Chapter 31: Restoration and market-based instruments

Dr Alex Baumber, School of Biological, Earth and Environmental Sciences, The University of New South Wales

Market-based instruments (MBIs) have become increasingly prevalent in the environmental policy sphere in recent decades and their application to ecological restoration reflects this global trend. MBIs can take a variety of forms, from simple grants through to complex offsetting and trading schemes. When implemented carefully, they can allow providers of ecological restoration services to capture a greater share of the economic benefits produced by their projects, as well as attracting new sources of investment into ecological restoration. However, MBIs also bring with them the risk that the diverse range of ecosystem services and functions provided by restoration activities may be commodified, over-simplified or traded-off against environmental degradation at other locations. This chapter explores the various classes of MBIs, the extent to which they have been used to promote ecological restoration and the advantages and disadvantages they offer.

MBIs cover a broad range of policy instruments including grants, subsidies, taxes, charges, penalties, certification programs and tradable permit schemes. Their unifying feature, according to the OECD (2007), is that they seek to address market failures relating to "environmental externalities". This term refers to the environmental costs or benefits related to an action that are not experienced directly by those undertaking the action and are not captured in traditional markets for goods and services. In the case of ecological restoration, the externalities in question primarily consist of the environmental benefits from restoration projects that may be felt well beyond the immediate restoration site, such as biodiversity conservation, soil protection, carbon sequestration and the provision of clean drinking water. These benefits are rarely captured in traditional markets for goods and services and, as a result, do not flow back to those undertaking restoration activities in the form of economic returns. MBIs have the potential to address this market failure and provide incentives to undertake further restoration work.

MBIs are often viewed as a more efficient alternative to "command and control" measures. For example, a tax on greenhouse gas emissions or the creation of a market to trade emission permits may be promoted as a more efficient alternative to an inflexible emissions cap being placed on every enterprise. A key economic principle behind such arguments is that enterprises are better placed than the government to determine the most cost-effective way to reduce their impact. Indeed, where markets for tradable permits have been created, an enterprise may determine that the most cost-effective way to reduce their impact is to continue emitting while paying someone else to stop (or to provide an offset by sequestering carbon in trees or soil). However, when looking at MBIs from the perspective of ecological restoration, the argument that they are a more efficient alternative to command-and-control measures has limited relevance. This is because governments rarely compel landholders to undertake restoration activities through regulation (except in limited cases such as mine-site restoration). Instead, the use of MBIs for ecological restoration tends to focus more on factors such as enhancing the cost-effectiveness of the limited pools of funds available for restoration work, the creation of economic incentives to undertake environmentally-beneficial activities and the potential for restoration activities to offset environmental damage elsewhere.

This chapter will progress from the simplest forms of MBIs, such as government grants, to the more complex market-based arrangements that can be used to direct payments to the providers of restoration services. Most of the measures discussed in this chapter fall under the category of PES - payments for ecosystem (or environmental) services (Wunder, 2005, OECD, 2010). However, this chapter also considers options that do not strictly qualify as PES, such as penalties for failing to restore degraded landscapes and incentives to design production systems that combine restoration with commercial harvest.

Simple MBIs – grants, penalties and taxation approaches

Government grants for restoration projects are common in many countries. These offer a simple way to incentivize restoration activities and compensate those undertaking them for the public benefits (i.e. positive externalities) they provide. Grants may be provided by municipal, state or provincial governments, along with schemes operating at a national level, such as the National Landcare Programme in Australia or the various restoration programs run by the Environmental Protection Agency (EPA) and the Fish and Wildlife Service (FWS) in the United States. Financial incentives to undertake restoration can also be provided through the taxation system, such as the tax concessions permitted for the creation of Voluntary Conservation Easements in the USA.

Grants programs may also be run by non-government organizations (NGOs), with this option being very common in the USA, where a wide range of foundations offer grants aimed at local areas or specific habitat types. In developing countries, international NGOs such as World

Wildlife Fund (WWF) provide an important source of funding for restoration projects, along with inter-governmental agencies such as the Global Environmental Facility (GEF) operated by the United Nations Development Program (UNDP).

Generally speaking, grants programs are aimed at voluntary restoration activities and aim to cover some or all of the costs involved. They vary in terms of whether they are intended to assist only with the direct costs of restoration activities or to also cover the opportunity costs of taking land out of agricultural production or, in some cases, to generate a profit for the landholder. Depending on the program, there may be specific rules about what kinds of costs can be covered using program funds (e.g. materials and labour), and which cannot (e.g. administrative and opportunity costs).

Apart from grants and tax breaks, a range of other simple incentives can be used to encourage landholders to protect or restore ecosystems, including access to credit and increased security of tenure. In Brazil, access to agricultural credit and insurance has been used to provide an incentive for Amazon landholders to comply with forest protection laws (Butler, 2011). Enhanced security of land tenure can also act as an incentive in situations where tenure is insecure, with an example being the Sumberjaya pilot program aimed at watershed protection in Indonesia (OECD, 2010). These types of non-monetary incentives can often have a significant impact on landholder decision-making and complement the monetary incentives offered under grants programs or tax breaks.

An alternative to using grants, tax breaks or other incentives to encourage voluntary restoration is the use of involuntary negative incentives such as taxes, fines or other financial penalties to compel certain stakeholders to restore ecosystems. This option is suitable only where restoration is a regulatory requirement or a condition that has been placed on a development approval. Restoration bonds used in the mining sector are a notable example of this approach, with the bond acting as both an incentive for the mining company to restore land to an acceptable condition as well as a source of funds to correct any damage if the company fails to comply.

Enhancing cost-effectiveness – reverse auctions

Grant applications are commonly assessed by a panel or committee who must decide which of the many applications they receive represent the best value for money. Considerable research has focused on ways to enhance the cost-effectiveness of public investment in restoration activities (e.g. Pannell, 2008, Crossman and Bryan, 2009) and MBIs have the potential to assist with this goal. A particular challenge for grants programs is "information asymmetry", whereby landholders bidding for grants have a better understanding of the true costs of restoration activities than the government agencies assessing them, which can lead to bids being inflated above the minimum level that the landholder would be willing to accept (OECD, 2010).

Auction approaches offer a means of overcoming the risks posed by information asymmetry and improving the cost-effectiveness of grants for ecological restoration. One prominent example of a grants scheme that employs an auction approach is the BushTender program in the Australian state of Victoria. This process is more accurately described as an inverse or reverse auction.

Unlike a traditional auction, where multiple bidders compete to purchase a single item, the BushTender process involves multiple providers of restoration services competing for a fixed pool of government funds (DEPI, 2014). Landholders offer to protect and restore areas of remnant native vegetation, with these competing bids being rated in terms of their likely biodiversity benefit relative to the cost (i.e. the amount of funding requested by the bidder). Bids with the highest cost-effectiveness ratings receive the limited funds available.

The metric used in the BushTender scheme to express the predicted benefit from each bid is known as the Biodiversity Benefit Index (BBI), which has a maximum score of 100% that takes into account the proposed management practices and the regional conservation significance of the site. The predicted gain in BBI is multiplied by the area of the proposed site to provide a predicted gain in terms of "habitat hectares" (Figure 31.1). For example, a 100 hectare site that is managed in such a way as to improve its BBI from 50% to 70% (i.e. a gain of 20%) would result in an overall gain of 20 habitat hectares. Proposals are ranked for cost-effectiveness based on the funds requested and their predicted gain. This then links to a vegetation quality assessment method which is able to monitor the actual change in "habitat hectares" over time by comparing the site to a benchmark based on a mature, long-undisturbed site of the same vegetation type, taking into account factors such as landscape context and the presence of large trees, understorey plants and logs (DSE, 2004).

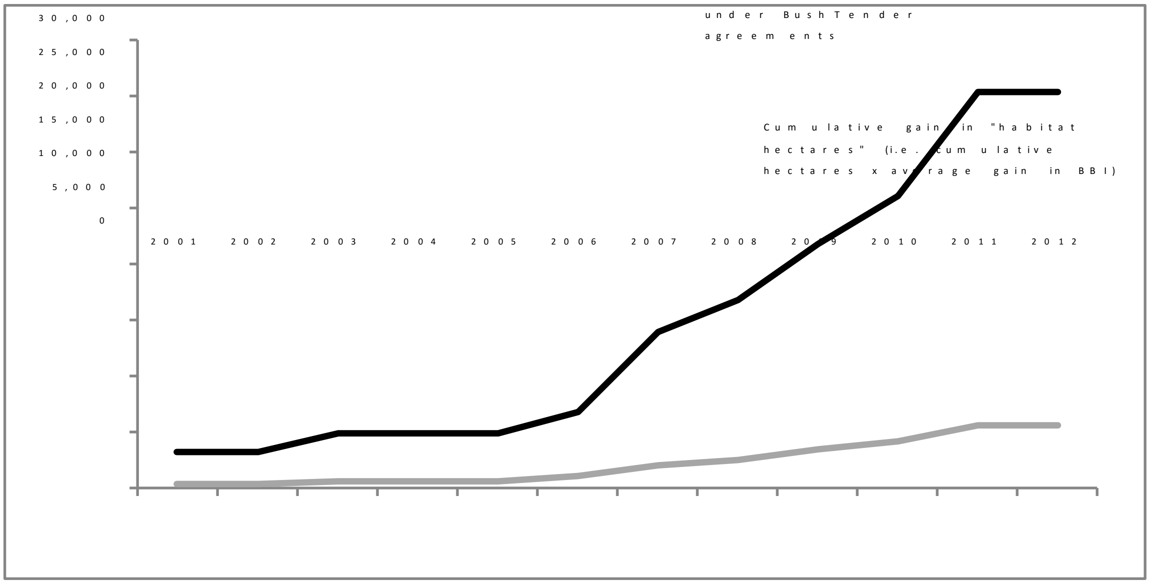

Figure 31.1: Cumulative hectares under BushTender agreements and gain in habitat hectares 2001-2012. Source: (DEPI, 2014).

Cost-effectiveness is promoted under a reverse auction approach due to the competitive nature of the bidding process and the fact that the bidders do not know what level of cost-effectiveness will be required to win funding. In theory, this should reduce the likelihood that bidders will ask for more than the minimum level they are willing to accept, for fear of missing out to a more competitive bidder. The OECD (2010) analysed a number of case studies where reverse auctions have been used to distribute environmental grants, include the Tasmanian Forest Conservation Fund in Australia, the Conestoga watershed protection scheme in the USA and the Sumberjaya watershed pilot in Indonesia. They found a strong case for reverse auctions enhancing the cost-effectiveness of grants programs, including a seven-fold increase in phosphorous reduction per dollar spent in the Conestoga example and a 52% cost-effectiveness gain in the case of the Tasmanian Forest Conservation Fund compared to allocating grants on a "first-come firstserved" basis. The Sumberjaya pilot program in Sumatra, Indonesia, is notable for the fact that it was NGO-funded (World Agroforestry Centre) and that it involved active revegetation rather than simply the protection of remnant vegetation.

A reverse auction approach is also central to one of the most prominent conservation programs aimed at agricultural landscapes – the Conservation Reserve Program (CRP) in the USA. The CRP is aimed at taking highly erodible and environmentally sensitive cropland out of production and contributes to ecological restoration through reduced soil disturbance, reduced chemical use and re-establishment of grasses and trees. A reverse auction is used to select the vast majority of participating CRP land under the general sign-up process, which weighs up competing bids using an Environmental Benefits Index (EBI).

A recent review by the US Department of Agriculture found that the use of auctions to distribute conservation payments can be more effective in terms of reducing costs and maximizing environmental benefits than other mechanisms, such as offering a single fixed price to landholders (Hellerstein et al., 2015). However, they also suggested reforms to some elements of the CRP, particularly the use of bid caps, which are designed to prevent landholders making excessive profits. Easing restrictions on how grant money may be used (e.g. for direct costs vs profits) has the potential to make a scheme more attractive to entrepreneurial landholders who can provide cost-effective restoration for a profit, but who would not apply if the scheme only covers a portion of direct costs.

The CRP provides a notable example of a grants scheme that is explicitly designed to cover the opportunity costs of taking land out of agricultural production. This reflects the fact that a key goal behind the development of the CRP was to support farmer incomes by simultaneously providing an alternative income source and reducing the US farm surpluses that were putting downward pressure on crop prices. The European Union's Common Agricultural Policy (CAP) is another example of a scheme developed to protect farmer incomes through subsidies and the "setting-aside" of farm land. Historically, the CAP has not had the same focus on environmental objectives that the CRP has had in the US, but recent reforms have made "restoring, preserving and enhancing biodiversity" a specified aim of the CAP. This includes the exploration of new market-based approaches such as a pilot program to link landholder payments directly to measurable improvements in habitat quality and biodiversity (European Commission, 2014).

A controversial aspect of auction approaches is the need to weigh up competing bids on a common scale, such as the Environmental Benefits Index (EBI) of the CRP or the Biodiversity Benefit Index (BBI) of the BushTender program. Assessing all bids on a common scale requires that diverse outcomes relating to biodiversity, soils and water must be weighed against one another, potentially disadvantaging projects with unique outcomes that cannot easily be compared to other projects. One solution to this problem under the CRP is to allow a relatively small number of sites with unique characteristics to join through a non-competitive continuous sign-up process, which is aimed at protecting land with the greatest conservation value, regardless of whether such sites would rank highest in terms of cost-effectiveness.

Other challenges around auction approaches include the risk that the predicted benefits will never be realized, the risk that offering payments will deter voluntary action that would have taken place without any payment (known as “crowding-out”) and the risk that payments will be made for projects that would have happened anyway (Hellerstein et al., 2015). This latter problem may be referred to as a failure to ensure the “additionality” of conservation projects receiving funding and can reduce the cost-effectiveness of an auction scheme. Ensuring that predicted benefits are realized can require expensive monitoring and verification processes, as well as mechanisms for rescinding payments in cases of non-compliance.

Tradable permit and offset schemes

Grants for ecological restoration, whether they involve an auction approach or not, fall under the broad category of payments for environmental (or ecosystem) services (PES). According to Wunder (2005), the criteria for PES are that the arrangement is voluntary, involves at least one ‘seller’ and one ‘buyer’, and is conditional on the delivery of a well-defined environmental service (or land use activity likely to secure that service). The examples discussed so far mostly follow the model of a single buyer (generally a government agency) paying a range of sellers for the public benefits that result from their ecosystem management. However, PES schemes can also be designed in such a way as to allow multiple buyers to compete for ecosystem services and for the benefits to be privately rather than publicly owned.

In theory, PES approaches that involve multiple buyers and multiple sellers should result in more efficient allocation of resources by enhancing competition. However, from the perspective of those planning ecological restoration activities, they also offer another key benefit - an alternative funding source that sidesteps the traditional reliance on grants from government agencies or environmental NGOs. Harnessing the capacity of businesses and wealthy individuals to pay for the services they derive from managed ecosystems offers the potential to greatly expand the pool of funding available for restoration activities.

PES schemes can operate according to either the "beneficiary pays" or the "polluter pays" principle. The most common beneficiaries involved in making payments under beneficiary pays schemes are government agencies (on behalf of the public), but some PES schemes have been successful at encouraging other beneficiaries to pay for ecosystem services as well. Costa Rica in particular has become well known internationally for its PES model, which has succeeded in directing voluntary payments from private companies (mostly hydroelectric plants) to landholders managing land for watershed protection, biodiversity conservation, carbon sequestration and landscape beauty (Porras et al., 2013). The demand in this case stems from a desire by corporations to be seen as socially responsible. A system of certificates for ecosystem services enables efficient over-the-counter transactions rather than having to rely on costly and time-consuming one-on-one negotiations between companies and landholders. While the main impetus behind Costa Rica's embrace of PES was a desire to slow deforestation rates (resulting in 860,000 ha of forest being protected between 1997 and 2012), the program has also resulted in the active reforestation of 60,000 ha and the natural regeneration of another 10,000 ha (Porras et al., 2013).

When it comes to polluter pays schemes, the most notable options with implications for ecological restoration are tradable offset schemes involving carbon and biodiversity. Carbon trading schemes generally operate by requiring emitters of greenhouse gases to hold permits covering their emissions, with additional permits or credits able to be purchased from landholders who sequester carbon through restoration activities. Biodiversity offsets involve developers being permitted to clear or degrade ecosystems provided that they restore a commensurate ecosystem elsewhere. The key pre-requisites for promoting restoration activities through a tradable offset scheme are:

1. Demand for credits to offset environmentally damaging activities, which may be created by a regulatory requirement or voluntary decisions by businesses to offset their impacts;
2. A system to verify that restoration projects are able to provide the required ecosystem services (e.g. carbon sequestration or habitat value) and award credits accordingly; and
3. A market mechanism to allow trading to take place between those providing the environmental services and those wishing to undertake damaging activities.

Australia provides an example of a country that has experimented with a variety of MBIs involving carbon and restoration over recent years, as shown in Box 31.1. Ironically, rather than following a progression from simpler to more complex schemes over time, the trend in Australia has been the opposite due to political considerations.

[!box!]

Box 31.1: The evolution (or regression) of marked-based instruments for carbon in Australia

In the lead-up to the 2007 federal election, a bipartisan political consensus emerged that Australia should employ a market-based cap-and-trade approach to reducing greenhouse gas emissions in line with its commitments under the Kyoto Protocol. This scheme, which came to be known as the Carbon Pollution Reduction Scheme (CPRS), would have placed emissions caps on large emitters but allowed trading between them, such that those with excess emission permits could sell them to those wishing to increase emissions. Alternatively, emitters could offset their emissions by purchasing offsets from reforestation projects.

The CPRS was progressed by the newly-elected Labor Government through a 2008 White Paper and 2009 negotiations with the opposition Liberal/National coalition, almost making it through parliament before the coalition switched leaders to the anti-CPRS Tony Abbott. Further progress was delayed until after the 2010 election, when a new parliamentary balance allowed Labor to negotiate a revised carbon pricing model. Unlike the CPRS, which involved placing caps on emitters but letting the price of permits "float" according to demand, the revised model placed no caps on emitters but instead required them to pay a fixed price for permits to the Government (i.e. a "carbon tax"). This price was set initially at $23 per tonne of CO_2-equivalent and was set to rise to $25.40/t$CO_2$-e within three years before transitioning to a floating price (Commonwealth of Australia, 2011). However, this transition to a floating price was never realized, as the scheme was scrapped after the Abbott-led coalition won the 2013 election on a platform of "scrapping the carbon tax".

In terms of market-based instruments, the change from the CPRS to the carbon tax represented a simplification from a multiple buyer/multiple seller model to one in which there were multiple buyers of permits but only one seller (the Government) and the price was fixed. However, despite the lack of a competitive market for emissions permits, a competitive market for offsets was created to complement the carbon tax. Under this arrangement, multiple providers of offsets were able to sell to multiple emitters wishing to reduce their carbon tax liability for whatever price the two parties agreed on (with the carbon tax acting as the effective maximum price for offsets). Reforestation and revegetation projects were able to earn offset credits under the Carbon Farming Initiative (CFI), which recognized the sequestration value of eligible activities following approved methodologies, such as permanent environmental plantings, human-induced regeneration and farm forestry.

The abolition of the carbon tax in 2014 represented a retreat from placing either emissions caps or taxes on emitters. However, it did not result in the total abandonment of market-based approaches, as the newly-created Emissions Reduction Fund (ERF) employed a reverse auction approach to distribute Government funds to providers of emission reductions or sequestration. Importantly (from a restoration perspective), the ERF incorporates the key elements of the CFI, allowing reforestation and regeneration projects to be eligible for ERF payments. Indeed, in the initial ERF auction in April 2015, sequestration projects represented around 60% of the 47 million tonnes of abatement purchased by the Australian Government (Clean Energy Regulator, 2015).

Both sides of politics in Australia have argued that their preferred model is the most efficient option for reducing greenhouse emissions at the lowest cost. Whilst the transition from cap-and-trade to carbon tax to reverse auction may not be what most advocates of market-based instruments would anticipate or recommend, a commitment to some form of market-based approach has been an enduring element of Australia's climate change policy in the period 2007-2015.

[!box ends!]

In addition to national schemes, such as the example discussed in Box 31.1, the United Nations Framework Convention on Climate Change (UNFCCC) also provides for international carbon trading under the Clean Development Mechanism (CDM) and Joint Implementation (JI) provisions of the Kyoto Protocol. The CDM offers the potential for investment money to flow from developed to developing countries for reforestation and afforestation projects. However, out of more than 1600 CDM projects created by 2010, only four were for reforestation or afforestation, with Thomas et al. (2010) arguing for CDM reforms to provide greater flexibility, simpler methodological and documentation procedures and a switch in focus from adjudicating to facilitating CDM reforestation projects.

In the case of biodiversity offsets, the demand stems from developers wishing to undertake environmentally-damaging activities that would not ordinarily be permitted under biodiversity protection legislation. While there may be a loss of biodiversity at the development site, the use of offsets is designed to ensure that there is "no net loss" overall. An example is the BioBanking scheme in place in the Australian state of New South Wales (NSW). After NSW strengthened its regulations on native vegetation clearing in 2005, the BioBanking scheme was introduced to enable developers to clear or degrade vegetation for particular projects - provided that biodiversity outcomes were enhanced elsewhere. Plant regeneration is one of the activities that can be used to generate biodiversity credits under the scheme, along with controlling grazing, retaining fallen timber, managing fire and controlling pests and weeds (Department of Environment and Climate Change, 2008). Other jurisdictions that have implemented biodiversity offset schemes include the USA, which pioneered the “no net loss” concept for wetlands in the 1970s, and Brazil, which allows landholders to use offsets to meet their requirements for retaining forested habitat (Doswald et al., 2012).

The advantages and disadvantages of tradable offsets for carbon or biodiversity depend on the perspective from which they are viewed. For businesses facing restrictions on carbon pollution or land clearing, they offer a cheaper and more flexible approach than having to comply with hard regulatory limits on their activities. The broader economy may also benefit from the lower cost of compliance and this may in turn make it politically more feasible to tighten caps in future years. An example of this is the European Union's emission trading scheme, in which the lower-than-anticipated costs of abatement in Phase I made it easier to convince member states to tighten their emission caps in subsequent phases.

From the perspective of those planning restoration projects, tradable offsets represent a potential new source of funding, but it is one that can bring with it a number of challenges. One key challenge is ensuring equivalence between the damaging activity and the restorative one. It is easier to make a case for equivalence in relation to carbon trading, as the Earth's atmosphere is an interconnected global commons and the locations at which CO_2 is added or removed is not particularly important. However, this is not the case for biodiversity outcomes, which are very much dependent on the location at which habitat restoration occurs. Furthermore, the complex and imprecise nature of biodiversity science can make it challenging for offset schemes to appropriately value biodiversity outcomes (Burgin, 2008).

Biodiversity offsetting schemes may attempt to ensure equivalence through a complex set of rules. For example, under the NSW BioBanking scheme, developers wishing to destroy habitat receive BioBanking statements that detail not only the number of credits that must be surrendered to offset the habitat destruction, but also the type of credit required (ecosystem or species credits) and the vegetation types in which those credits can be generated. Offset ratios also vary between projects, with the clearing of certain habitat types requiring the protection or restoration of an area several times larger. However, despite these measures, Gibbons and Lindenmayer (2007) suggest that biodiversity offsets are likely to be successful in achieving “no net loss” only in circumstances where clearing is restricted to relatively simple vegetation types, and where time lags between destruction and regeneration of habitat do not represent a significant risk.

While carbon offsets face lesser concerns around equivalence than biodiversity offsets, they can present difficult choices for restoration providers in terms of balancing the goal of carbon sequestration (which is valued in the carbon offset market) and other goals relating to biodiversity or other benefits (which may be desired by the project planners but have no market value). Focusing only on how carbon sequestration can be maximized may lead to monocultures of single-species, single-age plantations that comply with Kyoto rules but offer little in the way of habitat value. Furthermore, the issues of "additionality" and "crowding out", which were discussed in relation to auctions, also represent a key challenge for tradable offset schemes.

The latest frontier in the establishment of offset markets for environmental services is land degradation. Under the framework of the United Nations Convention to Combat Desertification and the Sustainable Development Goals to be introduced in 2015, targets have emerged around "zero net land degradation" or "land degradation neutrality". This has clear similarities with the "no net loss" provisions that underpin biodiversity offset schemes in countries such as the USA and Australia. While the development of a scheme for international land degradation offsets presents a potential opportunity to direct funding from activities that degrade soil fertility to those that restore them, it faces many of the challenges faced by other PES schemes involving tradable offsets. These include ensuring the reliability of trades, defining clear quantifiable units of measure, ensuring equivalence across a wide range of land types and the risk of time lags or delayed benefits (Tal, 2015).

One advantage for new schemes around land degradation or other issues is access to the considerable body of literature that has built up over the past decade providing policy advice on the implementation of PES schemes, including guides published by the Centre for International Forestry Research (Wunder, 2005, Fripp, 2014) and the Department for Environment, Food and Rural Affairs in the UK (DEFRA, 2013).

Combining restoration and commercial production

The final group of MBIs to be explored in this chapter do not involve the creation of new markets in environmental services but rather focus on existing markets and seek to promote production systems that jointly deliver commercial products and environmental services. A number of different terms may be used to describe this basic concept in different contexts, including multifunctionality (OECD, 2001) and conservation through sustainable use (Baumber et al., 2012).

One mechanism for giving preference to products that provide associated environmental benefits is certification against an industry sustainability standard. Figure 31.2 shows the logos of three prominent sustainability certification schemes operating in different industry sectors. These are the Forest Stewardship Council (FSC), which is prominent in the forestry sector, the Rainforest Alliance, which utilizes the standards of the Sustainable Agriculture Network (SAN), and the Roundtable on Sustainable Biomaterials (RSB), which has developed a set of standards for use in the biofuel sector.

Figure 31.2: Trademarks that may be displayed on products certified by the Rainforest Alliance, FSC and RSB. Reproduced by kind permission of the Rainforest Alliance, Forest Stewardship Council and the Roundtable on Sustainable Biomaterials.

The three standards used as examples here differ somewhat in the emphasis they place on different issues. The FSC standards have a strong focus on preventing over-harvesting of forests and forest clearing for plantation establishment. The RSB standards include provisions on life-cycle greenhouse gas emissions and food security, both of which have been prominent issues in the biofuel sector. The SAN standards have the strongest focus on social factors such as workers' rights, reflecting the position of the Rainforest Alliance as a key advocate for "fair trade".

Just as the FSC, RSB and SAN standards differ in their approach to environmental and social protections, they also differ in the degree to which they promote ecological restoration activities. For the most part, all three standards follow a benchmark of "maintain or enhance" when it comes to environmental values, but there some notable provisions that require land managers to undertake active restoration. This is particularly the case for the SAN standards, which require plantations or farms to:

- "establish and maintain vegetation barriers between the crop and areas of human activity" (SAN 2010 p. 20)
- "dedicate at least 30% of the farm area for conservation or recovery of the area's typical ecosystems" (SAN 2010 p. 20) and
- "use and expand its use of vegetative ground cover to reduce erosion and improve soil fertility" (SAN 2010 p. 42)

The above provisions represent an attempt to harness consumer demand for fairly-traded and environmentally-friendly agricultural products to promote ecological restoration outcomes. However, they are largely based on the notion that restoration areas are separate to production areas. In contrast, examples can also be found of production systems in which production and conservation outcomes are more closely integrated, such as:

- The cork oak forests of the western Mediterranean, which have been shaped by human management over a variety of spatial and temporal scales to create diverse mosaic habitats that support endangered species such as the Iberian lynx, the Iberian imperial eagle and the Barbary deer (WWF, 2006, Urbieta and Marañón, 2008).
- The damar agroforests of Sumatra, which are planted ecosystems based around the damar tree *(Shorea javanica*), and provide not only resin for the production of incense, varnish, paint and cosmetics, but also offer a range of environmental services and act as a buffer for the World Heritage-listed Bukit Barisan Selatan National Park (Kusters et al., 2008).
- Short-rotation cropping of poplar and willow in Europe for bioenergy, which has been shown to increase soil organic matter, improve water quality and enhance biodiversity Simpson et al. (2009), as well as filtering wastewater (Schroeder, 2012) and removing metals such as cadmium and zinc from contaminated soils (Laureysens et al., 2005).
- Mallee eucalypts that have been being trialled as short-rotation crops in Western Australia to produce bioenergy, eucalyptus oil and other products, while helping to mitigate dryland salinity (Stucley et al., 2012).

In cases where commercial production and the provision of environmental services are strongly connected, market-based initiatives that promote the commercial product may also help to promote the associated environmental services. The two bioenergy-based examples above are of particular interest due to the global proliferation of market-based incentives for the production of liquid biofuels and other forms of bioenergy. Table 31.1 lists a number of different policy instruments that have been used to promote bioenergy, along with examples of where they have been used and ways in which they could be modified to incorporate a preference for feedstock production systems that offer associated environmental benefits.

Table 31.1: Bioenergy support measures with the potential to promote environmental services

Policy option	**Example**	**Potential modifications to promote environmental services**
Tax breaks for biofuel producers	Brazil's biodiesel support scheme, which offers larger tax breaks for "social fuel" that comes from small family farmers.	While Brazil's scheme seeks to deliver a social benefit, a similar model could be used to preference production systems with restoration outcomes
Mandates requiring the use or supply of biofuels	EU Renewable Energy Directive, which provides greater support to fuels from non-food cellulosic crops through a system of "double-	A similar model of multiple-counting could be used to preference production systems with restoration outcomes

	counting”	
Mandates requiring the supply of renewable electricity (including bioenergy)	UK Renewables Obligation, which includes “banding” that provides higher levels of support for certain options (e.g. energy crops)	Similar to multiple-counting under biofuel mandates, the level of support for biomass crops for electricity could be based on the environmental services provided
Feed-in tariffs requiring electricity companies to pay a fixed price for bioelectricity	German feed-in tariffs, which have incorporated a bonus for biomass from land managed for landscape preservation	Higher feed-in tariffs could be applied to biomass crops with restoration outcomes

The kinds of land use options discussed above require compromises between environmental and economic objectives and raise the question of whether they should be characterised as “ecological restoration”. To some, ecological restoration should be aimed at restoring “naturalness” and be designed to "compensate for human influence on an ecological system in order to return the system to its historic condition" (Jordan, 1994 p. 32). To others, the very idea of naturalness is subjective and problematic. Lindenmayer et al. (2008 p. 82) argue that human perspectives will inevitably differ on what constitutes appropriate vegetation structure and condition and that, in landscapes long influenced by humans, “naturalness may not even be an appropriate characteristic to consider”. Similarly, Australia’s 2006 State of the Environment Report emphasizes that successful restoration may require that “absolute concepts of naturalness be abandoned in favour of management for specific objectives” (Beeton et al., 2006 p. 44).

Establishing plantations for a combination of commercial production and ecosystem enhancement may not fit within everyone's vision of ecological restoration. However, it is important to recognize that all forms of restoration require the prioritization of certain ecosystem attributes over others, either explicitly or implicitly. Restoration goals may revolve around the enhancement of one particular ecosystem attribute or function, such as erosion control, salinity mitigation or habitat provision, or they may involve the enhancement of multiple ecosystem attributes simultaneously. Any policy measures that are aimed at delivering on-ground environmental outcomes as a co-product of a commercial production system need to give careful consideration to which ecosystem functions should be prioritized over others and how to ensure these outcomes are not compromised by commercial pressures to maximize production.

Conclusion

As the range of schemes offering payments for ecosystem services and other market-based instruments continues to expand, more and more ecological restoration activities are likely to be established or modified in accordance with the incentives offered by these schemes. This presents an opportunity to increase the cost-effectiveness of restoration spending and to increase the funding available for restoration projects, but it also brings with it risks that certain projects will be compromised, simplified, under-valued or traded off against environmental destruction elsewhere. These opportunities and risks are likely to multiply as schemes progress in complexity from simple grants to single-buyer markets to markets involving multiple buyers and sellers, such as tradable offset markets around carbon, biodiversity or land degradation.

Markets for restoration services may be able to internalize some of the environmental externalities that currently go unvalued in traditional markets, but it is unlikely they will ever be able to value all of the outcomes that restoration can offer, at least not to the satisfaction of all stakeholders. Controversy around MBIs is largely unavoidable and stems from an inherent conflict between the diverse and often unique outcomes that restoration projects provide and the market requirement that outcomes be substitutable. Unlike commodities like wheat or oil, the outcomes of ecological restoration projects are context-specific and cannot be loaded onto ships and traded across the globe. Every restoration project produces a unique combination of outcomes for biodiversity, soils, water and climate that operate across a variety of scales and will be valued differently by different stakeholders.

A key challenge that will always remain for MBIs is striking a balance between having sufficient substitutability to keep a market functioning while recognizing the inherent differences between restoration projects in different contexts. However, debating how this balance should be struck and how MBIs could be improved need not stand in the way of providers of restoration services capitalizing on the opportunities that MBIs can provide. In many cases, it may not matter much to those undertaking restoration projects whether the scheme that has been set up is the most efficient one possible or whether the outcomes at one site are perfectly substitutable for those at another. Instead, what is likely to matter more is whether the scheme has created additional incentives for restoration and made additional sources of funding available. As shown in this chapter, many MBIs around the world have shown the capacity to do this – even if further work could be done to better align the incentives they provide, reduce barriers to participation and reduce the risk of perverse outcomes.

References

Baumber, A., Merson, J., Diesendorf, M. & Ampt, P. (2012) 'Revegetation, bioenergy and sustainable use in the New South Wales central west', *In:* Merson, J., Cooney, R. & Brown, P. (eds.) *Conservation in a crowded world: case studies from the Asia-Pacific*, NewSouth Publishing, Sydney

Beeton, R. B., Buckley, K. I., Jones, G. J., Morgan, D., Reichelt, R. E. & Trewin, D. (2006) *Australia: State of the Environment 2006*, Department of the Environment and Heritage, Canberra

Burgin, S. (2008) 'BioBanking: an environmental scientist's view of the role of biodiversity banking offsets in conservation', *Biodiversity & Conservation*, 17, 807-816.

Butler, R. (2011) *Could palm oil help save the Amazon?* [Online], Available: http://news.mongabay.com/2011/0614-amazon_palm_oil.html [Accessed 14 April 2015, Last Updated 14 June 2011]

Clean Energy Regulator (2015) *Auction Results: April 2015* [Online]: Clean Energy Regulator, Available: http://www.cleanenergyregulator.gov.au/ERF/Published-information/auction-results/auction-results-april-2015 [Accessed 22 June 2015, Last Updated 25 May 2015]

Commonwealth of Australia (2011) *Securing a Clean Energy Future: The Australian Government's Climate Change Plan*, Department of Climate Change and Energy Efficiency, Canberra

Crossman, N. D. & Bryan, B. A. (2009) 'Identifying cost-effective hotspots for restoring natural capital and enhancing landscape multifunctionality', *Ecological Economics*, 68, 654-668.

DEFRA (2013) *Payments for Ecosystem Services: A Best Practice Guide*, Department for Environment, Food and Rural Affairs, London

Department of Environment and Climate Change (2008) *BioBanking Assessment methodology* Department of Environment and Climate Change, NSW Government, Sydney

DEPI (2014) *BushTender* [Online]: Department of Environment and Primary Industries, State of Victoria, Available: http://www.depi.vic.gov.au/environment-and-wildlife/environmental-action/innovative-market-approaches/bushtender [Accessed 21 April 2015, Last Updated 2 December 2014]

DSE (2004) *Native Vegetation: Sustaining a living landscape, Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectares scoring method Version 1.3*, State of Victoria, Department of Sustainability and Environment, East Melbourne

European Commission (2014) *Call for Proposals: Pilot on-farm projects to test result-based remuneration schemes for the enhancement of biodiversity*, European Commission, Brussels

Fripp, E. (2014) *Payments for Ecosystem Services (PES): A practical guide to assessing the feasibility of PES projects.*, CIFOR, Bogor, Indonesia

Gibbons, P. & Lindenmayer, D. B. (2007) 'Offsets for land clearing: No net loss or the tail wagging the dog?', *Ecological Management & Restoration*, 8, 26-31.

Hellerstein, D., Higgins, N. & Roberts, M. (2015) *Options for Improving Conservation Programs: Insights From Auction Theory and Economic Experiments*, Economic Research Service, United States Department of Agriculture, Jordan, W. R. I. (1994) 'Sunflower Forest', *In:* Baldwin, A. D. J., De Luce, J. & Pletsch, C. (eds.) *Beyond Preservation: Restoring and Inventing Landscapes*, University of Minnesota Press, Minneapolis, USA

Kusters, K., Ruiz Perez, M., De Foresta, H., Dietz, T., Ros-Tonen, M. A. F., Belcher, B., Manalu, P., Nawir, A. A. & Wollenberg, E. (2008) 'Will agroforests vanish? The case of damar agroforests in Indonesia', *Human Ecology* 36, 357-370.

Laureysens, I., De Temmerman, L., Hastir, T., Van Gysel, M. & Ceulemans, R. (2005) 'Clonal variation in heavy metal accumulation and biomass production in a poplar coppice culture. II. Vertical distribution and phytoextraction potential', *Environmental Pollution*, 133, 541-551.

Lindenmayer, D., Hobbs, R. J., Montague-Drake, R., Alexandra, J., Bennett, A., Burgman, M., Cale, P., Calhoun, A., Cramer, V., Cullen, P., Driscoll, D., Fahrig, L., Fischer, J., Franklin, J., Haila, Y., Hunter, M., Gibbons, P., Lake, S., Luck, G., MacGregor, C., McIntyre, S., Nally, R. M., Manning, A., Miller, J., Mooney, H., Noss, R., Possingham, H., Saunders, D., Schmiegelow, F., Scott, M., Simberloff, D., Sisk, T., Tabor, G., Walker, B., Wiens, J., Woinarski, J. & Zavaleta, E. (2008) 'A checklist for ecological management of landscapes for conservation', *Ecology Letters*, 11, 78-91.

OECD (2001) *Multifunctionality: Towards an Analytical Framework*, Organisation for Economic Cooperation and Development, Paris

OECD (2007) *Business and the Environment Policy Incentives and Corporate Responses*, Organisation for Economic Co-operation and Development, Paris

OECD (2010) *Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services*, Organisation for Economic Co-operation and Development, Paris

Pannell, D. J. (2008) 'Public Benefits, Private Benefits, and Policy Mechanism Choice for Land-Use Change for Environmental Benefits', *Land Economics*, 84, 225-240.

Porras, I., Barton, D. N., ., Miranda, M. & Chacón-Cascante, A. (2013) *Learning from 20 years of Payments for Ecosystem Services in Costa Rica*, International Institute for Environment and Development, London

Schroeder, W. 2012. Capacity of poplar and willow clones to withstand high levels of wastewater application. *24th Session of the International Poplar Commission*. Dehradun, India.

Stucley, C., Schuck, S., Sims, R., Bland, J., Marino, B., Borowitzka, M., Abadi, A., Bartle, J., Giles, R. & Thomas, Q. (2012) *Bioenergy in Australia: Status and Opportunities*, Bioenergy Australia,

Tal, A. (2015) 'The implications of environmental trading mechanisms on a future Zero Net Land Degradation protocol', *Journal of Arid Environments*, 112, Part A, 25-32.

Thomas, S., Dargusch, P., Harrison, S. & Herbohn, J. (2010) 'Why are there so few afforestation and reforestation Clean Development Mechanism projects?', *Land Use Policy*, 27, 880-887.

Urbieta, I. R. & Marañón, M. A. Z. T. (2008) 'Human and non-human determinants of forest composition in southern Spain: evidence of shifts towards cork oak dominance as a result of management over the past century', *Journal of Biogeography*, 35, 1688-1700.

Wunder, S. (2005) *Payments for environmental services: Some nuts and bolts*, Center for International Forestry Research (CIFOR), Bogor, Indonesia

WWF (2006) *Cork screwed? Environmental and economic impacts of the cork stoppers market.*, WWF/MEDPO, Rome, Italy