

Why monitor? The role of monitoring in environmental management

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Abstract

It is widely accepted that monitoring is an important part of environmental management. Through monitoring, land managers can address some of the uncertainty they face about what they manage, how much effort is expended on management actions and how effective those management actions are. This information enables managers to modify their actions based on sound information. Monitoring means different things to different people. For monitoring to be useful to land managers, it must be done in a consistent manner such that trends can be detected and it must relate to the objectives for the environment being managed. Hence, monitoring programs must have clear objectives. As a land manager responsible for almost 17% of the area of Victoria, Parks Victoria requires a well-defined process to guide how it undertakes environmental management. To do this, it developed an Environmental Management Framework that relies on monitoring to relate the status of environmental values to the identified factors that threaten them and the actions undertaken to manage the identified threat. In this paper I will use this framework to illustrate the role of monitoring in environmental management. I will focus on the role of monitoring in evaluating how efficient management actions are as well as evaluating how effective those actions are in reducing threats, and ultimately, in conserving the values we aim to protect.

Introduction

Many people believe that monitoring is an important part of environmental management. However, whilst this view may be widely held, understanding of why monitoring is important and how information provided by monitoring can assist land managers varies. To help clarify why monitoring is an important part of environmental management, this paper explain Parks Victoria's approach to environmental management, and how monitoring fits into that approach. Whilst this paper focuses on Parks Victoria's approach, a number of points emerge that are relevant to most monitoring aimed at supporting environmental management, including monitoring by volunteers and friends groups.

What does Parks Victoria manage?

Parks Victoria is a land-management agency responsible for nearly 4 million hectares of land and sea, or approximately 17% of the land area of Victoria. This consists of approximately 3000 individual areas including National Parks, State Parks, Conservation Reserves, Metropolitan Parks and a range of other areas. With responsibility for such a large area spread across Victoria, Parks Victoria deals with

very diverse habitats and very diverse issues. The reasons different areas are managed and the uses of those areas vary too, ranging from conservation of natural and cultural values to a broad range of other uses such as water supply, education, recreation, apiary, fossicking and a multitude of other activities.

Uncertainty

The wide range of environments and the diverse range of issues that a management agency such as Parks Victoria has to deal with means one of the biggest challenges faced is uncertainty. For Parks Victoria, uncertainty exists at a number of levels:

- (i) There is uncertainty about what environmental attributes and threats are being managed across Victoria. For some parks, there might be a high level of knowledge, but it is not possible to undertake comprehensive surveys of all parks, so some areas are not well known at all.
- (ii) There is uncertainty about how ecosystems function in many places. For some areas that have been studied intensively, there might be a good understanding. For some areas, it might be possible to make reasonable guesses based on what is known for other locations. However, whilst science might be improving our knowledge of ecosystem functioning, a lot remains unknown.
- (iii) A big area of uncertainty is how well Parks Victoria meets its environmental objectives. Whilst a range of management actions are undertaken across many areas, often there is little understanding of whether that management achieves the objectives it is supposed to.
- (iv) Finally, there is uncertainty about whether management actions are undertaken in the best way possible to make good use of limited resources, time, people and money. This means there is not always good understanding of where improvements can be made.

This wide range of uncertainty means there is a big need for information to support environmental management. This information comes from a variety of sources, but one very important tool for land managers is monitoring. Through monitoring, uncertainty can be reduced, which hopefully will result in better management.

Monitoring

Monitoring means different things to different people. In its simplest form, checking what is at a particular location may be considered monitoring. Whilst this might be true, by and large, that sort of approach to monitoring is not very useful to a land manager. That is not to say information that this approach provides is not useful, but to achieve long-term conservation goals, land managers need more reliable information than this approach can give us.

Land managers need to be able to look for changes in what they are managing over time and to know with confidence when and where those changes happen. Hence, monitoring must be done in a consistent and repeatable manner so that across time, the same sort of information is compared. This monitoring might be as simple as systematic observation (e.g. a search over a specified area to record the presence of particular species), or more complex, rigorous measurement (e.g. transect-based sampling to estimate the abundance of a particular species in an area).

The techniques used for monitoring vary depending on the questions being answered. Monitoring techniques must collect information relevant to the objectives of the

monitoring program. In addition, if a monitoring program is expected to detect change of a particular size, then the effort expended on monitoring must allow the detection of that changes. This is influenced by the level of effort expended. As effort increases, then the size of change that can be detected decreases. However, increasing effort increases the cost of monitoring.

As well as collecting information in a consistent manner using appropriate methods, a monitoring program needs to provide information that is useful for guiding management. Consequently, any monitoring program needs to have clear objectives. These objectives must relate to the goals for the area or aspects of the environment being managed. For example, if management actions are aimed at improving the breeding success of a population of a particular species, then we need to monitor something that tells us about breeding success.

Environmental Management Framework

To illustrate how Parks Victoria undertakes environmental management, and how monitoring fits into that management, it is necessary to describe Parks Victoria's environmental management framework (EMF). The EMF is a risk management framework that helps determine what management is required and enables evaluation

effectiveness: did it achieve what it aimed to?
efficiency: what did it cost to achieve the outcome?

of the effectiveness and efficiency of that management.

In its more elaborate representation, the EMF seems to be complicated but in reality it is a simple, logical process. At a fundamental level, the framework has 3 main components:

- Values:* the aspects of the environment that we are concerned with, e.g. ecosystems, species, communities.
- Risks:* the consequences of any processes that threaten the values we manage.
- Actions:* what we do to reduce the risks and protect the values we are managing.

It is important to reiterate here that whilst this discussion focuses on Parks Victoria's approach to environmental management, clearly, the components that make up the EMF are part of any environmental management. The whole framework is integrated through monitoring at a number of levels. A simplified illustration of the EMF is given in Figure 1.

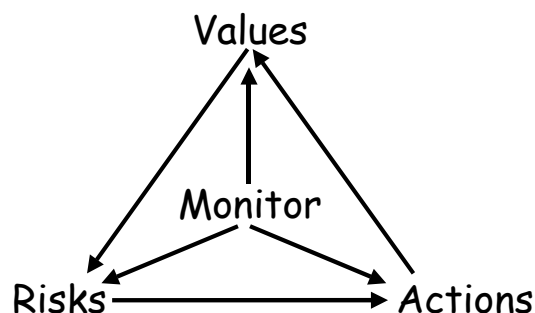


Fig. 1. Diagrammatic representation of Parks Victoria's Environmental Management Framework.

The step-by-step description of each of the tasks undertaken for the components of the EMF given below will help build an understanding of how the framework operates. This begins with the first component of the framework; environmental values.

Values

1. Identify

The first stage in the EMF is to identify the values of interest, i.e. what it is that you are managing. This may be a particular vegetation community, a species, a population or any aspect of the environment that we are concerned with managing

2. Objectives

Following from this, the next step is to specify in clear terms what our objectives for these values are, i.e. what do we hope to achieve for those values as a result of management actions. These objectives must be specified in a way that enables us to assess if objectives are being met. This is important because these objectives guide what management actions to do and what to monitor.

3. Monitoring

The next step is to determine what the current situation is. This is where monitoring is important. The current status or condition of the values needs to be determined relative to the objectives we set.

Risks

1. Identify

The next stage of the EMF considers factors that might prevent achieving the objectives set for the values, i.e. the risks to the values of interest. This information is essential for determining what management is required to achieve the objectives we set for the values.

2. Objectives

Once the relevant risks have been identified, it is necessary to determine what level the risk must be reduced to or maintained at to enable us to achieve the ultimate objectives for the values we are managing. This means we set objectives for the level of risk. As with the values, these objectives need to be specified in a way that is measurable.

3. Monitoring

Having set objectives for the level of risk, it is necessary to determine the current level of risk. Knowing the current level of risk helps determine whether management is necessary. It also provides a baseline against which the effectiveness of any management can be evaluated. Clearly, to do this, we need to monitor.

Actions

1. Identify

There is little point in undertaking any management actions without first considering the values being managed and the risks to those values. Once these things are known, it is possible to develop a management strategy that targets relevant risks and ultimately achieves the objectives the values being managed.

2. Objectives

As with values and risks, we need to set objectives for the management we propose to undertake. This is a clear statement of what action will be done and needs to be expressed in a way that is measurable so that we can evaluate whether we achieved what we said we would.

3. Monitoring

Monitoring actions involves recording what is actually done. This should include the nature of any work done, where it was done, as well as the amount of money, time and equipment used to do the work. Recording this information allows us to determine whether we did what we planned to do and relate what was actually done to what happens to the risks and to the values.

“Closing the loop”

The discussion above has described briefly each of the components of the EMF and the key tasks within each component. The framework enables evaluation of management. Evaluation is necessary to determine whether management is effective and to guide where improvements can be made. Monitoring is the critical link that enables this evaluation to occur. It is essential that this monitoring occurs at all levels, i.e. values, risks and actions. Through this monitoring, we are able to ask :

- Was the work done as planned?
- Did management actions reduce in the risk expected?
- Were the objectives for the values achieved?

By implementing the framework, a better understanding of how a system being managed operates should develop. This occurs through examining the relationships between management actions undertaken and changes in the level of risk and the values being managed. Because the framework is cyclical, what occurs as a result of management actions can be used to guide what to do in future. A worked example is given below.

Worked example

Values

As was described above, the first component of the EMF is *values*. In this example, the value of interest is a population of a particular species. The first task is to set objectives for this value. These must be specified in clear, measurable terms. Example could include:

- no reduction in population size
- an increase in the population size of x% over a specified time frame
- an increase of y% in breeding activity or reproductive success

All of these objectives are measurable. The next task is monitoring to determine the current status of the population relative to the objectives set. If the objective was an increase of 10% in breeding activity, we would need to measure what the breeding activity is at present.

Risks

The next step is to determine what threatens the population. It could be predation, fire, habitat fragmentation or a range of other factors. Assume the population is at risk from predation by foxes in this example. Having identified the relevant risks, we need to determine what the level of risk needs to be if we are to achieve our objectives for the population. Sometimes we might not know what level of risk is acceptable. In this case we still set an objective and use the results of the management to guide whether this is a sensible objective. In this example, we might set an objective to reduce fox activity by 50% over the next 12 months. Again, this is a measurable objective. To know whether management results in this objective being met, we need to monitor (using sand pads or bait-take for example) to determine the current level of fox activity is.

Actions

Once objectives for values and risks have been specified, the management strategy can be developed. In the example, if we are going to reduce fox activity, we might plan on implementing a poison baiting program. We also need to specify targets for how much work will be done. This might be to implement the poison baiting program over a specified area, with a certain number of bait stations placed a certain distance apart, and to check and bait those stations every 3 weeks. This is a clear, measurable target, and again, we monitor and record how much baiting was actually done, the time I took to do the work and what it cost.

Putting it together

Putting the results of monitoring all aspects of the EMF together can be used to guide future management so that objectives for the values being managed are achieved. With this information it is possible to examine if any changes in predator activity are associated with the amount of baiting done. It is also possible to evaluate whether there is with any change in the breeding success of the population we are trying to protect associated with the changes in predator activity. Answers to these questions will help determine whether more baiting is needed to reduce predator activity further or if what we are doing is enough.

Concluding remarks

Monitoring is a vital component of environmental management. By monitoring values, risks to those values, and what is done to reduce the risks, we improve our understanding of how the systems being managed operate and consequently, improve our knowledge of how to manage those systems. To be useful however, monitoring programs must have clear objectives and relate to objectives for the values being managed. For instance, there is little point monitoring the size of individuals if we actually need to know where they occur. Monitoring must also be done in a consistent way so the same sorts of information is compared across time.

Having acknowledged that monitoring is part of environmental management, it is important to also acknowledge that the resources of management agencies are limited. Management agencies deal with a multitude of issues. Consequently, agencies must determine what their priorities are and allocate resources to those priorities.

Monitoring can be time-consuming and agencies don't always have the resources to do it. This is where volunteers have a capacity to make a big difference to management. The contribution that volunteers make by undertaking important activities such as monitoring is extremely valuable and enables things to be done that otherwise would not. By working co-operatively with agencies to direct their work where it is most needed, the efforts of volunteers can be integrated with the management objectives for an area. Planning and effective two-way communication between volunteers and management agencies are essential to achieve this integration and make best use of resources of the agencies and the volunteers.