19 EXPLOITING THE BACK-LOOP OF THE ADAPTIVE CYCLE: LESSONS FROM THE BLACK SATURDAY FIRES

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Lesson #1. Successful monitoring does not necessarily have to be underpinned by an *a priori* hypothesis.

Lesson #2. Despite Lesson #1, there must be strong motivations to collect data and maintain data sets.

Lesson #3. Equal emphasis must be placed on monitoring management inputs and biodiversity outcomes.

Lesson #4. Expenditure should be monitored too.

Lesson #5. Monitoring data held by public agencies cannot be accessed quickly enough.

Lesson #6. We need to demonstrate if biodiversity monitoring is a good investment of public money.

Lesson #7. National standards for data collection, documentation and storage are needed.

Lesson #8. There should be a pre-planned response to events that will provide opportunities for biodiversity conservation.

Introduction

The Black Saturday Fires on 7 February 2009 were the worst bushfire disaster in terms of life (173 deaths), infrastructure (2133 houses) and economic cost ($AUD4.3 billion) in Australia's history (Teague *et al.* 2010). Immediately after this event there was a commitment by all parties to learn and do things better and a major inquiry was established to achieve this – a Royal Commission (Teague *et al.* 2010). The immediate period after events of this type represents an important window in which change and innovation occurs (Walker and Salt 2006). This is akin to the 'back loop' of the adaptive cycle (Gunderson and Holling 2002), which is the period in which there is a reorganisation of the system (see Figure 19.1). In this chapter I argue that the quality of data available during this period, the ability to access these data and to analyse them in a timely fashion, and thus turn them into information, are all critical for adaptive learning. I draw on my experience with the Black Saturday Fires to highlight eight observations relating to monitoring in the context of adaptive learning that are relevant for biodiversity conservation.

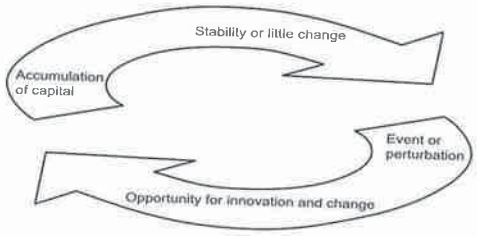

Figure 19.1. The adaptive cycle. Resilience theory predicts that systems cyclically tend towards a 'fore loop' of growth when capital is accumulated (e.g. expertise, funding, biomass, rules) followed by a relatively long period of stability, little change or innovation. External factors (e.g. bushfires, cyclones, political change, financial crises) then precipitate a 'back loop' of upheaval and reorganisation. This back loop represents a potential window – albeit often a small window – of opportunity for data collected during monitoring programs to inform innovation and change (adapted from Walker and Salt 2006).

Lessons

1. Successful monitoring does not necessarily have to be underpinned by an a priori hypothesis

'Omnibus surveillance monitoring' is the collection of longitudinal or repeated-measures data with no *a priori* hypotheses (Nichols and Williams 2006). This type of monitoring has been criticised repeatedly and implicated as a reason for the generally poor longevity of monitoring projects (Lindenmayer and Likens 2010). My experience with the Black Saturday Fires (and elsewhere) has led me to question this critique. Adaptive learning from the Black Saturday Fires was possible only because of the maintenance of a complete spatial and temporal coverage of several data sets collected as part of what can probably be best described as 'surveillance monitoring'. That is, there were no specific questions or hypotheses that underpinned the collection of these data. Nevertheless, these data sets are critical for interrogating important topics, such as bushfires. The availability of these data was critical in the Black Saturday study because events of this type are unpredictable in both their timing and location. What is the alternative to surveillance monitoring in these circumstances? If these data are collected only at sites where there is a current demand for it then opportunities for investigations at different locations are lost. Further, many well-defined monitoring programs draw on, and partly owe their success to, longitudinal surveillance data (e.g. climatic data, satellite imagery). Most long-term ecological studies owe their success to their ability to adapt and change focus, or change the set of hypotheses they address (Lindenmayer and Likens 2009). This suggests to me that motivations other than an *a priori* specific question can underpin good monitoring.

2. Despite Lesson #1, there must be strong motivations to collect data and maintain data sets

Although the data sets I used after the Black Saturday Fires were not collected and maintained with bushfires as the intended application, there were several other motivations for the custodians to collect and maintain these data. First, most of the data sets I used have many different potential applications and their collection is therefore easy to justify – and hard to stop. Second, several data sets were collected because the custodian was obligated or mandated to do so either by legislation or international convention. And third, some of these data sets are available publicly, which immediately makes the custodians more accountable for the maintenance of these data. So, while the existence of these data was not underpinned by specific questions or

objectives relating to bushfires, there was at least one strong motivator for the custodians to maintain each of these data sets. This observation leads me to suggest that data for which there are existing and strong motivations on the part of the custodian to collect and maintain should be collected as part of surveillance monitoring programs. An important motivation for other data – data for which no agency is mandated to collect (e.g. data collected as part of research) – is a well-defined objective and specific questions and a conceptual model that is being tested (Lindenmayer and Likens 2010).

3. Equal emphasis must be placed on monitoring management inputs and biodiversity outcomes

Adaptive management requires an understanding of the links between management inputs and outcomes. Management inputs (e.g. grazing regime, burning regime, herbicide application, planting technique) are often the key components of the system that can be manipulated in order to effect a change in outcomes. However, there is greater emphasis on measuring biodiversity outcomes, or finding biodiversity indicators, than suitable ways to measure management inputs, especially among research scientists. Fazey *et al.* (2005) found that only 13 per cent of studies published in journals focused on conservation biology actually tested conservation actions. To some extent this reflects difficulties researchers face collecting good management data. Many forms of management cannot be measured effectively at a single point in time or retrospectively. For example, many disturbances (e.g. grazing, fire) vary with timing, intensity and duration, so require some reasonably detailed information to be gathered over time. Land managers are often in the best position to record these data. The research I undertook after the Black Saturday Fires was only possible because the Government of Victoria collects, and keeps up-to-date, spatially explicit data on several aspects of forest management (e.g. prescribed burning, logging and clearing). All publicly funded land management agencies in Australia should collect, and make available, data on their management actions at a fine spatial resolution and make this a compulsory component for any publicly funded management on private land. Methods to capture these data should be a greater focus of researchers in this field.

4. Expenditure should be monitored too

Establishing links between management actions and biodiversity outcomes is important, but decision-making is also based on the relative cost-effectiveness of management options. In a biodiversity context this will give the marginal gain in biodiversity conserved per dollar spent. Greater biodiversity conservation outcomes can potentially be achieved within a budget if the most cost-effective options for management are identified. This is the thinking that underpins biodiversity auctions or tenders. That is, each proposal to conserve biodiversity is assessed according to its conservation value and each proposal is costed fully. Individual proposals or groups of proposals are ranked on the basis of their cost-effectiveness according to

$$\frac{B}{\$}$$

where B is biodiversity value and \$ is cost (Hajkowicz *et al.* 2008). The most cost-effective set of proposals are funded until the budget is expended. Windle and Rolfe (2008) used data of this type to calculate that the same amount of biodiversity could be conserved using one policy instrument (a tender) at 70 per cent of the cost of biodiversity conservation delivered using another instrument (a fixed-price mechanism). It is unacceptable that we cannot compare all biodiversity conservation programs in these terms. There are precious few biodiversity monitoring data sets in Australia in which actual costs of different management options are recorded, so it is not surprising that we have yet to effectively prosecute the argument that monitoring biodiversity is a cost-effective investment!

5. Monitoring data held by public agencies cannot be accessed quickly enough

A key feature of the back loop of the adaptive cycle – or the window of opportunity to institute change after major events – is that this window quickly closes again. A colleague and I took some 12 months to access the data sets we needed to undertake research on the Black Saturday Fires. By the time we had analysed these data the Royal Commission had handed down its final report and the window of opportunity for influencing major change in the way forest fuels are managed had been lost. As part of this research we tested empirically some recommendations of the Bushfires Royal Commission and found they would not meet their objective. Decisions made after major events will be more informed if we can quickly respond to these events with empirical studies. How can this be achieved?

The first change that is required is a shift in the culture of many publicly funded agencies. Many individuals in public agencies take the view that data collected by them are not for use by third parties. This is clearly not the case and is counterproductive to developing new insights. It is unacceptable that the ability to access data from public agencies often depends on the attitude of an individual within those agencies. All publicly funded land management or conservation agencies should maintain a central web-enabled repository of all data sets collected and maintained by them. There is a trend towards this (e.g. Australian Spatial Data Directory http://asdd.ga.gov.au/asdd/, Community Access to Spatial Information (CANRI) http://www.canri.nsw.gov.au/index.html). However, it is still difficult to find a single comprehensive list of data sets held by an agency and how these data can be accessed is not always transparent. Using our experience with the Black Saturday Fires as an example, we had to work through 27 individuals to access land management information for our study area. Finding key individuals took too much time and these people were all under pressure to respond to the Royal Commission, so often did not always place a high priority on our request to access data. An established protocol and dedicated system for disseminating data would avert these problems. We will continue to make ill-informed decisions if we cannot genuinely use the back loop of the adaptive cycle to generate improved knowledge.

6. We need to demonstrate if biodiversity monitoring is a good investment of public money

I believe that a key reason that biodiversity monitoring is not treated with greater priority, does not receive greater funding and is often not implemented effectively, is because we have failed to prosecute the argument that monitoring biodiversity is a worthy public investment. In other words, we have failed to monitor monitoring. The first step in doing this is to arrive at a set of criteria for assessing the effectiveness of monitoring programs. Just because a monitoring program addresses a specific question, is well designed, has produced a long time series of data of high quality and has led to several journal publications is not, in itself, a justification for spending public money to support it. And just because a monitoring program has fizzled out after a short period of time does not, in the broader sense, mean it was a failure. Further, I'm not aware of any monitoring programs that have quantified the cost-effectiveness of the program (but I may be wrong). I believe it is important to assemble a series of case studies from within and without the discipline of biodiversity conservation to illustrate whether improved monitoring is needed for effective biodiversity conservation in Australia.

7. National standards for data collection, documentation and storage are needed

Monitoring programs for biodiversity would benefit from a set of national standards, as has been established in many industries or disciplines (e.g. education, food supply, water, health, climate). The intention of standards is not to make monitoring prescriptive, is not to suggest

that one size fits all and is not to inhibit innovation or adaptation. Some key issues that could be the focus of national standards for monitoring, particularly where public expenditure is involved, are listed in Table 19.1.

8. There should be a pre-planned response to events that will provide opportunities for biodiversity conservation

It is inevitable that there will be events (e.g. bushfires, floods, accidents, disease, development proposals, lobbying) that provide windows of opportunity to review, and if necessary change, the way biodiversity is managed. As discussed above, the window of opportunity opened by these events may be small. Therefore, it is important that the data needed to inform such periods of review and innovation should be available to experts with the capacity to derive insights from the information and that these data are accessible in a timely fashion. At present the scientific response to such events is largely ad hoc and uncoordinated. There should be pre-arranged groups of key individuals that can respond to these events at short notice. One example of this is the Burned Area Emergency Response program (BAER) founded in the United States of America that brings together scientific expertise immediately after major fires to undertake a rapid risk assessment relating to environmental hazards. This model has been adopted by Australian bushfire agencies. Similar programs could be organised among scientists and managers in different areas of biodiversity

Table 19.1. Issues that could be considered as part of national standards for biodiversity monitoring. A set of minimum standards for monitoring outcomes should be mandatory where public expenditure is involved.

Issue requiring standard	Explanation
A definition of responsibilities	An understanding of which organisations are responsible for what data would clarify responsibilities and minimise duplication.
Design	Minimum standards around the design of monitoring programs would increase the utility of monitoring data. For example, this standard could specify that independent statistical advice must be sought prior to establishing a monitoring program.
A set of core data	The consistent collection of certain data across organisations and administrative boundaries would improve opportunities for adaptive learning because greater contrasts across environments and management approaches would be sampled. Standards for the types of management data that must be collected by public agencies and the way management costs are recorded are examples where standards could be developed.
Frequency of measurement	Collective knowledge of the rate at which some variables change may dictate a minimum frequency between measurements for certain entities.
Data quality	A standard for data quality might include a minimum acceptable observational error (i.e. error due to differences between observers or recording devices).
Expenditure	For reasons discussed earlier in this chapter, there should be minimum standards for reporting expenditure on biodiversity programs, particularly for actions that are publicly funded.
Metadata	Minimum standards in the way data are documented are highly desirable.
Data accessibility	As discussed earlier in this chapter, this is a key area that requires reform. Public access to all data via the internet should be an aim for public agencies and will improve accountability.

conservation to ensure a timely response to major events in terms of data collection, collation and analysis.

Conclusions

The adaptive cycle predicts that there are periods when there will be windows of opportunity for adaptive learning (Walker and Salt 2006). Unless we have access to high quality data during these often short periods of opportunity and are able to analyse these data in a timely way, then the changes that occur during these periods are unlikely to be based on empirical evidence. In my research after the Black Saturday Fires I was not organised to respond immediately as part of a group of skilled people, the monitoring data needed to do the research took too long to access and some key data (e.g. the cost of different types of fuel management) were not available. Thus, the Royal Commission handed down its findings – and they were accepted by Government – prior to the completion of my research. Interestingly, some of the recommendations made by the Royal Commission were not supported by our results. Decisions made during windows of opportunity that arise after major events will continue to be based on outdated information and rhetoric rather than empirically based evidence unless there is reform in the areas I have highlighted here.

Biography

Philip Gibbons commenced his career in 1988 working with land management agencies in Victoria and then New South Wales on forestry-related management, which included fire-fighting duties. Since his PhD in 1999 he has worked in research positions with CSIRO, the New South Wales National Parks Service and The Australian National University. His research focus is native vegetation management, land-clearing policy and biodiversity conservation and several of his projects rely on sound approaches to monitoring.

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