

Multilateral forestry research and tertiary forestry education for development: reflections on progress since the 1970s

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SUMMARY

The contemporary institutional landscapes for multilateral forestry research and tertiary forestry education for development were shaped largely in the last three decades of the 20th century. Some limitations of largely post-colonial arrangements in the 1970s for forestry research for development were addressed by the establishment of CIFOR and incorporation of ICRAF into the CGIAR system in the early 1990s, following international processes in which FAO, IUFRO and the World Bank played central roles. Contemporaneously, tertiary forestry education evolved and internationalised in conjunction with that sector more generally. Institutional arrangements for multilateral forestry research are now undergoing another phase of change, as key actors seek more impact without more investment. Traditional models of tertiary forestry education for development are similarly challenged by ongoing changes in higher education systems. Both forestry research and education need now to address the profound challenges and potential opportunities associated with major forces such as ongoing forest loss and degradation, climate change, economic globalisation, and social and demographic change. In parallel, the value of evidence-based policy and practice, and of multilateralism, are being challenged by resurgent political populism and nationalism. Together, these contexts suggest that those engaged in forestry research and education for development will need to be politically and institutionally astute, and proactive and strategic, in catalysing and pursuing opportunities; and that various collaborative models, both nationally and internationally, will remain important vehicles for sharing resources, commanding the attention of decision-makers, and realising development impacts.

Keywords: forestry education, forestry research, global South, research for development, sustainable development

Recherche forestière multilatérale et éducation forestière supérieure pour le développement: réflexions sur les progrès effectués depuis les années 70

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Les paysages institutionnels contemporains pour la recherche forestière multilatérale et la recherche forestière en éducation supérieure pour le développement ont été principalement ébauchés au cours des trois dernières décennies du XX^{ème} siècle. Certaines limites des arrangements, largement post-coloniaux dans les années 70, pour la recherche forestière en développement ont été visées par l'établissement du CIFOR et l'incorporation de l'ICRAF au système du GCRAI au début des années 90, à la suite des processus internationaux dans lesquels la FAO, l'IUFRO et la Banque Mondiale ont joué des rôles capitaux. Dans la même période, l'éducation forestière supérieure évolua et s'internationalisa plus généralement en conjonction avec ce secteur. Les arrangements institutionnels pour la recherche forestière multilatérale connaissent actuellement une autre phase de changement, alors que les acteurs-clé recherchent davantage d'impact sans investissement additionnel. Les modèles traditionnels d'éducation forestière supérieure pour le développement sont eux aussi ébranlés par les changements en cours dans les systèmes d'enseignement supérieur. La recherche et l'éducation forestières doivent à présent faire face aux profonds défis et aux opportunités potentielles associés à des forces majeures, telles que la perte et la dégradation forestières en cours, le changement climatique, la globalisation économique et les changements démographiques et sociaux. Parallèlement, la valeur des politiques et des pratiques basées sur des preuves et celle du multilatéralisme sont secouées par un populisme et un nationalisme politique résurgents. Mis ensemble, ces contextes suggèrent que les personnes engagées dans la recherche et l'éducation forestières pour le développement devront faire preuve de finesse politique et institutionnelle et être stratégiques et proactives pour catalyser et poursuivre les opportunités. De même, les modèles collaboratifs variés, nationaux et internationaux, resteront des véhicules importants pour le partage des ressources, afin d'attirer l'attention des preneurs de décision et de réaliser les impacts de développement.

Investigación forestal multilateral y educación forestal terciaria para el desarrollo: reflexiones sobre los progresos realizados desde la década de 1970

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El panorama institucional contemporáneo de la investigación forestal multilateral y de la educación forestal terciaria para el desarrollo se configuró en gran medida en las tres últimas décadas del siglo XX. Algunas limitaciones de las disposiciones, principalmente postcoloniales, de la década de 1970 para la investigación forestal para el desarrollo se abordaron con el establecimiento del CIFOR y la incorporación del ICRAF al sistema de CGIAR a principios de la década de 1990, tras los procesos internacionales en los que la FAO, IUFRO y el Banco Mundial desempeñaron un papel fundamental. Al mismo tiempo, la enseñanza forestal terciaria evolucionó y se internacionalizó a la par que ese sector de manera más general. Las disposiciones institucionales para la investigación forestal multilateral están atravesando ahora otra fase de cambio, en la que los principales agentes buscan más impacto sin más inversión. Los modelos tradicionales de educación forestal terciaria para el desarrollo se han visto cuestionados igualmente por los cambios que se están produciendo en los sistemas de educación superior. Tanto la investigación como la educación forestal deben abordar ahora los profundos desafíos y las posibles oportunidades asociadas a las principales fuerzas de cambio como la pérdida y degradación continua de los bosques, el cambio climático, la globalización económica y los cambios sociales y demográficos. Al mismo tiempo, el valor de las políticas y las prácticas basadas en evidencia, así como el del multilateralismo, se ven cuestionados por el resurgimiento del populismo político y el nacionalismo. En conjunto, estos contextos sugieren que las personas dedicadas a la investigación y la educación forestal para el desarrollo tendrán que ser astutas en lo político y lo institucional, así como ser proactivas y estratégicas, para catalizar y aprovechar las oportunidades; y que los diversos modelos de colaboración, tanto a nivel nacional como internacional, seguirán siendo importantes vehículos para compartir recursos, atraer la atención de quienes adoptan las decisiones y lograr impactos en el desarrollo.

INTRODUCTION

The case for the centrality of forests, and the ecosystem goods and services they provide, to what is now characterised as ‘sustainable development’ (World Commission on Environment and Development 1987) has been made by foresters since the 19th Century (Westoby 1989), by forest-related development institutions since the 1960s (e.g. Westoby 1987, World Bank 1978), and since the 1980s by multilateral initiatives and processes focused on forests that now characterise the international forests regime (Fernández-Blanco *et al.* 2019, Rayner *et al.* 2010). The scope of forest ecosystem goods and services recognised has broadened progressively, from an early emphasis on wood products and forest industry-based development, to the contemporary understanding of forests being foundational to much of the United Nations Sustainable Development Agenda (Katila *et al.* 2019) and to planetary health (e.g. Griscom *et al.* 2017, Rosenstock *et al.* 2019).

Key elements of the contemporary international institutional landscape of forestry¹ ‘research for development’ (*sensu* Bartlett 2016, Clark *et al.* 2016 – viz. research conducted in support of sustainable development) were shaped during the last three decades of the 20th century. Over the same period, tertiary forestry education also evolved substantially, reflecting an intersection of a broadening understanding of “the purpose of forests” (*sensu* Westoby 1987), the expansion of tertiary (‘higher’) education globally (UNESCO 2017), and

institutional changes in tertiary education systems (Kanowski 2000). During these three decades, John Spears worked successively for FAO and the World Bank, and on related international initiatives such as the World Commission for Forests and Sustainable Development (Krishnaswamy and Hanson 1999; see Lele *et al.* 2019). This paper is part of a Special Issue acknowledging his contributions to forestry for development.

These research and education trends from the 1970 have generally accelerated this century. Research and development (R&D) investment has both internationalised and grown since the 1980s (Dehmer *et al.* 2019), with global R&D expenditure more than doubling in real terms since 1996, to USD\$1,400 Billion (2013 value; UNESCO 2019). Similarly, tertiary education has globalised and internationalised (Altbach *et al.* 2009, Zajda 2015); access to both education generally and higher education specifically has improved dramatically, although remaining limited, inequitable and of poor quality in some regions and countries (UNESCO 2016, UNESCO 2017, World Bank 2018). Multilateral forest-related research and tertiary forestry education have evolved in these broader systemic contexts as well those more specific to forests and forestry (e.g. Katila *et al.* 2019, van Noordwijk 2019, Westoby 1987, Chapters 7 and 12; other papers in this Special Issue).

The genesis of this paper, as part of a series in honour of John Spears’ many contributions to forestry internationally, shapes its scope and focus. The paper describes the institutional

¹ The term ‘forestry’ is used here in a broad sense, building on established definitions (e.g. Helms 1998), to describe purposeful activities related to the conservation, sustainable management and restoration of forests and trees, and the realisation of their values, services and products; including in ‘agroforestry’ contexts (van Noordwijk *et al.* 2019) Such activities may draw on both traditional and modern knowledge, applied in particular societal and landscape contexts. The term does not privilege any particular interpretation, emphasis or outcomes of those activities.

gaps identified in the 1970s through processes led by international agencies or entities for whom Spears worked or with whom he interacted; the international institutional arrangements for multilateral forestry research for development that emerged; how tertiary forestry education relevant to development has evolved; the relationship between contemporary multilateral forestry research and forestry education for development and the ambitions articulated in the 1970s and 1980s; and future opportunities and challenges suggested by these reflections.

FORESTRY RESEARCH FOR DEVELOPMENT IN THE 1970S

Forestry research in the 1970s was dominated by institutions in the global North, addressing primarily topics of relevance to those industrialised economies. Some form of forestry research institution existed in most countries of the global South, but – with some notable exceptions – many were poorly funded and staffed, with inadequate facilities, and questionable research priorities (World Bank and FAO 1981). Their priorities largely reflected the post-World War II paradigm of industrial forestry-based development (*e.g.* Westoby 1962), and largely neglected the interface between agriculture and forestry (King 1987). A 1980 global survey identified some 600 forestry research institutions worldwide, of which 90 were engaged on what were then seen as priority topics for forestry in developing countries; 51 of these were in the global North, and four others were multilateral (CGIAR²) centres (World Bank and FAO 1981). Many of the Northern institutions were already engaged in bilateral or multilateral research and capacity development partnerships with those in the South. These arrangements reflected, variously, post-colonial bilateral relationships and multilateral initiatives facilitated by the UN FAO and by IUFRO, which had expanded from its pre-1950 solely-European membership to 267 institutional members from 68 countries by the mid-1970s (Johann *et al.* 2017).

One example amongst many is the international collaboration in forest genetic resources coordinated by FAO's Panel of Experts on Forest Gene Resources, established in 1968 (FAO 2012). The Panel facilitated and coordinated activities led by nominated (usually Northern) institutions, supported by both FAO and national development assistance agencies. For example, Australia's CSIRO took responsibility for collecting and distributing the genetic resources of eucalypts from Australia and neighbouring countries (FAO 2002); the UK's Commonwealth Forestry Institute coordinated collection and distribution of the genetic resources of tropical and subtropical American pines and legumes (Burley *et al.* 2009); Denmark's Forest Tree Seed Centre led teak germplasm collection, conservation and improvement in partnership with Thailand (Hedegard 1971); France's Centre Technique

Forestier Tropical (CTFT) led work on the genetic resources of many African hardwood species (FAO 1969). This cooperation often extended to related research on these species, such as that on plantation management and products (*e.g.* Burley *et al.* 2009, Turnbull 2003). Tropical forest management and forest products research followed broadly similar institutional arrangements, with – for example – partnerships between European institutions and those of their former colonies, and multilateral facilitation by FAO, in many cases building on long-established work. While there were some strong established or emerging institutions in the global South – for examples, various CTFTs in Francophone Africa, India's and Malaysia's Forest Research Institutes, or the precursors of Brazil's Embrapa – these were in the minority. Attempts to facilitate the establishment and work of 'regional'-level forest research institutions had generally not been successful (World Bank and FAO 1981).

MULTILATERAL FORESTRY RESEARCH FOR DEVELOPMENT – NEXT STEPS FROM THE LATE 1970S

A series of initiatives led by the World Bank and FAO, with the collaboration of IUFRO, from the late 1970s argued the case and progressively developed options for strengthening multilateral forestry research for development. Key stages in this process are summarised below.

The 1978 World Bank *Forest Sector Policy Paper* and World Forestry Congress

The 1978 World Bank *Forest Sector Policy Paper* (World Bank 1978), shaped in large part by John Spears as the then Forestry Adviser, characterised the situation of forests and their potential role in development in terms which are now familiar. It was concerned primarily with the loss of tropical forests to agriculture; the impacts of industrial logging, fuelwood consumption and shifting cultivation; recognising the high levels of reliance on forests and trees by the world's rural poor; the underinvestment in forestry for rural development and environmental services compared to that for industrial development; and the lack of institutional capacity in governance, research and education. The key messages of the *Paper* were complemented by those of the 8th World Forestry Congress, convened by FAO in the same year, the theme of which – *Forests for people* – built on FAO work subsequently published as *Forestry and rural development* (FAO 1981), which similarly signalled a reorientation of thinking away from a focus on forestry for industrial development to the broader roles and potential of forests and trees in livelihoods and development (Westoby 1978).

The World Bank *Paper* identified research priorities to support more sustainable transformation of tropical landscapes.

² Consultative Group for International Agricultural Research (see www.cgiar.org).

These included agroforestry systems, intensified forest management, fast-growing fuelwood plantations, alternatives to and more efficient fuelwood use, environmental research focused on forest catchment management and restoration, and research on smaller scale processing and pulp and paper technologies and on value-adding. It also identified training as an integral part of forestry development and of Bank support (World Bank 1978: 48–49).

Exploration and refinement of research priorities and institutional options in the 1980s

The research-related content of the World Bank *Paper* was amplified and refined with information from a global survey of developing country research needs, conducted by the World Bank and FAO in 1981, and presented at the 17th IUFRO World Congress later that year (World Bank and FAO 1981). Its conclusions, developing those outlined in the *Paper*, are succinctly summarised in the Abstract:

“... new priorities for research are ... directed towards the contribution of trees and forests to increased agricultural productivity and rural development, to the increased production and more efficient use of wood-based energy, and to the conservation and management of existing forest resources. Strategies advocated for ensuring more intensive research in these areas and for meeting technical and physical research needs include strengthening national research institutions in the developing countries themselves and more effective ‘twinning’ of national agencies with some 90 existing research agencies identified in the paper which are already carrying out research in these priority areas.”

The 1981 IUFRO Congress paper noted an almost universal preference for strengthening national institutions, but that other options were not mutually exclusive. It also suggested a third option not aired previously, that of new institutions and the possible role of a “small International Forestry Research Secretariat” (p 24), with a coordination and facilitation role complementing those of FAO and IUFRO.

The survey was considered and its recommendations endorsed by FAO’s Committee on Forestry at its 6th session in 1982 (FAO 1982), and the Secretariat suggestion subsequently evolved into IUFRO’s Special Program for Developing Countries, established in 1983 (Buckman 1986). Both the World Bank and FAO (1981) and Buckman (1986) outlined the role of the multilateral CGIAR system’s then 13 International Agricultural Research Centers in addressing the challenges facing agriculture in the developing world, noted their strengths compared to national centres and their research priority-setting process, and commented on the value of well-developed global and regional research networks, which they observed to be less well-developed in forestry than agriculture. Both noted in the latter context the respective roles of the Nairobi-based International Council for Research in Agroforestry (ICRAF), the establishment of which was catalysed by Canada’s International Development Research

Centre in 1977 (King 1987); and that of the Costa Rica-based regional Tropical Agricultural Research and Higher Education Centre (CATIE), established in its present form in 1973 with integrated research, education and extension objectives (CATIE 2015).

IUFRO’s President Robert Buckman (1986: 447) and his colleagues built on a suggestion first aired in the 1981 World Bank and FAO paper to propose an “International Council for Forestry Research and Extension” (INCOFORE), as “a small secretariat and advisory mechanism to focus on global and regional problems of forestry research and extension”, and reported on preliminary discussions about its structure and funding. Over the next few years, that proposal intersected with others emerging from the World Commission on Environment and Development (1987) and the CGIAR system itself, which identified the need for research that better integrated agriculture with its environment, natural resource and sustainability contexts and dimensions; that addressed the research constraints identified in the context of the recently-initiated Tropical Forests Action Plan (TFAP); and connected with the momentum then building towards the 1992 UN Conference on Environment and Development and its Agenda 21 (Sayer 1994).

The establishment of multilateral forestry research institutions within the CGIAR

In early 1988, an International Task Force on Forestry Research (ITFFR) established by the Rockefeller Foundation, the World Bank, UNDP and FAO identified the global research priorities listed in Box 1, and explored institutional options to address these constraints, including: “creating an independent world centre for the direction, execution and coordination of tropical forestry research; expanding the mandate of the CGIAR to include forestry research; and establishing a new consultative group or similar body with a specific mandate for forestry research” (Sayer 1994).

Box 1 Research priorities identified by the International Task Force on Forestry Research, 1988

(source: Sayer 1994)

- forestry’s role in agroforestry, watershed and arid zone land-use management;
- natural resource conservation and management;
- tree breeding and tree improvement;
- utilization and market research;
- policy and socio-economic research

Proposals to expand the CGIAR mandate into forestry were not uncontroversial: for example, ICRAF’s Director-General had noted in 1987 that the strong disciplinary focus of the existing CGIAR centers was not compatible with the inherently interdisciplinary research needs that characterised agroforestry (Lundgren 1987). Nevertheless, in 1989, the core group of actors who had initiated TFAP and ITFFR reconvened and eventually endorsed the incorporation of forestry research into the CGIAR system (Sayer 1994). The CGIAR’s Technical Advisory Committee subsequently recommended

that ICRAF join the CGIAR, as the International Center for Research in Agroforestry, with a global mandate for strategic agroforestry research; and the establishment of new CGIAR centre, the Centre for International Forestry Research (CIFOR), with a global mandate for strategic and applied research on forestry, and lead responsibility for coordination of forestry research within the CGIAR system. Consequently, ICRAF joined the CGIAR in 1991, with its headquarters remaining in Nairobi; and CIFOR was established in 1993 in Bogor, Indonesia, after more than two years of preparatory work led by the Australian Centre for International Agricultural Research (ACIAR) (Sayer 1994).

A series of consultative research priority-setting processes followed for both ICRAF and CIFOR. These drew from the ITFFR work (Box 1), ICRAF's established research program (ICRAF 1992a), ACIAR's developmental work for CIFOR, and consultations for policy research at both centers (Gregersen *et al.* 1992, Spears *et al.* 1994). A new ICRAF strategic plan was approved by the CGIAR in 1991 (ICRAF 1992b), and CIFOR's research agenda was formalised in 1994 (Sayer 1994) and incorporated into its first Strategic Plan (CIFOR 1996). CIFOR's focus emerged strongly as policy-oriented research and development, informed by and catalysing research on topics emerging from the ITFFR and subsequent processes (Sayer 1994; see e.g. Byron and Arnold 1997). These priorities are reflected in the initial research program areas summarised in Box 2.

The establishment of CIFOR and incorporation of ICRAF as international forestry and agroforestry research centres within the CGIAR system, and the research priorities they pursued, thus represented outcomes of ideas first proposed in the 1978 World Bank *Forest Sector Policy Paper*, and nurtured through the subsequent decade by FAO, IUFRO and the World Bank, in particular. This expansion of the CGIAR coincided with IUFRO's centenary, and the UN Conference on Environment and Development, in 1992 in Rio de Janeiro.

MULTILATERAL FORESTRY RESEARCH FOR DEVELOPMENT IN 2020

In the c. 30 years since multilateral forestry research for development institutions were established in the terms summarised above, the institutional landscape for such research has taken the shape characterised in Table 1, in the broader context of the international arrangements for forestry over-viewed by Dargavel (2010) and Fernández-Blanco *et al.* (2019), and detailed by Rayner *et al.* (2010). The role that each of these categories of institution plays is discussed below.

Global research centres: Since the establishment of CIFOR and the incorporation of the World Agroforestry Centre (formerly ICRAF) into the CGIAR system, the two centres have progressively worked more closely together: initially, mostly informally; since 2011, formally under the

Box 2 CIFOR and ICRAF research programs, early 1990s

CIFOR (Sayer 1994)	ICRAF (ICRAF 1992b)
<ul style="list-style-type: none"> • Policy development • Management and conservation of natural forests • Reforestation of degraded lands • Products and markets • Research support and information 	<ul style="list-style-type: none"> • Environmental characterisation and analysis • Multipurpose tree improvement and management • Component interactions • Systems improvement • Policy, adoption and impact analysis

TABLE 1 *International institutional landscape for forestry research for development*

Institutional character	Mode	Examples
International multilateral – global scope; broad agenda	Global research priorities and programs; usually conducted in partnership with national entities.	FAO, CIFOR, CIRAD, ICRAF, INBAR
International – global scope; more-focused agenda	Specific research and advocacy foci	Chatham House, EFI, ETRN, IIED, ODI, RRI, WRI; some IGOs and NGOs
International – global scope; network	Network facilitating research collaborations	IUFRO
International – regional scope	Regional research priorities and programs	APFnet, CATIE, RECOFTC
International research for development funding agencies	Bilateral and multilateral funding of research	ACIAR, DfID, EU, GIZ, IDRC, PROFOR, USAID
National or subnational research centres and universities	National and subnational organisation focus on priorities at those levels; universities' foci are more shaped by staff expertise and funding. Both are likely to engage in international collaboration.	National or subnational research organisations (e.g. EMBRAPA, Chinese Academy of Forestry, CIRAD, Kenya Forestry Research Institute); universities
Corporate	Focus on corporate business/operational priorities	Many large forestry sector businesses

framework of the CGIAR *Forests, Trees and Agroforestry* (FTA) research program (FTA 2017a); and since 2019, as a merged entity (CIFOR 2018, CIFOR-ICRAF 2020). Other CGIAR centres, notably Bioversity International, also play specific roles in FTA. Outside the CGIAR, INBAR's exclusive focus on bamboo and rattan (INBAR 2019) both complements and intersects with elements of CIFOR's and World Agroforestry's work. Knowledge syntheses commissioned by FAO Forestry Department (e.g. those published as its *Forestry Paper* series) continue their longstanding role in communicating research outcomes.

Research institutes with a global focus in specific topic areas: A small number of research institutes, typically drawing on a mix of philanthropic and official development assistance (ODA) funding, play leading roles in particular topic areas. Examples include the UK-based Chatham House (Royal Institute for International Affairs), International Institute for Environment and Development (IIED), and Overseas Development Institute (ODI); other European centres or networks, such as the European Forest Institute (EFI) and European Tropical Forest Research Network (EFTRN); and the USA-based Rights and Resources Institute (RRI) and World Resources Institute (WRI). In a few cases, of which France's CIRAD³ is a preeminent example, nationally-funded research organisations play substantive and wide-ranging forestry research roles internationally. International intergovernmental organisations, such as the International Tropical Timber Organisation and some other members of the Collaborative Partnership on Forests (CPF 2020), may also fund limited research in their areas of responsibility.

Global networks: IUFRO continues its leading role as the global network for cooperation in forest science, including as a facilitator of international meetings and collaborations. Some 42% of its global membership of 625 organisations is now in countries of the global South; of these, around a quarter are located in each of Africa and Latin America, and half in Asia (IUFRO 2019a; p28). In addition to its discipline-focused Divisions, IUFRO organises activities through a series of Special Programs, including that on Development of Capacities⁴, with a strong focus on the global South (IUFRO 2019a, p25–26).

International centres with a regional focus: Although long-foreshadowed (World Bank 1978), few regional forestry research centres have succeeded as stand-alone entities. A number of well-established regional institutions, such as Central America's CATIE (CATIE 2015), or the Bangkok-based Center for People and Forests (RECOFTC) (RECOFTC 2018), are predominantly education, training and extension centres with associated research functions. In some cases, regional networks (e.g. the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation; APFnet 2019), support research and tertiary education as part of their activities.

International research for development funding agencies: ODA agencies continued to play a key role in supporting forestry research for development, through both bilateral and multilateral programs and projects. It is difficult to characterise aggregate levels and trends of forestry development assistance and subsidiary research funding, which is typically reported as part of agricultural and/ or rural development funding. Expenditure on 'agriculture' as a whole represents a reasonably steady c. 4% of total ODA investment (c. US\$11b in 2017; FAO 2019a), but is generally expected to decline in the future (Arkin 2016).

The share of CGIAR funding for forestry research offers one measure of the proportion of 'agriculture' research funding directed to forestry. CGIAR forestry research (FTA, CIFOR, ICRAF) represented 9.6% of total funding committed in the period 2017–2021 to the CGIAR's specifically-targeted program and project investments ('Windows 2 and 3', respectively; total US\$2.23b; CGIAR 2019). In conjunction with ODA-specific data⁵, this suggests that the overall proportion of agriculture and rural development research funding spent on forestry is unlikely to more than 10%, and – as for agriculture and rural development generally – is similarly unlikely to increase significantly in real terms.

National or subnational research centres: National forestry research agencies, subnational agencies in countries with federal structures, and topic-specific research centres are (variously) well-established in countries of the global South. They frequently work with international partners in both multilateral and bilateral research activities. In general, however, their funding is following similar trends to that internationally. Relative levels of public expenditure on agriculture, including in research and development, were less in 2010 than in the 1980s, despite increases in developing countries (Yu *et al.* 2016). Hickey (2013) notes that many global research funding trends are reflected in forestry: amongst these, levels of public sector investment in research and development have been declining since 1981, although some of this reflects a shift to co-investment with the private sector; and there has generally been a shift in funding away from government institutions to universities. This has resulted – with some exceptions, where there are effective coordinating mechanisms – in a more fragmented and disjunct and, often, less strategically-directed research effort (e.g. for Australia: Turner and Lambert 2016; for the USA: McGinley *et al.* 2019).

Corporate: As in other arenas, the relative contribution of the private sector to forest research has been increasing over the past three decades (Hickey 2013), often in response to financial incentives for research and development investment, and for various forms of public-private partnership. Corporate investment in research is typically focused almost exclusively on supporting firms' specific interests; in forestry, this usually means research focused on forest products and on production

³ www.cirad.fr

⁴ the successor to the original IUFRO Special Program for Developing Countries

⁵ For example, the approximate proportion of the CGIAR budget spent on forestry is 10% (AG Bartlett, pers. comm.)

and processing systems, with investment on environmental and social issues limited to that necessary to meet sustainability commitments and regulatory compliance.

Current foci of multilateral forestry research for development institutions

Thirty years after the incorporation of forestry research into the CGIAR was agreed, the multilateral forestry research for development institutional landscape looks much like that envisaged in the 1980s. The two preeminent multilateral forestry research centres, albeit now merging under the maxim of ‘two heads are better than one’, have an annual budget of \$USD100m and a staff of 700 across 20 countries in the global South (CIFOR 2019a). Their research priorities, as articulated in the themes listed in Box 3, reflect both continuity and evolution over the three decades since those listed in Boxes 1 and 2 were identified. Sustainable management of landscapes and the livelihoods this supports, value chains and trade, and effective policy and governance mirror the early priorities; landscape restoration, climate change mitigation and adaptation, and gender, equity and rights have each assumed a greater significance over time.

Box 3 CIFOR-ICRAF Research Themes 2020 (source: CIFOR-ICRAF 2020)

- Restoration of landscapes and dependent livelihood systems
- Value chains and trade
- Sustainable and resilient landscapes
- Climate change mitigation and adaptation
- Supporting policies and governance that work
- Gender, equity and rights

Other, more specifically-focused research and advocacy institutes – such as Chatham House or WRI – play key policy-informing roles in their areas of focus. Their research foci are complemented by those of international environmental and social organisations – *e.g.*, the Forest Peoples’ Programme, the World Conservation Union (IUCN) or WWF. IUFRO’s Task Forces and Special Programmes continue to coordinate research efforts and enabling resources on topics of contemporary importance, and their topics⁶ and those of related publications⁷ illustrate the evolution of these internationally-agreed research priorities.

Regional (*e.g.* APFnet) or thematic (*e.g.* the Poverty Environment Network; CIFOR 2019) research networks are more common than institutions with a regional mandate, such as CATIE or RECOFTC. This reflects, at least in part, the advantages of the former in the context of what is often relatively transient and project-oriented funding. It also emphasises the commitment required to foster and sustain the success of the

latter, a challenge already evident in the 1970s (World Bank and FAO 1981).

The expansion of North-South and South-South research networks between institutions, beyond those of largely colonial or FAO-mandated origin in the 1970s, both reflects and has contributed to the emergence of greater forestry research capacity in the global South, including in its universities. As noted by Pardy (2016) and Yu *et al.* (2016) for agriculture, and Denham *et al.* (2019) for R&D generally, by much of the growth in public R&D expenditure has been in the developing economies, particularly those of the BRIC countries and others that have developed rapidly, such as Vietnam. In forestry research, as in other domains, the rise of China is particularly noteworthy (Hickey 2013). However, where economic development has been slower, and where public resources are most limited – for example in many African countries, or in the poorer countries of Asia-Pacific and Latin America – funding for research in general (Pardy 2016), and for national and sub-national forestry research institutions and programs within that context, remain very constrained and limiting. In many of these cases, international research project funding may be the only means by which these constraints can be addressed, at least for topics that are tractable within project timeframes (*e.g.* for PNG, Bartlett 2018).

The resource constraints familiar to most forestry researchers in the global South are also becoming more common in the global North, impacting on the capacity of Northern institutions to collaborate with multilateral and Southern partners. For example, Australian forestry research investment and capacity have declined substantially over the past 30 years (Turner and Lambert 2016); similar trends are evident in the USA this century (McGinley *et al.* 2019). As McGinley *et al.* (2019) note, such a trend demands greater collaboration between forestry research institutions and research and development stakeholders, including those in the private sector – but also constrains the topics and terms of collaboration, and limits the scope and continuity of research efforts.

Enhancing research quality and impact has become a central concern of research funders and institutions. An explicit, *a priori*, focus on articulating theories of change (*e.g.* FTA 2017b, Mayne 2015), identifying and refining pathways to impact (*e.g.* Douthwaite *et al.* 2007), and ensuring quality (*e.g.* Belcher *et al.* 2016) now characterise much forestry research planning, prioritisation and implementation. The challenges of evaluating impacts of research on complex, real-world problems have been addressed by conceptual and methodological advances, such as in ‘theory-based’ methods (*e.g.* contribution analysis, Riley *et al.* 2018). The utility of these approaches has been demonstrated in various ‘forestry research for development’ contexts (*e.g.* Halimanjaya *et al.* 2018, Young and Bird 2015).

⁶ see iufro.org > Science in IUFRO

⁷ see iufro.org > Publications > Series

FORESTRY EDUCATION FOR DEVELOPMENT IN THE 1970S

In 1970, FAO foreshadowed a “World Consultation on Education for Forestry and Forest Industries at which it is planned to discuss with reason rather than fervour the content of forestry education” (FAO 1970). That Consultation took place in Stockholm in 1971, with participants representing 75 countries and relevant international agencies. There were then⁸ some 354 forestry education and training institutions globally, 119 of which were in the global North and 135 in the global South (FAO 1977). Discussion focused largely but not exclusively on education and training in the developing world, the challenges of which were summarised as (Sisam 1972: 129):

“... the problem is to create a meaningful program and maintain high academic standards where there is no tradition of indigenous forestry education, no local teaching staff, no textbooks relevant to the local situation, a public unaware of the need for trained forestry personnel, and limited resources to devote to forestry education.”

The outcomes of the Consultation were summarised by its Chair (Sisam 1972). It:

- agreed that professional forestry education should be integrated into universities rather than offered by independent forestry schools, as had been the case in many countries; that the image of forestry and forestry students in universities needed to be improved; that education needed to recognise both the environmental and production dimensions of forestry, and should address its global context; and that continuing education was a necessary complement to degree programs;
- recognised the importance of technical and vocational education and training (TVET), noting that technical staff were usually responsible for the quality of operational activities; and the need for TVET programs to recognise the typically poor levels of prior education of those pursuing such training;
- identified poor extension and communication as major constraints to advancing the cause and delivering the benefits of forests and forestry in all countries;
- recommended strengthening international collaboration, bilaterally and multilaterally, between forestry education institutions, to capitalise on the strengths and resources of established universities in support of institutions in developing countries.

TERTIARY FORESTRY EDUCATION FOR DEVELOPMENT IN 2020

The 2030 Agenda for Sustainable Development conceives education in broad terms, encompassing formal, non-formal

and informal elements over a person’s lifetime (UNESCO 2016), and ‘at the heart’ of sustainable development (UNESCO *et al.* 2016: 24). Access to all levels of education has continued to expand in most countries (UNESCO 2017, World Bank 2018); tertiary education, the primary vehicle for ‘forestry’ education, has internationalised dramatically in the past few decades (Kanowski 2015, UNESCO 2017). Environment and sustainability education were championed by the *UN Decade of Education for Sustainable Development 2005–2014* (UNESCO 2016), providing a platform for linking SDG4 *Quality education for all* with forests (Kanowski *et al.* 2019). These trends provide the context for contemporary tertiary forestry education.

The outcomes of the 1971 FAO Consultation on Education for Forestry and Forest Industries (Sisam 1972) offer a starting point for reviewing progress in tertiary forestry education for development over the past c. 50 years. Its major recommendations and a commentary on their current status (author’s precis in both cases) are presented in Table 2, and discussed below.

Professional and technical forestry education

Institutionally, professional forestry education is now almost universally offered within university systems, as the 1971 Consultation recommended; the (incomplete) Global Forests Information Service (GFIS) listing of tertiary forestry programs identifies 290 universities in 84 countries offering tertiary education for forestry or the forest industries (GFIS 2019). TVET training is offered both by specialist forestry-focused (*e.g.* for Cameroon, Rekola 2019) and more generalist institutions; however, there is no semi-comprehensive global listing of these institutions comparable to that available for universities.

The image of forestry and forestry students

Historically, stand-alone institutions for forestry education fostered a mutually-reinforcing image of forestry and forestry students that might be characterised stereotypically as either – as seen from within – elite and heroic, or – as seen from the outside – marginal and technocratic (see, *e.g.*, Burley *et al.* 2009, Roche and Dargavel 2008). These perceptions were amplified by the almost universally male character of forestry student cohorts until the 1970s (*e.g.* Coutinho-Sledge 2015). The incorporation of professional forestry education into more comprehensive universities has largely addressed the issue of an educational identity separate from that of others, and forestry curricula have also typically been more integrated with cognate curricula, primarily those in environment, natural resources and sustainability. Student cohorts are now largely gender-balanced (see *e.g.* Rekola *et al.* 2017), and diverse (see *e.g.* Gilliss 2015), and so both more representative and inclusive. These changes are both welcome and

⁸ Data drawn from FAO 1977, which updated a 1974 FAO list compiled following the Stockholm Consultation (FAO 1977).

TABLE 2 Status of tertiary forestry education and training in relation to recommendations of 1971 FAO Consultation

1971 FAO Consultation – recommendations (drawn from Sisam 1972)	Current status – commentary (author’s interpretation; elaborations in text)
Professional forestry education should be integrated into universities rather than offered by independent forestry schools.	Now almost universal; some technical forestry schools remain independent.
The image of forestry and forestry students in universities needed to be improved.	Usually now not an issue, as forestry programs and students are now integrated with those of universities more generally.
Forestry education needs to recognise both the environmental and production dimensions of forestry, and should address its global context.	Curricula have broadened to address these and other dimensions of forestry.
Technical and vocational education is important, and needs to recognise the typically poor levels of prior education of those pursuing vocational training.	Progress in TVET has often been more limited than that in professional education.
Address poor extension and communication as major constraints to advancing the cause and delivering the benefits of forests and forestry.	Traditional extension capacity has generally diminished, but new approaches have emerged. Improving communication and outreach have been a major focus of many forestry institutions and curricula, but remain challenging.
Strengthen international collaboration, bilaterally and multilaterally, between forestry education institutions.	Various global, regional and multi- or bi-lateral programs exist; some are more durable than others.

necessary to enable truly-inclusive sustainable forest management and sustainable development (Arora-Jonsson *et al.* 2019). However, in parallel, diminishing numbers of ‘forestry’ students, and a diminution of the strong sense of common identity and purpose that characterised earlier eras of professional forestry (for both better and worse), have impacted on the capacity and viability of forestry-focused professional and student associations, and the roles they can play in enabling professional development.

In 2020, challenges to the standing of forestry as a discipline and profession remain both profound and significant, reflecting various complex interactions of economic, institutional and societal forces (see, *e.g.* Katila *et al.* 2019 for an overview). Hull’s (2011) reflection on these issues, “Forestry’s conundrum: high value, low relevance”, whilst set in the specific context of the USA, is much more widely applicable. Forestry educators, professionals and institutions in most countries continue to grapple with this conundrum.

Forestry curricula

Forestry curricula have broadened, both in the terms suggested by the 1971 Consultation, and in other dimensions, notably in the incorporation of the social sciences and interdisciplinarity (*e.g.* Gilless 2015). The curriculum challenges of balancing breadth and depth, and of specialist technical content and practical experience with more generic knowledge and skills, remain as real now as they were when professional forestry education became widespread from the early 20th century (see, *e.g.*, recent reviews: globally, Rekola *et al.* 2017; for Africa – Rekola 2019, Ramcilovic-Suominen *et al.* 2016; for USA – Gilless 2015). The Joint IUFRO-IFSA Task Force on Forest Education found, in its survey of forestry education and professional competency needs in nine countries across five continents (Rekola *et al.* 2017: 5):

“Generally speaking, forest education curricula in all studied countries should emphasize more generic competencies, such as leadership and management skills, social relations, and communication. However, many differences between countries are especially related to subject specific competencies. The most widely observed need was to increase the role of entrepreneurship, economics, and management.”

These results echo those reported two decades earlier by Sample *et al.* (1999), in their study of USA employers’ assessment of the ‘skills needed by graduates for long term success in forestry’, and which have a wider currency beyond the USA. Employers identified a suite of ‘soft’ and generic skills – abilities to work in a team, to listen and address public concerns, to take an innovative approach to working with the public, and to synthesise information from diverse sources – as generally being of greater or comparable importance to the more technical skills of understanding forest ecosystems, planning at landscape level, and developing and implementing innovative approaches to forest management.

The emergence, however tentative and tenuous thus far, of a green economy (*sensu* UNEP 2011) and the bioeconomy (*e.g.* Winkel 2017) presages the need for a wider knowledge and skill base for the sustainable management of forests and trees, including those on farms and in cities, for the breath of potential ecosystem goods and services (Lawrence *et al.* 2017); and to support the development of a diversity of innovative, sustainable forest industries at a range of scales (Macqueen *et al.* 2018, Panwar *et al.* 2016, Sanchez Badini *et al.* 2017). Similar challenges and opportunities will apply in managing forests in the context of climate change, which is likely to require strengthening a range of forest and land management knowledge and skills (Kelly and Brown 2019); and in the expansion of urban forestry, paralleling the ongoing

global demographic shift to cities (Dümpelmann 2020, Salbitano *et al.* 2016).

Forestry curricula and programs have become much more internationalised, as the 1971 Consultation recommended. Globalisation and the rise of information and communication technologies (ICT) and social media have enabled this, as well as underlining the importance of ICT competencies for future professionals (Kanowski *et al.* 2019). The internationalisation of forestry education is manifest in a range of complementary ways: within individual courses and programs; through specific international, including joint and mobility, programs; in the internationalisation of both undergraduate and graduate student communities at many institutions; through the development of international student networks (notably IFSA); and through the engagement of forestry 'youth' in international processes (for reviews, see Kanowski 2015, Kanowski *et al.* 2019).

The importance of technical and vocational education

Technical and vocational education (TVET) is generally poorly developed in many countries, especially those of the South, and for the natural resource sectors (Robinson-Pant 2016, UNEP 2017). TVET for rurally-oriented knowledge and skills suffers from perceptions, particularly among youth in many countries, that rural-based occupations and work are those of last resort (Robinson-Pant 2016). However, there are significant opportunities to improve household livelihoods, rural communities' resilience, and environmental outcomes from more effective technical and vocational education that is also more inclusive of women, the proportion of whom identifying as farmers and in rural employment has increased greatly (Lawrence *et al.* 2017, Robinson-Pant 2016). The 'green' knowledge and skills elements of TVET also need to be strengthened and embedded more widely in VET curricula (INRULED 2012, UNESCO-UNEVOC 2017). Regional forestry institutions such as CATIE and RECOFTC are amongst those who have addressed this need in their domains.

Extension and communication

Publicly-funded extension services for farmers, including small-scale tree growers, have declined in most countries (Mogues *et al.* 2015), catalysing new approaches, including those capitalising on the rapid development and reach of ICT (Sagor *et al.* 2014), and a greater emphasis on community-based capacity building (*e.g.* Bloomfield *et al.* 2018, Catacutan *et al.* 2015, Reid 2017), often facilitated by non-governmental and community-based organisations. Examples include the UK Sylva Foundation's *myForest* initiative (Sylva Foundation 2018), which facilitates forest information and knowledge exchange for landowners, and the community-based focus of international partnerships and initiatives such as the Global Evergreening Alliance (Global Evergreening Alliance 2020) or Forest and Landscape Restoration (Chazdon *et al.* 2017).

Communication about the value of forests and their sustainable management remains challenging (see Hull 2011,

as noted above), in part because the message is typically more complex than simple (*e.g.* for the case of large-scale tree planting to mitigate climate change: Chazdon and Brancalion 2019 *cf.* Bastin *et al.* 2019). The emergence of climate change as a dominant environmental and social issue globally, and the current and prospective role of forests in climate change mitigation and adaptation (*e.g.* IPCC 2019), illustrate both how forest-related communication can benefit from being embedded in a larger topic of strong public interest, but also how it can be submerged or distorted in such contexts. The rise of social media and concurrent decline of traditional media offer new opportunities for communicating about forests and forestry, as well as a myriad of new challenges (Kanowski *et al.* 2019). Examples of forest-related communications campaigns by government (*e.g.* Pollinate 2018, for Australia), NGOs (*e.g.* WWF 2019), the forest industries (WBSCD 2019), research organisations (*e.g.* Palahí *et al.* 2019), and of learning resources (*e.g.* APFnet 2019) or toolkits (*e.g.* FAO 2019b), illustrate both the diversity of approaches to effective communication and the resources and skills usually required to achieve outcomes.

Strengthened international collaboration between education institutions

Professional forestry education has followed the wider trend of increasing internationalisation in higher education (Kanowski 2015). Common collaborative arrangements include:

- global or regional networks fostering knowledge sharing and partnership in forestry education, such as the Joint IUFRO-IFSA Task Force on Forest Education (IUFRO 2019), the European SILVA Network (SILVA Network 2019), the African Network for Agriculture, Agroforestry and Natural Resources Education (Yayé *et al.* 2017), and the Asia-Pacific Forestry Education Coordination Mechanism (APFnet and AP-FECM 2018);
- international joint degree programs, such as those under the EU's Erasmus Mundus framework (*e.g.* SUTROFOR; SUTROFOR 2019), or the TRANSFORM program between European and Canadian universities (Leblon *et al.* 2013);
- international joint bilateral or multilateral courses, such as those facilitated by APFECM (AP-FECM 2019), or various partnership and student mobility programs (see Kanowski 2015);
- partnerships which focus on research students, typically in conjunction with capacity development and research collaborations, such as those facilitated by many national development assistance agencies or specific partnership research agencies (*e.g.* Australia's ACIAR);
- less formal international learning opportunities, such as the field visits or specialist training associated with most international meetings, many of which make specific funded provision for students (*e.g.* IUFRO 2019a; IFSA 2019).

However, resource and institutional constraints, and sometimes curriculum requirements, remain barriers to realising the potential of international collaboration between education institutions in forest-related topics (Kanowski 2015).

CONCLUSIONS

The emergence since the 1970s of institutions and networks to strengthen multilateral forestry research and tertiary forestry education for development was catalysed primarily by accelerating tropical forest loss and degradation, and the adverse consequences for the livelihoods of those most dependent on forests and for environmental services. These pressures have continued, only little abated, over the intervening five decades. Their underlying drivers have changed little since they were first formally addressed in an international multilateral context by the UN Conference on Humans and the Environment (the ‘Stockholm Conference’) in 1972 (O’Neill 2009), reviewed by the World Commission on Environment and Development (WCED 1987), or by the World Commission on Forests and Sustainable Development (WCFS 1999) a decade later. New or resurgent economic, social and political, and environmental factors have variously exacerbated these pressures: examples of each include the increasing globalisation of supply chains (*e.g.* Kröger 2013, Rousseau *et al.* 2019), populist nationalism (*e.g.* Brazil–de Area Leão Pereira *et al.* 2019, Hope 2019) and conflicts at a range of scales and durations (*e.g.* de Jong *et al.* 2007, Harwell 2010), and climate change and the multiple challenges that it presents for both mitigation and adaptation (*e.g.* Angelsen *et al.* 2018, Rosenstock *et al.* 2019). These underlying drivers and exacerbating factors show little sign of abating.

The ambitions of those who worked through the 1980s to strengthen multilateral forestry research institutions have largely been realised, although both the character of the CGIAR ‘forestry’ institutions and of the CGIAR system itself are now changing substantially (see *e.g.* CIFOR 2018, Bioversity International 2019, CGIAR System Council 2019). It remains to be seen whether the intent of these changes, primarily to realise greater impact more efficiently, will be realised; but it seems unlikely that the share of ‘agricultural’ research and development funding directed to forestry is likely to increase above its current level of *c.* 10%. The focus of multilateral forestry research, as conceived four decades ago, is likely to continue to consolidate under a limited number of global themes approximating those of CIFOR-ICRAF (2020): those of the environmental services, and value chains and industries, associated with sustainable management of forests and trees in their landscape contexts; of food and livelihood security and human health for communities at different scales; of forest and landscape restoration; of good policy and governance, respectful of rights and attentive to inequity; and of each of these in the contexts of climate change mitigation and adaptation. To respond most effectively

these challenges, multilateral forestry research needs, on the one hand, to maintain the critical mass and focus necessary to advance knowledge and its application in forest- and forestry-specific arenas; and on the other, to integrate effectively with other fields of research and practice, and with multiple interests and stakeholders. Experience in many contexts, such as asserting of the role and value of agroforestry research in the context of increasingly-industrialising agriculture (*e.g.* Leakey 2014), or of gender research in forestry (*e.g.* Asher and Varley 2018), suggests this is a continually challenging task.

Similar trends are evident in tertiary forest-related education, which has over the past five decades become more integrated with other tertiary education programs, more encompassing of the humanities and social sciences, more gender-balanced, and more internationalised. These positive trends have interacted with the institutional challenges of generally diminishing undergraduate student numbers and so of maintaining a critical mass of forest-focused academic staff, of often-declining public sector graduate employment opportunities that are not yet balanced by growth in private and non-government sectors, and of constraints on funding for international educational collaboration and student mobility. These constraints are often greatest for institutions in the global South. Conversely, the greater flexibility of many curricula, the emergence of graduate degrees as important professional pathways, and the enhanced connectedness and mobility of students act to counteract these constraints.

The contemporary institutional landscape for multilateral forest research and tertiary forestry education for development shares characteristics with the broader ‘international forests regime’ (see, *e.g.*, Fernández-Blanco *et al.* 2019, Singer and Giessen 2017), with elements of both coordination and fragmentation, marginality to dominant political discourses and agendas, and the consequent limitations for sustainable development outcomes. Enhancing the impacts of multilateral forestry research and tertiary forestry education for development – on societal understanding and demands of forests, their expression in forest and landscape governance and management, and on development trajectories – remain as much of concern to key actors and stakeholders now as in the 1970s. Advances in understanding of theories of change and of impact pathways offers the prospect of better directing investments and adapting institutional arrangements for multilateral forestry research, to make a greater difference to forest-based and -related sustainable development. Similarly, conceiving of tertiary forestry education in the broad sense encapsulated by SDG4 (Kanowski *et al.* 2019) can help inform prioritisation and targeting of investments in education.

Forty years ago, those who sought to advance multilateral forestry research and tertiary forestry education for development – such as John Spears – pursued opportunities to persuade governments, international agencies, and other key actors of the urgent need to strengthen research and education to better address the challenges facing forests and people in the global South; and developed strategies and institutions to

do so. In the contemporary world, with both the global South and North now more connected by global supply chains and information and communication technologies, similarly threatened by climate change and the other environmental impacts of unsustainable resource use, and experiencing major demographic and social transitions, the challenges for forests and people are even more global, and more pressing, than previously. However, in parallel, more populist politics are shaping policy priorities and responses that are less evidence-based and less multilateral (e.g. Hetemäki 2019, Pereira and Viola 2019).

Those of us who advocate for forests and trees and the benefits they deliver, and for the research and education required to harness these benefits for forest-based and -related sustainable development, will need to rise to the contemporary challenges and opportunities identified above, amongst others. To do so, we will need to continue to make the case for evidence-based action, and the role of research and education in enabling it (e.g. Hetemäki 2019, Kelly and Brown 2019); and to build on current forestry research and educational platforms, including those established over the past thirty years. Whilst the scale of forest-related challenges globally suggests there is a case for 'more of everything' (*sensu* Lindahl *et al.* 2017), in reality, resources for both forestry research and education are likely to remain limited relative to need. In conjunction with the diversity of national and sub-national institutional and social circumstances, this suggests that there is unlikely to be any single best strategy or institutional form to address these challenges, and that researchers and educators will need to continue to be politically and institutionally astute, and proactive and strategic, in catalysing and pursuing opportunities in their respective realms of endeavour and influence. It also suggests that various collaborative models, both nationally and internationally, will remain important vehicles for sharing resources, capturing the attention of decision-makers, and realising development impact. In these contexts, the coevolution of the major multilateral forestry research for development institutions and their commitment to partnerships (CIFOR-ICRAF 2020), and the continuing internationalisation of tertiary forestry education and collaboration between institutions (e.g. Rekola *et al.* 2017), are as important now as the steps taken internationally in the 1970s in each of the forestry research and education arenas.

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