Economic, Social and Cultural Factors Affecting Landscape Restoration

3

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Introduction

Many ecologists see the primary objective of restoration as being the re-establishment of biological diversity on degraded lands. It seems self evident that this is a worthy goal. By doing so biological diversity is conserved and the key ecological processes that are necessary for the functioning of ecosystems are, hopefully, restored. But ecological restoration is often difficult because the nature of the original ecosystems may be unknown or impossible to achieve because of historical events. For example, certain original species may have become extinct while new, non-native species may have become naturalized and invasive. It may also be difficult to define or reproduce the precise assembly rules needed for restoration to proceed. Additionally, of course, the cost of restoration can be found to be prohibitive, especially if the cost is borne unequally among the stakeholders.

However, there is a more fundamental impediment to restoration which, if not addressed, will limit the extent to which it can be implemented over large areas. That impediment is the potential it can have to adversely affect certain landholders in the region being restored. This may seem paradoxical. After all, the purpose of restoration is to improve and not hinder human livelihoods. The difficulty lies in what can be thought of as the distributional effects of restoration – the community as a whole may benefit but the direct and indirect costs of carrying out restoration may be paid by a much smaller number of individuals such as those owning or using the land that is treated. Under such circumstances it may be very difficult to persuade these land managers to participate in the restoration of large areas of degraded land even when the technical means to do so are available.

This chapter has two objectives. The first is to examine how such socio-economic circumstances as well as biophysical conditions can affect restoration options. The second is to describe some methods that might be used to evaluate the socio-economic consequences of restoration such that managers might revise their approaches and adapt to unexpected circumstances if this becomes necessary.

The landscape mosaic

Landscapes are not uniform. Rather, they are made up of a mosaic of vegetation types and land uses (Gilmour 2005). For example, many landscapes contain areas of relatively undisturbed "natural" vegetation as well as intensively cultivated agricultural land. There may also be areas of more disturbed native vegetation and areas of less intensively used agricultural land such as grazing land (Table 1). These differences reflect the changes induced by past events and management decisions as well as those caused by current disturbances such as grazing or fire.

Different parts of this ecological mosaic will deserve restoration treatments more than others. The most obvious areas for restoration are those that are highly degraded such as steep slopes, saline areas or eroding stream banks. Other sites that might deserve attention could be the often large areas of poor quality agricultural land surrounding patches of natural vegetation. There is unlikely to be any debate about the value of overcoming erosion or salinity but there may be some concerns about intervening to change current land use activities on agricultural land even when this is of poor quality. This is because such land may still be in use. Any changes in its use will have an opportunity cost.

TABLE 1. The ecological mosaic and its influence on restoration choices.

Bio-physical unit	Influence on restoration choices
Intact native vegetation	These areas are likely to be of greatest ecological significance because they are reservoirs of biodiversity and a source of species to recolonise degraded landscape areas.
Disturbed native vegetation	May still contain significant amounts of biodiversity but may also contain weeds and pest species. Often regularly burned by wildfires. Potentially available for restoration because any opportunity costs are likely to be small.
Intensively used agricultural land	This land is unlikely to be available for restoration because the opportunity cost would be too large.
Less intensively used or degraded agricultural land	This land may appear to be available for restoration and have a low opportunity cost. In fact it may be being (unofficially) used by some individuals or community groups and these would bear the cost of restoration.
Riverine areas	Important for biodiversity conservation but often degraded by graziers and other land users. Erosion from such areas may impact heavily on downstream stakeholders.
Unstable hillslopes, saline areas or otherwise highly degraded sites	High priority for restoration. Unlikely to be used by landowners and may be adversely affecting other downstream stakeholders
Fire-prone areas	The fire regime may vary across the landscape with some areas being more frequently burned than others, and therefore deserving different prevention and restoration efforts.

The type of restoration undertaken is also likely to vary with the type of land being treated. In the case of disturbed but mostly intact native vegetation, it may be possible to foster biodiversity by simply protecting the site from further perturbations. The costs of doing this may be relatively modest. However, this approach might not be possible on more degraded sites. In these cases the cost of restoration is likely to be higher and the more feasible objective may be to restore ecological processes and functioning rather than biodiversity. It is also likely that the treatment might be required to generate a direct financial benefit to justify the expense.

These land use patterns are, in part, a consequence of the socio-economic mosaic that overlays the ecological mosaic. Thus land might be owned by public and private landholders. It will also be distributed among landowners who differ in the sizes of the properties they own, in wealth and in political influence. Some farmers may have secure tenure for their land while others may not although they may believe they do so. Some farmers may not own land they use but may have long-term rights to use it for grazing or other purposes. In some cases there may be disputes over ownership of a particular area of land. Property rights are likely to be more strongly asserted over productive agricultural land than over degraded lands. On the other hand, some degraded lands may be treated as common property resources that are available to anyone for purposes such as grazing. In such cases further degradation is inevitable. The ability to intervene and undertake restoration in the various land units described in Table 1 will depend very much on who owns or uses the land and how these people fit into the various landowner or land user classes referred to above.

But, in addition to these on-site land managers there may also be other stakeholders with legitimate interests in the way these lands are managed. These might be downstream water users such as hydro-electric authorities or people living outside the region but interested in wildlife conservation. They may also include adjoining landowners affected by weeds, fire or erosion coming from the area.

This socio-economic mosaic and extended list of stakeholders has several consequences. Firstly, there are likely to be significant differences in the capacity of landowners and managers to undertake restoration or even prevent further degradation. Poorer farmers are more likely to be affected by fluctuations in agricultural prices or by periods of drought than are wealthy farmers and this will limit their capacity to act. Secondly, there are likely to be quite diverse views amongst the various stakeholders about where and how restoration should be carried out. Thus a farmer facing uncertain prices for agricultural produce is likely to be less concerned about protecting biodiversity than a city-based wildlife enthusiast with a secure job who is immune to market fluctuations.

Incorporating restoration into existing land use patterns

As mentioned above, many landowners may be reluctant to change their current land use practices even though these are causing land degradation simply because they cannot afford to do so. Others may be reluctant to act because they fail to recognize that degradation is occurring (or because the adverse consequences are largely occurring off their property). A third group may be reluctant to change because the proposed new land uses are seen as being too complex or radically different to those currently being practiced. This may be the case with many restoration systems that involve new biological communities, rather different management systems and which generate a quite different set of benefits to those usually experienced by most farmers. The fundamental task, therefore, is to develop ways of making these new systems sufficiently attractive to farmers and other landholders such that they will adopt and maintain them.

Some of the factors that may influence the attractiveness of restoration to landowners are shown in Table 2. Several of the most important factors involve land. Perhaps the most important of these is land tenure. Farmers without secure rights are unlikely to undertake a long-term venture like restoration because they have no way of ensuring that they will benefit from doing so. For those with tenure the area of their farm becomes important. Farmers with large amounts of land or with large areas of unproductive or relatively inaccessible land are more likely to be willing to undertake restoration on at least part of this land than those with only small landholdings or land that is, in their eyes, fully productive. The issue here is the opportunity cost of restoration. What are the economic opportunities forgone by taking land out of its existing use for restoration purposes (e.g., to create a corridor between two forest remnants)?

Sometimes landowners are legally obliged to undertake some form of restoration for the public good (e.g., to eradicate noxious weeds, maintain a particular fire regime, to revegetate and stabilize stream banks). In other case they are assisted in carrying out restoration for the public good by financial incentives or subsidies to carry out restoration. Certain forms of restoration may generate direct commercial benefits such as when there are payments for the goods (e.g., timber produced by new plantations) or the services (e.g., clean water, wildlife habitats) produced by restoration. Payments that are received in the short term are likely to be valued more than those that only arrive after some years.

The likelihood of a landowner receiving payments from goods or services generated by restoration may depend on just how degraded the landscape might be. For example, there may be rather less likelihood of a strong market for farm grown timber or non-timber forest products if there are large natural forest areas nearby that are already able to supply these. This situation may be reversed in a highly degraded landscape with little of the original forest remaining. In such a case the market prices for goods or services may be much greater. This means that a restoration system that can generate these goods and services is more likely to be attractive than one that does not.

In many parts of the world farmers derive a significant part of their income from activities off-farm. They may work for other farmers or may be employed in nearby towns. This means there is less need to achieve a commercial outcome from agricultural activities. Consequently, there may be greater scope for restoring at least part of the landholdings.

TABLE 2. Socio-economic factors that may influence the attractiveness of restoration to farmers and landowners.

Factor	Significance
Land tenure	Farmers without secure land tenure or usufruct rights are unlikely to undertake a land use activity such as restoration where the benefits take time to achieve.
Availability of agricultural land	The commercial viability of a farm will often depend on its size. It may be easier to undertake ecological restoration on a large farm than on a small farm because the initial impact of the change is proportionally smaller.
Productivity of land	Restoration will be more attractive on land that is regarded as unproductive (because of lost soil fertility, weeds, pests etc.) than on land that is still highly productive. This is because the opportunity costs incurred in converting productive land would be too high.
The likelihood of financial or other direct benefits arising from restoration	Landowners are more likely to be interested in a land use activity that benefits them immediately and directly. Benefits may come from goods such as timber or services such as improved water supplies or new wildlife habitats.
Availability of subsidies, incentive payments or tax concessions	Such payments may be especially significant for small, risk-averse landowners or those with low incomes.
Legal obligations to overcome degradation	There may be legal requirements on landowners to prevent fires or eradicate weeds or pests.
Availability of alternative sources of off-farm income	Landowners able to obtain income from off-farm employment may be more able to convert part of their land holdings to new uses such as restoration.
Attitude of neighbours	Neighbours can have positive and negative influences. Innovative neighbours can provide examples to be copied but conservative neighbours can also argue against change and diminish the propensity of innovators to take on risky new land uses.

Pannell (1999) has identified four key conditions that are necessary for a farmer to adopt a new land use. The first of these is that a farmer must be aware of the innovation. Being told about it is rarely sufficient. A rather more powerful introduction is to actually see the innovation in use. Field demonstrations of restoration that clearly show the benefits of the new system can be very useful (especially if these benefits develop quickly and have a cash value) and demonstrations on the land of a neighbour with similar field conditions may be especially persuasive. Secondly, there must be a perception by farmers that it is feasible to test the innovation on their land. A complex change involving the planting of large numbers of seedlings of different species may be rather less attractive than, say, a change simply involving fencing to limit grazing pressures or a change in fire regimes. Thirdly, the innovation must be feasible but it must also be seen as being of low risk and sufficiently promising to be worth testing in a small scale trial. Finally, even at this early stage, it should be clear that the innovation will promote the farmer or landowner's overall objectives. That is, it should be clear that it will be in the self interest of the landowner to make the change. Though the relative financial profitability of alternative land uses drives many farming decisions, farmers are often motivated by other factors as well. For example, many landholders may be keen to overcome environmental degradation for their own and for the community good. Others may be motivated by a sense of stewardship or a desire to be seen as good land managers.

Rather different and sometimes more complex arrangements might be needed where restoration is undertaken as a community activity rather than by individuals. This might occur when a community acquires the rights to administer a village commons or people group together to manage a local watershed area. In such circumstances the community may have acquired control of land previously being degraded by unregulated use (e.g., the disturbed native vegetation or less intensively used agricultural land of Table 1). Forests are often able to regenerate once such areas are no longer burned, grazed or logged meaning a new economically valuable resource is created. A common approach is for the community to take advantage of the new forests and establish management rules that regulate who can access the land and the extent to which any resources (e.g., timber, pasture) can be used (Gilmour 1990). Unlike the situation described above involving individual farmers, the opportunity costs in this case are mostly very low.

Case studies

Case Study 1: Appropriate policy settings can facilitate the restoration of degraded landscapes

The natural vegetation of the Shinyanga region of north west Tanzania is mainly miombo woodland and acacia scrub and has a rainfall that varies between 650 – 1100 mm. The lands are used by pastoralists who practice a form of communal grazing. These people traditionally maintained a series of enclosures (5-100 ha) to provide fodder during dry periods as well as supply other products such as thatch material, medicines and firewood.

Degradation occurred throughout the region following a period of deforestation in the 1920s and 1930s which was aimed at eradicating tetse fly. Large areas of woodland were also converted into agricultural land for cash crops such as cotton and rice. The traditional grazing practices were further disrupted after 1975 when many people were relocated as part of the Government's "villagisation" program. This sought to improve the provision of government services such as education and health by forcing people into special villages where they could be more easily contacted. But this change destroyed local management practices. By 1985 the traditional land management systems had virtually died out and the system of maintaining enclosures was abandoned. Overgrazing and degradation became widespread throughout the region. In 1986 President Nyerere called it "the desert of Tanzania".

After the mid 1980s the villagisation scheme was abandoned and the government adopted a new policy of decentralization. Communities were given tenure over their lands and the old enclosure and management systems were revived. This allowed natural vegetation to recover even in what appeared to be highly degraded sites. Tree planting was also encouraged. The result has transformed the landscapes and fostered a remarkably widespread recovery of woody vegetation across an area of some 250,000 ha.

The main lesson is that large scale restoration can be possible at a very low cost if appropriate policy settings are established. In this particular case the government recognized that traditional community management practices had previously allowed a stable form of land use to evolve and that it needed to empower these traditional institutions once more to enable them to re-establish these practices (Source: Barrow and Melenge 2003, Wood and Yapi 2004).

Case Study 2: Degradation can only be overcome if there is a sharing of costs and benefits among the various stakeholders

Salinisation has occurred in parts of southern Australia following the clearing of some of the original forests and woodlands. The replacement of deep-rooted native species by shallow-rooted agricultural crops changed the hydrological cycle by causing a reduction in evapo-transpiration. This has allowed saline ground waters to rise close to, or even reach, the soil surface. Large areas of previously productive land have been adversely affected. In some landscapes it is possible to reverse these changes by planting fast-growing tree species in recharge areas (e.g., on hillslopes). These trees increase water useage and cause water tables to decline thereby reducing salinisation in discharge areas (e.g., in valleys). Trials have been carried out to explore just which landscape units should be planted to generate the greatest benefit. These generally show that the more a watershed is reforested the greater the hydrological improvement (Schofield 1992).

But the technical success of tree planting is not necessarily sufficient for it to be widely adopted. Trees can help overcome salinisation but they are costly to establish and they also replace existing land uses such as cropping. This has financial consequences. It may be possible to grow trees for some commercial benefit but, unlike annual agricultural crops, the financial returns are less frequent. Many farmers may be unable to afford to convert a significant area of their farm to trees and still remain financially viable. The dilemma increases when more than one landowner is involved. It is often the case that the land use practices causing salinisation are some distance away from where the effects become evident. This means that salinisation in one area belonging to Landowner A (e.g., in a valley) may be induced by land clearing and other activities on another area (e.g., upslope) belonging to Landowner B. This poses a particular dilemma. Why should Landowner B replant trees across his land for the sake of Landowner A? Further, if he is to be compensated for doing so, should it be only Landowner A who pays or should other downstream water users (e.g., townspeople) who are now receiving salty water also pay?

The key lesson is that there are usually a large number of people concerned with, and affected by, the management of degraded lands. These include those actually using the land as well as neighbours and others who may live some distance away but who have a legitimate interest in how the land is managed. If rehabilitation is to occur there must be a way of ensuring that the costs are shared amongst those who benefit from the change (Source: Walsh et al. 2003, Pannell and Ewing 2006, Environment Australia undated).

Case Study 3: Degradation can cause ecosystems to move to a new state condition. It can be very costly to reverse such changes

The rangelands of the states of Queensland and New South Wales in Australia have a rainfall of less than 600 mm. This rainfall is highly variable and drought is common. Prior to the arrival of graziers in the second part of the nineteenth century these areas were occupied by aboriginal people. The aboriginals were hunter-gatherers and frequently burned some of these lands as part of their hunting efforts as well as for other purposes. The fire regime changed and the frequency of fires greatly diminished when graziers arrived with their herds of sheep and cattle.

The new herbivores have reduced grass biomass. This decline, plus the absence of fire, has allowed many woody plants to regenerate. These woody species include native trees such as *Eucalyptus* or *Acaci*a as well as native shrubs such as *Eremophila* spp. and *Cassia* spp. These new woody species have, in turn, helped shade out more of the remaining grasses. The outcome has been a major change in the balance between grasses and woody plants and has led to a significant reduction in the supply of pasture to the sheep and cattle herds.

An intense fire would help control the woody plant populations but the new ecosystems do not normally have enough fuel to sustain such a fire. Sufficient fuel can be produced after an above-average rainy season but these good seasons are rare in these regions. Under such circumstances many graziers would rather use the pasture generated in these rare good periods to feed their stock rather than as a fuel to reduce woody plants.

The situation represents a significant management dilemma. From the graziers point of view the new systems are becoming degraded since they produce less pasture. If woody plants continue to encroach then many farms may become unprofitable since they will have too little pasture. The obvious solution is to re-introduce fire to exclude woody plants and favour grass. But some graziers may already be in the situation where they cannot afford to burn the additional pasture (i.e., fuel) provided by an above-average rainy season but must use it to feed their stock in order to pay their accumulated debts. But if they do not burn the situation will only get worse.

The key lesson is that economic circumstances can prevent degradation from being overcome even when the ecological knowledge necessary to restore a site is available (Source: Daly and Hodgkinson 1996, Burrows et al. 1990, Burrows 2002).

Case Study 4: Not all technical solutions are necessarily appropriate

Many of the savannah lands in the Lake Chad Basin of northern Cameroon have become degraded because of firewood harvesting, overgrazing and cotton farming. The result has been widespread degradation.

Trials have been carried out to test various ways of combating this degradation. These trials have generally sought to limit water run-off and conserve soil and have included a variety of earthworks including ploughing and various kinds of small dams and barriers to water flow. Tree planting using both native and exotic species was carried out within these treatment areas.

Most of these trials have been technically successful and the trees have flourished although there were differences between exotic and indigenous species in terms of survival and growth rates. However, it seems unlikely these technical solutions will be widely adopted. Most of them involve heavy machinery such as tractors or bulldozers and are simply too expensive for local farmers to adopt. Further, the tree planting methods used were able to incorporate a variety of commercially useful products such as fuelwood, fodder and medicines etc. but they did not allow for the incorporation of food crops.

The main lesson is that technical solutions alone are not sufficient to overcome degradation. Ways must also be found of incorporating these solutions into existing farming practices such that land managers can afford to adopt them (Source: Wood and Yapi 2004).

Monitoring change and measuring success

It is a relatively straight forward matter to monitor the bio-physical changes caused by restoration. This can be done by measuring attributes such as changes in plant cover, tree growth rates, plant species composition, hydrology or movements in wildlife as new habitats develop. It is a rather more difficult task to monitor change and measure the socio-economic "success" of restoration. As noted earlier, there may be a large number of stakeholders who may react quite differently to a restoration or rehabilitation project with some judging it a "success" and others counting it a "failure". The problem is in deciding how to take account of these different views and reactions. This problem means it is difficult to be prescriptive about the ways monitoring should be carried out. Different methods will be needed in different situations. None the less, certain indicators may be more generally useful. These are outlined in Table 3.

One obvious indicator is the economic circumstances of people living in the area. Restoration is unlikely to be possible if household incomes are declining. In fact these circumstances are more likely to promote further degradation. This was the situation in Case Study 3 involving undesired woody plants. Rather "success" is more likely if incomes are increasing. This improvement may come from increased agricultural productivity (because of soil conservation), from tourism or from the sale of goods such as timber or grazing rights. Success is likely to foster further success and enable larger areas of degraded land to be treated.

A further promising sign would be the willingness of external stakeholders to pay for ecological services such as clean water derived from restoration. In the situation described in Case Study 2 a payment by downstream water users might be sufficient to compensate a landowner for reforesting part of their land to restore the former hydrological cycle. In such a case it may take time before the benefits of restoration become evident but monitoring of groundwater levels would provide evidence that positive changes were underway.

A third indication of “success” would be evidence that local communities continue to protect and maintain restoration areas in the expectation that the process will eventually benefit them. This was the situation in Case Study 1 in Shinyanga, Tanzania where the extent of the recovery was not clear when the process started. On the other hand, there was considerable traditional knowledge, especially amongst older people, about how these systems functioned and this would have provided some confidence that restoration was possible.

Strong evidence of support would also be provided by spontaneous new restoration projects initiated at other sites as a consequence of the benefits generated by earlier restoration efforts. Similarly, the development of new business enterprises that engage in the

TABLE 3: Socio-economic indicators of the success of restoration activities

Indicator	Reason
Incomes of resident households improving.	Farmers with declining incomes are unlikely to be able to afford to implement or maintain restoration activities.
Payments being made for ecological services.	External stakeholders willing to pay land managers for on-site restoration activities that yield ecological services such as clean water, biodiversity or wildlife habitats.
Individual landowners continuing to protect and maintain restored sites	Landowners continue to view restoration on their land as being a valid and beneficial land use.
Spontaneous restoration at other sites by individual landowners without the need for external subsidies or support	The benefits of restoration are self evident to individual landowners resulting in increased areas of degraded land being treated. The more of such new sites the greater the “success”. A corollary of this is that no new areas of degradation are evident.
Development of private enterprises able to carry out or benefit from restoration activities (e.g., seedling nurseries, reforestation companies, weed control companies, ecotourism groups etc.)	Restoration and the land uses it fosters have become commercially profitable and created employment and new economic opportunities.
Development of institutions and learning networks amongst landowners aimed at fostering rehabilitation.	These institutions and networks generate, accumulate and transfer knowledge about restoration and the ways it can be incorporated in local land use systems.
Validation and community support for policies, regulations and institutions designed to protect restored areas and prevent future degradation	These regulations may be formal government legal regulations, traditional community regulations or new rules established by communities to facilitate the management of newly acquired common property resources. The institutions may be traditional community organisations or government regulatory bodies.

restoration program are also likely to be indicators of "success". These might be seedling nurseries, tree planting groups, weed control groups or businesses specializing in removing animal pests. As restoration matures there might also be opportunities for eco-tourism. There was no evidence of any landholders at the Lake Chad sites described in Case Study 4 spontaneously adopting the restoration techniques being tested. This was because the approaches were simply too expensive for any individual to adopt even though there was evidence that they could work.

A key indication that restoration is likely to be a long-term activity independent of external support is the development of local organizations and institutions able to generate, accumulate and transmit knowledge. These institutions may revive traditional ecological knowledge systems and incorporate this knowledge with modern scientific knowledge and that gained by actually carrying out restoration (e.g., Case Study 1 at Shinyanga). Restoration is, ideally, a process of adaptive management but there should be systems or organizations able to collate and synthesise knowledge and make it more widely available.

Finally "success" might be indicated by the continued community support for policies, regulations and institutions designed to protect restored areas and prevent future degradation. These devices are likely to be the primary means by which individuals are prepared to sacrifice short-term individual benefits for the sake of large scale collective action that benefits the community as a whole. Without credible instruments like these this trade-off might be impossible to establish.

Conclusions

Degradation has many causes but it is often the result of adverse social and economic circumstances affecting individual land users. These circumstances have to be changed if degradation is to be stopped and the site restored. This means that ways have to be found to enable land users to include the necessary changes within their current land use plans if restoration is to proceed. The ways in which this might be done will depend on the degree of degradation that has occurred, the nature of the landscape mosaic and on the socio-economic circumstances of the particular land managers.

All restoration necessarily involves some adaptive management since it is rarely possible to forecast just what will occur over time. Such management requires feedback to indicate if a successful trajectory is being maintained. There are a number of socio-economic indicators of "success" that might be used including that peoples livelihoods are improving and that restoration is being spontaneously taken up by new land managers without the need for further external support. Perhaps the key indicator, however, is that institutions and learning networks have evolved enabling different experiences to be integrated, synthesized and shared amongst practitioners (Berkes et al. 1998). Such learning networks will assist these communities to withstand future ecological or economic shocks and prevent further degradation.

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