristics. We’ll draw on these personality types as the subject progresses.
Hour 2 - Form research cohorts to share work on first term readings, instruct on the negotiation of group rules/learning contracts (they will self-govern), and start them discussing their respective disciplines (majors) and its tenets/assumptions, as a way of correcting for lack of core subjects in course.

Assessment
Journal/forum question options:
“How did I make the decision about what university to attend and what program to undertake, given information, aptitude, emotion and advice received?”
“How do I feel about the personality type that I was defined as in today’s exercise? What did I learn about the way I work, alone and in teams?”
Week 2: Thinking about academic disciplines.

Goal
Get students thinking about the disciplines they have been studying, and the way in which those disciplines relate to others in terms of assumptions, methods, burdens of proof, and gaps. Use sustainability frameworks (eg. MEA) as a heuristic to identify those disciplinary gaps.

Lecture content
- What is sustainability’s history? What does sustainability comprise?
- What disciplines are thus valuable in contributing to sustainability?
- Guest lecture about such processes, particularly related to disciplinary interactions (humorous if possible).
- Where do disciplines come from and why?
- The languages of disciplines: probabilities, events, places, frequently, description, relationships.
- Assumptions and values inherent to disciplines.
- Interdisciplines, and broad vs. narrow career paths.
- Post-normal science/Mode II science/science vs. expertise

Tutorial approach
Hour 1 - Break into groups to discuss readings.
Hour 2 - Playing on stereotypes of various disciplines, look at all the personality types explored in the previous week and identify what discipline each combination might be attracted to. Then call on people from those combinations to check and see if they were correct, and – if not – what the ‘misfit’ student’s experiences are in that culture. Discuss what other stereotypes exist related to disciplines, and where they come from (e.g. media, movies, etc). Is there a hierarchy of disciplines? What causes this? What are the languages or dimensions with which discipline-members speaks to one another? How do they communicate with those outside their discipline or outside the academy?

Assessment
Journal/forum question options:
“What does my chosen discipline say about me? What doesn’t it capture about my singular talents?”
“How does my discipline contribute to sustainability or unsustainability? How do I feel about that?”
Week 3: Intro - Looking outside the academy.

Goal
Introduce students to the wide range of other perspectives that are necessary for capturing an accurate picture of any sustainability issue, and the different approaches that may be required to communicate with those stakeholders.

Lecture content
- Who else matters? (e.g. knowledge cultures like local, specialized, strategic, integrative).
- Defining, identifying, categorizing stakeholders: proportional, random, special interests, the converted, and opponents.
- Frameworks and tools for engaging other cultures.
- Engagement from the other side: invited guest from Aboriginal community, or grazier/irrigator community.
- Social learning as a valid research outcome.
- The tyranny of distance: overcoming space with ICT or public participation GIS
- History: avoiding cultural clashes by considering our past.
- Traditional ecological knowledge and philosophy.
- What about where there are no words? Collaboration in art and music.
- Explain subject trajectory and where specific methods fit into frameworks learned.

Tutorial approach
Hour 1 - Break into groups to discuss readings.
Hour 2 - Facilitated exercise working through one such framework for identifying stakeholders (policy makers, demographics, practitioners, potential linkages), and working through the decision-making cycle in a manageable, local issue.

Assessment
Journal/forum question options:
“Who else am I? What identities and allegiances do I have other than my discipline that affects the way I see issues?”
“How do methods from my discipline limit the kinds of questions that can be answered with it? Who will it leave out? What does it do well?”
Week 4: Integration to understand a system.

**Goal**

Give students a picture of the range of methods that can be applied to help a team to form a common understanding or picture of a complex, society-environment issue. Provide detailed information (from experts/mentors) on how to undertake one or two such approaches.

**Lecture content**

- Why is it important to hold a common understanding of a system?
- Translation to common units (e.g. probability, energy, ecosystem services, carbon stocks, site).
- Interdisciplinary ethnography/area-based investigation, place-based learning communities.
- Oral/environmental history, documentary, natural history, narrative.
- Systems thinking, group model building, communities of practice.
- Input/output modelling, or stocks and flows
- How these approaches can be used in other stages of sustainability problem-solving, and what happens next?

**Tutorial approach (2h)**

Hour 1 - Break into groups to discuss readings.

Hour 2 - Expert-led discussion of pre-worked cases, including steps, data needs, resources, disciplines and stakeholders involved, how geographical dispersion was handled, issues of translation, findings, pros and cons. Perhaps offer two modules in sequence, or parallel offerings with choice.

**Assessment**

Journal/forum question options:

“Which of these methods am I drawn to? Why? What would I contribute?”

“Which of these methods would I have difficulty participating in? Why?”
Week 5: Integration to elicit, generate and choose between options.

Goal
Give an overview awareness of the range of ways in which management options can be elicited/generated and choices made in challenging society-environment issues.

Lecture content (3h)
- The difference between wants, needs, priorities, and decisions.
- Undertaking meta-analysis (lit review).
- Citizen juries and consensus conferences.
- Optimisation (e.g. genetic algorithms, simulated annealing).
- Economic approaches (e.g. triple bottom line, non-market valuation, extended cost-benefit analysis, natural resource accounts).
- Sustainability redesign, charrettes/planning cells, and information visualisation.
- Decision analysis: multi-criteria methods, Bayesian decision networks, public participation GIS.
- How can these approaches be used in other stages, and what happens next?

Tutorial approach
Hour 1 - Break into groups to discuss readings.
Hour 2 - Expert-led discussion of pre-worked cases, including steps, data needs, resources, disciplines and stakeholders involved, how geographical dispersion was handled, issues of translation, findings, pros and cons. Perhaps offer two modules in sequence, or parallel options with choice.

Assessment
Journal/forum question options:
“Which of these methods am I drawn to? Why? What would I contribute?”
“Which of these methods would I have difficulty participating in? Why?”
Week 6: Integration to implement and assess decisions/status quo

Goal
Give an overview of the ways in which decisions can be assessed for suitability, implemented, and monitored to assess progress. (Note that many methods employed to assess progress ex post are also often employed to assess status quo as discussed in week 4, and vice versa.)

Lecture content
- Methods for assessing, implementing and monitoring decisions.
- Policy analysis and integration.
- Knowledge systems analysis.
- Metrics (state of the environment reporting, criterion and indicators, change detection).
- Risk assessment and management (e.g. US Office of Technology Assessment).
- Extended environmental and social impact assessment, sustainability assessment.
- How can these approaches be used in other stages, and what happens next? (e.g. adaptive management iterations).

Tutorial approach
Hour 1 - Break into groups to discuss readings.
Hour 2 - Expert-led discussion of pre-worked cases, including steps, data needs, resources, disciplines and stakeholders involved, how geographical dispersion was handled, issues of translation, findings, pros and cons. Perhaps offer two modules in sequence or parallel options with choice. Perhaps explore recent government department reports relevant to each student’s area/interests. Have students identify approaches and assumptions used in these debates/programs.

Assessment
Journal/forum question options:
“Which of these methods am I drawn to? Why? What would I contribute?”
“Which of these methods would I have difficulty participating in? Why?”
Week 7: Team-building (in situ?).

Goal

Develop a common understanding of the importance and difficulty of doing team work. Build teams and facilitate cohesion of these teams through team-building exercises located – possibly – at the site of the ‘issue’ to be studied by the teams. Explore the problem domain to get started on setting a team research direction. This gives student teams the chance to get started on their research over the break.

Lecture content

- Why work in teams to integrate? Advantages and disadvantages.
- Characteristics of good teams: diversity, independence, decentralization, decision analysis approach.
- Social psychology (e.g. groupthink in cohesive, homogeneous settings), multiple realities, positive conflict.
- Team roles– definer, analyst, interpreter, critic, synthesizer, disparity monitor, task monitor, emotional monitor.
- Academic teamwork.
- Team function: machine, biological system, or sense-making mind.
- Group work agreements and ground rules.
- Dealing with conflict; Delphi method for resolving expert opinion.

Tutorial approach

First half – Midterm on first six weeks’ content.

Second half - Facilitated team construction process (drawing on Myers-Briggs done in week one), followed by team building exercises (e.g. survival scenarios) with reflection on the experiences. Specifically focus on recognizing the difference between empirical claims (what is known), value claims (what we care about) and normative claims (what we should do). Conclude with discussion and development of team ground rules/learning contracts (structure, decision-making, norms, conflict and risk, meeting arrangements) and general research direction.

Assessment

Journal/forum question options:

“What team role do I usually play? Which would I like to? Which am I uneasy about?”

“How do I usually resolve conflict with others? How might this play out in a team?”

Plus an identification of teams, with submitted set of ground rules signed by all team members, and a first week research task identified.
Week 8: Project paradigms and frameworks

Goal
Develop an awareness of the importance of formal project management skills in any research or implementation project, including major steps involved and how to handle leadership amongst peers. Discuss the range of process philosophies and frameworks in which the above methods can be included. Emphasise that participation can occur at many stages through the process (recalling week 3).

Lecture content
- Grant applications and research project management.
- Method vs methodology vs philosophy.
- Deliberation.
- Adaptive management.
- Action research.
- Systems analysis and design (SAD, e.g. soft systems).
- Expert systems.
- Scenario planning.
- When and where stakeholders can get involved.

Tutorial approach
Hour 1 - Break into (new?) groups to discuss readings.
Hour 2 - Expert-led discussion of pre-worked cases, including steps, data needs, resources, disciplines and stakeholders involved, how geographical dispersion was handled, issues of translation, findings, pros and cons. Perhaps offer two modules in sequence or parallel options with choice.

Assessment
Journal/forum question options:
“Which of these paradigms am I drawn to? Why? What would I contribute?”
“Which of these paradigms would I have difficulty participating in? Why?”
Week 9: Meta-research - Generating a research question and choosing methods

Goal
Self-directed student research groups (ideally with mentorship from PhD students) will begin developing a research plan to tackle the issue suggested by the lecturer by deciding upon a specific research question and deliberating about methods. Additional group research and meetings may be required before and after official class times to ensure progression. Teams must seek assistance and resources from lecturer/mentors as soon as they know what they need.

Team work
Full group discussion of the importance of having the right research question and choosing appropriate methods, based on theory learned. No formal lectures; group work and lecture clarification, advice, instruction when required.

Assessment
Work on group project, and journal/forum question options:
“How does the research question my team has chosen draw on or challenge my expertise?”
“How has my team reached our decisions, and negotiated any conflict? Has it been fair?”

Week 10: Meta-research - Understanding and feeding the methodology.

Goal
Self-directed student research groups (mentored) will continue developing a step-by-step plan to tackle the research question they have decided upon using the method(s) they have chosen. This will require understanding better how chosen methodologies operate, and what kind of information it requires and where it can be found or created (this may draw on previous methods subjects). Additional group research and meetings may be required before and after official class times to ensure progression. Teams must seek assistance and resources from lecturer/mentors as soon as they know what they need.

Team work
No formal lectures; group work and lecture clarification, advice, instruction when required.

Assessment
Work on group project, and journal/forum question options:
“Have I participated equally in team activities this week? What role have I played?”
“How do the methods we are exploring in my team draw on or challenge my expertise?”
Week 11: Meta-research – Division of labour

Goal
Self-directed student research groups (mentored) will refine their research plan to tackle their research question by negotiating respective roles and tasks, as well as determining what expertise would be required that they do not hold but which will need to be recruited. Additional group research and meeting may be required before and after official class times to ensure progression.

Team work
No formal lectures; group work and lecture clarification, advice, instruction when required.

Assessment
Work on group project, and journal/forum question options:
“Does the approach we have taken to solving/exploring our research question leave out any important perspectives or connections? How do I feel about that?”
“Have we negotiated the division of labour in such a project to everyone’s satisfaction? Is equity of effort important?”

Week 12: The role of the individual integrator.

Goal
Not all interdisciplinary sustainability research is done by teams. Individual integrators integrate in their own mind and have a particular set of career challenges.

Lecture content
- Fish-scale model of science vs the Renaissance person.
- Challenges of an interdisciplinary career path (especially in academia).
- Integrators: the source of creativity in problem-solving, or the facilitator?

Tutorial approach
Discussion of interdisciplinarity in light of disciplinary social psychology discussed earlier in the subject. Students are invited to share individual reflections on the experience; did any of them find themselves acting as ‘integrators’ or hubs? Was that a comfortable role? Was that a leadership or facilitation role?

Career-path discussions from several individual integrators from a range of jobs (academia, government/public service, private companies, etc): Pros, cons and advice.

Assessment
Continue with team research outside of class time, and journal/forum question options:
“Would I make a good individual integrator? Why or why not?”
“Would I make a good team integrator? Why or why not?”
Appendix: Integrative curriculum

Week 13: Meta-research – Project management and sequencing

Goal
Self-directed student research groups (ideally with mentorship from PhD students) will finish developing their research plan to tackle the research question they have chosen, including a detailed consideration of project paradigms as discussed in week 8. Additional group research and meeting may be required before and after official class times to ensure progression.

Team work
No formal lectures; group work and lecture clarification, advice, instruction when required.

Assessment
Work on group project, and journal/forum question options:
“How is the duration of this project limiting what theory/perspectives/elements we are able to address in our project? How do I feel about the impact of this limitation on our plan?”
“What kind of project management process or research paradigm are we using? Does it resonate with me?”

Exam week: Assessment due – team and individual

Goal
For students to share experiences of group work and what they learned about the methods they tackled for their chosen research question. Team presentations will be held in the exam week because there is no final examination in the subject. Also due are team reports, team reflections and individual reflections.

Team work
Team presentations

Assessment
Team presentations, team reflections and individual reflections.