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GOALS AND APPROACHES: OPTIMISING INTERFERENCE LEVELS IN CONSERVATION SYSTEMS

Abstract: In order to maximise conservation goals when restoring an ecosystem, management must make choices about the appropriate level of interference within the managed area. Interference levels may range from a zero interference policy through to intensive interference. A selection of different approaches to interference is presented and case studies illustrating each approach are examined. The most suitable approach is dependent on the goals of management. It is concluded that the selected approach will provide a framework for identifying the optimum interference level within specific conservation systems.

Keywords: Conservation management. Optimal interference. Minimum interference. Research by management. Ecological restoration.

INTRODUCTION

The purpose of New Zealand conservation is "To seek long term viability for the full range of … species, communities and ecosystems" (Saunders 2000, p. 216). Conservation managers are faced daily with decisions of whether to take action within a system, what type of action to take, what amount of action or whether to do nothing at all.

It is important to understand the conservation goals in order to determine the best management approach to take in order to reach these goals. Selecting an optimal management approach can be used as a basis to determine the optimal level of interference.

This paper analyses several approaches, including a minimum interference approach, an ecosystem approach, a research by management approach, a community garden approach and in-situ/ex-situ approaches in order to determine what sort of goals are best achieved by each approach and what sort of interference is warranted within the framework of each approach.

A range of case studies is used to illustrate different conservation management goals and the different approaches used to reach those goals. The type and level of interference associated with each case study is examined.

CONSERVATION GOALS

Broadly speaking conservation goals, or at least specific objectives within an umbrella goal have two fundamental aspects that relate to interference level.

The focus of conservation goals

Conservation goals have a focus. The focus ranges from narrow in scope, such as a flagship or keystone species or population of a species, through to a community focus, or a habitat focus, to broad in scope such as an ecosystem or a landscape focus (Saunders 2000).

The state of the focus and its rate of change are important. The focus has a 'current condition' that is relative to a 'desired condition'. In terms of the current condition the focus may range from 'severely degraded' to 'pristine' and it may be improving or declining over time in response to management actions and/or natural factors. (Saunders 2000)

The 'conservation management spectrum'

Conservation goals lie within a 'conservation management spectrum' (Saunders 2000). The position of the goal within the conservation management spectrum ranges from simply observing change in the focus, through to slowing decline, to halting decline, to restoration, to crisis recovery at the far end of the spectrum.

The position in this continuum may change over time. For example as restoration is completed it may move to preventing loss. This can be broadly divided into restoration and maintenance phases though this division is primarily artificial. (Saunders 2000)

DETERMINING OPTIMAL INTERFERENCE

In order to evaluate what type and level of interference is appropriate, it is necessary to select an approach or framework to make management decisions within. It is important to recognize that conservation is not solely a scientific activity and decisions may also be judged by political, economic, aesthetic, cultural and even religious considerations (Saunders 2000). The approaches presented here are predominantly scientific but are by no means the only approaches available. Particular approaches are not exclusive and several case studies presented combine more than one approach.

Rather than attempting to determine if specific types of interference are optimal, on an absolute scale, at the outset of a conservation project, the primary decision is which broad approach will best achieve the management goals. Considerations are, the focus of conservation goals, the current condition of the focus and where management goals lie within the conservation management spectrum. Keep in mind that over time the condition of your focus will change and goals will shift within the conservation management spectrum.

A minimum interference approach

Hinewai, a 1000 ha reserve on Banks Peninsula, New Zealand is being managed for "the protection and restoration of native vegetation and wildlife" (Wilson 1994, p. 373). Management actions primarily involve checking for establishment and eradicating specific plant species deemed as pests (including *Clematis vitalba*, *Pinus radiata* and *Tradescantia fluminensis*), reducing the populations of introduced mammals (including goats, sheep, possums, hares and rabbits), clearing tracks and borders and taking precautions against the risk of fire (Wilson 1994).

A minimum interference approach sets a purposely low level of interference at the outset. The exact definition of 'minimum' is very subjective. In a minimum interference approach the decision of where 'minimal' lies, along with the natural inputs such as energy, soil, climate and rainfall, will dictate achievable goals.

Minimum interference is an appropriate approach when the desired condition of the conservation focus is not precisely specified. The goals of the restoration of Hinewai do not mandate specific criteria for success such as specific species composition or benchmark against a pristine reference ecosystem. Narrow success criteria can unnecessarily constrain restoration efforts (Hobbs & Norton 1996).

Minimum interference is also an appropriate approach when the current condition of focus is relatively close to the desired condition. The ecosystems of some of New Zealand's offshore islands are relatively intact. Particularly those islands that are pest-free can be managed with very little interference (Wright & Cameron 1990).

The Guanacaste National Park (GNP), a "terrestrial and marine garden" (Janzen 2000, p. 524) in the northwest of Costa Rica is largely being restored on a minimal interference management policy. A

10,600 ha "semi-conserved island" (Janzen 2000, p. 526) of dry forest in a sea of marginal cattle-grazed introduced African grasslands in the late 1970's, GNP is now 135,000 ha (and a 70,000 ha marine environment), too large for any type of intensive approach over the majority of its area.

The principal goal of the GNP restoration project is stated as "Use existing dry forest fragments as seed to restore … tropically diverse land to a dry forest that is sufficiently large and diverse to maintain into perpetuity all animal and plant species, and their habitats, known to originally occupy the site." (Janzen 1986, p. 11)

Key interference involves preventing what used to be regular burning of large sections of the landscape by anthropogenic fires. The natural dispersal of seeds by birds, bats, wind, rodents, ungulates, carnivores and water do the rest. Over 40,000 ha of GNP are now rapidly regenerating young forest. Over 60% of Costa Rica's recorded species occur within GNP though it is only 2% of the area of Costa Rica (Janzen 2000).

In certain situations a minimum interference approach is not optimal. Restoration ecology involves moving a system to a desired state by reinitiating successional processes along a desired trajectory (Hobbs & Norton 1996). In the GNP, by removing fire, dry forest remnants are able to resume the trajectory that prevailed prior to human disturbance. However, under certain disturbance regimes, ecosystems may have undergone a non-linear transition between different metastable states (Hobbs et al. 1996) and will not return across the system threshold without intensive intervention. One such example appears to be colonisation of un-grazed pasture dominated by tall, vigorous introduced grass species by native New Zealand woody species (Reay & Norton 1999). Gorse and broom have been shown (McCracken 1993) to act as a naturally occurring secondary successional pathway to native forest. It is partly this serendipity that has facilitated the rapid revegetation at Hinewai (Wilson 1994). However, in the absence of a natural secondary successional pathway, an intensive approach, such as planting of a nurse crop can considerably accelerate return to forest (Reay & Norton 1999).

If the ecosystem is severely degraded then it is unlikely that the ecosystem attributes will be the same as the original ecosystem after restoration. This will mean that some ecosystem components and/or processes cannot be restored with a minimal interference approach. The introduction of the South Island robin to Hinewai reserve by the Department of Conservation (DOC) in May 1992 was unsuccessful, possibly because of predation.

An ecosystem approach

"It is the adoption of management goals focused on important natural ecological functions .. which is at the heart of the required paradigm shift from the traditional focus on species and habitats alone" (Saunders 2000, p. 141).

The Department of Conservation's (DOC) six 'mainland island' projects cover around 11,500 ha and are 'intensively' managed over approximately 8,500 ha of this area. The 6,000 ha Hurunui river, a mainland island in North Canterbury has two stated goals. “To protect the beech forest ecosystems of the North and South Branches of the Hurunui River and restore them, as much as possible, to their original states and secure their species assemblages and unique habitat character” and “To develop effective and efficient predator and pest control programmes for large valley based forest habitats, and to ensure these developments are tested in a robust and scientific manner”. (Saunders 2000, p. 49)

An ecosystem approach seeks to promote desirable ecosystem attributes, and remove or mitigate against negative impacts on the ecosystem and interference can broadly be classified into two types, enhancement and supression. The health of the ecosystem can be tested by benchmarking against a suite of ecological attributes (Hobbs & Norton 1996). The mainland islands are characterised by long-term project goals and visions focused on an ecosystem approach (Saunders 2000).

Mitigation of negative impacts on the ecosystem is predominantly predator and pest control in the New Zealand context. In most places in mainland New Zealand it is impossible to fully restore ecosystem structure, composition and processes without managing exotic pests such as goats (*Capra hircus*), deer (*Cervus* spp) and brushtail possums (*Trichosurus vulpecula*).

The promotion of desirable ecosystems attributes generally involves enhancing the rate that successional pathways occur (discussed above). Interference may range from seeding desirable plant species to intensive planting regimes.

The key to a successful ecosystem approach is careful monitoring and benchmarking of ecosystem attributes; structure, composition and processes. A historical approach attempts to use a past state as a reference and actively move the current condition of an area to the desired condition. Interferences are chosen based on whether the interference will bring the desired state closer. This approach can lead to unattainable goals but does provide a clear management focus (Hobbs at al. 1996). More general benchmarks include biodiversity indices such as species count and macro-invertebrate community index.

In order to optimize pest control it is important to carefully choose and monitor a selection of indicator species (Norton 2000). In the Hurunui mainland island native mistletoes are monitored in order to benchmark vegetation response to possum control (Saunders 2000).

A more subjective aspect of an ecosystem approach is the naturalness of interference. Protecting specific ecosystem components directly, such as fencing off rare plant species or providing nest boxes for birds are more characteristic of narrow-focus approaches and are arguably not features of an ecosystem approach. Likewise use of poisons in pest control is currently necessary in order to achieve the desired ecosystem responses but has potential long-term effects that are not well understood currently. To be sustainable in the long-term pest control interference must seek to reduce reliance on poison based controls.

The disadvantages of an ecosystem approach are that it requires a high level of understanding of ecosystem processes at the outset. In the absence of this knowledge it can be successfully combined with a 'research by management approach'.

A research by management approach

The Mapara reserve in the King country is a 1400 ha podocarp/hardwood forest that in 1989 became home to New Zealand's first 'Research by Management' (RbM) approach to conservation management. Monitoring at Rotoehu in the Bay of Plenty using nest cameras had shown that possums, ship rats and harriers predated nesting female Kokako (Moore & Innes 1996). The goal of the Mapara experiment was to determine if controlling predators would halt kokako decline and if so how low did the predator population have to be.

An adaptive management or RbM approach involves the integration of existing interdisciplinary experience and scientific information into dynamic models that attempt to make predictions about the impacts of alternative policies (Holling 1978 cited in Walters 1997). An RbM approach is unique because it "proceeds as a science based enquiry rather than being based on an unquestioned statement" (Saunders p. 155). An RbM approach does not assume sufficient knowledge at he outset to answer the question, "What level of interference is optimal?". Instead it makes answering this question a management goal.

An RbM approach provides the knowledge to reduce uncertainty in the decision-making process. Pest control illustrates that an RbM approach is essential to determine the optimal level of interference. For example, Norton (2000) has shown that vegetation response to possum control is not straightforward and variation depends on density of possums prior and subsequent to control, frequency of control, composition and structure of vegetation before control, presence of a propagule source for re-colonisation, influence of other herbivores and the choice of indicator species used for monitoring the health and status of the forest. This complexity can only be optimised by carefully designed scientific experimentation (Norton 2000).

The high cost of implementation and institutional barriers present the primary problems with RbM. Walters (1997) relates that he has been involved in the planning phase of 25 adaptive management projects in 20 years, only two of which could be considered successful.

A community 'garden' approach

The Karori conservation area is unique in New Zealand in that this 250ha, mixed shrub/hardwood forest is in the centre of the Wellington urban area. The goal of management is to create a secure place for populations of native plants and animals and an accessible place for people to experience them (Lynch 1995). Management of Karori includes habitat improvement, clearing of weeds, planting seedlings and creating wetlands by sanctuary volunteers. (Lynch 1995). Species such as rata, mistletoe, maire, invertebrates, reptiles, fish, frogs and of course native birds will be introduced to the sanctuary (Lynch 1995).

A community 'garden' approach is often characterised by 'maximum' interference primarily for the purpose of fostering anthropocentric community goals. The composition and structure of the restored ecosystem is more like an arboretum, a museum of species, than ecosystem or minimum interference approaches would result in. This approach relies on considerable human resource input making it well suited for an urban environment.

Taking three years to design and eight months to construct, the 8.6 kilometre predator-proof fence surrounding Karori reservoir cost 2.1 million dollars. An intensive eradication program targeting 14 species, the most ever attempted in a New Zealand, will be implemented to make Karori a pest-free area. (Thompson 1999).

Under an ecosystem or minimum interference approach it is seldom warranted to fence conservation areas. Where isolation is desirable it is better to use mountains and rivers as natural barriers in a bio-geographic island sense (Saunders 2000). Reasons for not fencing areas include resource limitations, the desire for recruitment from outside the conservation area and the recognition that ecosystems may not start and finish at anthropogenic boundaries. Even when a predator-proof fence is constructed it is necessary to operate a web of back-up systems to handle occasional unavoidable breaches (Thompson 1999). The success of predator control in mainland islands has further reduced the arguments for predator-proof fencing. The urban surroundings at Karori warrant the construction of the fence in this situation, both to avoid the use of poison based pest control and to contain vulnerable populations of flightless native species.

Parts of the Guanecaste National Park can be seen as a community 'garden', though on a very different physical scale from Karori reservoir and with a strong corporate focus. Socio-economic integration at local, regional and national level is a key goal for GNP. The 120 employees have a $US1.6 million annual operating budget in the local biodiversity, education, environmental services and eco-tourism industries thus becoming part of the economic restoration of the region.

Other approaches

The Takahe (Porphyrio mantelli) population in the Murchison mountains in Fiordland consists of around 120 birds (Maxwell & Jamieson 1997). Conservation managers are attempting to maximise the population of Takahe in-situ in several ways. Visitors to Fiordland require a permit to visit the Murchison mountain area, deer population which compete with Takahe for food have been nearly eliminated and considerable scientific research has been completed to understand the ecology of the bird more fully. Ex-situ methods include the captive rearing program that removes excess eggs from Takahe nests, raises them in captivity returns them to the wild population around one year of age. (Maxwell & Jamieson 1997).

Narrow scope conservation goals, with species or population focus, can be managed with in-situ or ex-situ interference. In crisis recovery situations ex-situ interference provides better insurance against stochastic environmental events. It may also maximise the population, by captive rearing excess eggs for example. However "it is neither desirable nor possible to protect all species in ex situ situations" (Norton 1993). Additionally there is some risk that socially inherited behaviour may be lost by captive rearing.

In non-critical situations it may make sense to re-evaluate your narrow scope species or population focused goals with respect to broader approaches discussed earlier. Goals that are based around population responses of flagship or umbrella organisms can go hand in hand with broad ecosystem based goals.

CONCLUSION

Having examined a diverse range of conservation management case studies it is evident that no single policy or generalisation can offer simple rules of how to optimise interference.

The author suggests that careful choice of conservation goals and a management approach that is tailored to those goals is a necessary first step. Choosing a management approach must take into account the focus of management goals and its current condition. Mildly degraded system, or degraded systems with high resilience may be good candidates for minimum interference approach. Goals involving restoration of a variety of organisms to a near pristine state or a reference state mandates an ecosystem approach. If it is desirable to understand in detail the responses within a system then a research by management approach is appropriate. Goals focusing on socio-economic benefits are best managed with a community garden approach. A clear management approach provides the necessary framework to guide interference levels and policy.

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