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Designing Market-Based Instruments for Biodiversity Conservation: Learning with the Australian experience and evaluating Portugal's potential

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This thesis is the final step of a six year walk, and my main goal was to use all the knowledge and technical skills learned during these year and try to achieve an outcome that make me proud and fulfilled. This wasn't an everyday work, it demanded innovation, lots of research, but most of all passion and enthusiasm.

With this set in mind i planned the following year in order to accomplish that task. The planning included a trip to Australia, which was amazing, but it was also an enormous spring of knowledge, an honestly changed my view of world. The rest of the time was mainly me and the laptop, my great companion, from who i need vacations urgently.

This is not entirely my merit, several people played an extremely important role in this entire process. My basis of engineer forces me to do this chronologically by order of appearance:

First of all family, my parents at the top, Clara e José, for their sponsorship that allowed me to study at this level, but most of all by their endless support and understanding. Sorry mom to do this in English, i promise you the Portuguese version will be publish in 2010.

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Abstract

Biodiversity has been increasingly recognized as one of the key elements in human development and well-being. The loss of biodiversity is considered alarming not only because of its ethical and esthetical value, but also, because it comprises a variety of services essential for the health, regulation and prosperity of the biosphere. Given their significance, one might expect that the ecosystem services would be prized by markets and explicitly protected by the law, however, neither has been the case. International experience has shown that market-based instruments (MBIs), which basically provide economic incentives to modify behaviour, may be a more effective way to achieve many environmental goals, often yielding better results by harnessing the powerful cost-benefit motivations of businesses and individuals.

This study intends to demonstrate the potential of market-based instruments in biodiversity conservation, particularly in protected areas. However biodiversity is not restricted to the network of national parks and other protected areas on state-owned land, it also needs to be protected and managed on privately-owned land. The goal of this work is to design a MBI, to be implemented in Portugal, in order to incentive private landowners in protected areas to achieve economic and social development without depleting the natural capital available.

The design of the instrument started with the assessment of MBIs already running, with a special focus in the Australian experience. A methodology is proposed for that assessment in order to standardize the approach and analysis of this type of instrument. To overcome uncertainties and to get more information on the likely costs and benefits it is considered preferable to use an already trialled mechanism as basic framework. The instrument is designed using the basics of the Liverpool Plains Scheme (Australia), but some changes are introduced to improve it and make it more suitable to Portuguese reality. A potential target area in Portugal is selected according to several criteria, as a case study to illustrate the instrument application. It is proposed an implementation program and schedule.

MBIs offer an opportunity to integrate biodiversity conservation into the economic market, however without a strong economic foundation, designing market mechanisms can result in costly mistakes. The success of this instrument will mainly depend on the ability to motivate the landowners to participate, in order to create competition between them, which will result in better outcomes at a lower cost. On the other hand, the ability to involve companies in the scheme, basically increasing the demand, will be decisive to its economic sustainability and growth. These are the keys features that will decide the success or failure of its implementation.

Keywords: Biodiversity, Ecosystem Services, Biodiversity Conservation, Market-based Instruments.

Resumo

A biodiversidade tem sido reconhecida cada vez mais como um dos elementos-chave no desenvolvimento e bem-estar humano. A actual tendência de perda de biodiversidade é considerada alarmante, não só devido ao seu valor ético e estético, mas também, porque inclui uma série de serviços essenciais para a saúde, a regulação e prosperidade da biosfera. Dada a sua importância, seria de esperar que os serviços dos ecossistemas fossem valorizados pelos mercados e expressamente protegidos pela lei, contudo, não é esse o caso. A experiência internacional tem demonstrado que os instrumentos baseados em mercado (MBI), que, basicamente, oferecem incentivos económicos para modificar comportamentos, podem ser uma maneira mais eficaz para alcançar muitos dos objectivos ambientais, muitas vezes gerando melhores resultados, aproveitando as poderosas motivações custo-benefício de empresas e indivíduos. Este estudo pretende demonstrar o potencial dos MBI para a conservação da biodiversidade, especialmente em áreas protegidas. A biodiversidade não é restrita à rede de parques nacionais e outras áreas protegidas em terrenos pertencentes ao Estado, a biodiversidade também precisa ser protegida e gerida em propriedade privada. O objectivo deste trabalho é criar um MBI, que tenha potencial de implementação em Portugal, e que permita que os proprietários privados em áreas protegidas possam alcançar o desenvolvimento económico e social, sem esgotar o capital natural disponível. O processo para desenvolver o instrumento começou com a avaliação de MBIs já em executados ou em execução, para esse efeito é proposta uma metodologia para padronizar a abordagem e análise deste tipo de instrumento. Para superar as incertezas e para obter mais informações sobre os custos e benefícios é preferível utilizar como base um instrumento já testado. O instrumento é projectado usando os princípios do Liverpool Plains Scheme (Australia), mas são introduzidas algumas alterações para melhorá-lo e torná-lo mais adequado à realidade Portuguesa. Uma potencial área alvo de implementação em Portugal é seleccionada de acordo com vários critérios, e é proposto um cronograma e programa de execução. Os MBI oferecem uma oportunidade para integrar a conservação da biodiversidade nos mercados económicos, porém sem uma forte base económica, a sua concepção pode resultar em erros dispendiosos. O sucesso deste instrumento dependerá, sobretudo, da capacidade para motivar os proprietários a participar, de forma a gerar concorrência, o que cria condições para obter melhores resultados a um custo mais baixo. Por outro lado, a capacidade de envolver as empresas, basicamente, gerando um aumento da procura, será determinante para a sua sustentabilidade económica e para o seu alargamento. Estas são as características chave no sucesso ou fracasso da sua implementação.

Palavras Chave: Biodiversidade, Serviços de ecossistemas, Conservação da biodiversidade, Intrumentos baseados em mercado (MBI).

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CHAPTER 1 – Introduction

1.1. The Area of Research;

Biodiversity has been increasingly recognized as one of the key elements in human development and well-being, playing a crucial role on the global environmental equilibrium. The loss of biodiversity is considered alarming not only because of its ethical and esthetical value, but also, because it comprises a variety of services essential for the health and prosperity of the biosphere and for the maintenance of regulation services provided by natural systems, of which many species are indispensable elements. Human actions are fundamentally, and to a significant extent irreversibly, changing the diversity of life on Earth. Most ecosystems and the biodiversity within them have become exposed to multiple pressures, such as habitat destruction, pollution, overexploitation and climate change (EEA, 2007).

The need for protecting and safeguarding biological diversity on this planet as the size and impact of human population expands is increasingly well understood. Significant efforts are underway all over the world to save endangered species, protect ecosystem services, and conserve vulnerable genetic diversity. However maintaining biodiversity requires more than just protecting wildlife and their habitats in nature conservation reserves, it is also about the sustainable use and management of all natural resources and safeguarding the life-support systems on earth. Although many losses of biodiversity, including the degradation of ecosystems, are slow or gradual, they can lead to sudden and dramatic declines in the capacity of biodiversity to contribute to human wellbeing.

Our quality of life depends not only on a strong economy, but also on a healthy natural environment. Biodiversity is a major contributor to the economy through the provision of many ecosystem goods and services. Many of the goods and services provided by biodiversity and ecosystems are crucial, but not always quantifiable in monetary terms. Biodiversity loss continues because current policies and economic systems do not incorporate the values of biodiversity effectively in either the political or the market systems and many current policies are not fully implemented. These failures include, for example, perverse production subsidies, undervaluation of biological resources, failure to internalize environmental costs into prices and failure to appreciate global values at the local level (UNEP, 2007). The danger is that if these unpriced values are not included in the decision-making process, the final decision may favour outcomes which do have a commercial value. Hence decision makers may not have full awareness of the consequences for biodiversity conservation.

Society needs mechanisms for determining the appropriate trade-off between biodiversity protection and the human activities that create value for people but result in biodiversity loss. Economics offers some techniques to help in this decision-making process. Valuing biodiversity using economic techniques and incorporating those values into the decision-making process can be a powerful way to demonstrate the importance of biodiversity protection to the broader public.

The traditional and most direct approach to environmental management is to impose restrictions, guidelines, penalties, and fees. This command-and-control method can be difficult and expensive to implement, monitor, and enforce, especially in countries with weak institutional capacity. There are now a wide range of experiences with instruments for the conservation and sustainable use of biodiversity. As a result, policy-makers and their advisors have a broad appreciation of the flexibility and effectiveness of various instruments, both market and non-market. Of particular interest, more recently, have been examples of successful market creation that have moved biodiversity firmly into the context of economic growth and development. Entrepreneurial activity has been harnessed in a number of cases to make market outcomes consistent with social objectives.

A market based strategy goes beyond the traditional approach of governments to use regulation, education and suasion to achieve environmental outcomes. A market based instrument (MBI) uses markets to change behaviour of consumers and businesses to the benefit of the environment. An MBI can include a wide array of tools such as fees, rebates and subsidies, through to green offsets and the creation of new markets.

Generally, MBIs offer an opportunity to integrate biodiversity conservation into the economic market. This has several advantages compared to the command and control instruments used in conservation. In particular, when properly designed and used in appropriate circumstances, they can achieve results beyond those of legal regulations, or at least achieve the same results at lower costs. Furthermore, there are cases where command and control approaches do not work well for a variety of reasons (e.g. implementation and enforcement issues) but MBIs could.

The strength of MBIs is that they rely on local knowledge to establish a price for environmental services. In essence, MBIs reveal information about an individual landowner's minimum price for undertaking a certain action. This contrasts, for example, with a subsidy-based approach whereby a government risks setting a price judged too high by landowners with a subsequent lack of participation, or setting a price to low thereby engendering overpayment.

1.2. Personal Motivation

Biodiversity is a central element in everyone's life, not only from a dependency point a view but also as source of cultural and recreational richness. Despite such an important role, biodiversity is not being managed in a sustainable way, putting in danger the future of the world's biological diversity. This means the next generations probably won't be able to see and experience the same richness of wildlife and landscapes we have now days.

To avoid this scenario new approaches and tools for biodiversity conservation are needed. This is one of the biggest challenges of this century, and what drives me to develop this work. The main motivation is to give a relevant contribution for this research area, through the development of a tool that can effectively help the protection of biodiversity by engaging all stakeholders in that effort.

The following quotations are the two main ideas that inspired this work.

"While climate change takes up much of the media attention, in one fundamental way biodiversity loss is an even more serious threat. This is because the degradation of ecosystems often reaches a point of no return — and because extinction is forever."

Stavros Dimas, EU Commissioner for Environment, Green Week 2006

"Biodiversity is not restricted to the network of national parks and other protected areas on state-owned land. Biodiversity also needs to be protected and managed on privately-owned land. This can be achieved by developing a suite of market-based instruments such as financial incentives to promote biodiversity protection. These include funding landholders to protect biodiversity, taxing destructive practices and introducing trading and banking schemes for property's supporting biodiversity conservation. The advantage of such instruments is that they allow biodiversity to be protected at minimum cost."

(Bennett, 2003)

1.3. Purpose and Objectives

This work intends to demonstrate the potential of market-based instruments in biodiversity conservation, particularly in protected areas. With this concept in mind, the goal of this work is to design a market-based instrument, to be implemented in Portugal, for managing biodiversity on private land, able to preserve the ecological values without prejudice to the economic development and social stability of the landowners. This tool intends to conciliate the conservation needs of the protected area, established by the managing authority, with the landowner's activities and their management of the existing biodiversity values in their lands.

The current management of Portuguese Protected Areas often results in conflicts with the landowners, mainly due to measures that restrict land use and some activities, but also due to scarce communication. The current solutions (ex. regulatory policies) are not been able to answer this challenge, so new approaches are required to balance the conservation measures and priorities with the economic activities developed in those areas. This balance is essential to maintain local and regional development, especially inland, but also to guarantee prosperity and well-being for rural populations, in order to avoid the current trend of human desertification in those areas.

The goal of this study will be accomplished through the:

- Creation of a methodology to standardize the approach and analysis of market-based instruments;
- Review of MBIs already running, or finished;
- Design of an MBI;
- Plan an implementation program and schedule.

It is intended that this work can answer to the following questions:

- What role can MBIs have in biodiversity conservation?
- How can MBIs boost the participation of private landholders in environmental management?
- Which type of MBI has more potential to be implemented in Portugal, and where?
- Which procedures and resources are needed to set up an MBI?

1.4. Display of the thesis

On Chapter 2 is explained the theoretical background needed to understand the role of biodiversity in human wellbeing, and the current trend of biodiversity loss. The dependency of human societies from natural resources is vast, the study of the ecosystem services is currently the most common approach to demonstrate it. Human development resulted on a trend of biodiversity loss that requires conservation agreements and measures to be stopped. These responses, at global and European level, are described in this chapter.

One of the most common responses around the world is the creation of Protected Areas, this solution is explored in this chapter as well as their effectiveness and problems. These areas, in several countries, comprise public and private properties, which tend to difficult their management due to lack of cooperation or involvement of the landowner's.

This relationship between the economic development and biodiversity health isn't sustainable, due to several factors, but in this chapter is given special attention to the fact that markets fail in internalize all costs of biodiversity. To handle those problems are explored some principles of the economics of biodiversity, such as the total economic value (TEV).

To answer the challenges of biodiversity conservation and management new policies and instruments can be used. The different options are described in this chapter, but it will focus on market-based instruments and their potential to offer more efficient solutions.

To understand how this type of instruments works it is important to study and assess examples of its application on the field. One of the countries with a large experience on the implementation of MBIs is Australia. Before the assessment of MBIs already running, it is proposed a methodology to standardize the approach and analysis of this type of instrument (Chapter 3).

From the several Australian examples three case studies were selected and explained on Chapter 4. This country has already trialed several types of these instruments, in order to tackle some of their environmental problems, such as biodiversity loss. The case studies illustrate three of the different approaches that this type of instruments allows, to improve biodiversity management in private land. The principles, methodologies and results of each instrument are examined and compared between them.

Following this analysis, Chapter 5 goes over the main points discussed and summarizes the lessons learned from the Australian experience with market-based instruments.

Chapter 6 focuses on Portugal and in the biodiversity values and challenges it faces. It starts with an overview of the natural resources of Portugal, followed by a quick glance at the protected areas in Portugal, and their importance in the national strategy for biodiversity conservation. In this chapter it's also analyzed the use of economic instruments, especially market-based instrument for biodiversity conservation.

On Chapter 7 is proposed an instrument that aims to enhance biodiversity conservation on private land, using as starting point one of the Australian case studies previously analyzed, being then modified and shaped according to the Portuguese characteristics and needs, but also to review and correct some of the flaws identified on chapter 4. Doing so, the effectiveness of that instrument can be improved, what will increase the success of its execution in Portugal. The selection of the case study is justified through several criteria, and then are described the necessary changes to improve its performance.

After designing the instrument, the next step is to select a potential area for its implementation. The criteria to choose that area are explained on Chapter 8. The chosen area is then characterized, by screening the most relevant economic, social and environmental features. This knowledge about the area in study is essential to plan and schedule the execution of the instrument, defining the timeframe and the resources needed for each step.

The conclusions and future developments are explained on Chapter 9.

CHAPTER 2 – Theoretical background and Literature Review

2.1. Biodiversity

2.1.1. What is biodiversity?

No feature of Earth is more complex, dynamic, and varied than the layer of living organisms that occupy its surfaces and its seas, and no feature is experiencing more dramatic change at the hands of humans than this extraordinary, singularly unique feature of Earth. This layer of living organisms - the biosphere - through the collective metabolic activities of its innumerable plants, animals, and microbes physically and chemically unites the atmosphere, geosphere, and hydrosphere into one environmental system within which millions of species, including humans, have thrived (Millennium Ecosystem Assessment, 2005). Breathable air, potable water, fertile soils, productive lands, bountiful seas, the equitable climate of Earth's recent history, and other ecosystem services are manifestations of the workings of life. It follows that large-scale human influences over this biota have tremendous impacts on human well-being.

The most widely used definition for biodiversity is the one used by the Convention on Biological Diversity (CBD)[1], which defines it as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (Millennium Ecosystem Assessment, 2005).

Table 2.1 – Definitions by CDB

Genetic material	any material of plant, animal, microbial or other origin containing functional units of heredity.
Species	groups of individuals who mate or have the potential to interbreed, and that are reproductively isolated from other groups similar.
Ecosystem	a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit.

Source: (CBD, 2004)

Important attributes of diversity include:

- Abundance - how much there is of any one type. For many provisioning services (such as food, fresh water, fibers), abundance matters more than the presence of a range of genetic varieties, species, or ecosystem types.

[1] United Nations Convention on Biological Diversity (CBD), Article 2.

- Variation - the number of different types over space and time. For understanding population persistence, the number of different varieties or races in a species or variation in genetic composition among individuals in a population provide more insight than species richness.
- Distribution - where quantity or variation in biodiversity occurs. For many purposes, distribution and quantity are closely related and are therefore generally treated together under the heading of quantity. However, quantity may not always be sufficient for services: the location, and in particular its availability to the people that need it, will frequently be more critical than the absolute volume or biomass of a component of biodiversity.

Estimates of the total number of species on Earth range from 5 million to 30 million. Irrespective of actual global species richness, however, it is clear that the 1.7–2 million species that have been formally identified represent only a small portion of total species richness (UNEP, 2007).

A promising approach to identify areas featuring exceptional concentrations of endemic species and experiencing exceptional loss of habitat is the "hotspots" approach. First promoted in the mid-1980s by British ecologist Norman Myers, focuses on "biodiversity hotspots"—regions with exceptionally high concentrations of endemic species (those found nowhere else) and high habitat loss (see Myers *et al*, 2000). An updated analysis released in February 2005 identified 34 hotspots worldwide. These 34 regions contain 75% of all threatened mammals, birds, and amphibians within only 2.3% of the Earth's surface.

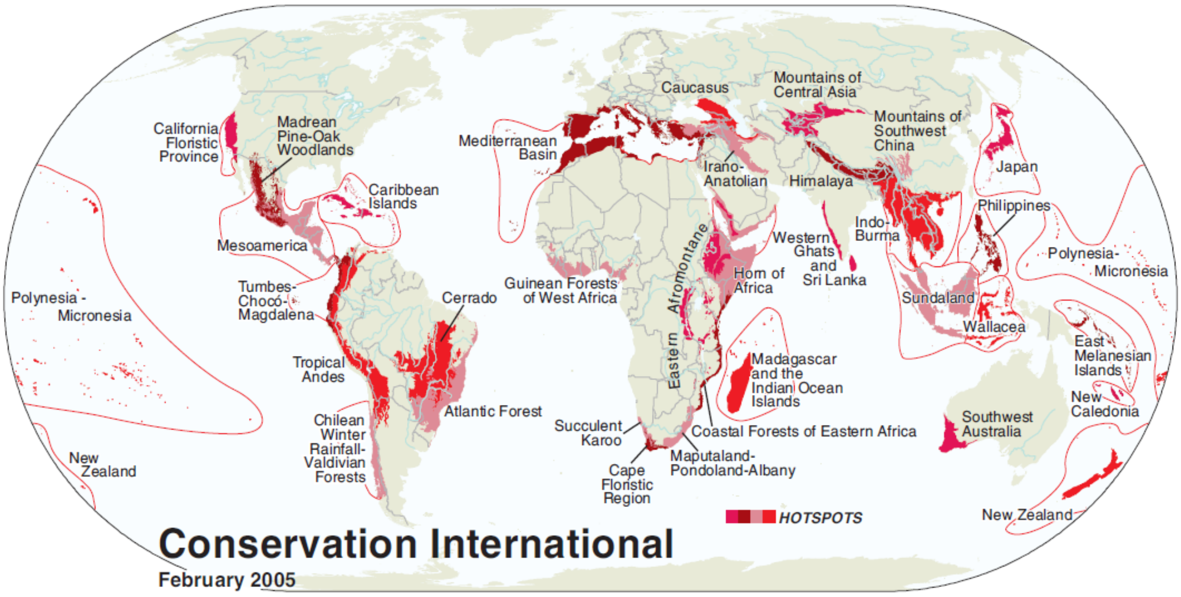

Figure 2.1 - Hotspots distribution around the world. *Source: Conservation International, 2009.*

These realms of biodiversity are currently under a growing pressure due to several factors, but especially the growth of population and consumption patterns. More than a billion people live in the biodiversity "hotspots" identified by Conservation International; and in most of these hotspots, population growth is higher than the world average (Jenkins, 2004). However the hotspots approach has been criticized because it excludes areas with lower species richness that nevertheless provide important ecological services (e.g., water capture or carbon sequestration) or scenic beauty (see Hoekstra *et al* 2005).

A distinctive aspect of biodiversity is the "public good" nature of many of the goods and services it provides. From an economic point of view it is clear that biodiversity is a public good, so that biodiversity conservation needs to wrestle with some of the most complex problems in resource-allocation theory. In general, it's expected that markets will tend to under conserve biodiversity, though there are interesting examples of markets effectively integrating conservation and development via ecotourism. Habitats and ecosystems are frequently managed in the context of common property institutions and practices. The poor management of an open access resource due to the absence of hierarchically superior institutions is called the "tragedy of the commons" (Hardin, 1968). Consumption of the common resource by one agent restricts use by others. If these negative externalities are not taken into account, the resource is overused and the allocation is inefficient. These characteristics will be better discussed further ahead.

All available evidence points to a sixth major extinction event currently underway. Unlike the previous five events, which were due to natural disasters and planetary change the current loss of biodiversity is mainly due to human activities (UNEP, 2007). The current rapid rates of habitat and landscape changes and modifications, increased rates of species extinction, and the reduction in genetic variability due to population declines, are having impacts on natural processes and on the needs of people.

The world has already lost much of its biodiversity. Recent pressure on commodity and food prices shows the consequences of this loss to society. Urgent remedial action is essential because species loss and ecosystem degradation are inextricably linked to human well-being.

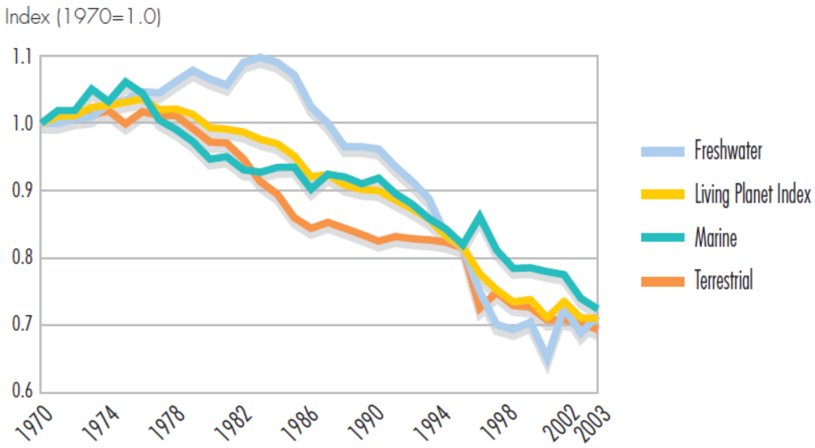

Figure 2.2 - Living Planet Index. *Source: UNEP, 2007.*

Economic growth and the conversion of natural ecosystems to agricultural production will continue, and it is not reasonable to put a brake on the legitimate aspirations of countries and individuals for economic development. However, it is essential to ensure that such development takes proper account of the real value of natural ecosystems. This is central to both economic and environmental management.

2.1.2. Why is biodiversity important?

The ecological diversity of species and ecosystems across biomes and ecoregions reflects the remarkable outcomes of biodiversity's evolutionary history and sets the stage for its future (Wilson, 1991).

Looking at the biologists' discussion of biodiversity, it seems there are several quite distinct issues that are of concern. One is that natural ecosystems are complex and highly interdependent, so that small changes can lead to far-reaching and unexpected repercussions. This will affect species and ecosystems the but also the human wellbeing. One example is the contribution that the extinction of passenger pigeons may have made to the emergence of Lyme disease as a serious problem in the US (Blockstein, 1998). Another is the impact of eliminating a keystone species (ecologists use the term "keystone species" to describe a species whose removal will cause an entire ecosystem to change substantially), such as sea otters in the California coastal marine environments which led to a greatly changed and impoverished marine coastal environment (Power, et al., 1996). In both cases the loss of one species lead to cascading changes that most observers would probably not have expected, changes that were incidentally to the disadvantage of humans.

Another issue that seems to motivate biologists' concern about biodiversity is the possible social value of the organisms that are being lost. There are real option values associated with biodiversity conservation. Extinction, which is the loss of biodiversity in its more dramatic form, is irreversible, and not knowing completely what values will be lost through extinction is putting in stake the future options of our society.

There are several economic contributions of biodiversity to human societies, it provides or enhances ecosystem productivity, insurance, knowledge and ecosystem services (Heal, 2004).

Biodiversity contributes to the productivity of both natural ecosystems and agricultural systems, and it does so through different mechanisms. Natural systems benefit directly from a diverse mix of species, agricultural systems benefit from the existence of a pool of genetic variability. Some studies show that more diverse communities are on average more stable and robust in the face of environmental fluctuations (Naeem & Li, 1997).

The insurance role of biodiversity is an important defence against disaster in the form of new diseases, without reserves of genetic variability we may not be able to develop varieties of our agricultural crops and animals that can resist these new disease varieties. An example comes from the recent history of rice production. In the 1970s, a new virus threatened the Asian rice crop. This virus appeared capable of destroying a large fraction of the crop and in some years destroyed as much as one quarter. Developing a form of rice resistant to this virus became of critical importance. Rice breeders succeeded in this task with the help of the International Rice Research Institute (IRRI) in the Philippines. The IRRI located a variety of wild rice that was not used commercially but which was resistant to the virus. The gene resistance was transferred to commercial rice varieties, yielding commercial rice resistant to the threatening virus. This would not have been possible without the genes from a variety of rice that was apparently of no commercial value, without it, the world's rice crop, one of its most important food crops, would have been seriously damaged. An interesting additional detail of this story is that the variety of wild rice that was resistant to the virus was found in only one location, a valley that was flooded by a hydroelectric dam shortly after the IRRI found and took into its collection the critical rice variety.

Biodiversity is also important as a source of knowledge. We can learn, for example, from natural organisms how to make chemicals that have important and valuable properties, certain plants and animals are known to produce substances that are highly active pharmacologically (Heal, 2004).

2.1.3. Ecosystems Services

Ecosystems and the biological diversity contained within them, provide a stream of goods and services, the continued delivery of which remains essential to our economic prosperity and other aspects of our welfare. In a broad sense, ecosystem services refer to the range of conditions and processes through which natural ecosystems, and the species that they contain, help sustain and fulfil human life (Daily, 1997)

Such services are defined in the Millennium Ecosystem Assessment (2005) as ''the benefits people obtain from ecosystems.'' These benefits include food, water, timber, leisure, spiritual benefits, among others. Different combinations of services are provided to humans from the ecosystems, their ability to deliver the services depends on complex biological, chemical, and physical interactions.

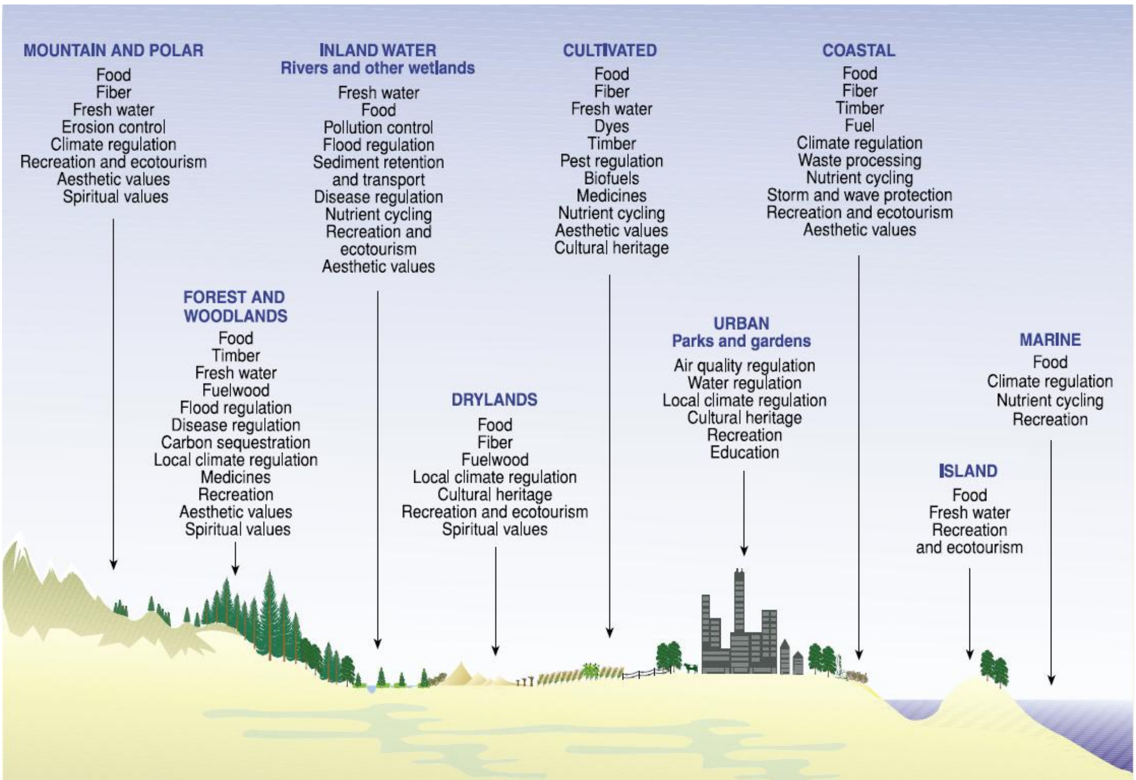

Figure 2.3 - Ecosystems and some services they provide. *Source: Millennium Ecosystem Assessment, 2005.*

Ecosystem services are increasingly promoted as a means for documenting the values humans place on ecosystems and evaluating benefits derived from natural resources (Costanza, et al., 1997; Millennium Ecosystem Assessment, 2005) This is an important trend, and particularly important in the case of biodiversity conservation where values are often difficult to describe in economic terms and rarely well-explained in natural resource decisions.

Biodiversity is the foundation of ecosystem services to which human well-being is intimately linked (Millennium Ecosystem Assessment, 2005)**.** The variety, quantity, quality, dynamics and distribution of biodiversity that is required to enable ecosystems to function, and the supplying benefits to people, vary between services. The roles of biodiversity in the supply of ecosystem services can be categorized as provisioning, regulating, cultural and supporting. The Millennium Ecosystem Assessment defines them as:

- *Provisioning services:* The goods or products obtained from ecosystems such as food, freshwater, timber, and fibers.
- *Regulating services:* The benefits obtained from an ecosystem's control of natural processes such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards. "Regulating" in this context is a natural phenomenon and is not to be confused with government policies or regulations.

- *Cultural services:* The nonmaterial benefits obtained from ecosystems such as recreation, spiritual values, and aesthetic enjoyment.
- *Supporting services:* The natural processes such as nutrient cycling and primary production that maintain the other services.

Table 2.2 - Biodiversity benefits to agriculture through ecosystem services

Provisioning services	*Regulating services*	*Cultural services*	*Supporting services*
Food and nutrients Fuel Animal feed Medicines Fibres and cloth Materials for industry Genetic material for improved varieties and yields Pollination Pest resistance	Pest regulation Erosion control Climate regulation Natural hazard regulation (droughts, floods and fire)	Sacred groves as food and water sources Agricultural lifestyle varieties Genetic material reservoirs for improved varieties and yields Pollinator sanctuaries Erosion control	Soil formation Soil protection Nutrient cycling Water cycling

Source: Millennium Ecosystem Assessment, 2005; UNEP, 2007.

People everywhere rely on ecosystems and the services they provide. So do businesses. However, many of the world's ecosystems are in serious decline, and the continuing supply of critical ecosystem services is now in jeopardy.

Despite the importance of ecosystems, they are being modified in extent and composition by people at an unprecedented rate, with little understanding of the implications this will have in terms of their ability to function and provide services in the future (Millennium Ecosystem Assessment, 2005).

The value of ecosystem services lost to human society, in the long term, may greatly exceed the short-term economic benefits that are gained from transformative activities. Costanza *et al* (1997) estimated that the annual value of these services is US$16–54 trillion, with an estimated average of US$33 trillion.

The loss or degradation of ecosystem services will have impacts on human well-being. It will also profoundly affect businesses. Higher operating costs or reduced operating flexibility should be expected due to diminished or degraded resources (such as fresh water) or increased regulation.

Every threat creates opportunity. Innovation and technology to minimize the damage to ecosystems and to mitigate impacts already occurring are creating significant new business opportunities for those who are aware and prepared.

The loss of biodiversity and ecosystems is a threat to the functioning of our planet, our economy and human society (Sukhdev, *et al*, 2008). It is essential to start tackling this problem as soon as possible.

2.2. Tackling biodiversity loss

The need to protect biodiversity has never been greater, as populations around the world use more natural resources and as expanding cities and farms dramatically alter wildlife habitat. Human activities have caused plant and animal extinctions to reach rates one thousand times greater than background rates, perhaps comparable to those experienced during the great mass extinctions of the past (Pimm, *et al*, 1995). Responses to the continuing loss of biodiversity are varied, and include further designation of protected areas, and, increasingly, the improved management for biodiversity in production landscapes and seascapes (UNEP, 2007). There are recent signs of an emerging consensus that biodiversity conservation and sustainable development are inextricably linked, as for example illustrated by the endorsement by the 2002 Johannesburg World Summit on Sustainable Development (WSSD) of the CBD's 2010 target.

Table 2.3 - The 2010 target at global and European level.

At global level	
6th conference of the parties to the Convention on Biological Diversity (the Hague 7–19 April 2002)	Adoption of a Strategic Plan for the Convention on Biological Diversity (Decision VI/26) including the 2010 target 'to achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth'.
World Summit on Sustainable Development (Johannesburg, 26 August–4 September 2002)	Endorsement of the target for 'achievement by 2010 of a significant reduction in the current rate of loss of biological diversity' and recognition of the critical role played by biodiversity in sustainable development and poverty eradication.
7th conference of the parties to the Convention on Biological Diversity in Kuala-Lumpur, 9–27 February 2004	Adoption of a framework (Decision VII/30): • to facilitate the assessment of progress towards the 2010 target and communication of this assessment; • to promote coherence among the programmes of work of the Convention; • to provide a flexible framework within which national and regional targets may be set, and indicators identified.
At pan-European level	
5th 'Environment for Europe' Ministerial Conference (Kiev, 21–23 May 2003)	Endorsement of a resolution to 'halt the loss of biological diversity at all levels by the year 2010', according to seven key targets in the areas of: forests and biodiversity; agriculture and biodiversity; a pan-European ecological network; invasive alien species; financing biodiversity; biodiversity monitoring and indicators; public participation and awareness.
At EU level	
European Council (Gothenburg, 15–16 June 2001)	Adoption of the EU Strategy for Sustainable Development, which has as a headline objective 'managing natural resources more responsibly' and states that biodiversity decline should be halted with the aim of reaching this objective by 2010.
Conference 'Sustaining Livelihoods and Biodiversity: Attaining the 2010 Target in the European Biodiversity Strategy' (Malahide, 25–27 May 2004)	A large stakeholder consultation was organised within the process for review of the EC Biodiversity Strategy and Biodiversity Action Plans which resulted in the 'Message from Malahide', identifying the need for further action under crosscutting themes and major sectors influencing European biodiversity to halt its loss by 2010. The Malahide Conference also endorsed a first set of EU headline biodiversity indicators to assess progress towards the 2010 target.
European Council (Brussels 28 June 2004)	Conclusions on 'Halting the loss of biodiversity by 2010' (10997/04).
European Commission 2006	Communication on Halting the Loss of Biodiversity to 2010 and Beyond (COM(2006)216 final).

Source: EEA, 2007

In 1992, the largest-ever meeting of world leaders took place at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. An historic set of agreements was signed during this summit, including two binding agreements, the Convention on Climate Change, which targets industrial and other emissions of greenhouse gases such as carbon dioxide, and the Convention on Biological Diversity the first global agreement on the conservation and sustainable use of biological diversity. The biodiversity treaty gained rapid and widespread acceptance. Over 150 governments signed the document at the Rio conference, and more than 187 countries have ratified it (CBD, 2004; Billé, 2006).

The Convention has three main goals, the conservation of biodiversity; sustainable use of the components of biodiversity; and sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way. The Convention stands as a landmark in international law, it recognises for the first time that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process (CBD, 2004; Billé, 2006). The agreement covers all ecosystems, species, and genetic resources. It links traditional conservation efforts with the economic goal of using biological resources sustainably, and sets principles for the fair and equitable sharing of the benefits arising from the use of genetic resources, notably those destined for commercial use. It also covers the rapidly expanding field of biotechnology, addressing technology development and transfer, benefit-sharing and biosafety. Importantly, the Convention is legally binding, countries that join it are obliged to implement its provisions.

The Convention reminds decision makers that natural resources are not infinite and sets out a new philosophy for the 21st century, that of sustainable use. While past conservation efforts were aimed at protecting particular species and habitats, the Convention recognises that ecosystems, species and genes must be used for the benefit of humans. However, this should be done in a way and at a rate that does not lead to the long-term decline of biological diversity. The Convention also offers decision makers guidance based on the precautionary principle that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat (CBD, 2004). The Convention acknowledges that substantial investments are required to conserve biological diversity. It argues, however, that conservation will bring us significant environmental, economic and social benefits in return.

2.3. EU Approach

In 1995, a pan-European response to the CBD came when more than 50 countries endorsed the Pan-European Biological and Landscape Diversity Strategy (PEBLDS). The European Community, as contracting party to the CBD, adopted a Biodiversity Strategy in 1998, providing a comprehensive response to the CBD (EEA, 2007).

Within this policy framework and the wider sustainable development agenda it was agreed at global level in 2002 to significantly reduce the rate of biodiversity decline by 2010; Europe decided to halt the decline by 2010. The EU target "to halt the decline of biodiversity in the EU by 2010 and to significantly reduce the rate of biodiversity loss globally by 2010" now represents a political beacon, a waypoint in the process towards sustainable use of natural resources and a healthy environment. Indeed, at national level, a growing number of European countries have included the 2010 target as part of their national biodiversity strategies. However, halting biodiversity loss by 2010 is not an end–point in itself, the European Commission intends to launch a debate on a longer–term vision within which to frame future policy - on the kind of nature we want in the EU, and on the EU's role in safeguarding nature worldwide (Communication from the Commission, 2006).

This political agreement on the 2010 target has been accompanied by a growing consensus on the need for long-term, structured, global and European coordination of biodiversity monitoring, indicators, assessment and reporting efforts as a sound funding basis. Having set a target to halt the loss of biodiversity by 2010, it became essential to examine and report on progress. To make this process meaningful to a range of audiences, a set of indicators was needed (EEA, 2009).

The SEBI 2010 indicator set has been used by the European Commission to support its assessment of progress in implementing the Biodiversity Action Plan. While SEBI 2010 is pan-European in scope, some of the indicators specifically link to the community policy framework that exists for EU Member States. SEBI 2010 was established in 2005 as a process to select and streamline a set of biodiversity indicators to monitor progress towards the 2010 target of halting biodiversity loss and help achieve progress towards the target (EEA, 2009).

Many methodologies have been developed under national and EU research programmes but have still not reached their potential. Either they have not been applied fully due to shortcomings in data availability or there has been a lack of consensus on a particular method's application. Four methodological areas where methods either exist or are currently being developed deserve particular attention due to their pertinence to future phases of SEBI 2010: accounting for the physical stocks and flows of ecosystem goods and services; the valuation of ecosystem goods and services; biodiversity and climate change impacts and adaptation links; and, modelling future trends for biodiversity and ecosystems in Europe and in the global context.

2.4. Protected Areas

Protected areas are the cornerstones of all national and regional biodiversity conservation strategies. Now that they also represent one of the largest land allocations, governments and other stakeholders are increasingly demanding accurate reports of both their material and nonmaterial values (Mulongoy, 2004). Protected areas are a traditional mean for pursuing wildlife management and have become increasingly central to conservation strategies (Naughton-Treves, *et al*, 2005).

The International Union for Conservation of Nature defines a protected area as "a clearly defined geographical space recognized, dedicated and managed, through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008). Protected areas are internationally recognized as a major tool for conserving species and ecosystems (UNEP-WCMC, 2008) and as the most important core 'units' for in situ conservation (Chape *et al*, 2005)

The more than 100 000 protected areas that now exist worldwide, covering more than 12% of the Earth's land area, do not reflect a single approach to conservation, but instead show an extraordinary variety of management objectives. They range from strictly controlled reserves, where only a handful of scientists are allowed to enter, to cultural landscapes with thousands of human inhabitants, where biodiversity conservation is integrated with many other activities.

Their common names do not necessarily help to distinguish them – for example in most places a "national park" is a fairly strictly protected reserve, while in Europe the term is used for an inhabited landscape or seascape with more general planning and environmental controls. In fact, there are more than 1 000 terms used globally to designate protected areas (Mulongoy, 2004). Such variation in terminology and in management approaches has led to some confusion. After testing a system with 10 categories, IUCN simplified this to six categories in 1994, which have more or less come to represent an international consensus about management types in protected areas.

Table 2.4 - Definitions of the IUCN protected area management categories

Category Ia *strict nature reserve: protected area managed mainly for science* area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring
Category Ib *wilderness area: protected area managed mainly for wilderness protection* large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition
Category II *national park: protected area managed mainly for ecosystem protection and recreation* natural area of land and/or sea, designated to (i) protect the ecological integrity of one or more ecosystems for present and future generations, (ii) exclude exploitation or occupation inimical to the purposes of designation of the area and (iii) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible
Category III *natural monument: protected area managed mainly for conservation of specific natural features* area containing one or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance
Category IV *habitat/species management area: protected area managed mainly for conservation through management intervention* area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/ or to meet the requirements of specific species
Category V *protected landscape/seascape: protected area managed mainly for landscape/seascape conservation and recreation* area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area
Category VI *managed resource protected area: protected area managed mainly for the sustainable use of natural ecosystems* area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs

Source: IUCN, 2004.[2]

Protected areas are a key instrument of global commitments intended to preserve, for the benefit of present and future generations, a range of goods and services essential for life on Earth. They are sources of pure water, natural buffers against climate change, and other vital ecosystem services, genetic storehouses, protection for sacred sites, and places for recreation and spiritual and physical renewal. Local communities and indigenous peoples, for example, depend on natural resources such as forest products for survival, and wild lands can hold important cultural values, which protected areas can

[2] IUCN 1994 cited in Chape *et al*, 2005, p.3

help to safeguard. Protected areas are also important for ecological research and education and can make significant contributions to local economies through the development of sustainable forms of tourism.

Table 2.5 - Protected areas and IUCN categories, 2005.

IUCN category	Number of protected areas	Area km2	% of total protected area	% of total number of sites
Ia	5 549	1 047 944	5.41	4.85
Ib	1 371	638 686	3.30	1.20
II	4 022	4 475 085	23.09	3.52
III	19 813	270 925	1.40	17.33
IV	27 466	3 004 992	15.50	24.03
V	8 495	2 392 692	12.34	7.43
VI	4 276	4 283 634	22.10	3.74
No category	43 304	3 267 054	16.86	37.90
Total	114 296	19 381 012	100.00	100.00

Source: UNEP-WCMC, 2007.

2.4.1. International Conventions, Agreements and Initiatives that affect protected areas

Since the 1970s, international organizations and conventions have fostered the establishment of international sites and have encouraged national governments to set a number of protection targets. There are some key international instruments that affect protected areas and their conservation success.

Table 2.6 – Key International Conventions, Agreements and Initiatives that affect protected areas

UNESCO Man and the Biosphere Reserves
UNESCO's Man and the Biosphere Programme's (MAB) overriding aim is to improve the global relationship of people with their environment. The Programme was launched in 1970, and its Biosphere Reserve concept was launched in 1974, with revisions in 1995. Biosphere reserves have three interconnected functions: • Conservation: landscapes, ecosystems, species and genetic variation; • Development: economic, human and culturally adapted; • Logistic support: research, monitoring, environmental education and training. Currently there are 531 Biosphere reserves in 105 countries.
The Ramsar Convention on Wetlands
The Convention on Wetlands, also known as 'the Ramsar Convention', was signed in Ramsar, Iran in 1971. The Convention aims to conserve and wisely use all wetlands through local, national and regional cooperation in concert with sustainable development. A broad definition of wetlands is used, with protected habitats including lakes, rivers, marsh, peatlands, near-shore marine areas, coral reefs, mangroves, and similar human-made areas such as rice paddies. It currently has 158 signatory Parties who are encouraged to identify important wetland areas for inclusion in the List of Wetlands of International Importance and designate them as international protected areas. As of August 2008, the Ramsar List contains more than 1,759 wetlands covering 161 million hectares.
UNESCO World Heritage Sites
The United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Programme seeks to 'encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity'. The UNESCO World Heritage Convention, which promotes the designation of biological and cultural World Heritage Sites, was adopted by UNESCO in 1972, and has been ratified by 185 State Parties. To be included on the World Heritage List, sites must be of outstanding universal value and

meet at least one out of ten selection criteria. Parties put forward their nominated sites to UNESCO every year and, if accepted, sites are inscribed to the World Heritage List. Currently there are 679 cultural, 174 natural and 25 mixed sites, in 145 countries.

Natura Network 2000

Natura 2000 is an EU-wide ecological network of conservation areas with the aim of maintaining and restoring endangered habitats and species of Community interest. The establishment of the Natura 2000 network was initiated in 1992 through the adoption of the Habitats Directive. Together with the Birds Directive, the Habitats Directive provides a common framework for the conservation of wildlife and habitats within the EU and is the key European initiative for maintaining the biodiversity of the Member States.

Significant progress has been made in the establishment of the Natura 2000 network through designation by Member States of more than 18.000 sites, that now cover around 15–30% of the territory of the EU Member States.

Now that the network is nearing completion, it is crucial that attention turns more towards management of the sites. The implementation of management plans clearly raises the issue of the availability of financial and other resources required.

Convention on Biological Diversity (CDB)

The Seventh Conference of the Parties in 2004 was a key CBD meeting for protected areas, with Decisions 28 and 30 leading to the 2010 and 2012 targets for protected area coverage. The 7th CoP was also where the Programme of Work on Protected Areas (POWPA), as an annex to Decision 28, was agreed upon.

Decision 28 (Annex): Programme of Work on Protected Areas

Goal 1.1: To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals.

Target: By 2010 terrestrially, and 2012 in the marine area, a global network of comprehensive, representative and effectively managed national and regional protected area systems is established as a contribution to:

(i) the goal of the Strategic Plan of the Convention and the World Summit on Sustainable Development of achieving a significant reduction in the rate of biodiversity loss by 2010;
(ii) the Millennium Development Goals – particularly Goal 7 on ensuring environmental sustainability;
(iii) the Global Strategy for Plant Conservation.

Decision VII/30: Strategic Plan: future evaluation of progress. Provisional framework for goals and targets:

Target 1.1: At least 10 per cent of each of the world's ecological regions effectively conserved.

Target 1.2: Areas of particular importance to biodiversity protected.

Goal 4.3 of the Programme of Work on Protected Areas: To assess and monitor protected area status and trends.

Target: By 2010, national and regional systems are established to enable effective monitoring of protected area coverage, status and trends at national, regional and global scales, and to assist in evaluating progress in meeting global biodiversity targets.

Millennium Development Goals

Goal 7: to 'ensure environmental sustainability' and within this goal there are two targets which are relevant to protected areas.

Target 1: Integrate the principles of sustainable development into country policies and programmes, and reverse the loss of environmental resources.

Target 2: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss.

Source: UNEP-WCMC, 2008.

The Global Environment Facility (GEF) is the major source of funding for conservation and sustainable use of the Earth's biodiversity. In its first decade of operation, the GEF provided nearly $1.1 billion for approximately 200 biodiversity projects involving parks and other types of protected areas, this portfolio supports more than 1000 sites covering more than 2.26 million km^2 (Mulongoy, 2004).

As the financial mechanism for the Convention on Biological Diversity, GEF receives guidance from the Conference of Parties on policy, strategy, programme priorities and eligibility criteria related to the use of resources. Bolstering the sustainability of protected area systems is one of four main directions in which the GEF will seek to develop its portfolio. This priority targets are not just ecological sustainability, but also institutional, social, political and financial sustainability in the context of national protected area systems. Their objectives include an expanded engagement of the private sector, further development of innovative financial mechanisms, intensified capacity-building and comprehensive stakeholder participation, and an emphasis on *in situ* conservation through the conservation of globally important and threatened sites and ecosystems.

Most conservationists celebrate the expansion of protected area coverage and greater attention to biodiversity, however, they often disagree regarding how best to manage parks and reserves and, more fundamentally, what the underlying purpose of protected areas should be (Naughton-Treves, *et al*, 2005).

Twenty-five years ago, protected areas were largely the domain of ecologists, forestry officials, and the occasional land-use planner. Now they are included in the international arena as part of the Millennium Development Goals, and their mission has broadened substantially, protected areas are expected to directly contribute to national development and poverty reduction.

Despite the international and national efforts in creating and maintaining protected areas there are still several problems and threats regarding, for example, their management.

2.5. Problems of the Protected Areas

The apparent growth in the number of protected areas worldwide, do not change the fact that species are still becoming extinct, habitat are lost at an alarming rate, and that the integrity and viability of many conservation areas is under threat from numerous interventions.

2.5.1. Poor representation of habitats;

Despite disagreement about geographic priorities, most conservationists agree that more land needs to be protected for several reasons. Many habitats are not well represented in the current network of protected areas. For example, only 0.6% of the world's marine areas are currently protected. Freshwater habitats are also poorly represented (UNEP, 2007).

Hoekstra *et al* (2005) argue that if in place of species loss, conservationists were to focus on rates of land conversion their concern would shift from tropical rainforests to Mediterranean forests or temperate grasslands. Only a fraction of the original area of these biomes is under protection, and nearly half of the area has been lost. Similarly, mangroves and tropical dry forests are underrepresented in protected area networks. Ecologist Bob Pressey played a major role in highlighting the issue of poor representation (Pressey, 1993,1994), he often made the point that the selection of reserves was driven more by the aesthetic love of grandeur and beauty than by ecological knowledge or criteria.

2.5.2. Lack of connectivity between protected areas;

Some species, especially large animals, need large areas of natural habitat in order to feed and find mates. Few protected areas are large enough to support more than a few individuals of these species, and many are isolated from other areas of natural habitat. To address this, corridors must be put in place between protected areas to allow species to move from one protected habitat to another. The linking of protected areas to form networks or systems is very important for the survival of many species; however, such connectivity remains rare.

One of the goals of GEF projects is to link protected areas and their surroundings through, for example, buffer zones, corridors, cultural linkages, integrated ecosystem management, integrated coastal zone management and transboundary protected areas.

2.5.3. Lack of funds;

Putting representative protected area networks in place and managing them effectively requires money. However few countries, even among the richest, have managed to define and establish ways to provide long-term, sustainable financing for individual protected areas, let alone a network. This funding gap is particularly acute in developing countries and for marine protected areas. There is a clear need to find new and sustainable financial resources to supplement funding for existing protected areas and to support the establishment of new protected areas.

2.5.4. Poor management;

The declaration of a protected area is not an end result, a whole series of conditions must be in place for protected areas to be effective. Effective management is essential to ensure that nature is being conserved within the defined boundaries. Management activities include monitoring the health of habitats, ensuring that the rules of the protected area are respected, and working with local people to balance nature protection with their needs and aspirations.

The information on protected areas is, in general, about their extension, the ecological values they have and their effectiveness and evolution towards the defined goals, although there is little detailed information about their management. To fill that gap, WWF International (2004) created a tracking tool based around 30 key questions relating to management in forest protected areas where they run or fund projects. This tool was used in 206 forest protected areas, in 37 countries in Europe, Asia, Africa and Latin America.

The results show consistent patterns of strengths and weaknesses around the world. In general, issues relating to protected area legal establishment, condition assessment, boundary demarcation, design and objective setting have been quite well addressed, while activities relating to people (both local communities and visitors) are less effective, as are management planning, monitoring and evaluation, budget and education and awareness.

Table 2.7 - Strengths and weaknesses in protected areas management

Ten highest scored questions (in descending order)	Ten lowest scored questions (in descending order)
Legal status	Education and awareness
Biodiversity condition assessment	Monitoring and evaluation
Protected area demarcation	Current budget
Protected area objectives	Security of budget
Protected area design	Fees
Regular work plan	Management plan
Protected area regulations	Local communities
Management of budget	Visitor facilities
Resource management	Indigenous peoples
Research	Commercial tourism

Source: WWF International, 2004.

2.5.5. Human activities

Closely linked with poor management are threats from widespread and either poorly managed or illegal human activities occurring within protected areas in many parts of the world. Although globalization have brought greater external funding to developing countries for protected areas, these changes have also opened remote areas to logging, oil extraction, mining, poaching of protected animals, and encroachment by human settlements and agriculture. Human activities outside of protected areas are also often a threat - such as those leading to pollution, climate change, and the introduction of invasive species.

2.5.6. Private landowners in protected areas

In a few European countries the implementation of Natura 2000 caused severe disputes between local residents, especially local landowners, and conservation agencies. In the latter half of the 1990s, citizen protests against the establishment of nature parks in Germany became a frequent feature of the environmental politics scene.

These conflicts were prompted by a number of factors (Stoll-Kleemann, 2001):

- Citizens were neither consulted nor involved in decisions to establish nature conservation areas.
- The instruments used to accomplish the conservation outcome were seen as imposing disproportionate and unusual costs on local landowners and residents, both in terms of foregoing productive (agricultural) or consumptive (leisure) uses of the land.
- The designation was commonly perceived as having negative impacts on livelihoods.
- There was only a restrictive compensation policy for those perceived to be negatively affected.
- In countries with a well-developed system of rights and obligations and sophisticated institutions for their monitoring and enforcement, citizens understand that opposition has to come before the projects are implemented. In such systems, failure to oppose a policy is frequently interpreted by courts as tacit consent. Policies that have become a *fait accompli* are therefore much harder to overturn.

The above factors explain why the attempts of German conservation agencies to designate Natura 2000 sites met with local opposition. What were the costs of trying to implement Natura 2000 under these circumstances?

They can be summarised in four categories:

1) Cost of delay. The most immediate impact was a delay in protecting the area while other solutions were being investigated or while awaiting the outcome of arbitration and adjudication.
2) Costs of conflict. The most visible costs were destroyed property, the need for additional security forces etc. More significant, however, were the opportunity costs of conflict in terms of time and resources that could more productively have been devoted to other purposes.
3) Costs of policy revision. Many protection policies that have run into opposition have to be extensively revised before undergoing another round of scrutiny.
4) Cost of regulatory risk. Conflict makes it worthwhile for opponents to subject conservation policies to a degree of legal scrutiny that would not otherwise have been required. In the process, higher judicial bodies are frequently called on to define the exact boundaries of policy intervention.

As a result, courts can arrive at a much more circumscribed set of policy options than previously thought possible. For example, the Higher Administrative Court in Lüneburg issued a ruling in 1999 questioning whether conservation agencies even had a mandate to declare land as a part of a protected area if that land had previously been disturbed (Stoll-Kleemann, 2001).

2.6. Economics of biodiversity

Biodiversity interacts with the economic welfare of individuals in complex ways. Biodiversity and ecosystems are important as key productive assets (*e.g.* fish, or timber), for the "services" they provide (*e.g.* as carbon sinks or in water purification) now or in the future, and for the sheer pleasure we get from their continued existence (aesthetic values, cultural values, etc.).

Decisions about biodiversity management are complex by the fact that various types of market failure are associated with natural resources and the environment. Market failures occur when markets do not reflect the full social costs or benefits of a good. Factors that cause market failures related to biodiversity protection include:

(i) many ecosystems provide services that are public goods, and these type of goods have two specific characteristics. The first is non-excludability. Individuals do not own environmental amenities, such as clean air or clean water. Yet it may not be possible to exclude them from enjoying the benefits of these environmental amenities, and similarly from experiencing costs for example due to their pollution. Secondly, many environmental goods and services are non-rival, which means that enjoyment of the environment by one individual does not exclude enjoyment by others, at least up to certain levels (Lansdell & Stoneham, 2006).

(ii) many ecosystem services are affected by externalities (the side effects of human actions; for example, if a stream is polluted by runoff from agricultural land, the people downstream experience a negative externality. Externalities can also be positive, eg the crop pollination services performed by wild bees).

(iii) property rights related to ecosystems and their services are often not clearly defined.

Ecosystem valuation can help resource manager's to deal with the effects of market failures by measuring their costs to society in terms of lost benefits. The costs to society can then be imposed, in various ways, on those who are responsible, or can be used to determine the viability of actions to reduce or eliminate environmental impacts.

Economics has a well-established method for assessing the relative merits, from a society wide perspective, of alternative resource uses. This is known as *Benefit Cost Analysis* (BCA) and is widely used by policy makers. Importantly, the BCA process needs costs and benefits to be estimated in monetary terms so that they can be compared. But this is difficult when some of the costs or benefits involve biodiversity, which does not usually have a monetary value. In particular, it is difficult to put a dollar figure on the benefits of conserving biodiversity or the costs of losing biodiversity. We therefore need techniques that can account for the full range of values generated by changes to the stock of biodiversity.

The concept of Total Economic Value (TEV) has proven useful as a conceptual framework for keeping track of the wide range of complex and interrelated physical and value flows involved in valuing the natural environment. This approach is based on valuation techniques that have been subject to gradual improvement in recent decades and to capture a wide range of values, since these are reflected in some way in human preferences (Dixon *et al*, 1998; Costanza & Farber, 2002). Economists use distinct value categories to capture these various sources of biodiversity's contribution to human wellbeing, with the most fundamental categories being those of use and non-use values. Taken together, these value categories make up the TEV of biodiversity, *i.e.* the total contribution of biodiversity to humanity (Pearce and Moran, 1994). The concept of the TEV allows evaluating the benefits of policies that affect the availability of biodiversity. It does so by assessing the changes in the values within each value category of the TEV that occur as a result of the policy.

Has previously mentioned TEV consists of use value and non-use value, which according to Defra (2005) has the following definitions and categories.

According to Dixon *et al* (1998) the use value of an environmental resource express the level of welfare, or utility, an individual withdraw from the current use of this feature. Use value involves some interaction with the resource, either directly or indirectly:

- *Direct use value:* Individuals make use of a resource in either a consumptive way (e.g. the fishing industry and agriculture) or a non-consumptive way (e.g. rambling).
- *Indirect use value*: Individuals benefit from ecosystem services supported by a resource rather than actually using it (e.g. watershed protection for flood mitigation, cycling processes for agriculture or carbon sequestration).

Non-use value is associated with benefits derived simply from the knowledge that the natural environment is maintained. By definition, non-use value is not associated with any use of the resource or tangible benefit derived from it, although users of a resource might also attribute non-use value to it. Non-use value can be split into three basic components:

- *Altruistic value:* Derived from knowing that contemporaries can enjoy the goods and services the natural environment provides.

- *Bequest value*: Associated with the knowledge that the natural environment will be passed on to future generations.
- *Existence value*: Derived simply from the satisfaction of knowing that ecosystems continue to exist, regardless of use made of them by itself or others now or in future (also associated with 'intrinsic value').

Finally, two categories not immediately associated with the initial distinction between use value and non-use value are:

- *Option value:* An individual derives benefit from keeping open the option to make use of some aspect of the natural environment in the future, even though he or she does not currently plan to make such use. It is "an additional value to any utility that may arise if and when the good is actually consumed" (Perman et al. 1999), and only exists because of uncertainty concerning future preferences and/or the availability of the good, and if the value is risk-averse. It can be regarded as a form of insurance to provide for possible future use.
- *Quasi-option value:* A related value arising through avoiding or delaying irreversible decisions, where technological and knowledge improvements can alter the optimal management of a natural resource. It does not require risk aversion. It is particularly relevant to the precautionary principle.

The TEV demonstrates the wide range of benefits that biodiversity conservation policies can generate for people, ranging from tangible consumption benefits such as provision of timber and food to immaterial benefits such as existence values based on the knowledge that a species is being conserved. The TEV allows us – at the highest level of abstraction – to summarise the total contribution of biodiversity to human well-being by adding together the individual value components (Pearce and Moran, 1994).

The concept of TEV is widely used in biodiversity economics but it is not free of significant criticism and a number of scientists have questioned its ability to capture actual values of natural resources and have proposed other value categories. One such category is called *inherent value* (Farnworth *et al*, 1981), defined as "values that support other values" in ecological systems. It includes natural processes of selection and evolution and the life support functions of ecosystems in an all-encompassing perspective.

Finally, some scholars have stressed the importance of psychological values in determining the wellbeing that can be gained from different ecosystems (Nunes *et al*, 2004). While ecological values are meant to determine the well functioning of a system, psychological values are used to determine the perceived quality or the perception of nature. As such, differences between ecological and psychological values pertain to what is being valued: the quality of the system or how the system is perceived.

2.6.1. Valuing Ecosystems Services

Economic valuation can be defined as the attempt to assign quantitative values to the goods and services provided by ecosystems (Kumar & Kumar, 2008). The economic value of any good or service is generally measured in terms of what we are willing to pay for the commodity less what it costs to supply it. Where an environmental resource simply exists and provides us with products and services at no cost, then it is our willingness to pay alone that describes the value of the resource in providing such commodities, whether or not we actually make any payment.

The main objective of valuation of ecosystem services is to generally indicate the overall economic efficiency of the various competing uses of functions of a particular ecosystem. That is, the underlying assumption is ecosystem resources should be allocated to those uses that yield an overall net gain to society, as measured through valuation in terms of the economic benefit of each use adjusted by its costs (Kumar & Kumar, 2008). Valuation of ecosystem services relies on some very bold assumptions like centrality of market, utilitarian framework, substitutability and resource fungibility and technological optimism (Chee, 2004).

Economists have developed a variety of techniques for valuing ecosystem services, which can be divided into three categories that range from pure market to non-market based techniques. Applicable valuation methods differ for private and public services. The marginal value of private goods can generally be derived from market prices, whereas marginal values of public goods have to be established using non-market valuation techniques (Hein *et al*, 2006).

2.6.1.1. Market-based techniques;

Where a benefit generated by biodiversity is bought and sold directly in markets we can use standard economic techniques to estimate values for both buyers and sellers. The market price method uses standard economic techniques for measuring the economic benefits from marketed goods, based on the quantity people purchase at different prices, and the quantity supplied at different prices.

For example, water pollution has caused the closure of a commercial fishing area, and agency staff wants to evaluate the benefits of a cleanup. The market price method can measure total economic surplus for the increased fish harvest that would occur if the pollution is cleaned up.

However, market-based techniques are rarely used to value biodiversity because many of the benefits of biodiversity cannot be exchanged in markets. Also, where market forces operate successfully to secure biodiversity protection, biodiversity values are not really needed to aid public policy. One exception to this is biodiversity prospecting (the search among genes of living organisms for chemical compounds of commercial value in pharmaceutical, agricultural and industrial applications). Here, although market forces ensure a supply, there is a role for policy in ensuring equitable sharing of and access to benefits from these resources.

2.6.1.2. Revealed preference techniques;

Revealed preferences techniques seek to elicit preferences from actual, observed market-based information. Preferences for environmental goods are usually revealed indirectly, when an individual purchases a market good to which the environmental good is related in some way. They are all indirect, because they do not rely on people's direct answers to questions on how much they may be willing to pay (or accept) for an environmental quality change. Thus the emphases of these techniques are mainly on their contribution to valuing biological resources. The values obtained could be considered sufficient for cost-benefit purposes, but they will rarely reflect biological health. As such these techniques provide only a lower bound estimate of the value of a particular biological resource. The techniques included in this group are in particular the travel cost method, or hedonic price and wage techniques on adverting behaviour. In most cases they only capture use values, leaving non-use values out of consideration .This is not the case, though, with simulated market methods.

The common underlying feature is a relationship between a market good and the environmental commodity. For example, when using the travel cost method, researchers estimate the economic value of recreational sites by looking at the generalized travel costs of visiting these sites (Bockstael *et al*, 1991). Conversely, practitioners of the hedonic price method estimate the economic value of an environmental commodity, say, clean air, by studying the relation between house prices and air quality (Palmquist, 1991). The averting behaviour or production cost function methods is characterized by exploring the relationship of the environmental commodity through a generalized cost function (Cropper & Freeman III, 1991). For instance, improvement of air quality can be accessed on the basis of expenditures made to avert or mitigate the adverse effects of air pollution. Avoided cost damage costs, preventive expenditures, repair costs (or restoration), compensation costs, replacement costs, and relocation costs are specific instances of this method. Finally, the production factor method estimates the economic value of an environmental commodity through the input–output relationship of such a commodity in a production function. For example, the economic value of a cleaner soil is related to the value of the increased agricultural output through a dose response method (Nunes *et al*, 2004).

2.6.1.3. Stated preference techniques;

The methods discussed so far are limited in their ability to reflect all the values that biodiversity has to offer, in particular non-use, or passive use, environmental benefits. It is clear that people are willing to pay for such benefits. However, they are likely to be valued at zero in decision-making processes unless their monetary value is somehow estimated. So, how much are they worth? Since people do not reveal their willingness to pay for them through their purchases or by their behaviour, the only option for estimating a value is to ask people questions.

This has led to the development of another set of methods, known as stated preference techniques, in which people are asked how much they would be willing to pay for the service offered by a biodiversity resource.

Stated preferences (SP) techniques are based on the simulation of the market, and thus on "prices observed" for the good to be valued. Results are achieved through a questionnaire to be filled out by the population, or a sample of it. In simulated market conditions, the supply side is represented by the interviewer, who typically offers to provide a given amount of units of the good at a given price. The respondent, who either accepts or rejects the offer, represents the demand side. One of the most crucial issues in this kind of method is to be precise in the description of the market, and yet simple and clear enough for people to understand it. This is important, because biological and landscape diversity are among the goods for which it is difficult to simulate a clear, credible, precise and understandable market in a poll process.

The best known method is the contingent valuation methodology (Mitchell and Carson, 1989). Indeed, the contingent valuation (CV) method is currently one of the most often used techniques for the valuation of environmental goods. This is partly due to CV features that constitute important advantages over revealed preference methods (Sen, 1995). First, the CV method is the only valuation technique that is capable of shedding light on the monetary valuation of the non-use values, which typically leave no "behavioural market trace"'. Ignoring such values will lead to a systematic bias in the estimation – essentially an underestimation – of the total benefits of biodiversity. Second, CV allows environmental changes to be valued even if they have not yet occurred (i.e., ex ante valuation). Therefore, CV offers a greater potential scope and flexibility than revealed preference methods. It allows the specification of hypothetical policy scenarios or states of nature that lie outside the current or past institutional arrangements or levels of provision. Third, CV allows enriching the information base by submitting the process of value formation to public discussion, and hence it is recognized as "an effective tool for policy decision-making".

A disadvantage is that they are based on questionnaires. There is a difference between what people state and how this is revealed in practice. Also, it is difficult to tie an economic value to an ecosystem service through a questionnaire when the general public may be ill informed or unfamiliar with the subject. Revealed preference methods can only be used for a limited number of biodiversity value categories, as they do not allow a monetary assessment of non-use values (Jones-Walters & Mulder, 2009).

2.6.2. Policy Instruments available for Natural Resources Management (NRM)

There are number of choices of actions to achieve NRM outcomes. Suasive approaches are policy tools that encourage changes in behaviour through the provision of information, such as via general education programs, guidelines and codes of practice, training programs, extension services, and research and development. Regulatory approaches require changes in behaviour by introducing penalties for parties who don't comply with the regulatory provisions. Types of regulatory instruments include standards (including planning instruments), licensing, mandatory management plans and covenants. Market-based instruments are policy tools that encourage behavioural change through market signals rather than through explicit directives or 'one size fits all' approaches. There are a range of types of market based instruments including market creation (such as through cap-and trade schemes), offsets, subsidies and grants, accreditation systems, stewardship payments, taxes and tax concessions. Public provision of services is often used where the management solution has the characteristics of a public good which make it difficult or uneconomic for the service to be provided by the private sector. A national park is an example of a public good that is provided by government.

ABARE (2001) has identified the following factors influencing the choice of policy options:

- The expected costs and benefits (if cost is too high intervention may not be justified);
- The relative costs and benefits compared to other measures should be identified;
- The expected effectiveness of the instrument in achieving the defined targets;
- Efficiency concerns relating to the administration, monitoring and enforcement costs and the level of information required;
- Flexibility of the policy to deliver an optimal outcome in the face of changing conditions and the extent to which individuals can determine their response to the policy;

- The acceptability of the policy to stakeholders. This is especially important with incentives, as the take-up of an incentives program may be low if the individuals or community do not welcome the policy;
- Equity concerns about the impact of the policy upon stakeholders.

Environmental and natural resource management (NRM) problems are usually at the difficult end of the policy spectrum. There are often complex spatial and temporal interactions between the causes of environmental problems and their effects; similar actions tend to generate different (non-standard) environmental impacts in different locations and at different times (Lansdell & Stoneham, 2006). Some environmental benefits tend to be generated in association with others. For example, biodiversity enhancement through revegetation retention may be jointly produced with water quality improvements and salinity mitigation. Many different stakeholders, each with potentially different objectives, expectations, motivations and cost structures, are involved in the production and consumption of environmental outcomes.

2.6.3. Transaction Costs and NRM policy

Allocation of property rights to ecosystem services facilitates the basis for exchange in markets. Assuming no costs of exchange, the final outcome of exchange is not dependent on the initial ownership of the property rights and full information will be revealed through trades (Coase, 1960). However, the assumption of no costs of exchange is not tenable and transaction costs are pervasive in market institutions. Transaction costs can be defined as those costs that are attributable to:

- codifying property rights, and identifying and enforcing ownership over property rights;
- seeking out buyers or sellers of property rights;
- negotiating a sale;
- measuring the quality and quantity of goods; and,
- contracting specifications about the transfer of property rights. Contracting issues include when delivery will occur and the uncertainty about any intervening period and incomplete aspects of the contract.

Transaction costs are important because they consume resources that could be used for other purposes (Wills I. , 1997). According to Lansdell & Stoneham (2006) the costs that are attached to the (potential) transactions that could enhance the provision of environmental goods, include costs due to:

- property rights such as costs associated with the definition, monitoring and enforcement of property rights and determining previously hidden information in order to define or monitor a property right and the cost of enforcement due to the communities understanding and acceptance of the property right and its allocation;

- asymmetric and hidden information, through either having to estimate or reveal supply or demand related information held by one group or party and not another, or not held by anyone, and the risk associated with making a deal without full information;

The lack of or inappropriate specification of property rights for environmental goods is known to result in inefficient or missing markets for these goods. Coase (1960) suggested that if property rights were clearly specified, and there were no transaction costs, firms would trade to arrive at an efficient outcome. However, in the case of environmental goods, property rights and transaction cost issues are linked, and the transaction costs cannot be ignored. In order for the transactions, or the exchange of rights, to be sufficiently credible for agents to be willing to participate, there must be high acceptance of the link between the rights specified and the environmental outcomes sought as well as acceptance of the security of those rights.

Information asymmetry refers to a situation where one party to a deal has more relevant knowledge than the other party. This can mean that it is hazardous for the uninformed party to do business with the party who has the hidden information. Akerlof (1970) showed that the existence of asymmetric information can render some seemingly competitive markets inefficient. In extreme cases, this phenomenon can prevent markets being formed because the uninformed party is liable to be exploited and may therefore be unwilling to participate. As a result, the potential benefits of doing business (which may be very large) may not be realised. Latacz-Lohmann & Van der Hamsvoort (1997) explain how information asymmetry affects the functioning of markets for environmental goods and services associated with private land. There is a "clear presence of information asymmetry in that farmers know better than the program administrator about how participation would affect their production plans and profit."

Transaction costs are very important because they consume resources that could be used for other purposes (Wills, 1997)

2.7. Market-Based Instruments

Markets are used to supply many essential items in our lives including food, clothing and shelter and are the mechanism by which landowners are rewarded when their land produces valuable ecosystem goods such as food and fibre products (even when their production reduces the production of other ecosystem services such as water quality protection). Markets work well at providing rewards – and markets for ecosystem services may prove to be one way of rewarding and encouraging land managers to protect and produce ecosystem services.

Market-based instruments are broadly defined as mechanisms within which property rights are voluntarily exchanged, generally using a monetary numeraire, and in which participants may be differentiated between, according to the property rights exchanged or the monetary payment or both (Whitten *et al*, 2003). They are intended to achieve behavioural change in a flexible manner avoiding use of prescribed behaviour or technology. They are generally applied where an efficiency or equity dividend over alternative mechanisms is envisaged.

MBIs can achieve outcomes by altering market prices, setting a cap or altering quantities of a particular good, improving the way a market works, or creating a market where no market currently exists. The key interest in MBI application is achieving policy targets at reduced cost.

Market-based instruments (MBIs) are gaining acceptance as important policy mechanisms for achieving environmental protection goals. Around the world a variety of MBIs are being tested and applied to different environmental problems. The adoption of MBIs is based on the premise that these instruments offer the potential to achieve efficiency gains over more traditional regulatory instruments.

The regulatory approach often prescribes conditions for resource access and usage such as various conservation acts that restrict the uses to which land covered with native vegetation can be put by limiting clearing. In many cases the regulatory approach has failed to achieve the goals set, or has proved to be very expensive. As a result governments are starting to look for more effective and cheaper ways of achieving environmental outcomes. Efforts are being made to develop systems that satisfy government and community aspirations for higher environmental standards whilst also being flexible and amenable to the running of businesses. Increasingly these efforts are focusing on the potential of MBIs to meet the multiple criteria of effectiveness, efficiency and flexibility.

The use of MBIs has been studied for biodiversity (Stoneham, *et al,* 2003), non-point source pollution (Cason, *et al*, 2003), and land conservation (Latacz-Lohmann & Van der Hamsvoort, 1997), among others.

MBIs have two potential cost advantages over more traditional instruments. First, MBIs allow different firms/individuals to make different adjustments in response to their unique business structures and opportunities. Second, incentives to discover cheaper ways to achieve outcomes provide dynamic ways of reducing the future costs of achieving targets.

The strength of MBIs is that they rely on local knowledge to establish a price for environmental services. In essence, MBIs reveal information about an individual landowner's minimum price for undertaking a certain action. This contrasts with a subsidy-based approach whereby a government risks setting a price judged too high by landowners with a subsequent lack of participation, or setting a price to low thereby engendering overpayment.

There is also a concern that more traditional policy tools (suasion and regulation) are not achieving the natural resources management (NRM) outcomes the community desires. MBIs can complement these approaches by:

- allowing the flexible adoption of better NRM;
- encouraging innovation to achieve NRM outcomes;
- contributing to long-term and relatively self-sustaining solutions;
- leveraging private investment in NRM; and
- addressing market failures.

The economic rationale for using market-based instruments lies in their ability to correct market-failures in a cost-effective way. Market failure in NRM occurs when the market does not give appropriate signals to participants that ensure natural resources are managed sustainably, for example the full cost of decisions are not reflected in the market.

Whether by influencing prices (through taxation or incentives), or setting absolute quantities (emission trading), or quantities per unit of output, MBI implicitly acknowledge that firms differ from each other and therefore provide flexibility that can substantially reduce the costs of environmental improvements.

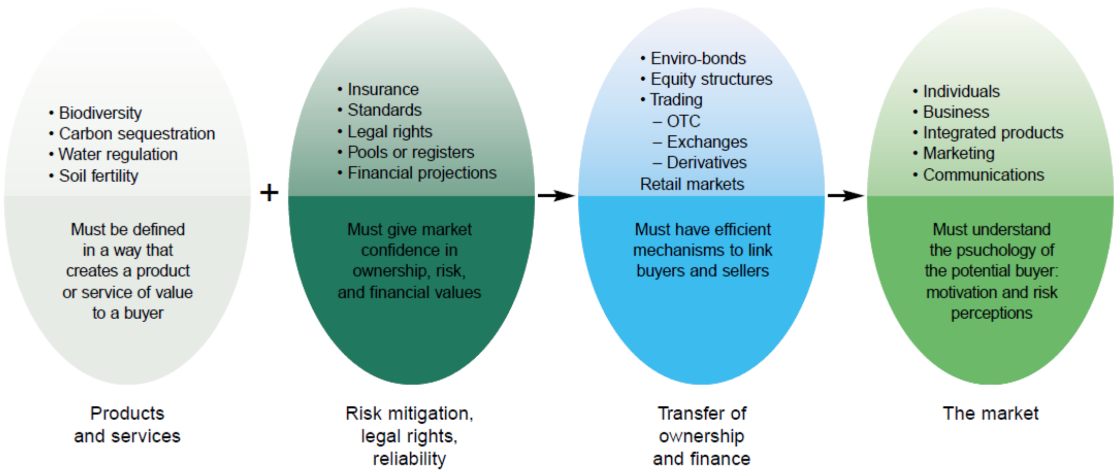

Figure 2.4 - New market solutions to conserve biodiversity. *Source: Jenkins, et al, 2004*.

Some argue that the level of transaction costs involved in MBIs, for example through modelling and measuring environmental outcomes, making field visits or through entering individual contracts, make them less cost effective policy tools than they appear (Lansdell & Stoneham, 2006). This is not necessarily true, the additional level of benefits that MBIs are able to deliver as a result of incurring the transaction costs, where there is some heterogeneity, can reduce the net transaction costs of a well designed MBI compared to available alternatives.

One of the biggest risks with the current enthusiasm for MBIs lies in the propensity for governments or agencies to believe they can pick up and use exactly the same design as a previously applied MBI to address environmental problems that they face in their region or to achieve a different environmental outcome (Lansdell & Stoneham, 2006). This entails the risk that although some situations may appear similar, changes in different characteristics including among many other things, the functioning of the ecosystem, the characteristics and number of landholders involved, the institutional setting, and the information held by different parties that can have significant implications for the effective design of the mechanism, will not be recognised and the mechanism will fail to deliver the environmental objective cost effectively. Other agencies may then observe this failure as one due to that type of market based instrument not being cost effective, whereas it was actually a failure of the agency to design the instrument to achieve their objective given the particular characteristics of the problem they faced.

Designing the mechanism that will match demand and supply cost effectively will require consideration of the appropriate property right or form of contract, the information held by or available to the respective parties, the transaction costs that the use of different design features will involve, and the benefits that different design features are likely to achieve. An understanding of the transaction costs that are likely to be incurred on the ground for different mechanism designs may be important.

There are many different forms of MBIs that have potential to be cost effective in situations with different characteristics. Auctions, offsets and cap and trade systems will each be appropriate in different circumstances. Other mechanisms, for example labelling systems, taxes, fees, subsidies and grants may be cost effective in other situations.

There are however, according to Lansdell & Stoneham (2006), a number of common characteristics that can enlighten about the basic form of the mechanism that is likely to be suitable in a particular case

- The nature of public understanding and acceptance of the objective;
- The extent of costs associated with measuring and monitoring the unit of exchange;
- The extent of landholder knowledge about alternative methods of production of the environmental good; and,
- The number of players involved in the supply and/or demand of the environmental good.

Where public understanding and acceptance of the environmental objective is low, regulation that makes participation in the mechanism compulsory may entail high transaction costs, for example due to high monitoring and enforcement costs. Where there is not necessarily widespread understanding and acceptance of the need for the landholders involved to bare the costs of achieving the objective an MBI that uses voluntary participation to determine the lowest cost provision of the environmental outcome, such as an auction, may be more likely to achieve the objective at minimum transaction cost.

Different mechanisms involve trades of different magnitudes of the environmental outcome occurring with different regularity. In a cap and trade system for example, a small quantity of an environmental good may be traded frequently by many participants in the mechanism. Offset and auction systems tend to involve once-off trades to exchange a contract that will deliver the environmental good. Some transaction costs are fixed for the implementation of mechanisms, whereas others are attached to individual trades. Where transaction costs associated with each trade or exchange are higher, the impact on the net cost of a mechanism that requires frequent trading that each have a small impact on the environmental outcome will be greater than the impact on the net cost of a mechanism that makes fewer trades to reach the environmental objective.

Where landholders have access to good knowledge about the production of environmental outcomes, for example, about the alternative actions that produce environmental outcomes and the relative amount of environmental good produced by different actions, it will be less costly for them to make trade decisions based on the production of private goods relative to that of environmental goods. Here transaction costs associated with each trade decision may be small enough that land holders will determine the most valuable trades and a cap and trade system may be cost effective.

Where landholders do not have access to this information the transaction costs associated with a mechanism that relies on frequent trades increase disproportionately.

Different mechanisms require different numbers of participants on the demand and/or the supply side to create the competition necessary to deliver an efficient outcome. For example, auctions for conservation contracts require sufficient supply to ensure opportunity costs are revealed truthfully. Cap and trade and offsets systems require sufficient heterogeneous participants to create trades that produce enough value for the mechanism to be cost effective.

In Europe MBIs have been classified into five main types (EEA, 2005):

1) *Tradable permits* that have been designed to achieve reductions in pollution (such as emissions of CO2) or use of resources (such as fish quotas) in the most effective way through the provision of market incentives to trade.
2) *Environmental taxes* that have been designed to change prices and thus the behaviour of producers and consumers, as well as raise revenues.
3) *Environmental charges* that have been designed to cover (in part or in full) the costs of environmental services and abatement measures such as waste water treatment and waste disposal.

4) *Environmental subsidies and incentives* that have been designed to stimulate development of new technologies, to help create new markets for environmental goods and services including technologies, to encourage changes in consumer behaviour through green purchasing schemes, and to temporarily support achieving higher levels of environmental protection by companies.
5) *Liability and compensation schemes* that aim at ensuring adequate compensation for damage resulting from activities dangerous to the environment and provide for means of prevention and reinstatement.

Australian literature has tended to define MBIs within a typology describing three types of intervention: price based; quantity based; and market friction (NMBIPP, 2004).

2.7.1. Price-Based;

Price based MBIs either assign or impact directly on the price of the desired environmental outcome. Individuals and firms then respond to the modified market signals and adopt the resource use or management practice that offers them the greatest benefit. While these instruments cannot guarantee the extent of changes, they act to cap the costs incurred under the instrument.

Price-based MBIs assign a price to environmental impacts within existing markets through the imposition of positive (e.g. competitive allocation of grants through tenders or auctions) or negative (e.g. charges and taxes) instruments. Firms and land managers then respond to the modified market signals and adopt the resource use or management practice that offers them the greatest benefit and, if the policy is effective, leads to a better resource management outcome. While these instruments cannot guarantee the extent of changes, they act to cap the costs incurred under the instrument.

2.7.2. Quantity-Based;

Quantity-based or ‘tradeable rights’ instruments create a market in the rights to engage in either a damaging activity (greenhouse gas emission), or more often to access a scarce resource (water) by restricting the total level of activity and allocating rights to participate in that activity. An efficient allocation of rights is then determined through a market mechanism. In some cases, rights to valued new environmental commodities are created (such as rights to carbon sequestration). Tradeable rights instruments tend to be used when it is important to get a defined environmental outcome - for example, when exploitation of an ecological community is close to a level that may cause irreversible or unacceptable degradation. Greenhouse gas emissions are increasingly being traded in carbon markets while offsets are increasingly being required for developments that clear native vegetation.. Government or a designated authority must determine the total quantity of the good to be expressed in the rights, who can own the various rights, the initial allocation of rights, the conditions under which trade can take place, and how rights will be monitored and enforced (Murtough et al. 2002).

2.7.3. Market Friction;

Market friction mechanisms are a catch-all term for instruments designed to improve the efficiency of an existing market for the desired ecosystem service. Market friction instruments primarily work by reducing transaction costs and thus increasing the accessible gains from trade. For example, improving water market efficiency through the introduction of brokers or simplified trading arrangements would constitute a market friction MBI. Three types of market friction reductions stand out: (1) *market creation* for inputs/outputs associated with environmental quality, as with measures that facilitate the voluntary exchange of water rights and thus promote more efficient allocation and use of scarce water supplies; (2) *liability rules* that encourage firms to consider the potential environmental damages of their decisions; and (3) *information programs*, such as energy-efficiency product labelling requirements.

Using this classification, it is possible to organize MBIs, in the following way:

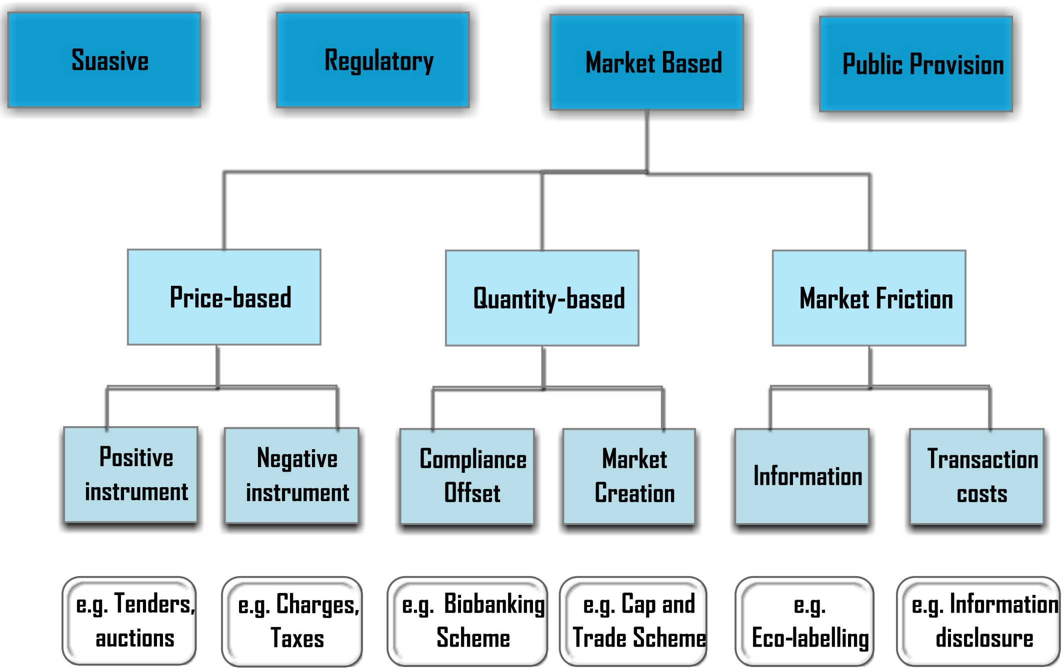

Figure 2.5 - Types of MBI, according to the Australian literature.

CHAPTER 3 – Methodological analysis of MBI case studies

Interest among policy makers in the practical application of market-based instruments to achieve environmental goals has increased markedly over the last two decades. For example, the OECD has actively promoted their utilization and undertaken various reviews of its member countries experience with MBIs. There are many different forms of MBIs that have potential to be cost effective in situations with different characteristics. Auctions, offsets and cap and trade systems will each be appropriate in different circumstances. Other mechanisms, for example labeling systems, taxes, fees, subsidies and grants may be cost effective in other situations.

To successfully implement MBIs, it is important to know how they "work" in theory as well as practice. There are many things we can learn from the analysis of implemented MBIs that together could provide a useful checklist of factors against which potential future successful MBIs can be designed and implemented. Analyzing experiments and field pilots is also useful when policy makers are faced with specific problems for which economic theory is unclear and there is no practical, relevant experience.

The first task of the work is to collect information on the MBIs already used to address biodiversity issues. Existing databases of information, such as the OECD database, on economic incentives were consulted. For further data collection, a variety of sources were used, including books, journals, "grey" literature (i.e. unpublished reports) and internet documents.

In order to simplify the literature review, an assessment methodology was constructed. The idea was to facilitate comparison between the instruments in use in different areas, allowing seeing at a glance, the key differences between them.

This proposed methodology is based on the following principles:

- Before choosing and implementing an incentive program, the project managers should gather and clear articulate information concerning the environmental problem and possible solutions. This background information helps ensure the correct incentive is chosen, that it is well designed and increases the likelihood of the incentive/s meeting the objectives.
- Where the objective is clear, and the knowledge, skills and capability exist to understand the relevant characteristics of the problem and model and measure the environmental outcome there's better potential to design and implement market based instruments that efficiently match demand with supply.
- There are a number of common characteristics that can inform the basic form of mechanism that is likely to be suitable in a particular case. Although it may be clear that a particular

mechanism is likely to be suited to a particular problem, there are many subtle design features within a basic type of mechanism that if not correctly interpreted and addressed can cause the mechanism to fail where it could otherwise have been successful.

- Recent developments, including new ideas about mechanism design, science and technology, and contract design create the prospect of designing specific procedures that enable individuals to interact in ways that allow potentially valuable transactions to proceed. However, designing these mechanisms so that they are efficient and effective is not an easy or costless task.

Three promising examples of the practical use of various MBIs will be chose and analyze in more detail.

3.1 Proposed Methodology

Aims

1. What environmental problem and economic or market failure/ failures is the project seeking to address?
2. What's the objective/s?

Elements

3. What market mechanisms are being used?
4. How is/are the commodity/commodities being defined?
5. How are property rights being specified? Is there regulatory underpinning for its allocation?
6. Who is the buyer? Who is the seller?
7. Is it addressing point source or diffuse source, or both?

Project evaluation

8. What monitoring arrangements are/will be in place?
9. Timetable, milestones?
10. Total costs (including transaction costs)
11. Participation levels

3.2 Designing MBIs

The goal of this work is to design a MBI, having this in mind, it's important to identify specific features that are essential for this task. In addition to the analysis of running or finished case studies the designer must consider the following:

Basic Principles

- Keep all the stakeholders involved. Early consultation and public participation as well as real understanding of their positions is critical.
- Maintaining equity in implementation. Make sure the poor are not unduly affected or devise appropriate compensation schemes for them.
- Consistency and plan compatibility. Schemes that emerge locally should aim for regional, national or international compatibility.
- The time-scale of schemes needs to be short enough to be attractive to participants but long enough to have the desired effects on biodiversity;
- Matching Demand and Supply Cost Effectively.

Target area characteristics

- Understanding the landscape, the players involved and the interactions between them;
    - Are there many potential participants?
    - Is the problem in a particular area or widespread?
    - Are the properties similar to each other?
- The science available;
    - Is there a substantial amount of biophysical information about the problem?
    - Is the source of the problem to be overcome diffuse or can it be pinpointed?
- The institutional setting;
    - Does there need to be a lot of control over the process?
    - Is the tool likely to be acceptable to the community?
- The economic and social issues in the local/regional context;

CHAPTER 4 – Presentation of the part of the world to be studied

In 2002 Australia released the *Australian Terrestrial Biodiversity Assessment,* the biggest audit of the country's wildlife and natural areas ever conducted, that confirmed the 2001 *State of the Environment Report* which had also found that Australia's rich and distinct biodiversity was under multiple threats and still in decline. Major threats are numerous including the loss of habitat to human settlement, agriculture and grazing, introduction and spread of alien species, pollution and altered fire regimes. However, one of the greatest is habitat destruction from land clearing.

In the 20th century Australia increasingly followed the western model of declaring public formal reserves with defined boundaries and legislative status, which were generally managed to exclude human commerce and extraction. Australian national parks were influenced by a political culture which had few population pressures and little appreciation of indigenous rights or interests. As mapping of vegetation improved in the seventies and eighties it became increasingly apparent that the reserve system fell well short of representing the nation's variety of natural environments.

The understanding of the terrestrial and marine ecology of Australia was low, more data and knowledge were required to create new policies, programs and legislation able to tackle the biodiversity loss and to improve the effectiveness of protected areas. One of the most important additions to knowledge in the context of extending protected areas in Australia, was the development of a major framework called the Interim Biogeographic Regionalisation for Australia (IBRA). IBRA divided the continent into bioregions based on complex overlays of data and evaluated the adequacy of their representation in conservation reserves.

A critical component in this rapid development of knowledge was the availability of unprecedented funding. In 1997 the Australian federal government, using the proceeds of a part sale of the national telecommunications network, established a $2.5 billion dollar Natural Heritage Trust. The fund was described as the largest effort towards environmental rescue and agricultural sustainability ever undertaken by any Australian Government.

Therefore, while remaining committed to the priority of securing legislatively protected and publicly managed parks, the Australian environment movement has increasingly adopted the implications of science and acknowledged that protected areas must be complemented and connected with "off reserve" conservation management.

Australia is facing a range of complex natural resource management (NRM) problems including water quality, salinity, biodiversity decline and soil erosion. Governments, industry, communities and individuals invest significant levels of funding each year towards addressing these NRM problems. To improve the efficiency and effectiveness of this expenditure a range of MBIs are currently being tested or implemented across Australia.

To better understand the use of MBIs in Australia I visited the country, more specifically, New South Wales (NSW). During this visit I talked to several stakeholders involved in this type of projects, such as government agencies, NGO's, landowners and project managers. They provided me essential information and knowledge for the development of this work, mainly about their field experience, which is very difficult to obtain from the analysis of the available documents and reports.

4.1 Case Studies

As previously mentioned there are numerous MBIs being applied in Australia. For this study it is considered important to select three case studies, which represent an interesting variety of approaches. One of the selection criteria is the area of intervention, case studies developed in NSW are preferable, because would be easier for me to visit the sites. It is also important to choose different types of MBIs (price and quantity-based), with different participation targets, ranging MBIs designed for a dozen of landowners to schemes designed for several hundreds.

Considering these criteria, the three selected case studies are, the Biodiversity Banking and Offsets Scheme (Biobanking), the Liverpool Plains Land Management Tenders project and the Environmental Services Scheme (ESS).

First, these three case studies are explained, according to three main topics, the problem, the goals and the approach used to solve the problem.

Secondly they will be described according to the methodology proposed on Chapter 3.

4.1.1 Biodiversity Banking and Offsets Scheme

Problem

The NSW Government is using offsets to assist in addressing the cumulative effects of development in NSW and in particular, to help meet the goal of maintaining or improving biodiversity. This approach is intended to allow development to occur in a sustainable way without putting extra stress on the environment.

The Department of Environment and Conservation (DEC) designed a Biodiversity Offsets and Banking Scheme (BioBanking) to support the Biodiversity Certification process under the *Threatened Species Legislation Amendment Act 2004.* The BioBanking approach intends to secure better biodiversity conservation outcomes than can currently be achieve through individual negotiations and will lead to potentially lower transaction costs.

BioBanking would be used in areas where biodiversity certification has been conferred on the planning instrument, and in other areas under specified circumstances. Where development has an unavoidable impact on biodiversity, the development will only be able to proceed if offsets can be used to achieve a 'net maintain or improve' outcome for biodiversity.

This would mean that persons who currently require threatened species licences, assessments, concurrences, or who are required to apply the threatened species test of significance, can participate in the BioBanking scheme, instead of going through the existing complex processes.

This scheme only addresses biodiversity values, including threatened species populations and communities or their habitats. It will not reduce the assessment requirements for Aboriginal heritage sites, polluting activities or other environmental impacts, or address those impacts. Likewise, it will not reduce the need for any other approvals or assessments under any other legislation.

Goals

This scheme is intended to provide a market based approach to help reduce cumulative biodiversity losses caused by population growth and development pressures around urban areas, along the coast and at major inland development sites.

BioBanking is a way of ensuring that offsets are implemented consistently and strategically in advance of the impacts of development. This generates better environmental outcomes at lower cost more quickly.

The BioBanking scheme was designed to:

- complement existing conservation programs on private lands;
- link with and complement local government processes;
- be consistent with the property vegetation planning process under the *Native Vegetation Act 2003*.

A scheme review will be conducted after the first two years of operation.

Approach used to solve the problem

The BioBanking scheme allows ‘biodiversity credits’ to be generated by landowners who commit to enhance and protect biodiversity values on their land. These biodiversity credits can then be sold on the open market, generating an alternative income source for the landowner to help manage the land for conservation. Landowners can decide which areas of their land they will include as the biobank site, allowing different economic activities (such as primary production) to continue on other parts of their land. Management actions are set out in the biobanking agreement and may include the management of grazing, fire, weeds, human disturbance and other actions, depending on the threatened species present at the site.

Developers can buy these credits and use them to counterbalance (offset) the impacts on biodiversity values that are likely to occur as a result of development.

Under this new approach, landholders can voluntarily create biodiversity credits by establishing biobank sites on their land. Biodiversity credits are issued once a biobanking agreement with the Minister for the Environment has been approved; the number and type are calculated using the BioBanking Assessment Methodology and the Credit Calculator.

All biobanking agreements are registered on the land title. The obligation to protect and manage the land is binding on both current and future owners of the site. This agreement allows them to create and sell a specified number of credits in exchange for committing to ongoing conservation management of the land. Landowners can also decide who they will sell their credits to, the price of their credits, and the timing of the sale.

Anyone is able to purchase these credits from the landholder, although it is expected that developers seeking to use credits to offset impacts to biodiversity will be the main purchasers.

The overall price paid for each credit will be determined by the market. A prescribed amount will be paid into the BioBanking Trust Fund when the credits are first sold to provide for payments back to the owner of the biobank site over a long period of time to assist with carrying out the conservation management actions. The remaining amount of the sale price is agreed directly between the landholder and the credit purchaser and is paid directly to the landholder.

Developers can voluntarily use the scheme to potentially offset development impacts on biodiversity. To do this they must use the biobanking assessment methodology to calculate the required number and class of biodiversity credits and then obtain a biobanking statement which will confirm that their project meets the improve or maintain biodiversity. Credit requirements are then incorporated into the development consent. Credits must be obtained and retired before work commences.

The required credits can be estimated (and even purchased) during project formulation, avoiding delays and uncertainty. However, an exemption from the current 7 part threatened species assessment process is *only* obtained where the development meets the strict improve or maintain test. This test means avoiding impacts on areas of high conservation value and, in less sensitive areas, using biodiversity credits to counter-balance any unavoidable impacts. If not wishing to participate in the scheme, the developer will use the normal threatened species assessment system.

The regulatory framework

DECC will use provisions in the *Threatened Species Conservation Act 1995* (including the 2004 amendments) and the *National Parks and Wildlife Act 1974* (such as conservation agreement provisions) to ensure that the scheme and management actions (offset measures) are enforceable. DEC will also develop a rulebook for the schemes that sets out the requirements of all participants. The rules will apply to all developers subject to the scheme, irrespective of whether they provide their own offset or transfer their obligation to another party. It would include:

- the objectives of the scheme
- the assessment procedures for quantifying biodiversity gains and losses
- the datasets underpinning the assessment procedures
- the scope of the scheme
- operation of the offset fund (including collection of charges and payments from the fund)
- the roles and responsibilities of:
    - participants
    - the scheme manager (including verifying offsets and tracking credit ownership)
    - approved conservation brokers (e.g. reporting and financial assurance requirements)
    - any advisory panel

Biodiversity offsets (secured by in-perpetuity conservation agreements or covenants) might include:

- enhancing habitat on private land to improve its biodiversity value
- reconstructing habitat in strategic areas to link areas of high conservation value or increase buffer zones around areas of high conservation value
- acquiring land that contains very high conservation values through the open land market. This land could be placed in a private or in the public reserve system.

On ground conservation management actions might include:

- removing or reducing grazing pressure (controlled grazing) to allow for natural regeneration of native plants
- controlling exotic plant species that compete with native species
- leaving fallen timber on the ground (i.e. not collecting fire wood) to provide shelter for wildlife
- controlling animals (foxes, cats) that pose a threat to wildlife populations
- planting or regenerating locally indigenous trees, shrubs and grasses.

There will be two main types of participants in the scheme:

- developers that require credits, and
- offset providers (private conservation stewards) whose projects would generate credits.

Conservation brokers might also play a role in the scheme to assist private conservation stewards to put together and market their projects. Conservation brokers might include Catchment Management Authorities (CMAs), not-for-profit organisations (e.g. the Nature Conservation Trust (NCT)), non-government organisations or conservation entrepreneurs from the private sector.

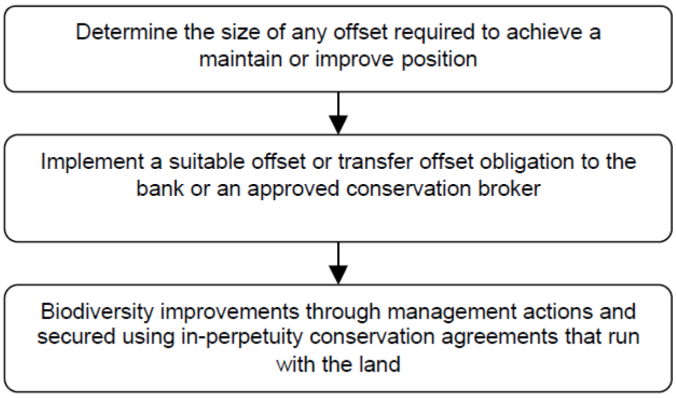

Figure 4.1 - Major steps of the BioBanking scheme. *Source: DEC, 2005.*

Scheme administration

BioBanking is managed by DECC. The core functions of DECC are:

- register biobank agreements
- issue biobanking statements
- manage the public registers
- audit biobank sites
- enforce biobanking agreements and statements
- prepare annual reports on the scheme.

Catchment management authorities will be able to help landowners establish biobank sites where appropriate. Local government and other NSW State Government agencies will be involved in the scheme administration in accordance with the legislation:

- Local government will incorporate biobanking statements into the development consent.
- Department of Planning will be consulted before biobanking statements are issued (where required).
- Department of Primary Industries will be consulted on biobanking agreements.
- Department of Lands will register biobanking agreements on land title.

Scheme administration costs

Conservation brokers and developers that choose to meet their offset obligation by arranging the offset works themselves, will be required to pay the scheme manager a charge to cover scheme administration costs. This charge will include:

- verifying and monitoring programs in the offset scheme (developments and offsets)
- seeking additional expert advice (e.g. scientific or legal advice)
- contracting services from other parties (this may include assistance from CMAs) other scheme administration costs, including:
    - providing information to developers, private conservation stewards (landholders) and other stakeholders
    - maintaining the credit register
    - compliance monitoring and reporting.

The BioBanking scheme works as follows

Developers (or their advisers/consultants) would use a rule-based assessment tool to determine:

- whether the proposed development could meet the 'maintain or improve' requirements with offsets (for example, a development in 100 ha of high quality vegetation of a type that is 95% cleared would not meet the maintain or improve requirements, even with offsets).
- where the use of offsets is appropriate, the loss in biodiversity with development
- the number of 'biodiversity credits' needed for the development to achieve a 'maintain or improve' outcome overall.

The developer could then either:

- reconfigure the project to reduce or eliminate the losses, and/or

- add additional on-site offset works to the project to bring the net package to a 'maintain or improve' position, and/or
- implement an appropriate offset program (in accordance with the assessment methodology and the scheme rules) or purchase the required number of credits from an approved conservation broker (which may include DEC). The developer would provide the certificate (stating the number of credits they have purchased) to the consent authority to demonstrate that they have met their offset obligation.

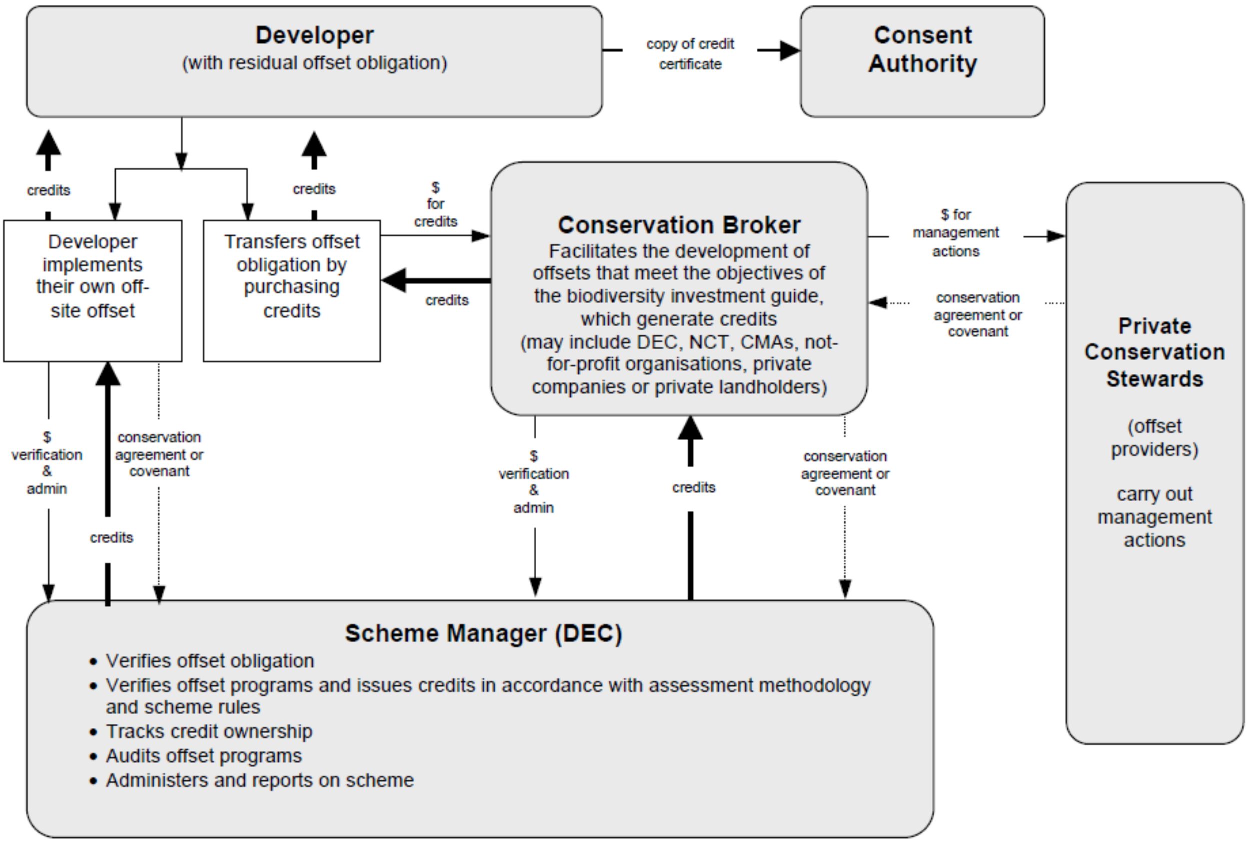

Figure 4.2 - Detailed process overview. *Source: DEC, 2005*

Credit calculations using the BioBanking Assessment Methodology

The BioBanking Assessment Methodology provides a set of rules to determine the number and type of biodiversity credits that a development site will require to offset impacts, and that a biobank site can create and sell to protect biodiversity values. The BioBanking Credit Calculator software is used to apply the methodology rules and determine credit requirements for development sites as well as the credits landowners can generate and sell.

There are two main types of biodiversity credits – species credits and ecosystem credits. It is likely that both types of credits would be required or generated for any site

• Ecosystem credits are created for all ecological communities, as well as threatened species that can be reliably predicted as occurring on site, using the presence of vegetation that provides habitat for a given ecological community or threatened species. The number of ecosystem credits is calculated based on vegetation surveys.

• Species credits are created for threatened species that cannot be reliably predicted using habitat surrogates. The number of species credits is calculated based on targeted survey reports.

The methodology assesses all biodiversity values, including the composition, structure and function of ecosystems, and threatened species, populations and ecological communities, and their habitats (as defined in the *Threatened Species Conservation Act 1995*).

The number of credits

The number of credits calculated depends on a number of factors such as site values (e.g. the structure and function of ecosystems), and landscape context (e.g. the values for connectivity and area of vegetation).

The methodology uses the scores from each of these factors to derive the change in biodiversity values as a result of either development, or protection and management over time.

The improve or maintain test

The improve or maintain test measures the impacts of development on biodiversity values. A development is considered to improve or maintain biodiversity values if impacts on other areas are counter-balanced by the retirement of credits in accordance with the offset rules, and if red flag areas (areas that are important for biodiversity conservation and that cannot easily be replaced) are avoided, subject to the variation provisions. The development footprint may need to be modified to meet this test.

Red flag areas include over-cleared vegetation types (including endangered ecological communities) and threatened species populations or habitat which cannot withstand further loss because only a small number of populations remain and/or all viable populations are considered essential for the survival of the species.

There may be some circumstances in which developments impacting on red flag areas still meet the improve or maintain test (the variation provisions). A set of Ministerial protocols will specify the situations in which these variations could be justified. These protocols will be publicly available. The Director General of DECC must apply the protocols and must be of the opinion that avoiding red flag areas would be unnecessary and unreasonable in the particular circumstances. The Director General must publish reasons for the decision.

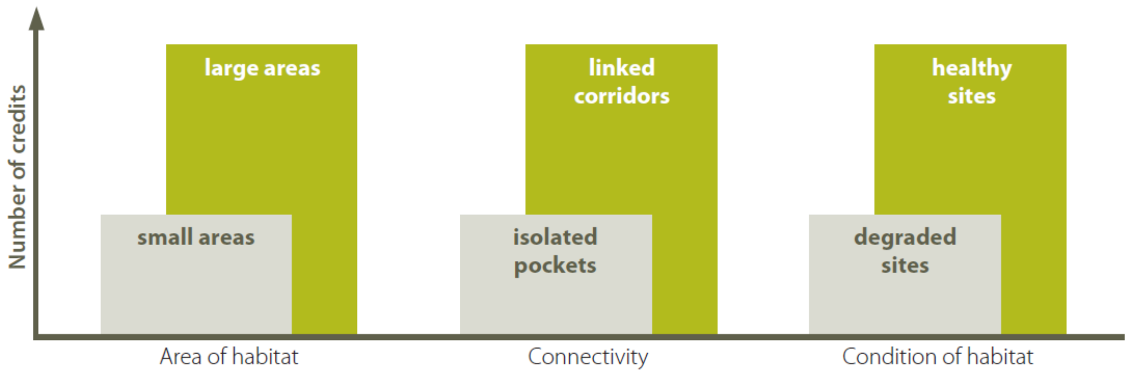

Figure 4.3 - Factors important in credit calculations. *Source: (DECC, 2007)*

The price of credits

The price of biodiversity credits will be based on the characteristics of the biobank site from which the credits are generated, as well as the existing supply and demand for credits by the market.

The location, condition and area of a property defined as a biobank site will affect the credit price. For example:

• Small, isolated sites may have higher management costs than larger sites adjoining other areas already managed for conservation.

• Surrounding land uses or past management behaviour may influence the presence of weeds or other biodiversity threats, which may affect the level of management required.

• The location of the property will also affect the land value, which in some cases may influence the return on credit sales expected by the landholder.

While buyers and sellers of credits are free to negotiate the price, credits will be priced to ensure the Total Fund Deposit is reached as soon as possible. Payment is made into the BioBanking Trust Fund when credits are first sold by a biobank site owner, until the Total Fund Deposit has been reached.

This provides capital for future payments to the biobank site owner for the long-term management of the site. Both the Total Fund Deposit and the schedule of payments are set out in each biobanking agreement. The price of biodiversity credits will be based on a combination of the minimum price determined by the Total Fund Deposit (Part A costs) and any additional return negotiated between the landholder and the buyer (Part B costs).

Calculating the price of credits

Total price of credits = **Part A Total Fund Deposit** + **Part B Return to landholder**

Part A – Total Fund Deposit: *The estimated cost of management and reporting, for the life of the agreement.*

Part B – Return to landholder: *Costs that landholders may seek to charge when setting the credit sale price, which may include:*

- *establishment costs (e.g. application fee)*
- *field assessment*
- *preparation of management plans*
- *land value*
- *opportunity cost*
- *return or risk margin.*

Figure 4.4 - The price of credits. *Source: (DECC, 2007)*

The BioBanking Trust Fund

Some of the income generated from managing the land for conservation will be paid to the landholder through the BioBanking Trust Fund. The Fund invests funds deposited through the sale of biodiversity credits on behalf of the biobank site owners. The funds plus investment earnings are used to make payments to the biobank site owner to help cover the cost of managing the site, over time.

The BioBanking Trust Fund provides a financial incentive to biobank site owners to continue to carry out obligations under the biobanking agreement (in addition to legal mechanisms), and also ensures that if land established as a biobank site is sold, the new owner of the site has the capacity to continue to manage the site.

The amount deposited into the BioBanking Trust Fund from credit sales is called the Total Fund Deposit, and is the estimated cost of carrying out the management actions on a biobank site. The Fund Manager will keep separate accounts for each biobank site and will publish publicannual reports.

The Total Fund Deposit and future schedule of payments to the landholder are set out in each biobanking agreement. These payments are made each year after the landholder submits a report showing compliance with the agreement. If the future investment return is lower than expected for an extended period, discussions with the landholder would determine possible future payments.

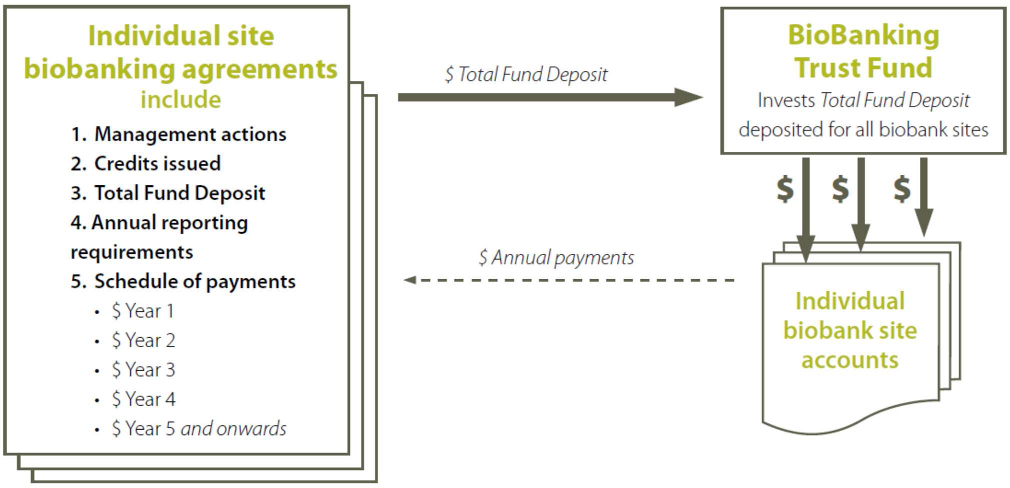

Figure 4.5 - The relationship between a biobanking agreement and the BioBanking Trust Fund. *Source: (DECC, 2007)*

The biodiversity credit market

Once credits have been issued to a biobank site owner, they can immediately be sold to any buyer. Each biobank site may generate a number of different ecosystem or species credits, and any of these credits may be sold separately or in groups.

Biodiversity credits may be purchased to achieve conservation goals, the sale of the credits provides funds for the ongoing management of the site; and to offset the impacts of a development on biodiversity values by purchasing credits and then retiring them in accordance with the scheme rules. Credits from one or more sites may be required to satisfy the number and type of credits needed.

In addition, credits can be purchased as an investment for re-sale at a later date, purchased in advance of project approval (which can be resold later if not used), acquired to build a portfolio of credits to offset future development.

Developers will seek to purchase credits available for the lowest price. Landholders will aim to get the best possible return from their credit sales.

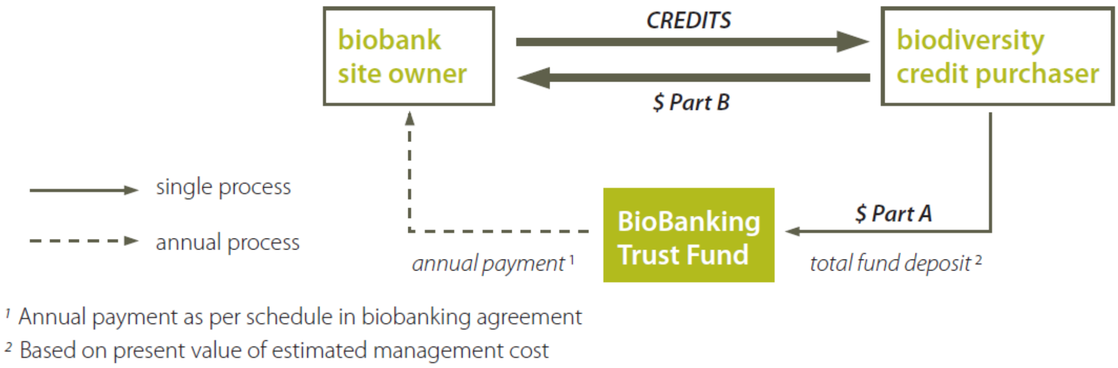

Figure 4.6 - Credit transactions. *Source: (DECC, 2007)*

Worked example

A landholder with 200 hectares establishes a biobank site and receives 1000 credits.

Part A costs for the ongoing management costs were estimated to be $394,000 (to provide payments of $100,000 in year 1, $80,000 in year 2, $40,000 in year 3, $20,000 in year 4 and $10,000 for year 5, and onwards).

Part B costs, for establishing the agreement and the expected return to the landholder, were calculated to be $80,000.

The total price of credits would be $394,000 + 80,000 = $474,000, or $474 per credit.

If the landholder sold all 1000 credits for $600,000 (or $600 per credit), $394,000 is deposited into the BioBanking Trust Fund and the balance of $206,000 is paid directly to the landholder.

Payments into the BioBanking Trust Fund only need to occur on the first sale of credits (or if retired, before the first sale). If the credits are sold a second (or subsequent) time or the Total Fund Deposit has been met, the full credit sale price is exchanged directly between buyer and seller.

If the Part B amount were to include the land value for the biobank site at $10,000 per hectare (so totalling $2,000,000), the additional cost above the Trust Fund amount would be $2.08 million. This would increase the individual credit cost to $2,394.

A $5 million development proposal that saves six months on time to obtain their approvals could save $375,000, or 15% in interest and expenses. Even at the higher credit price example, this saving would fund over 150 credits.

For additional information on this scheme see Appendix 1.

4.1.2 Liverpool Plains Land Management Tenders project

"When farmers act to fix their land management problems, the whole community benefits."

David Walker, Executive Officer, Liverpool Plains Land Management Committee.

Problem

The Liverpool Plains Land Management Committee was established in 1992 as an autonomous group driven by landholders to ensure resources are managed for the economic, social and environmental needs of the catchment and its communities. Strong linkages with government agencies and community bodies provide the necessary expertise and assistance to the Committee. The LPLMC is a key partner with the over-arching Namoi Catchment Management Authority.

To provide an operating framework or blueprint for its activities, the LPLMC developed a Catchment Investment Strategy (CIS) to guide funds to priority landscapes and ensure accountability. All proposals submitted through the Land Management Tenders must fit within the broader framework of this blueprint. The CIS sets out recommended actions to remediate the catchment problems and to encourage the matching of land use with best management practice and land capability.

In order to ensure this match, the Liverpool Plains has been classified into Land Management Units (LMUs) on the basis of geology, soil type and slope. This allows a 'common language' to be used in assessing and managing land types for their agricultural capacity and environmental sensitivity. Geology, mapping and soil survey of the Liverpool Plains region have determined nine different LMU classifications and the area of each within the catchment. The LMUs also assist the identification and targeting of priority areas. Land Management Units are fundamental to the Land Management Tender assessment process so landholders are encouraged to be familiar with LMUs and to use them as the basis of their property planning and Land Management Tender proposals.

Figure 4.7 – Liverpool Plains Catchment**.** *Source: LPLMC, 2005.*

The Liverpool Plains catchment

The Liverpool Plains catchment covers 1.2 million hectares of some of Australia's most productive winter and summer cropping land, rainfall ranges from 615mm – 720mm, catchment wide the population is 20,000 people and the regional agricultural production and processing are estimated to be worth $280M/year.

Through the looking glass in 25 years, without change:

- 175,000 ha salt affected
- 125,000 ha waterlogged
- 25,000 ha severely eroded
- Downstream river ecosystems, communities and irrigation industries suffering salinity burden Biodiversity below critical mass
- Fragmented riparian zones
- Floodplain quality deteriorated
- Catchment restoration cost prohibitive

The main environmental issues of the catchment are the declining biodiversity and natural conservation; farm enterprise and land type mismatch; spreading dryland salinity and water logging; soil erosion and soil structure decline, increasing frequency and severity of flood events and the decreasing water quality and quantity.

Goals

The Liverpool Plains Land Management Committee (LPLMC) partnered with WWF-Australia to trial an exploration of using market based techniques to simultaneously deliver government policy, community expectations and landholder requirements for the greatest ecological return across a catchment. The guiding principle was to test and evaluate the overall effectiveness of this instrument in the marketplace.

The WWF involvement grew out of its interest in providing and promoting cost-efficient incentives for conservation investment within its broader aim of finding solutions to natural environment challenges and ecosystem restoration.

The Land Management Tender trial was commenced in the Liverpool Plains in 2001. Further Tender Rounds have been held in 2003 and 2005, and by the close of the 3rd Tender Round some $7.4M of public and private funds will have been allocated to improving land management. Of this investment, $1.8M is public funding and an impressive $5.6M is the landholders' own contribution, a far higher ratio than that achieved by conventional funding mechanisms. A total of 128 landholders have been involved in the process with towards 16,700 ha of the catchment having undergone land management change. For instance, native pasture will have been established on over 7,000 ha and improved pasture established on over 8,000 ha. The area of remnant native vegetation that will have been conserved and managed totals more than 800 ha.

Approach used to solve the problem

The easiest way to understand the Land Management Tender process is to consider that it allows farmers to set a price, their tender price, for the 'community benefit' component of an ecological services project, just as they can set the price for other farm products. This price is then used by the purchaser (i.e. the taxpayer, represented by LPLMC) to assess the relative value of the ecological services project offered, on the basis of its quality compared to similar 'products' being offered by other farmers. The assessment allows the rationing of limited funds towards the best value 'products' by allowing competing tenders to be ranked, and then funded in order of value-for-money.

Landholders are invited to determine the significant environmental issues impacting on their properties, and to create action plans that address these issues and provide community benefit through increased biodiversity, improved water quality and reduced salinity. While the elements of their action plan should be thoroughly costed by the landholder for their own clear understanding of their commitment of financial, labour and management resources necessary to see it through to completion, LPLMC is really only concerned with the tender price - that amount of money being charged by the landholder to the taxpayer for the community benefit component of the project.

The tenders are assessed against an 'Environmental Benefit Index' system of objectively ranking and determining their merit and relative value. Projects judged by the LPLMC as worthy of purchasing are approved and then contracts are exchanged. The landholder is paid over the term of the contract in accordance with a schedule, whereby instalments are paid at the completion of agreed and assessed milestones, including on-going management.

Self-determination and ownership are two fundamental principles underlying the system. The projects are drafted and designed by the landholders themselves with assistance where necessary in tender development or advice on the farm and catchment-wide merits of their proposals. However, it is entirely up to the farmers to decide what actions they are prepared to offer and at no time is direction given in the setting of tender prices.

In general, projects that have multiple and broad benefits are encouraged. For example, a proposal aimed at stabilising gully erosion, in isolation, is given far less value than an integrated project that involves fencing and revegetating the gully and converting adjacent degraded cropping land to perennial pasture, which, in conjunction with improved grazing management will lead to better ground cover and reduced run-off. If designed properly, the whole 'package' has a far bigger and broader impact on biodiversity, water quality and salinity risk and is therefore more worthy of community investment.

The course of events in a Land Management Tender round can be shown as follows:

1. Launch of Tender Round and Information Sessions
2. Field Days
3. Property Action Plans
4. Farm Visits
5. Tenders Prepared and Submitted
6. Tenders Assessed and Ranked
7. Negotiate Contracts
8. Project Implementation and Management

Step 1: Launch of Tender Round and Information Sessions

LPLMC pools the available funds from the range of funding sources (eg. Local, State and Federal Governments, Private and Public Trusts, Business Donors) and launches the Land Management Tender round in the local media. A series of Information Sessions with landholders are held at various locations around the catchment to describe the Catchment Investment Strategy (CIS) and the Land Management Unit (LMU) criteria. The operation of Land Management Tenders and the difference between public and private benefit is explained.

Step 2: Field Days

Interested landholders then attend a Field Day which helps them understand the environmental issues impacting on the catchment: salinity, groundcover and pasture management, soil health, riparian zone management, and biodiversity. Such understanding is the foundation to the development of effective projects. They discuss how changed management can start to remediate those problems and improve the sustainability of their farming operations. In most cases landholders come to realise that most of the management changes discussed will actually improve their farm's productivity, in addition to providing a dividend to the wider community in improved catchment health.

Step 3: Property Action Plans

Landholders start to identify their own on-farm environmental issues and how they impact on the catchment. They attend a property planning workshop where a farm aerial photograph is used to categorise their farm landscape into LMUs and possible project sites are identified and assessed against the CIS. Landholders begin preparing a proposed action plan that meets the needs of their farm and the community and which can be met by their financial and management resources.

Step 4: Farm Visits

LPLMC staff visit farms with participants to inspect sites and provide technical advice and broad project planning guidance. In particular, they are advised as to the extent of the community benefit comprised in their proposed project. Action plans are completed.

Step 5: Tenders Prepared and Submitted

Landholders convert action plans to the formal 'Tender Application' format. This sets out the on-ground action and the on-going management that they propose over the term of the agreement. Setting the amount they should charge as their tender price, i.e. the amount of money they wish to charge the wider community for the ecological services provided, can be one of the principle uncertainties encountered by landholders in the Land Management Tender process. One method used to determine the tender price can be to estimate what they think is the relative share between their own on-farm benefit and the benefit to the wider catchment. An alternative could be to determine the maximum they can afford to contribute towards the cost of the project, and then set the amount of their tender to provide the balance.

Step 6: Tenders Assessed and Ranked

Firstly, the project is assessed in the field by a different LPLMC staff member to the person who visited previously (Step 4, above). The project is scored in terms of the current condition of a number of parameters, and their likely condition once the project has been implemented and managed for the duration of the agreement. The parameters used include ground cover, perenniality, grazing management, riparian corridor condition and existing remnant vegetation health, and are used as surrogates for the projected improvements to water quality and biodiversity, and the reduction in salinity. Then Tender applications are assessed by a panel made up of LPLMC staff and independent advisors. Provided they meet preliminary qualification criteria, their data is entered into a matrix to create a project Environmental Benefit Index (EBI).

The LPLMC approach has been to individually calculate the sum of scores in the three key measures of biodiversity, water quality and salinity benefit. Once tabulated, the scores are added to give an overall Environmental Benefit, which when divided by the project tender price provides the EBI. While the mathematical model is complex, users quickly become familiar with it and appreciate its capacity to provide an objective method of valuing the ecological worth of each application.

STREAMBANK MANAGEMENT		YEAR		
		0	3	10
SITE		Initial State	Works Completed	Project Completed
Stream length to be managed: (one point/km/bank)	Current	0		
	Planned		4	8
Vegetation type: (annual weeds – 0.25, native grasses – 2.5, grasses & trees – 4)	Current	0.25		
	Planned		2.5	4.0
Groundcover: (<20% cover - 0.6, 50-69% cover – 5.5, >90% cover – 10)	Current	0.6		
	Planned		5.5	10
Erosion: (Severe – 0.2, Moderate – 5, None – 10)	Current	0.2		
	Planned		5	10
Weeds: (noxious - 0.1 exotic – 2.5 none – 10)	Current	0.1		
	Planned		2.5	10
Stock management: (set-stocked – 1, rotationally grazed – 3 crash grazed -7 excluded – 10)	Current	1.0		
	Planned		3	7.0
	SCORE (current)	2.15		
	SCORE (planned)		22.5	49

Figure 4.8 – Example of a streambank management score. *Source: LPLMC, 2005.*

Step 7: Negotiate Contracts

LPLMC and the landholder reach agreement on the actions that constitute the major milestones, and the percentage payments that relate to their achievement. Contracts are exchanged, and 30% of the Tender price is paid as an advance.

Step 8: Project Implementation and Management

Projects begin and 'milestones' are assessed prior to further payments being made. Farmers notify LPLMC when the milestone is complete, so the Tenders Project Officer can visit to assess the work and authorise payment. In this way the projects are driven largely by the landowners, although LPLMC continues to provide advice, support and encouragement.

Understanding and using the Environmental Benefit Index system

In keeping with the Liverpool Plains Investment Strategy ideals of market-based assessment of value, efficiency and innovation in project funding, the LPLMC developed an Environmental Benefit Index (EBI) system. This essentially is a method of objectively assessing and scoring individual tenders to value the ‘ecological worth’ of a proposed on-farm project. And importantly, it enables the pool of landholders’ tenders to be ranked.

It is a proven method of balancing scientific reasoning and practical operations to deliver the best projects for the catchment and the community.

The Liverpool Plains approach has been to individually calculate biodiversity, water quality and salinity benefit scores, add these together to give an Environmental Benefit sum then divide by the project bid price to arrive at an EBI. A series of tables, parameters and a mathematical model* have been developed which requires simple input of core data by staff to obtain the indices. These include: location, rainfall, soil type, water quality measures (eg salinity, turbidity), topography, current and proposed land use, management, groundcover type and condition, weeds, scale of project and length of agreement.

The process of calculating the EBI score is:

1. $\text{Environmental Benefit Sum} = \text{salinity benefits} + \text{biodiversity benefits} + \text{water quality totals}$
2. $\text{Environmental Benefits Index score} = \frac{\text{Environmental Benefit Sum}}{\text{Tender Price}}$

In simple terms, a project EBI indicates the environmental benefit per dollar. When each project is assessed for EBI and ranked, the funding Committee can create a ranked list of competitive projects, to be ‘owned’ and delivered by landholders under a business model with clearly defined contractual milestones.

A range of factors are considered to enable the calculation of environmental benefit. In all cases current conditions are recorded and final project conditions are estimated. Biodiversity benefit scoring includes health, rarity and size of the remnant as well as distance to, and health of, adjacent remnants. Salinity benefit scores consider the priority of the sub-catchment and LMU, soil water holding capacity, average rainfall, salinity occurrence on the property and in the catchment along with current and planned land use. Water quality benefit considers stream bank and buffer zone vegetation, groundcover, erosion, grazing management and weeds, adjacent land use, distance of stream to be managed and connection to a major river.

By way of example, a selection of the Environmental Benefit working tables for the three key objectives of Biodiversity, Salinity and Water Quality are shown below, with their apportioned ratings for various events and outcomes, both before and after the project.

Example - The Blomfield Family – 'Colorado', Caroona

The Blomfield family has farmed the 1,000 ha 'Colorado' since 1946 and Sandy has observed the whole farm becoming static. "A monoculture of speargrass (Austrostipa sp) started up and gradually spread across the grazing country and the scope for productivity increases was becoming increasingly limited."

He said a catalyst for change was the need for another family to earn a living off the land. "With my son Derek and his wife at home - which meant extra hands and more backs, it also meant we had to ramp up the farm's performance so it could support us all. Their enthusiasm to convert marginal cropping land to productive perennial pastures gave us impetus", he said.

"We focused our summer and winter cropping operations on the far more productive and suitable black soil country, while our red soils were re-orientated towards perennial pastures and cattle grazing", he said. And it was a good move. The improved native pastures are providing productivity benefits and drought tolerance. But they're also using up more water, run-off has declined and the tree-lines we've placed strategically to intercept deep-drainage and limit salinity risk on the lower black soil country are showing real results, already," he said.

The issue.

The solution.

Figure 4.96 – Results in *The Blomfield Family – "Colorado". Source: LPLMC, 2005.*

Sandy has been involved in Landcare groups over the years, but with the Land Management Tenders arriving on the scene, he said "We became attracted to an alternative to implement actions and change. I've got to say actually developing the tender at first was a bit of a challenge – it's a whole new way of thinking, though with some advice and help along the way it's quite simple really.

"It has enabled us to gain knowledge and understanding of ecological processes, and see the bigger catchment-wide picture. It's a really worthwhile system; while it's not going to attract everyone, it's a real catalyst for improvement in farm management change and environmental funding," he said.

	Activity	Milestone
Part 1	The subdivision of paddocks (creating 26 paddocks @ 17.5 ha average), fertilising and better pasture management via a rotational grazing system to increase water usage and decrease run off	Milestone 1 by February 2002
Part 2	Five tree belts comprising a mix of She Oak, Black Wattle, Kurrajong and Yellow Box will be planted. The pockets of trees are designed to promote biodiversity and catch water leaving contour banks	Milestone 2 by October 2002
Part 3	The sowing of perennial pastures into a LMU C 12 ha long-term cropping field	Milestone 3 by June 2003
Part 4	Subdivision development on LMU G country (265 ha) combined with the sowing of perennial pasture into 25 ha to improve a degraded area. The area is to be managed to increase ground cover and water usage to deliver a salinity risk reduction and heightened biodiversity service	Milestone 4 by June 2004
Ongoing	A pasture monitoring and rotational grazing management practice will be implemented to achieve gains in vegetative quality and biodiversity	Milestone 5 by June 2012

Figure 4.10 – "Colorado" milestones and schedule. *Source: LPLMC, 2005.*

For additional information on this scheme see Appendix 2.

4.1.3 Environmental Services Scheme (ESS)

Problem

Traditional sources of farm revenue have not recognized the value of the services farmers provide to the environment. Good land management can, for example, slow the march of salinity, reduce acid sulfate in soil and improve water quality. To combat continuing land degradation, salinity, declining biodiversity and other environmental issues, the NSW Government commenced a groundbreaking scheme to reward rural landholders who help the environment through implementing good land management.

One of the key tools was the endorsement of a market-based approach supported by the community to develop sustainable long term solutions. The Government allocated $20m to create an Environmental Services Investment Fund (ESIF) which would provide incentives to land managers to manage their properties for specific environmental outcomes.

In order to investigate the feasibility of using this market-based approach to incorporating natural resource considerations into economic decision-making at the property level, the Government announced in July 2001 that $2m would be allocated from the ESIF to conduct a trial to establish 20 working examples of properties or (groups of properties) where environmental services would be identified and a value placed on them. The $2m investment would be used to support the activities carried out by the participating landholders. The trial was referred to as the NSW Environmental Services Scheme (ESS). On 13 June 2002, the then Minister for Land and Water Conservation launched the Environmental Services Scheme (ESS) seeking expressions of interest from landholders, or groups of landholders, to establish 20 working examples of properties where environmental services can be identified and a value placed on them.

Goals

The overall aim of the scheme was to identify the environmental benefits provided by changed land use activities to enable them to be valued by the community. Eventually, the goal was to create a market for trading these environmental services. Another objective of the scheme was to look at some of the practical issues that will arise in the development of a market to support the environmental services produced on-farm. These include the costs associated with including environmental services within rural production, how to define and create ownership of the services produced, and the types of financial, contractual and incentive arrangements necessary.

The ESS project was led by an Environmental Markets Team jointly established between Forests NSW, the Department of Infrastructure, Planning and Natural Resources, and NSW Agriculture. Other agencies were also contributing.

The main focus of the project was the integration of production-based land uses with those which produce environmental services, including salinity benefits, carbon sequestration, biodiversity enhancement, acid sulfate soils mitigation, soil and water quality improvement.

The major results expected from the trial include:

- Quantifying the full value of environmental services
- Building knowledge of the most effective ways to manage environmental services at the property and landscape level
- Gaining information to establish markets for environmental services, and
- Developing ways to support property rights and trading systems.

These results could be used as a basis for the ESIF to direct funds for operational scale incentives programs which promote land use changes and management actions offering the best and most cost-effective environmental outcomes. In addition, through developing a better understanding of the factors influencing decision-making by landholders, the project will contribute to our ability to improve the social well-being of our rural communities.

Approach used to solve the problem

One of the essential conditions for potential markets for environmental services is a system for measuring the environmental value of changes in land use or management. It is necessary to determine suitable parameters that can be used as a satisfactory indicator of these environmental services.

Suitable parameters should provide a measure at a property level that can be related to the environmental service at a catchment or regional scale, be simple to understand, be accurate, cheap to measure and reliable to use. They should also be capable of being combined into a single environmental benefits index (EBI) where more than one environmental service is a priority. This requires that each parameter can be expressed in a form which allows combination with other parameters, i.e. the units must have a similar basis with scores out of a common maximum value such as 10 or 100.

The approach developed by the project team to implement the project has involved six main strategies:

1. Identifying the types of environmental services that would be examined;

The specific 'services' selected for the project emphasised the provision of public benefits rather than exclusively private benefits. While almost all environmentally beneficial activities undertaken on a property have the potential to generate both public and private benefits, it was agreed that only the public benefit component of a service could legitimately be captured as a 'commodity' suitable for being traded or purchased. For this reason, this partitioning of benefits was an important criterion for including a specific service. As well the service was described in terms which focused on the public benefits.

Six individual environmental services were selected:

i. Carbon sequestration - related to greenhouse gases and air quality
ii. Terrestrial biodiversity benefits - related to improvements in the value of vegetation as habitat for other life-forms
iii. Salinity benefits - related to improvements in stream water salinity
iv. Soil benefits - related to retention of soil on the property
v. Water quality - related to retention of nutrients on the property
vi. Acid sulfate soil benefits - related to reduction in the production and export of acid products from acid sulfate soil regions.

In choosing these environmental services it was important that they were able to be clearly linked with specific land use changes that landholders could readily implement and incorporate into a whole property plan. To simplify the process, the following set of eight approved land use changes or activities was described:

- establishing perennial pastures,
- improved management of existing perennial pastures,
- establishing commercial tree plantings,

- establishing environmental plantings of trees or shrubs,
- regeneration of native vegetation,
- establishment of saltbush,
- engineering works (such as earthworks to control runoff or drainage),
- reintroduction of natural wetting or drying cycles in former wetlands or estuarine areas.

Each land use category was chosen because it was likely to generate significant (though varying) amounts of the six chosen environmental services. In addition, they were all capable of successful integration into a commercial business plan for each property.

2. Determining the best ways to measure a range of environmental services;

One of the essential conditions for potential markets for environmental services is a system for measuring the environmental value of changes in land use or management. If it is possible, the impact of these changes should be measured directly, e.g. estimating the quantity of an increased carbon sink created through tree planting using standard carbon accounting techniques. In many instances, however, it is not possible to measure the value of these changes in contributing to additional environmental service levels through direct means.

In the case of salinity benefits arising from tree planting throughout the catchment, the impacts on stream water quality are the product of a large number of inputs from specific sites, and the individual contributions will mostly be difficult or impossible to measure directly. In other cases the benefits are not evident until long after the original action is taken as in the case of improving habitat for biodiversity through recreating vegetation systems.

In these cases it is necessary to determine suitable parameters that can be used as a satisfactory indicator of these environmental services (this is sometimes referred to as a surrogate measure). Suitable parameters should have the following features. They should:

- Provide a measure at a property level that can be related to the environmental service at a catchment or regional scale
- Be simple to understand
- Be cheap to measure and reliable to use.

They should also be capable of being combined into a single environmental benefits index (EBI) where more than one environmental service was a priority. This requires that each parameter can be expressed in a form which allows combination with other parameters, i.e. the units must have a similar basis with scores out of a common maximum value such as 100.

With these criteria in mind, a series of six environmental services indices was developed during 2002, together with toolkits to estimate these indices at a property level for each approved land use change. The toolkits were based on existing, or in some cases, newly developed biophysical models and were developed by Technical Working Groups composed of scientific experts in the relevant fields including State and Commonwealth agencies and universities.

3. Developing and implementing a cost-effective process for competitive selection of the trial participants;

A two stage process was developed for selecting participants in the project involving (i) Expressions of interest (EOIs); (ii) Full applications from an invited shortlist.

Stage (i) – Expressions of interest

Expressions of interest were called by advertisement in the press, and by direct advice to a list of potential applicants who had registered their interest when the project was originally announced. Altogether over 400 information packages were distributed. A total of 145 expressions of interest was received, which included 5 groups of applicants. A desktop process was used to select a shortlist of 75 applicants including six groups.

The selection process used a checklist to assess whether the EOI complied with a range of criteria (location within priority areas, income derived mainly from farming, the extent and suitability of land use changes proposed, integration into a whole farm plan, demonstration value of site), together with an estimate of the potential environmental services to be produced by each proposal. Applications were first scored and assessed by Regional staff, and then independently assessed by a central coordinating panel.

Desktop estimates of the potential environmental services produced by specific land use changes were made using simple ranking systems from 1 to 5 (from low to high value) based on the consensus opinion of the expert Technical Working Groups. The relative rankings for the level of environmental benefits produced by each land use change which were used in these systems were ordinal rankings, i.e. the intervals between adjacent scale values were not directly proportional to differences in the quantity of benefits produced by the action. With this qualification, the rankings were used to calculate the quantum of services produced from the given land use change, by adding together the rankings or scores for each environmental service to produce a sum of the values for all services. This sum was then multiplied by the area of change in hectares to give an estimate of the Total Benefits potentially produced by the specific land use change proposed.

Summing the Total Benefits for all land use changes produced a Grand Total of potential environmental services. The Grand Total of environmental benefits was then used to rank the EOIs on the basis of the expected magnitude of benefits produced. An additional ranking was developed based on dividing the Grand Total by the total area of land use changes to give an Average Total Benefits per hectare figure (a type of quality of land use change assessment). The two rankings were used jointly to develop a shortlist.

A close level of agreement was observed between the independent assessment of the EOIs by the central coordinating panel and the assessments made by Regional managers and technical staff familiar with the properties and land use changes in question. Given that the final selection process was independent of this expert local opinion of the relative merits of proposals, the desktop methods used appear to have reasonable substance.

Stage (ii) - Full applications

Shortlisted applicants were invited to submit detailed applications for consideration in the second stage of the process. To assist in this process, Regional DIPNR Investment Services staff were provided with a range of decision support systems to allow them to discuss with landholders, the range of options for land use change on the property and the resulting impacts of these changes on farm economic performance and the production of environmental benefits. The decision support systems included the six toolkits developed to estimate environmental services, together with a spatially based modelling tool termed the land use options simulator (LUOS Version1) which was used to calculate the salinity benefits for various land use change scenarios.

Each landholder was also given assistance to prepare a property plan showing the current land use and proposed land use changes. Standard descriptions were provided for each land use as a general guide to the standards of management practice expected. A formal application and bid was prepared by the landholder which required the provision of financial information about the business, together with a comprehensive outline of the proposed changes and the bid price.

A formalised selection process was developed. In brief each application was first assessed by Regional DIPNR staff using the 'toolkits' to estimate the environmental benefits (or disbenefits) of the full suite of land use changes proposed by each applicant. This required a visit to the applicant's property by field staff, and the collection of basic data from the site for subsequent entry into the toolkits. The toolkits were then run and the output indices for each management unit on the property (defined as the total area of each specific land use change) were entered into a spreadsheet, developed for the purpose. The separate indices (five in total for any specific site – since sites occurred either in salinity priority areas or acid sulfate soils areas) were then normalised to a common basis and added together to form a composite Environmental

Benefits Index (EBI).This composite EBI was used together with other measures (the demonstration value of the site and cost-effectiveness of the bid), to produce a total score for each application.

All bids were then ranked on the basis of their total score on the three criteria: environmental benefits, cost-effectiveness and demonstration value. Final selection also took account of the need to ensure adequate geographic spread across the State, representation of specific enterprises and inclusion of a full range of land use changes to meet the project objectives.

In addition to the 20 selected sites, an eligibility list was created.

The selected applicants were then advised of their success and invited to negotiate a contract for the provision of the agreed services. The first contract was signed in February 2003. By October 2003, a total of 24 contracts had been signed.

4. Preparing and executing the necessary contractual arrangements for engaging selected applicants;

A generic contract was drawn up based on standard DIPNR and SF contracts for the supply of services and joint venture arrangements with landholders (11). The contract contained a background recital that states: “The Landowner and the Department intend to work together to improve understanding of the role of Environmental Services and demonstration of that role to other interested parties. This Contract sets out the basis on which the Department will pay the Landowner for undertaking agreed land use changes, and the framework in which the Landowner will both undertake and maintain the specified land use changes.

These requirements were intended to ensure that land use changes were of an enduring nature and to avoid perverse outcomes such as the subsequent removal of land use changes intended to be permanent. This was seen as a more desirable approach for a trial than requiring legal attachments to title. The specifics of the contract were contained in separate Schedules covering the land use changes, a timetable for implementation of works, payments, and provision for monitoring environmental services and reporting for compliance.

5. Establishing systems for monitoring the production of environmental services from land use changes and contract compliance;

One of the primary aims of the ESS project is to develop accurate, cost-effective methods for quantifying the environmental services produced by land use change. Access to the properties in the trial will allow an assessment to be made of the range of tools developed for this purpose. As the ESS is not designed to carry out or fund major research programs, it was not envisaged that these baseline assessments and monitoring would answer all questions. However an opportunity exists to gather sufficient information to improve the predictive power of the toolkits, as well as allowing a good demonstration and reporting of the toolkits in operation. Baseline information is required to test the assumptions about starting conditions in many of the toolkits, and where possible to assess the conditions of each site prior to land use changes in order to build on the initial assessments made by Regional staff. At some sites, implementation of land use changes was undertaken quickly to take advantage of favourable conditions and alternative sampling strategies have been necessary.

Monitoring is also required to build further confidence in the indices; to check the direction and magnitude of environmental benefits following land use changes; and for continued calibration and/or validation of individual toolkits. The toolkits have been developed with the assumption that best management practices are being followed by the landholders. To calibrate the indices and their models, it is essential that the actual management practices achieved by individual landholders are known, so that this underlying assumption can be tested and if necessary, input values to the toolkits adjusted. A general outline of considerations underlying the specific monitoring programs on each site was developed by a workshop of scientific, technical and field staff. This outline was then used as a basis to develop specific protocols for each site.

Specific protocols for each site are consistent with the overall objectives of the monitoring but are also tailored to suit site and resourcing constraints. The strategies adopted to carry out this program include:

- Carry out surveys and assessments as appropriate
- Conduct sampling
- Install any necessary monitoring equipment
- Establish on-going data collection program
- Co-ordinate data input and maintenance
- Assess compliance with Best Management Practices as specified in the Contracts – develop a compliance list (e.g. checklist) based on agreed Management Actions.

Monitoring compliance with contractual obligations is also a component of the project to ensure that specific land management changes are carried out and milestones are met. An attempt will be made to amalgamate the compliance monitoring process with the collection of routine management data by landholders (e.g. for improved pasture management).

This process is also important as part of developing more efficient, coordinated systems to measure environmental change.

Eventually it may be possible for these measurements to be made directly by landholders, as well as by relevant agency or Catchment Authority staff as at present. Baseline assessment and monitoring programs have been carried out progressively since July 2003. Delays in completing contracts (largely due to the drought) and the complexity of designing robust, yet affordable monitoring methods, have affected this aspect of the project. It is anticipated that all sites will be assessed and monitoring programs put in place by end-December 2003.

6. Evaluating the benefits and costs to the farm business of land use changes for environmental services.

A key area of interest in the ESS is to measure the returns from existing and proposed land uses and how these changes affect farm profitability. To determine the effect of the ESS on farm profitability, a firm of agricultural and management consultants have been engaged by NSW Agriculture. The principal task of the contractors is to establish baseline farm profitability (the without ESS scenario). The following farm performance indicators are required:

- Whole farm gross margin - sum of individual enterprise gross margins (enterprise income less enterprise variable costs) received from farm enterprises;
- Net farm income - whole farm gross margin less overhead costs (overheads include costs like depreciation but exclude finance costs like interest);
- Farm business return - net farm income less imputed cost of operator labour and finance costs (measures overall farm profit);
- Equity per cent - net worth expressed as a percentage of total assets (total assets less total liabilities divided by total assets); and
- Return to equity - business return expressed as a percentage of farm equity (a measure of the return to capital owned by the operator).

The contractors will work with individual landholders to develop a whole farm budget which can be used to determine the above parameters. Because a key focus of the ESS is on the profitability of land uses, the whole farm budget will need to specify individual enterprise gross margins rather than traditional accounting approaches. A major component of the task involves the development of the gross margins:

i. for the whole farm (covering non-land use change areas as well as the unchanged areas of the property); and
ii. based on costs and returns under “average” seasonal and market conditions.

NSW Agriculture will provide a generic set of gross margin budgets for the contractors to adapt to individual property conditions. Revised enterprise budgets will be part of the final product provided by the consultant

These services were chosen because they include the major categories of environmental services of value to the community. Another essential criteria was that it was feasible that acceptable methods for their measurement could be developed within the timeframe of the project. It was also important that the selected services could be clearly linked with specific land use changes that landholders could readily implement and incorporate into a whole property plan.

Environmental service indices were developed for each of the six services by teams of scientific experts from various agencies and other institutions. Where possible, existing indices of each service were adopted. If models already existed that provided an adequate way of estimating each index, then these were used. In other cases, new models were developed.

Indices were established for each of the selected environmental services which express the quantity of service produced in clearly understood units, for example, tonnes of sediment retained. Additionally, toolkits were developed to estimate these indices for each property and land use change.

The toolkits were based on existing, or in some cases, newly developed, biophysical models. They were developed by Technical Working Groups composed of scientific experts in the relevant fields including State, Commonwealth and University organizations.

The toolkits were used as part of the process to select the properties for inclusion in the trial. One of the toolkits, the Carbon Sequestration Predictor (CSP), was developed to allow rapid estimates of the potential for land use changes involving revegetation to create increased carbon sinks. The CSP requires minimal data inputs and is capable of continuous improvement using new data on carbon sequestration potential in areas where this is limited, for example in low rainfall zones.

A biodiversity toolkit has also been developed for use by advisers with some ecological experience to assist landowners in assessing the benefits to biodiversity that are likely to result from a change in the way they use their land. The toolkit was a product of collaboration between key government departments and stakeholders in NSW and Victoria including DIPNR, DEC and DPI (Forests NSW). It has been designed to:

- Score the current biodiversity value of a site.

- Estimate the magnitude and direction of change in biodiversity value resulting from land use change.
- Incorporate these current and potential values into a Biodiversity Benefits Index.

The toolkit is unique in that it has been designed to cover a wide range of alternative vegetation options, including commercial and environmental native tree plantings as well as other typical land use changes on farmland

Contracts were signed with 24 individual landholders covering approximately 11,000 ha of land use change. The properties selected for the project were chosen to represent a range of locations, enterprise types, land use changes and environmental and production benefits.

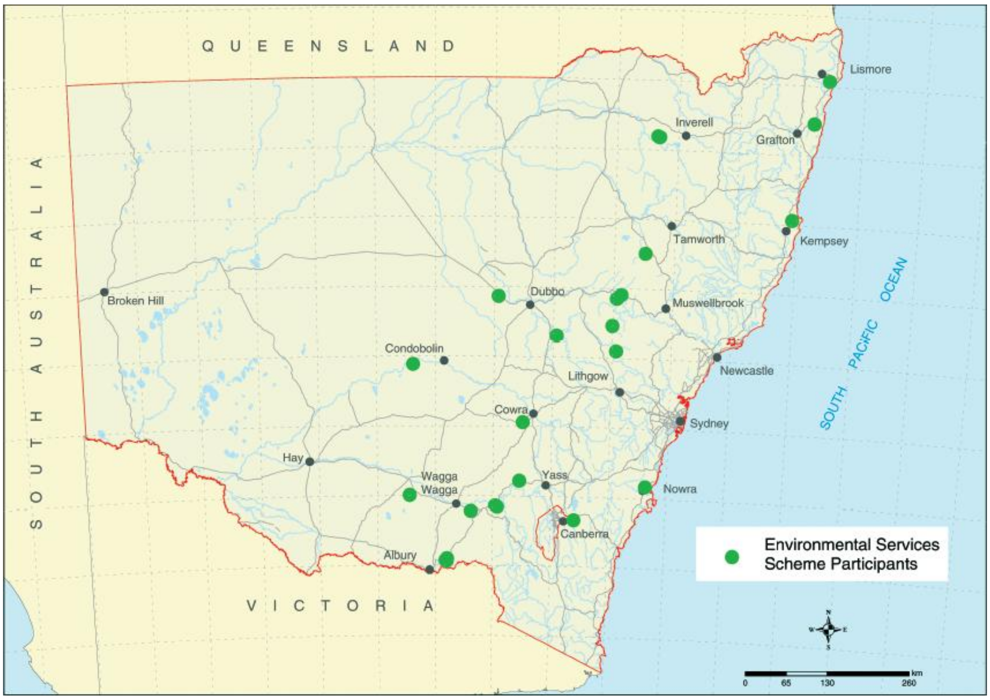

Figure 4.11 – ESS participants Maps. *Source: Alastair, 2003.*

Monitoring and evaluation was conducted over the five years of the contracts to determine the impacts of these changes on resulting environmental services provided.

For additional information on this scheme see Appendix 3.

4.2 Assessment and review of the case studies according to the proposed methodology

4.2.1 *Biodiversity Banking and Offsets Scheme (Biobanking)*

1. What environmental problem and economic or market failure/ failures is the project seeking to address?

This scheme is intended to provide a market based approach to help reduce cumulative biodiversity losses caused by population growth and development pressures around urban areas, along the coast and at major inland development sites.

This scheme presents a new option for companies to offset their impacts in a cheaper way, and also provides a new source of earnings for private landowners all over New South Wales. It is an alternative to an already existing system of offsets that doesn't work properly. It also wants to replace the grants that governments usually give landowners to protect biodiversity, which generally do not achieve good results. This scheme intends to give more responsibility to the landowners and to make them have a more active role in biodiversity conservation.

2. What's the objective/s?

The main concept is sustainability, this scheme intends to help conserving biodiversity, but without stopping the economic growth and also giving people (landowners) the possibility to earn more money doing better land management. BioBanking is a way of ensuring that offsets are implemented consistently and strategically in advance of the impacts of development. This generates better environmental outcomes at lower cost more quickly.

A point of additional interest is that this market can and will be connected to the carbon market that is being created in Australia. In a few years landowners involved in this scheme will have biodiversity (ecosystems and species) credits and carbon credits to sell in the market.

3. What market mechanisms are being used?

Under this approach, landholders can voluntarily create biodiversity credits by establishing biobank sites on their land. They do so by entering into a "biobanking agreement" with the Minister for the Environment. This agreement allows them to create and sell a specified number of credits in exchange for committing to ongoing conservation management of the land.

The overall price paid for each credit will be determined by the market. A prescribed amount will be paid into the BioBanking Trust Fund when the credits are first sold to provide for payments back to the owner of the biobank site over a long period of time to assist with carrying out the conservation management actions. The remaining amount of the sale price is agreed directly between the landholder and the credit purchaser and is paid directly to the landholder. In this way, both parties to the transaction receive something of value, and the environment is better protected.

4. How is/are the commodity/commodities being defined?

Commodities are defined as biodiversity credits, these are issued once a biobanking agreement has been approved. The credits represent an improvement in the condition of biodiversity values such as an improvement in the habitat or an increase in the habitat or population of a threatened species. The number and type are calculated using the BioBanking Assessment Methodology and the Credit Calculator.

5. How are property rights being specified? Is there regulatory underpinning for its allocation?

A rule-based approach determines the credit requirements and calculation.The allocation of property rights will be done through the signing of legally binding contracts with land managers (sellers), and those buying credits are committing to secure the conservation of biodiversity in perpetuity.

6. Who is the buyer? Who is the seller?

The sellers will be the landowners who commit to enhance and protect biodiversity values on their land. The “biodiversity credits” to be generated can then be sold.

Anyone is able to purchase these credits from the landholder, although it is expected that developers seeking to use credits to offset impacts to biodiversity will be the main purchasers. Developers can voluntarily use the scheme to potentially offset development impacts on biodiversity. To do this they must use the biobanking assessment methodology to calculate the required number and class of biodiversity credits and then obtain a biobanking statement which will confirm that their project meets the improve or maintain biodiversity. Credit requirements are then incorporated into the development consent. Credits must be obtained and retired before work commences.

7. Is it addressing point source or diffuse source, or both?

Both.

8. What monitoring arrangements are/will be in place?

The landowners have to do an annual report of their activities, the DECC (Department of Environment and Climate Change) receives the reports and evaluates them. Biobank site owners are required to submit an annual return detailing their performance in fulfilling the conditions of the biobanking agreement. Failure to submit a satisfactory report could result in annual payments being withheld.

DECC will publicly release an annual report on the scheme's performance on its website. This report will provide the community with information about the number and type of credits issued, the biobanking agreements signed, and the biobanking statements issued. It will also report on the financial aspects of the scheme.

9. Timetable, milestones?

The agreement between the landowners and the government is attached to the land title and exists in perpetuity. The landowners that join the scheme have a management plan to follow and the penalties for non compliance are judicial prosecutions.

10. Total costs (including transaction costs)

This scheme demands a large budget from DECC because of their role in the scheme, they will do a lot of field work, monitoring and making sure every commitment is been accomplished. However there was no available information about the costs.

11. Participation levels

The targets are all private landowners but most of the participants are essentially farmers.

The participation level fits Scenario 3 – low participation (Appendix A – Proposed Regulation 2007), that estimated:

- 30 biobank sites;
- 8 biobanking statements;
- 12 sets of credits retired.

The main reasons are:

- Current economic scenario (economic crisis);

- Lack of awareness and information about the scheme (the scheme is very complex, it takes time to fully understand him);
- Initial costs of participation (each landholder must hire at his own expense a consultancy to evaluate his land and calculate his credits);
- The commitments regarding land management and actions to develop;
- Perpetuity of the compromise;

This scheme started recently, but the analysis of the available data allows taking some conclusions about improvements needed and what are the potential drivers for the scheme failure.

Improvements needed

- Develop tools in a website that allow landowners to evaluate themselves their land and calculate their credits, reducing the costs of join the scheme;
- Use taxes that compensate landowners who sell their properties at a lower price because of joining the scheme (allow them to discount in taxes the difference between the value of the land before joining the scheme and the selling value);
- Do more information sessions.

Main Drivers for failure of the scheme

1. Scheme complexity;
2. Perpetuity of the agreement;
3. Initial costs;
4. Lack of demand.

1. Although people identify the scheme as a good opportunity to make money the scheme is very complex (methodology, legislation, credits, land management, Biobanking Trust Fund) and the information provided till now is not enough.
2. When a landowner joins the scheme is land will be permanently under this management plan and actions of conservation. He cannot quit the scheme, and if he dies or sells the land, the following owner continues on the scheme and he must follow the management plan. This may be a problem for some buyers, so the market value of the land will decrease.

3. The management costs are easily calculated and there are already projections of the costs for each year and for each action the landowners must accomplish. The problem is before starting the land management.
4. First, landowners must hire at their own expense a consultancy recommended by DECC to evaluate their land and to calculate how many credits it worth's. Only then they will be prepared to join the scheme. This investment is high and raises more concern if the market doesn't show strong signs of demand.
5. *It's essential that developers join the scheme in order to create a big demand that can generate attractive profits for the landowners (Most important Factor).*

4.2.2 *Liverpool Plains Land Management Tenders project*

1. What environmental problem and economic or market failure/ failures is the project seeking to address?

A range of environmental problems are resulting from inappropriate land use. The main environmental issues of the catchment are the declining biodiversity and natural conservation; farm enterprise and land type mismatch; spreading dryland salinity and water logging; soil erosion and soil structure decline, increasing frequency and severity of flood events and the decreasing water quality and quantity.

The project also examines how market-based mechanisms can be used to implement a catchment-based natural resource management plan. This project addresses the problems of multiple benefits, non-standard values and asymmetric information - a range of different agents hold the information needed to make the cost-effective environmental decisions. It also addresses the need for farmers to be rewarded for environmentally responsible management.

2. What's the objective/s?

The Liverpool Plains Land Management Committee (LPLMC) partnered with WWF-Australia to trial an exploration of using market based techniques to simultaneously deliver government policy, community expectations and landholder requirements for the greatest ecological return across a catchment. The guiding principle was to test and evaluate the overall effectiveness of this instrument in the marketplace. The goal was to provide and promote cost-efficient incentives for conservation investment within its broader aim of finding solutions to natural environment challenges and ecosystem restoration.

3. What market mechanisms are being used?

This natural resource auctions is based on the idea that the funding body pays for certain environmental services provided by the landholder. The services that the funding body wished to purchase were advertised allowing landholders to tender for projects. The incentive offered is more attractive to the farmer in terms of cost sharing, but the potential benefits for the funding body are that the investment is strategic and more likely to result on long-term outcomes.
The project team developed ways to rank the tenders using environmental indices, in this case, the Environmental Benefits Index. This allowed objective and defensible decisions about which projects would deliver the most environmental outcomes for the least cost.

4. How is/are the commodity/commodities being defined?

Commodities are defined as environmental services – on-ground actions consistent with the Investment Strategy will deliver required catchment outcomes. The commodities will be defined through the Environmental Benefits Index (salinity and biodiversity). The Index will rate the environmental outcomes of bids and this will be used to compare the cost-benefit of bids.

5. How are property rights being specified? Is there regulatory underpinning for its allocation?

Conditions attached to funding will ensure the maintenance of works funded and thereby specify property rights. The Environmental Benefit Index will define property rights. There will be a specific contract secure this conditions.

6. Who is the buyer? Who is the seller?

Government is the buyer and landholders are the sellers.

7. Is it addressing point source or diffuse source, or both?

Both.

8. What monitoring arrangements are/will be in place?

Many of the actions implemented during the project will not produce environmental outcomes during the project period. Environmental outcomes monitoring will therefore need to focus on ensuring that the actions are implemented in a way that will facilitate the optimum possible environmental outcomes beyond the project period. The research-based actions recommended in the Investment Strategy will underpin this.

9. Timetable, milestones?

LPLMC and the landholder reach agreement on the actions that constitute the major milestones. Projects begin and milestones are assessed prior to further payments being made. Farmers notify LPLMC when the milestone is complete, so the Tenders Project Officer can visit to assess the work and authorize payment.

The contracts signed establish a ten year commitment.

10. Total costs (including transaction costs)

By the close of the 3rd Tender Round some $7.4M of public and private funds have been allocated to improving land management. Of this investment, $1.8M is public funding and an impressive $5.6M is the landholders' own contribution, a far higher ratio than that achieved by conventional funding mechanisms.

11. Participation levels

A total of 128 landholders have been involved in the process with towards 16,700 ha of the catchment having undergone land management change. For instance, native pasture will have been established on over 7,000 ha and improved pasture established on over 8,000 ha. The area of remnant native vegetation that will have been conserved and managed totals more than 800 ha.

The benefits of the Land Management Tender system can be seen equally for both landholders and funding providers.

The buyers (Funding Organization)

- can assess, rank and select tenders which provide the greatest benefit for least cost;
- can target particular outcomes and critical areas;

- broadens the scope of on-farm impacts to across-catchment impacts;
- enables a thorough review and evaluation for accountability;
- enables the development of a catchment-wide ecological database;
- funding linked to actual and timed delivery;
- business model adopted with incumbent roles and responsibilities.

The sellers (Landholder)

- all on-ground works costs and benefits fully planned and accounted for
- farm management changes induced
- raises awareness and understanding of environmental issues to higher levels
- provides significant 'ownership' and 'custodian' ethics
- introduces competitiveness among farmers to participate in catchment health
- erases the 'hand-out' mentality
- fits farmers' concept of 'doing business'

4.2.3 *Environmental Services Scheme (ESS)*

1. What environmental problem and economic or market failure/ failures is the project seeking to address?

The main environmental problem is the degradation of natural resources through current rural production systems. Current systems do not incorporate the value of environmental services produced on a property into the cost of production and economic decision making at a property and landscape level.

The project is seeking to address the failure for the market to value environmental costs and benefits, and hence demonstrate how incentives for sustainable land management practices could be developed.

2. What's the objective/s?

The overall aim of the scheme is to identify the environmental benefits provided by changed land use activities to enable them to be valued by the community. Other goal of the Environmental Services Scheme is to look at some of the practical issues that will arise in the development of a market to support the environmental services produced on-farm. These include the costs associated with including environmental services within rural production, how to define and create ownership of the services produced, and the types of financial, contractual and incentive arrangements necessary.

3. What market mechanisms are being used?

The project will develop the mechanisms needed for environmental services markets by property level testing of relationships and by recognizing the value of the environmental services generated on twenty 'working example' farms.

Applicants in the scheme were selected after an Expression of Interest process. 75 landholders were shortlisted and lodged detailed proposals. Each landholder submitted a competitive bid for funding sought. ESS participants were ultimately selected using an objective process based on the cost effectiveness of their proposals, the estimated environmental services provided and the demonstration value of the site

Indices were established for each of the selected environmental services which express the quantity of service produced in clearly understood units, for example, tonnes of sediment retained. Additionally, toolkits were developed to estimate these indices for each property and land use change. The toolkits were based on existing, or in some cases, newly developed, biophysical models. They were developed by Technical Working Groups composed of scientific experts in the relevant fields including State, Commonwealth and University organizations.

4. How is/are the commodity/commodities being defined?

The project will define environmental services "products" and identify land management benchmarks for activities impacting on these products.

5. How are property rights being specified? Is there regulatory underpinning for its allocation?

A key aim of the project is to assess issues surrounding the creation of property rights over environmental services produced at the farm level. The allocation of property rights initially will be through the development of a legally binding contract with land managers.

6. Who is the buyer? Who is the seller?

In the first instance, the NSW Government will be the buyer and the land managers on the twenty farms will be the sellers.

7. Is it addressing point source or diffuse source, or both?

Both.

8. What monitoring arrangements are/will be in place?

The Scheme monitors the physical impact and the cost of producing specific environmental services, as well as the transactions costs associated with measuring and tracking service provision at the farm level.

Modelling is used to assess the impact of incremental gains in specific environmental services at a property level, to enable extrapolation across the landscape. The financial modelling compares cost of production and returns under current primary production systems with systems incorporating the production of marketable environmental services.

9. Timetable, milestones?

Work to implement land use change has commenced across 11.000 hectares, with regular payments to landholders over the 5 year contracts.

10. Total costs (including transaction costs)

Land use changes on the properties involved are being funded through an investment of $2 million from the NSW Salinity Strategy's Environmental Services Investment Fund.

The contracts signed have a total value of $1.7 million. Work to implement land use changes commenced on these properties and the first income stream payments totalling over $600,000 were made. The approach appears to have been remarkably effective in encouraging land use change, with average costs around $190/ha for enduring land use change.

11. Participation levels

A total of 24 individual landholders have entered into contracts under the project. Amongst the successful applicants were three groups which included 7 landholders. Since these groups were treated as though they were a single site during the selection process, there were a total of 20 separate successful bids/sites.

CHAPTER 5 – Lessons Learned with the Australian Experience

The Australian experience on implementing MBIs allowed taking several lessons, such as on the importance of this type of instruments, how they work and what are the keys for success.

MBIs can be considered as an important policy instrument for the management of biodiversity on private land. They have the capacity to provide landholders with an incentive to produce desired biodiversity outcomes, for instance, auctions can outperform traditional instruments such as grants and fixed input price schemes for the provision of biodiversity benefits. MBIs also have the capacity to attract significant landholder engagement, encourage voluntary change and improve the potential to target public investment.

MBIs work on the principle that policies that induce people to make decisions in their own best interest are often more effective than those that exhort or force individuals to act in a particular way. MBI mechanisms represent a decentralised approach to conservation in that landholders, based on their own financial interests, determine the desired reduction in environmental harm. This avoids the problem of a "one size fits all" strategy that is unlikely to be cost effective with heterogeneous landholders. It also leaves the decisions about how to best achieve a particular environmental goal at a farm or paddock level with the most qualified person to make this decision, the landholder.

A key to the successful application of MBIs is that they recognise that landholders possess information, individually and collectively, that can be used to more effectively deliver desired environmental and natural resource management outcomes. By creating an opportunity to trade, landholders reveal important information that allows for more cost-effective use of conservation funds. The MBI approach also provides dynamic incentives for landholders to address environmental problems.

A necessary condition for the effective implementation of MBIs is adequate monitoring and enforcement of landholder's actions. Simply creating a market for conservation action is not sufficient, and considerable regulatory oversight is required to ensure desired environmental outcomes. Another key to the successful implementation of MBIs is an understanding of the cause and effect of conservation actions and environmental outcomes. Information to support natural resources management decisions and sustainable land management can be greatly enhanced by MBIs, in particular through the use of decision support tools (metrics). Metrics are used in a range of mechanisms and can be used to link farm scale actions to regional targets.

The cost of initially establishing MBIs is substantial. Although MBIs, especially auctions, offer substantial savings in the delivery of environmental benefits, they are initially expensive to establish. This is because of high initial set up costs in terms of bio-physical modelling, and the costs associated with communicating the purpose and method of MBI approaches with stakeholders.

MBIs require well-developed communication strategies, the case studies show that there must be an effective communications strategy about the mechanisms and the benefits they deliver to ensure landholder participation. MBIs also need adequate testing prior to implementation, although the theory behind MBIs is well developed, the details of how to apply the mechanisms must be adapted and tailored to the landscape, environmental problem, institutional capacity and other relevant local factors.

CHAPTER 6 – Portugal

6.1 Biodiversity in Portugal

Located in the western part of the Iberian Peninsula, occupying around a fifth of its area, mainland Portugal extends between latitudes 37º and 42º N, measuring 561 km at its longest point, its breadth varying between 112 km and 218 km. The border with Spain, much of which is delineated by rivers, covers some 1200 km. Despite its small size (89,000 km^2), Portugal reveals a great diversity of habitats and landscapes which can only with difficulty be fitted into regional divisions. Climate, relief, soil, and the hydrology all act together to differentiate neighbouring, and seemingly homogeneous, regions. The diversity of habitats and landscapes in Portugal, result of many geographical and historical factors, has given rise to a great variety of natural life, particularly species with a restricted area of distribution within continental Europe (ICNB, 2005).

Portugal, in the European context, is considered a rich and diverse country in flora and fauna. In addition to the species typically Atlantic, offers a large number of Mediterranean species. It has, moreover, a large number of endemisms, as well as species considered as relics of the genetic and bio-geographical point of view. The decisive factors for this reality are not only natural - Portugal is in the enclave of three bioregions receiving atlantic and mediterranean influences - but also the centuries of human activity that provided ecological conditions for a harmonious development. However, the existing biodiversity in Portugal is threatened and their main cause are the changes resulting from the development of the agriculture economy, changes in use of soil, abandonment of agriculture land, intensification of agricultural processes, environmental quality degradation of some habitats and urban pressure on fragile systems, are some of the most common and damaging factors to biodiversity.

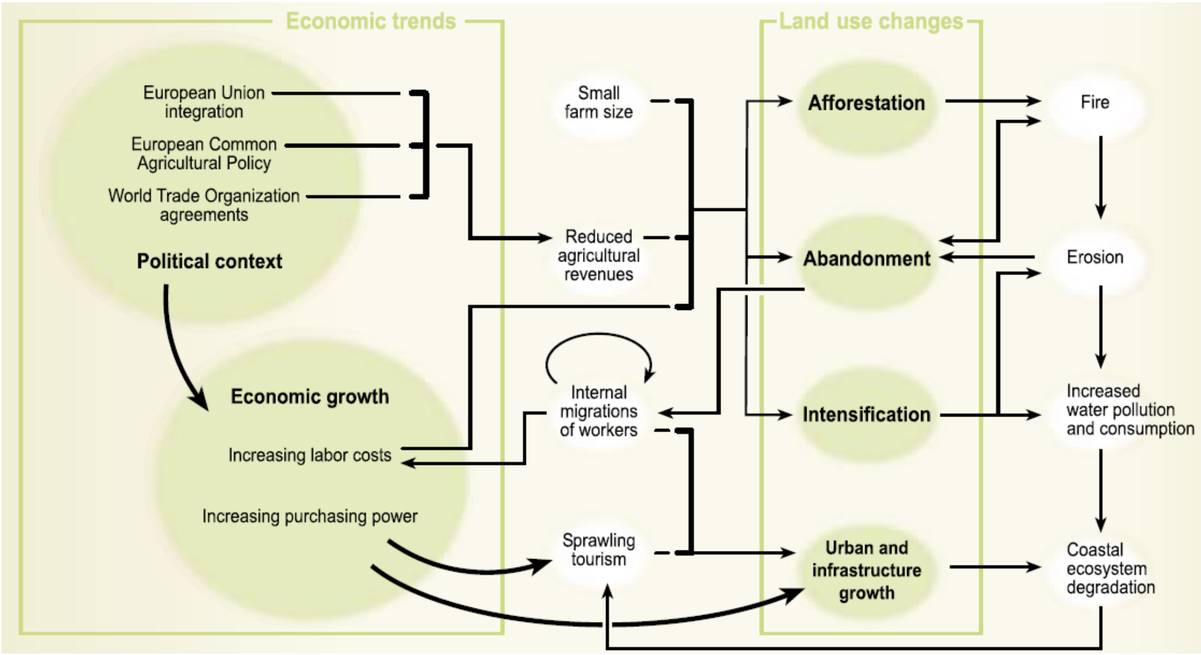

Figure 6.1 - Feedbacks and Interaction between Drivers in Portugal Sub-global-Assement. *Source: Millennium Ecosystem Assessment, 2005*

6.2 Policy framework for biodiversity conservation

Nationally, the adoption of Law Nº9/70, 19 June, introduced in the national legal system the concept of national park and reserve, promoting the classification of the most representative area of national heritage.

The policy of nature conservation in Portugal is embodied in the Law of the Environment (Law Nº11/87 of 7 April), the National Strategically Reference Framework (NSRF) and the National Strategy for Sustainable Development (NSSD).

Aiming the framework of global policies on the environment and sector policies on the conservation of nature, as stipulated in the Law of the Environment, is defined the National Strategy for Nature Conservation and Biodiversity, adopted by Resolution of the Council of Ministers nº. 152/2001 of 11 October. Given the need to provide Portugal with a strategy for the conservation of biological diversity, responding to the commitment set out in the CBD, this strategy sets the general objectives that will be valid until the year 2010, regarding the strategic options for the conservation nature and biodiversity.

The legal regime for the conservation of nature and biodiversity, on the application of Decree-Law No. 142/2008, establishes the Elemental Network for Nature Conservation (ENNC) and envisages the establishment of the national register of natural values classified (file of information about natural classified or regarded as values under threat).

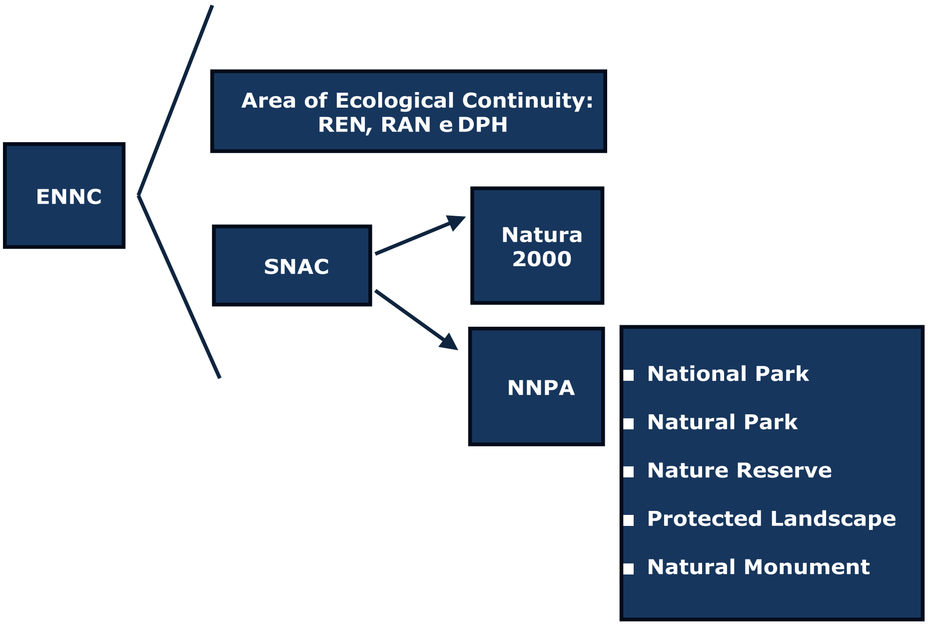

Figure 6.2 - Elemental Network for Nature Conservation. *Source: ICNB, 2005*

The nature conservation policy in Portugal is reflected in practice by a number of measures and actions that embody the work of the Instituto de Conservação da Natureza e Biodiversidade (ICNB). In land-use planning there were created the plans for protected areas, plans for coastal planning or the sector plan for Natura Network 2000; regarding the environmental impact studies ICNB is asked to evaluate projects to develop in Protected Areas and Natura 2000 areas and major national projects with implications for conservation of biodiversity. Internationally the involvement is lower, but one example is the project MedWet - conservation of Mediterranean wetlands (ICNB, 2005). Conservation projects developed by ICNB are varied in nature, from projects to conserve species and habitats in the Serra of Malcata up to Green Days in the area of information disclosure, studies and research projects, the Life projects and other field conservation programs, some of which developed by entities outside the ICNB.

6.3 Protected areas in Portugal

The current Portuguese legislation concerning protected areas distinguishes five categories: National Park; Natural Park; Natural Reserve; Natural Monument; and Protected Landscape.

Table 6.3 – Types of protected areas in Portugal

Category	Description
National Park	Area with ecosystems that weren´t almost altered by human activities, samples of special natural regions, natural or humanized landscapes, geomorphological sites or habitats of species of ecological, scientific and educational interest.
Natural Park	Area which is characterized by containing natural landscapes, humanized and semi-humanized, with national interest, and an example of harmonious relationship of human activities and nature.
Natural Reserve	Area for the protection of flora and fauna habitats.
Natural Monument	Natural occurrence containing one or more aspects that by their uniqueness, rarity or representativeness in terms of ecological, aesthetic, scientific and cultural require preservation and maintenance of its integrity.
Protected Landscape	Area with natural landscapes, humanized and semi-humanized, of regional or local interest, resulting from the harmonious interaction of man and Nature that shows great aesthetic value and natural.

Source: (ICNB, 2005)

Portugal has designated a group of areas, scattered across the country, which are of particular ecological interest within the European context (Nature 2000 network). However, various areas of the country are already part of international nature conservation networks, such as Biogenetic Reserves (Council of Europe), Ramsar Sites (Ramsar Convention), Biosphere Reserves (MAB/UNESCO) and sites covered by the Convention Concerning the Protection of World Cultural and Natural Heritage (UNESCO). In Portugal, the protected areas are 7,2% of national territory, divided in 44 classified areas.

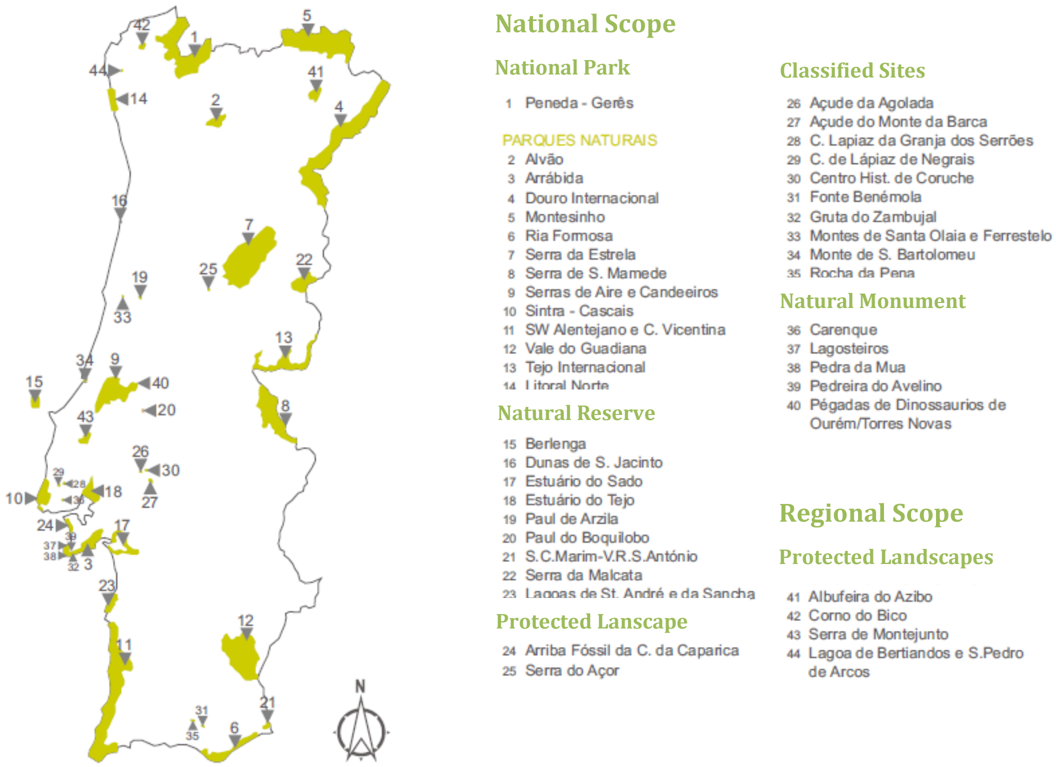

Figure 6.4 – Protected Areas in Portugal. *Source: ICNB, 2005.*

The Portuguese National Strategy for the Conservation of Nature and Biodiversity (NSCNB) does not match only to the fulfilment of an internationally legal obligation assumed by Portugal in the context of the Convention on Biological Diversity, nor is it a simple corollary of the European Community's strategy on biological diversity. It is rather a fundamental guiding document for policies which interfere with the subject of this strategy: the conservation of nature and biodiversity, as well as the safeguarding of notable geological, geomorphological and palaeontological heritage.

The NSCNB points out some strategic options e action guidelines to promote e develop the Portuguese protected areas. The third strategic option intends to promote the recovery of protected areas and ensure the preservation of its natural, cultural and social heritage. According to this document, the management of protected areas should focus on pursuing the essential objectives of his creation, promoting knowledge, monitoring, preservation and dissemination of existing environmental values, as well as the preservation and enhancement of cultural heritage and traditional activities, in order to promote sustainable local development. It also points out the need to promote within the protected areas suitable and specific measures to conserve biodiversity and ensure a strict and balanced territorial management, respectful to the objectives of each protected area and ensure a strict management of land use, in order to safeguard the existing environmental values and to promote the proper location of the activities necessary to ensure the economic and social development of populations.

The implementation of this strategy showed difficulties to conciliate the conservation goals with the human activities and the economic development. Conflicts between private landowners and protected area managers are frequent especially due to restrictions in land use. These problems make it hard to achieve a good cooperation of all stakeholders for an effective management of the protected area. It is also clear the need of further efforts to better connect and engage the managers of protected areas with the various actors involved, including municipalities.

The existing landscape in these areas often reflects the necessary balance between human action and the environment. The fall of this balance due to lack of human action reflected commonly consequences for everyone, as fires, soil degradation and depletion, climate change or the depopulation of considerable areas of the national territory. Faced with this situation becomes clearer the urgent need to create instruments to enhance the action of those populations and to involve them in the management of these areas, contributing also to the reduction of existing conflicts between resident populations and managing bodies of its territory. Adding to that, the national network of protected areas face operational problems that hinder the achievement of a large part of its objectives, not only lack of funding but also lack of human resources to implement policies, monitor and supervise effectively the protected areas.

It is also extremely important to promote awareness and education, to disseminate among the population and local economic agents the values of natural and cultural heritage of protected areas, not only to better achieve their safeguard but also to encourage its use as a sustainable local development factors, reversing the process of desertification of these areas.

6.4 Market-based instruments in Portugal

According to the NSCNB, "for a more effective management, should be used, when appropriate, mechanisms that allow greater flexibility and better mobilization of synergies, notably through contractual arrangements and processes with landowners and producers forestry – whose action is of paramount importance in these areas, as well as non-governmental organizations or other associations".

In Portugal, despite the many declarations of intent, the economic instruments for environmental protection are just the beginning. Certainly there are some initiatives in the right direction: small tax breaks for the purchase of equipment for renewable energy, tax differences in one or another product; system of patronage extended to the environment, subsidies to businesses and municipalities for environmental investments. Other instruments, such as support for energy efficiency, business modernization, urban renewal and environmental measures, although not based on environmental performance criteria, tend to generate benefits for the environment. These measures, while positive, do not imply, however, a coherent strategy or goals for the application of economic instruments. Particularly in the area of nature conservation and heritage there are no relevant incentives to the private sector activities of nature conservation and heritage.

6.4.1 Law of Local Finances

The Law nº 2/2007 of January 15th approves the Law of Local Finances, with the goal to set the financial regime for municipalities and other local administration. In this law we can find some points that introduce fiscal or financial benefits related to protected areas or Natura 2000 network areas.

One example is the 6th Article, regarding the support of local sustainability, were we can find the following principles:

2 - The support of local sustainability is assured by:

a) Positive discrimination of municipalities with protected and natura 2000 network areas, through the Municipal General Fund (MGF);

c) Concession of exemptions or fiscal benefits, related to taxes which revenue belongs to the municipality, to taxpayers that develop their activities according to environmental quality standards.

This law indroduces new criterion for fund distribution, according to the area classified as protected are and Natura 2000 netwok. The previously cited MGF is a financial transfer from the national state, which intends to give the adequate economic conditions to the municipalities, according to their tasks, operations and investment needs (Article 22º)

The distribution of this fund follows several criteria (nº1 of article 26), were we can highlight:

c) 25% in direct proportion to the area weighted by a factor of altitude range of the city and 5% in direct proportion to the area that affect the Natura 2000 and protected areas; or

d) 20% in direct proportion to the area weighted by a factor of altitude range of the city and 10% in direct proportion to the area that affect the Natura 2000 and protected areas, in municipalities with more than 70% of the territory assigned to the Natura 2000 protected area.

6.4.2 Fund for the Conservation of Nature and Biodiversity

The approval of the Legal Regime for the Conservation of Nature and Biodiversity, by Decree-Law nº 142/2008 of 24 July was an important step towards the realization of the National Strategy for Nature Conservation and Biodiversity. This legislation is a key tool for the clarification and policy framework for nature conservation and foresees the establishment of a Fund for the Conservation of Nature and Biodiversity, in order to support the management of basic infrastructure support nature conservation, particularly in the areas that comprise the Elemental Network for Nature Conservation (ENNC).

The activity of this fund focuses on allocating resources to projects and investments needed for management and conservation in Portugal, to promote the recognition of the economic value of biodiversity through mechanisms for offsetting certain types of loss, and the development of market instruments that support the policies of biodiversity conservation.

In 3 August, of 2009 the Decree-Law nº 171/2009 created the Fund that, according to the 2 º article, set the following goals:

1 — The Fund's mission is to fund initiatives that support management of the Elemental Network for Nature Conservation, and promote conservation through economic valuation of biodiversity and ecosystem services.

2 — In carrying out its activities, the Fund has the following objectives:

a) Support projects for nature conservation and biodiversity, focusing on those areas that make up the RFCN;

b) Promote projects or studies that contribute to the enlargement of the areas included in (ENNC);

c) Encourage conservation projects of endangered species at national level;

d) Support the acquisition or lease, by public authorities, of land in areas that make up the National System of Classified Areas, or outside them, when they are of great importance for nature conservation,
e) Participate in funds or systems of credits of biodiversity.
f) Promote and support education and awareness of nature conservation and biodiversity;
g) Support specific actions of research for nature and biodiversity conservation;
h) Foster communication, dissemination and visitation in protected areas;
i) Create, or contribute to, specific financing mechanisms that support entrepreneurship in the areas that make up the National System of Classified Areas with significance for nature conservation and biodiversity;
j) Support the revitalization of degraded areas of the ENNC.

3 — The Fund may establish mechanisms for coordination with other public or private funds, national or international, related to the development of mechanisms for economic valuation of ecosystem services, in particular, through market instruments or systems of biodiversity credits.

The creation of this fund opens new possibilities for the implementation of market-based instruments in Portugal, in particular, because it can be a new source of funding but also can help to build the financial framework behind the projects.

The review on the appliance of MBIs in Portugal show that their full potential is yet to be explored, this instruments offer a variety of solutions and approaches that can positively contribute for biodiversity conservation in Portugal. Designing and testing MBIs is a challenge for conservation practitioners in Portugal, and an opportunity to increase the knowledge on biodiversity and ecosystem services

CHAPTER 7 – Identifying potential target areas in Portugal

Protected areas in Portugal have potential for the implementation of a MBI, they all have relevant ecological values, such as habitats or species, that require specific management. Protected areas in Portugal aren't fully owned by the government, there is private ownership inside these areas. MBIs address the environmental management of private landowners in order to accomplish the conservation goals set for that area.

To select a target area in Portugal for this type of instrument it is important to establish criteria and priorities, according to the natural, economic and social context at local and regional level.

7.1 A target area in Portugal

When selecting an area to trial the MBI there are several criteria that need to be carefully analyzed. This process of selection has two stages, the first is to select one protected area from the full list of national classified areas. The second step is to set the boundaries of the trial area, before implementing these instruments in a large scale it is important to test it on a smaller area. The working area will be only a fraction of the protected area.

The choice of one protected area from a wide variety of national protected areas was based on ecologic, economic and social criteria. Protected areas outside the urban centres have, in general, fewer projects, lower visibility and more difficulties to gather funds, despite having extraordinary ecological values and motivation to participate and experiment new conservation approaches. So the first criterion was to select a protected area from a rural environment.

Rural areas also have special characteristics and problems that can be improved by the use of MBIs. Typically these areas suffer of human abandonment due to low economic prosperity, the main activities developed by the landowners (agriculture and grazing) aren't enough source of income and not competitive in markets. The landholders aren't normally entrepreneurs and the education level is usually low. MBIs create a new source of income for the landowners, but also disseminate knowledge among them, which will contribute to the improvement of their agriculture and grazing techniques and management actions, enhancing their competiveness and success. For these reasons the economic development and wealth, human abandonment and the education level of the landowners are other criteria to select the protected area.

Dealing with a trial there are specific features that influence the choice of the target area, such as the size, the number of landowners implicated, the administrative bodies at the site and their role.

The size of the area where to implement the MBI is central, and is linked with the number of landowners that will be included in the scheme. This type of mechanism must be trialled first in small scale, to learn more about local needs and to improve its design; only after this field experience it is wisely to implement it on a larger scale. For that reason only a fraction of the selected protected area should be used to apply the MBI. To decide the size of that target area we must consider three main factors, are the most relevant ecological values of the park present at the fraction? Does this fraction include properties with distinctive characteristics (e.g. size, value)? Are there a sufficient number of landowners to create competition between them?

When selecting a specific area of intervention it is also relevant to identify the administrative bodies with jurisdiction at site, the legal framework and obligations. The presence of landowner's association's or other bodies such as nongovernmental organizations is of great help to the scheme implementation and management, but also to increase the participation levels. It is easier if there is an intermediate vehicle of information between the scheme managers and the landowners, because it will reach more people with the right message. These intermediates are also very important because they know all the players, the landscape, as well as the main opportunities and expected difficulties. It is though important that these types of organizations are present on the selected area.

A potential area for the implementation of a MBI in Portugal was then selected, according to the previously explained criteria. The chosen option was the Natural Park of Guadiana Valley.

7.1.1 Natural Park of Guadiana Valley

The Natural Park of Guadiana Valley was created by Decree 28/95 of 18 November, following several studies which revealed the high richness of wildlife, flora, geomorphology, landscape, history and culture. The Park is currently regulated by its Land Use Plan, Resolution of the Council of Ministers nº164/04 of 10 November.

This high richness, together with the fact that the identity of the landscape and biodiversity of the area is threatened by the gradual disappearance of traditional systems of land use, justified the classification as Natural Park, in order to safeguard natural, cultural and scenic values, while promoting the sustainable development in the region.

Nature and landscape conservation, protection of fauna and flora, the maintenance of ecological balance and protection of natural resources, justify security measures to ensure the necessary natural conditions for or the stability and survival of species, groups of species, biotic communities or physical aspects of the environment, when they require human intervention for their perpetuation.

Having in regard the Directive 79/409/EEC, of 2 April, on the conservation of wild birds, the natural values in this protected area contributed to its designation as a Special Protection Area, promoted through the Decree-Law 384-B/99, 23 September, as SPA of Guadiana Valley.

Birds are one of the most visible groups of the Natural Park. Birds of prey nest in the slopes that surround the watercourses, such as the Bonelli's eagle, golden eagle and eagle owl, the largest specie of owl in Europe.

Table 7.1 – Bird species in Natural Park of Guadiana Valley

Common Name	Scientific Name
Bonelli's Eagle	*Hieraaetus fasciatus*
Golden Eagle	*Aquila chrysaetos*
Eagle Owl	*Bubo bubo*
Black Stork	*Ciconia nigra*
Lesser Kestrel	*Falco naumanni*
Great Bustard	*Otis tarda*
Little Bustard	*Tetrax tetrax*
Black-bellied Sandgrouse	*Pterocles orientalis*
Calandra Lark	*Melanocorypha calandra*
Stone curlew	*Burhinus oedicnemus*

Source: ICNB, 2005.

Moreover, in order to integrate the Park in the Natura 2000 network, part of the area was also included in the 1st stage of the National List of Sites, through the Resolution of the Council of Ministers 142/97 of 28 August in the scope of Directive 92/43/EC of the Council of 21 May, on the conservation of natural habitats and of wild fauna and flora.

The Natural Park is located in the valley of the Guadiana River, covers an area of 69 600ha in territory belonging to the districts of Mértola and Serpa.

Figure 7.1 – Map of Natural Park of Guadiana Valley. *Source: ICNB, 2005.*

The contrast of scenery is the most striking feature of this classified area, the rolling plains that dominate the region alternate with the mountains of S. Barão and Alcaria Ruiva, or with the valleys of the Guadiana river, where we find important patches of Mediterranean woodlands.

PNVG occur in three major geomorphological structures: the plains with slight wave that dominate the entire area, home to dryland crops and large areas of cork oaks, the quartzite elevations of the mountains of Alcaria Ruiva and S. Barão, the valleys of the Guadiana river and its tributaries, rimmed by cliffs and Mediterranean woodlands. It is the presence in these structures of numerous biotopes - the banks and beds of watercourses, Mediterranean scrub, rocky outcrops, forests, cereals steppes, and fallows - that give this area a biodiversity that deserves to be preserved.

The economic and social context of this area is also important for the design and implementation of market-based instruments. The use of indicators can illustrate the economic and social reality or trends, of Mértola and Serpa districts.

The indicators of population, education and employment show similar trends in both districts, a decrease of young and middle age individuals, and a growth on elder citizens. The most common education level is the lowest available and the majority of individuals work for others. The unemployment rate is in both districts is 12%.

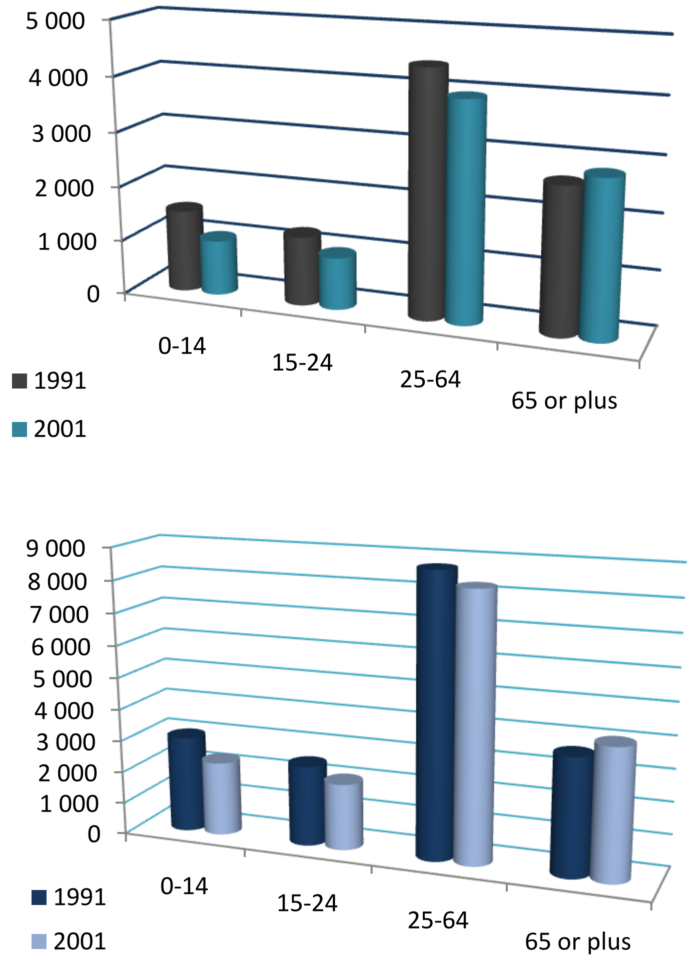

Figure 7.2 – Resident Population in 1991 and 2001, in Mértola (on the top) and Serpa. *Source: (INE, 2009).*

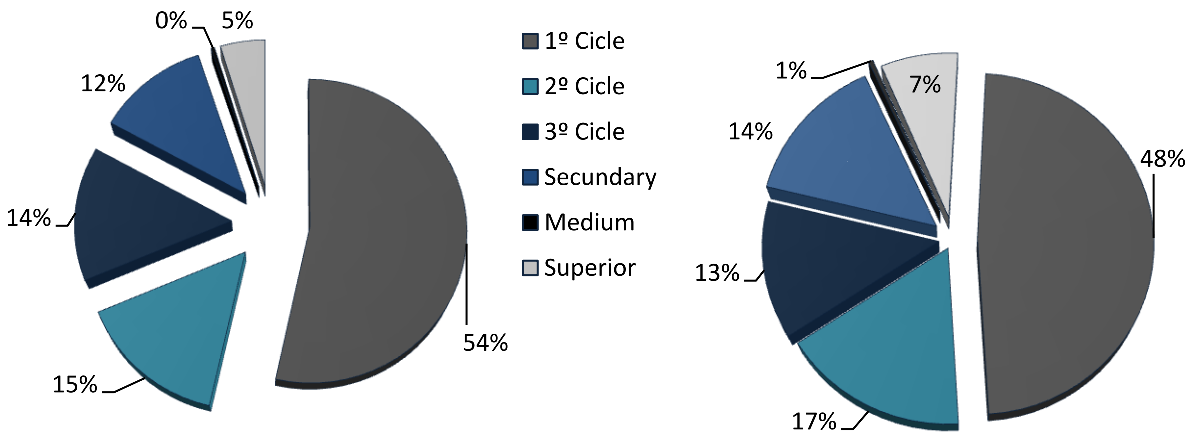

Figure 7.3 – Resident Population by level of education achieved (2001), in Mértola (left) and Serpa (right). *Source: (INE, 2009).*

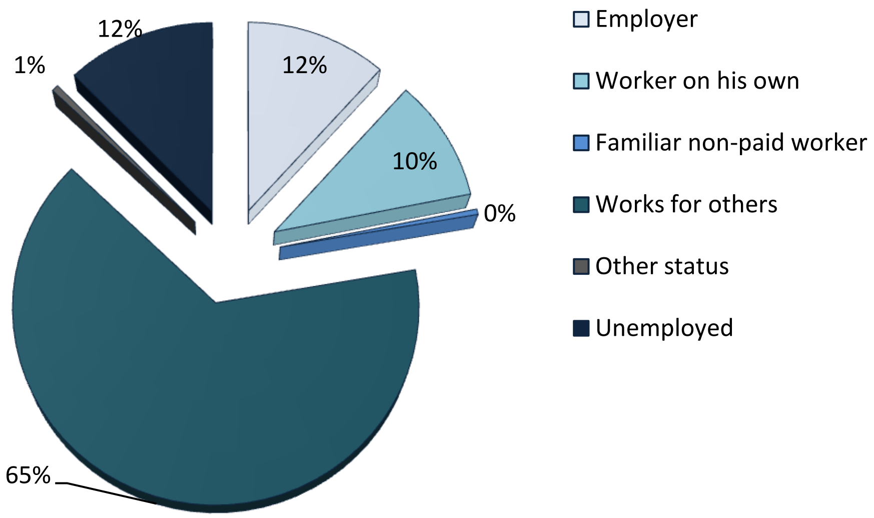

Figure 7.4 – Resident population by employment status (2001). Mértola and Serpa have exactly the same values. *Source: (INE, 2009).*

7.1.2 *Land Use Plan for the Natural Park of Guadiana Valley*

The Decree-Law nº 19/93 of 23 January, makes it mandatory to provide the protected areas of a land use plan, these special plans for land use are an essential tool for effective management of the territory, aligning the protection of natural resources with economic development.

The land use plan for the Natural Park of Guadiana Valley, hereinafter called POPNVG has the legal nature of administrative regulation, which forces the alignment of the inter-municipal plans and regional planning to its principles, as well as programs and projects developed in that area. The area of intervention POPNVG is defined in the decree which classified the Natural Park of Guadiana Valley.

The POPNVG sets regimes to safeguard natural resources and values, ensuring the permanence of the indispensable systems for sustainable use of the intervention and setting rules for the harmonization and compatibility between human activities and the maintenance and enhancement of natural and semi-natural landscapes and ecological diversity, as well as for the improvement of life quality and economic development of the people present there.

This plan sets overall objectives of ensuring active participation of all public and private entities, working closely with local residents; correct the processes that could lead to degradation of the existing natural values, creating conditions for its maintenance and upgrading and ensuring the protection and promotion of natural values and cultural landscape, concentrate efforts on priority areas for nature conservation, and framing human activities through the rational management of natural resources and recreation and tourism to promote both economic development and well-being of populations in a sustainable way.

The POPNVG comprises in Articles 8 and 9 the activities prohibited and conditioned, respectively. These restrictions have not only influence the management of the park, but also the activities and economic development of communities living within the park.

Table 7.2 – Forbidden and limited activities in Natural Park of Guadiana Valley

Article 8 – Forbidden Activities – In the intervention area of the Plan it is forbidden to execute the following activities:
Urbanization operations outside the areas defined in this POPNVG as urban areas;
The release of industrial waste water or untreated domestic in water courses, on the soil or subsoil;
The release of pesticides surplus, pesticide grout and washing water with detergents;
The collection, capture, killing or possession of copies of any plant or animal species subject to protection measures, including destruction of nests and harvesting of eggs and the disturbance or destruction of their habitats, with the exception of actions taken by the PNVG and actions of scientific duly authorized by the ICNB;
The capture of specimens of any aquatic species, except for actions authorized by the Directorate General of Forestry (DGRF), with prior opinion of the ICNB;
The practice of sport motorcycles off the roads, municipal roads, firebreaks or when that could cause pollution, noise or degradation of natural factors of the area, namely raids and organized tours of vehicles all-terrain;
The introduction or reintroduction of non-native species, animal or plant in the wild, especially of game or not, or invasive weeds, including acacia (Acacia spp.) Ailanthus (Aillantus altissima) or pitosporo (Pittosporum undulatum);
The introduction of new stands of eucalyptus operated in the short term;
The practice of sports and recreational activities that may cause pollution, noise or degradation of the natural values in PNVG.

Article 9 - Limited activities - Notwithstanding the opinions, authorizations or approvals required by legislation and when done outside of urban districts, are subject to authorization or binding opinion of the PNVG management committee the following activities:
Construction and demolition of any nature, except for maintenance works;
Installation of new distribution lines and electric power transmission, satellite transmission and retransmission of signals;
Installation and modification of industrial activities outside the areas provided for that purpose, including

mineral extraction and inert;
Installation of new farming and grazing activities with an intensive nature;
Installation of new forests;
Changes to the morphology of the soil or vegetation, except those resulting from the normal agricultural, forestry and grazing management;
Prospecting and exploration of geological resources;
Camping and caravanning in locations designated for such purpose;
Overflights by aircraft with engines below 1,000 feet, except for reasons of control or fire fighting, rescue operations or to approach or landing in airport infrastructure already approved by the competent authority;
Activities and organized competitions for fishing and aquaculture;
Realization of sports events;
The practice of sport motorcycles off the roads, municipal roads, firebreaks or when that could cause pollution, noise or degradation of natural factors of the area, namely raids and organized tours of vehicles all-terrain;
Interventions in the areas of safeguards contained in the summary plan of this Plan;
The installation of windpower parks;
The approval of forest management plans.

Source: ICNB, 2005.

To set the boundaries of the potential trial area, which comprises only a fraction of the Natural Park, is required scientific knowledge and cartography (preferably Geographic Information Systems) that weren't available. To choose this area it is necessary field work, for data collection and modeling, in order to build consistent maps, which can more truthfully show, for example, the existing ecological values or the private property boundaries.

CHAPTER 8 – Proposed instrument

The main goal of the instrument is to change the environmental management of private land in protected areas, in a way that it is possible to conciliate the conservation of biodiversity with the economic development and landowners activities. In the Portuguese context there are four main compelling reasons for including private land in a comprehensive biodiversity conservation strategy:

- Private land can make a major contribution to conserving biodiversity and wildlife habitats, particularly those species and habitats poorly represented on public land;
- A landscape approach to conserving flora and fauna must involve private land and is essential for long-term management of natural systems;
- Biodiversity conservation is dependent on the willing cooperation and full support of the community. Private landholders have a special significance as major stakeholders. Biodiversity conservation on private land can provide a means for the community to support and participate in conservation; and
- A conservation oriented, "ecologically healthy" approach to property management has benefits for landholders and for the sustainability and long-term variability of agricultural systems and other rural-based enterprises (Forge, 1994).

One of the key points of this strategy is to improve the relationship and communication between the landowners and the managers of protected areas. The landowners are critical for the success of the conservation plan established for a protected area, without their compliance it is difficult to efficiently manage the natural resources available. They need to participate actively in the conservation effort, but in a way that their economic prosperity and productive activities are not reduced or forbid.

This instrument can also aid landowners in rural areas, with low incomes, which depend almost exclusively on agriculture or grazing. It can represent another source of income to the landowners, which will enhance their competitiveness and life quality, strengthening the social network of that region, in order to reverse the current human desertification of rural areas.

Before choosing and designing a market-based instrument, information concerning the problem and possible solutions should be gathered and clearly articulated. To be cost effective, a mechanism must be designed to achieve the desired objective at least total (including transaction) cost. To do this, the characteristics of the problem that have the potential to impact significantly on the transaction costs involved in different design features must be recognised and understood. This includes understanding the landscape, the players involved, the science available, the interactions within the landscape and between players, and the institutional setting.

Nevertheless, some of these issues may be difficult to evaluate before implementation (Comerford & Binney, 2004). One option for dealing with uncertainty is to trial a mechanism before implementing it on a large scale. Additionally, some information on the likely costs and benefits may be gained from other group's use of similar mechanisms.

For this reason the instrument proposed in this study uses one of the three Australian experiences explained on Chapter IV, as basic concept. Although, some modifications need to be done in order to improve it and make it more suitable to Portuguese reality. There are also some modifications to include other ideas and approaches regarding private land management in protected areas.

In a sentence, the great challenge of this instrument is to achieve economic and social development in areas with high ecological value, without depleting the natural capital available.

8.1 Select one of the previous three

To meet the goals of this work the Liverpool Plains Scheme is the most suitable instrument. This choice is explained by several criteria.

First of all, the implementation of the instrument is relatively plain, with comprehensible steps and with strong involvement of the landowner's. The legal framework of this instrument is not as complex as other case studies, which is important to allow its execution, and because it's simplicity is leverage to the participation of decision makers and landowner's. More intricate schemes tend to reduce the interest and enthusiasm of potential participants.

More complex legal frameworks call for the involvement of more organizations and institutions, creating more bureaucracy that delays the implementation of the scheme and frights the landowners that are not use to deal with that type of requirements. This instrument aspire to engage rural populations, generally with low instruction and facing economic difficulties, so it must be a priority to create an instrument that is easy to understand and that allows their participation without initial costs (e.g. lawyers) or major technical concerns. For this reason is essential a good support from the management bodies to ease the involvement of the landowner's.

This instrument also focus on the contribution that landowner's can give to the design and planning of the conservation measures, this teamwork is very important to achieve superior results and to increase the motivation of the landowner's. This type of relationship between the project managers and participants is one of the features that enhance the effectiveness of the instrument. By doing field days and farm visits (steps 2 and 4, respectively) the project managers go beyond the standard information sessions, there is a high communication effort and interaction with the landowner's. These field actions help them to better understand the environmental challenges and opportunities in their properties, and also give them a landscape perspective, which is essential to perceive their property as part of a hole. Recognizing this concept is very important to change attitudes and to improve a sense of community conscience and responsibility sharing.

The activities or measures employed in this instrument are easy to accomplish and yet very effective to the conservation goals. Planting tree belts or practicing a rotational grazing management are very effective actions that do not demand great effort or special technical skills. These types of measures help landowners to increase their productivity and also meet the conservation needs in those areas, which creates an attractive win-win situation. By broadening knowledge about the ecologic processes involved in farm managing, and their importance for the farm productivity and prosperity, this instrument contributes for the economic development and competitiveness of these areas.

8.2 Modifications that need to be done to make it better

The general framework of the selected scheme (Liverpool Plains) will remain very similar to its original, however there are four issues that need improvements.

The first of all is that the properties must be managed in a coordinated way across landscapes rather than as independent units. Ecosystems don't obey the rules of private property, what one farmer does – in fencing his land, blocking animal migrations, spraying crops, introducing new crop varieties, hunting and fishing, logging, pumping groundwater or managing livestock diseases – has ramifications far beyond the farm. What economists call "externalities" or "spillovers" mark the very essence of ecosystems (Sachs, 2008). For these reasons, sound environmental management requires an ecosystem approach that goes far beyond private property.

Secondly, the assessment and ranking of the tenders must to use a different approach. In the Liverpool Plains scheme, the projects are scored in terms of the current condition of a number of parameters, and their likely condition once the project has been implemented and managed for the duration of the agreement. The parameters used include ground cover, perenniality, grazing management, riparian corridor condition and existing remnant vegetation health, and are used as surrogates for the projected improvements to water quality and biodiversity, and the reduction in salinity.

This assessment must be based on the identification and valuation of the existing ecosystem services, using the total economic value approach, in order to include all use and non-use values. The index used to calculate the environmental value of the project also needs to include some features that will positively influence that value, one example is that if the area of the project creates an ecological corridor, its environmental benefit is higher. This means that when calculating the merit of each project features such as the connectivity and health of the area will enhance the final value.

The third issue is the length of the contracts signed with the landowners. The Liverpool Plains scheme has 10 year contracts, but in the proposed instrument the contracts will be longer. The analysis by Jones & Schmitz (2009), entitled *Rapid Recovery of Damaged Ecosystems*, identified the average recovery time for damaged ecosystems as 10-42 years and was not more than 56 years. This study looked at several ecosystems, including forests, grasslands, prairies and both fresh and marine waters. The types of impacts reviewed included agriculture, deforestation, eutrophication, introduction of alien species, oil spills, power plants, logging and trawling. Based on these estimates, the contracts will be for 20 years, in order to ensure an adequate timeframe for the recovery of the existing ecosystems. The commitment will be signed with the property and not with the owner, this way the following owners will have to continue the management of the land as planned.

The fourth issue is the involvement of companies in the scheme and the importance of private capital. To be really successful, these instruments need appropriate institutional infrastructure, incentives, financing and governance: in short, investment. Public funding is very important, but is a scarce resource, so private funding can have a role in the economic sustainability of the project. The participation of companies can assume the form of sponsoring or as an offset. Private businesses need to partner with governments to define sustainable practices aimed at using resources at sustainable rates and with environmentally sound technologies. Engage companies in biodiversity conservation is very important and this instrument could be a good tool for that purpose.

Below some important aspects related to this four issues are discussed and explained with more detail.

8.2.1 *Issue 1*

To date, relatively little elaboration of the scales of ecosystem services has taken place (Turner *et al*, 2003; Millennium Ecosystem Assessment, 2005). Scales refer to the physical dimension, in space or time, of phenomena or observations (Peterson & Parker, 1998). Ecosystem services are supplied to the economic system at a range of spatial and temporal scales, varying from the short-term, site level (e.g., amenity services) to the long-term, global level (e.g., carbon sequestration) (Turner, *et al*., 2000; Limburg *et al*, 2002). Scales and stakeholders are often correlated, as the scale at which the ecosystem service is supplied determines which stakeholders may benefit from it (Vermeulen & Koziell, 2002).

The scales of ecosystem services can also be used as a basis for establishing compensation payments to local stakeholders that face opportunity costs of ecosystem conservation (Tacconi, 2000). In addition, it provides insight in the appropriate institutional scales for decision making on ecosystem management.

The assessment of scales and stakeholders enhances the applicability of ecosystem services valuation to support decision making. (Hein *et al*, 2006).

Agricultural landscapes hold tremendous potential for producing a diverse stream of ecosystem services. Yet, because the spatial configuration of particular ecosystems is critical to the supply of many services, realizing this potential requires that farms be managed in a coordinated way across landscapes rather than as independent units. Under existing incentive programs, this level of coordination is typically neither required nor encouraged (Goldman e*t al*, 2007).

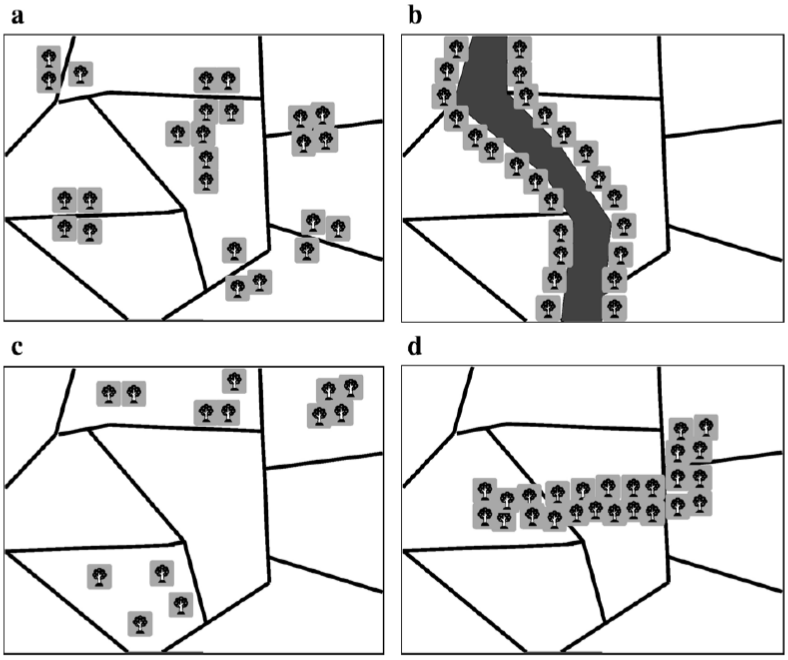

Figure 8.1 - In each cartoon below, trees represent conserved area. White is intensive agriculture, and the black lines delineate property boundaries. In b the gray curve is a river. Each cartoon represents a possible landscape configuration that could promote certain services. (a) Would promote local services such as pollination. (b) Is appropriate for regional services such as water purification and flood mitigation. (c) Represents a landscape in which critical mass rather than configuration is important, i.e. a certain number of landowners must participate. (d) Is an example where critical mass matters less but landscape configuration is important. Trees must be clustered together to form a large forest patch. Either c or d would be appropriate for global services such as carbon sequestration though d would be preferable for long-term ecosystem service provision. *Source: Goldman et al, 2007.*

Landscape vision is essential for the provision of ecosystem services. For local and regional services such as pollination and hydrologic services respectively, we have argued the need for particular landscape designs that may be accomplished only by cross-boundary cooperation and conservation, due to specificity of configuration. For global services such as carbon sequestration, landscape composition rather than configuration is essential in the short run. In the long run, however, there is a possibility that configuration would become more important, underscoring the need for landscape-scale management. Designing institutional incentives to reward landscape management is thus important for all classes of services.

Services at different scales require different management considerations. All require a landscape design, but they differ in their requirement for cross-boundary, landscape-scale management. Local and regional services require this type of management now whereas global services, like carbon sequestration, may benefit most from this type of management in the future but could be enhanced by proper farm-based management in the short term. Regardless, conservation incentives designed to reward landscape visions and designs can benefit all classes of services, and it is to these types of incentives that our focus now turns.

There are a number of transaction costs involved with landscape-scale, cross-boundary conservation that are beyond those inherent in farm-based conservation incentives (such as dealing with new entrants, contract length, information asymmetry, and monitoring and enforcement costs) (Goldman *et al*, 2007). These costs can be described as economic, social/cultural/ psychological, and implementation costs. Cooperative conservation can lead to the problem of free riders and holdouts. In this situation, one or more landowners refuse to participate in conservation because they can capitalize off the benefits of others (free riders) or because it is not in their best interest (holdouts). Holdouts are especially problematic if one landowner's lack of participation prevents others from being able to participate (if the reward depends on everyone's participation). Free riders and holdouts generate transaction costs beyond those in single agency agreements. Social costs of cooperative schemes arise from requirements for cooperation. Cross-boundary cooperation is contingent upon ideology, land tenure, power, uncertainty, and trust. If landowners' ideologies include conservation and if they are assured that their property rights will not be compromised, that they share power with the managing organization in the conservation initiative, that the agency giving the incentive is stable, and that their neighbours are invested and trustworthy, then such cooperation is much more likely (Bergmann & Bliss, 2004). Cooperative conservation accentuates issues of trust. Landowners are sometimes hesitant to engage in conservation programs because they lack trust in the managing organization (Lockeretz, 1990; Kraft *et al*, 1996; Forshay *et al*, 2005). Landscape-scale management adds a further dimension to trust when one landowner's reward is contingent upon his neighbour's behaviour. Distrust can limit dialogue among stakeholders and therefore impede landscape-scale management (Bergmann & Bliss, 2004).

Finally, cooperative reward schemes can lead to transaction costs through implementation complexities. There are more stakeholders involved which lead to higher transaction costs (Elmendorf, 2003; Barrett

& Peles, 1994). Also, if the relative ability of landowners in a landscape to provide the ecosystem service or services is different, then payments would have to be scaled appropriately to provision, and provision is difficult to measure.

8.2.2 *Issue 2*

Good science is also a key ingredient of successful MBIs. Scientific input to MBIs must be at an appropriate scale, relevant to the environmental preferences and able to account for the fact that outcomes are highly sensitive to the exact location in which a management action is undertaken. It may be possible to reduce costs by ensuring that the science used to model and measure biodiversity outcomes is transportable to applications in other regions and to other types of mechanisms and by keeping abreast of technological developments that can reduce the cost of information exchange.

Science and technology is used to measure or model the unit of exchange involved in transactions that occur through the mechanism. Without being able to measure the environmental good or to model the environmental good that will arise as a result of an action, the benefits of different transactions cannot be identified and the cost effective transactions are not apparent. In cases where general rules of thumb provide accurate estimates, the transaction costs of employing sophisticated science may not capture a significant increase in benefits such that the use of that science is worthwhile. However, where rules of thumb do not provide good estimates of the environmental outcome, incurring increased gross transaction costs from the use of sophisticated science and modelling is likely to produce a substantial increase in benefits, thus result in lower net transaction costs (a lower cost-benefit ratio overall).

An incentive mechanism such as a competitive tender allows landholders to bid for providing a service. Depending on the objective of the tender, different bids may propose different activities to achieve different types of environmental outcomes. To be able to evaluate and compare the different bids, you need a way of scoring the environmental benefits of each bid. A metric is a way of determining that score. Only then can you take into account the bid prices and determine which bids offer the best value for money. Using a well-designed metric helps ensure that bids are assessed in an efficient, transparent, and equitable manner.

Before constructing the metric, it is important to examine the relevance of the following key elements and decide if you need to incorporate them into your metric (DNRW, 2008):

- Quantity versus quality – you need to be able to measure both; consider, for example, hectares versus species.

- Spatial relations – do some spatial combinations of management changes yield greater outcomes?
- Relative change – what benchmark are you measuring improvements against? Is the baseline a duty of care? Is the duty of care requirement already defined?
- Location – are there upstream/ downstream impacts? Consider distance to benefit.
- Timing – how long will it take to achieve the outcome? Is short-term change preferable over long-term change? Do you rate permanent change more highly?
- Implementation risk – what is the likelihood of the landholder failing to change management practices?
- Outcome uncertainty – what is the probability that the desired outcome will not result?
- Irreversibility/thresholds – what happens if nothing is done? Extinctions? Thresholds passed?
- Adverse impacts – will the solution create problems?

In the Liverpool Plains Scheme the environmental benefit is calculated according to the following equation:

Environmental Benefit Sum = salinity benefits + biodiversity benefits + water quality benefits totals

The proposed instrument must use a different approach. The first step is to identify the ecosystem services supplied in the target area (Natural Park of Guadiana Valley), and then specify the scale and boundaries of each ecosystem service. Having this knowledge, the next step is to do the valuation of the ecosystem services, according to the total economic value principles, in order to obtain all use and non-use values.

The ratings of the ecosystems services will be based on their value, condition and on their significance for the conservation strategy of the park managers. The conservation priorities of the target area will influence the rating of the ecosystem services, because the one's that most contribute to the conservation goals must prioritized, by being given a higher value.

After having this value for each ecosystem service, there are other features that will increase the value of environmental benefit. The condition of the land (healthy sites will get more points than degraded sites), the connectivity of the land (linked corridors will get more points than isolated pockets), the current management of the land (individuals that already have good management practices must get more points because they are more likely to implement and follow the planned management actions) and the technical merit of the proposal (the effort of the landowners must be prized).

So when calculating the total environmental benefit value of a landowner proposal, it will reflect the sum of all ecosystem services present in land, plus the rating of the other aspects previously mentioned (ex: connectivity, technical merit).

An important issue in the valuation of ecosystem services is the double counting of services. Many environmental resources are complex and multifunctional, and it is not obvious how the myriad of goods and services provided by them affect human welfare (Kumar & Kumar, 2008).

The various processes involved in the regulation services are paramount to the functioning of ecosystems, and in that sense underlie many other services. However, including both the regulation and these other services in the assessment of the total value of an ecosystem may lead to double counting. For example, pollination is crucial to sustaining the fruit production of an area. Including both the pollination service and the service "production of fruit" would lead to double counting—the value of the pollination of fruit trees is already included in the value of the fruits.

Hein *et al*, 2006 propose to deal with double counting by arguing that regulation services should only be included in the valuation if (i) they have an impact outside the ecosystem to be valued; and/or (ii) if they provide a direct benefit to people living in the area (i.e., not through sustaining or improving another service). In the first case, it is the spatial configuration, and the interactions with ecosystems or society outside the studied system, that determine the value of the service. For example, if an ecosystem is supporting a population of bees that plays an important role in the pollination of crops in adjacent fields, this should be included in the valuation. Regulation services also need to be included if they provide a direct benefit to society. An example of a service that provides a direct benefit is the service "protection against noise and dust" provided by a green belt besides a highway. If this affects the living conditions of people living inside the study area, it needs to be included in the valuation. A prerequisite for applying this approach to the valuation of regulation services is that the ecosystem needs to be defined in terms of its spatial boundaries - otherwise the external impacts of the regulation services cannot be precisely defined (Hein *et al*, 2006).

Auctions can be a cost-effective means by which to increase the provision of diffuse source environmental outcomes. It is though important to measure and take in account all outcomes that occur from an action (that are jointly supplied), positive or negative, to avoid negative secondary environmental impacts, such as reduction in water quantity through revegetation to increase biodiversity.

8.2.3 *Issue 3*

The conservation of biodiversity needs to be done on a long term basis. Short term commitments do not assure the preservation of biodiversity, because to do it effectively, that effort must be continuous. Biodiversity is a living capital, constantly changing and vulnerable to external aggressions. To maintain the balance between human activities and biodiversity health the work needs to be permanent, otherwise, small efforts in a certain moment will be lost after a period of time. If a specie or habitat is lost, it cannot be recovered, there is an ecological threshold that we need to understand and to avoid.

Human societies will only achieve a sustainable growth if they integrate biodiversity as a pillar of their development, and learn to manage it wisely, an that's a task for life. Investing in conservation measures or projects with short term commitments is a wrong option. Recuperate or maintain biodiversity values of a certain area, requires an initial investment, which is generally high, to change behaviours and to renew infrastructures and tools. After implementing these initial measures, the following work that needs to be done, reporting/compliance and site maintenance, generally requires lower investment. If the continuity of the conservation project is not guaranteed, some of the initial investment will be lost due to lack of maintenance, which will call for more funding in a future project.

These types of instruments achieve more efficient outcomes if the commitment is signed with the property and not with the landowner. That is the approach to employ in this instrument, because it will guarantee that the management actions are accomplished, even if the landowners changes.

In an ecological and economic point of view, short term commitments are not a good option for conservation projects. However they are more attractive to landowners and to other private investors. Long-term agreements have a tendency to discourage participation, which also affects the capability to gather funds.

The landholder's motivation is very important. Motivation is a complex issue and is influenced by a number of factors including the perception of the risk associated with the change, the age of the landholder and the severity of the degradation issue. Motivation is also linked to personal experience. A positive personal experience with the change through observation of other landholder's success or the success of a trial may override the perception of risk or the age factor.

When discussing the type and length of the agreements other significant issue are the motivations to break them. Up until this point it has been assumed that landholders who enter management agreements will be conscientious managers. This view is consistent with the voluntary nature of most existing management agreement programs which have tended to attract highly committed landholders who require only modest incentives to enter into stewardship arrangements. However, it cannot be assumed that all landholders will faithfully accomplish their commitments to conservation in the long term. According to (Bowers, 1996; CSIRO Wildlife and Ecology, 2001) some of the factors which may influence landholders to change management arrangements include:

- *Changes in ownership and management:* When management of land passes from one individual to another there is no guarantee that the next manager will have the same commitment to conservation of a remnant;
- *Financial resources:* Changes in the financial position of a landholder can have both positive and negative impacts on approaches to management. Lack of resources may stop a landholder clearing vegetation to establish pasture despite the fact that it is economic to do so. On the other hand, high levels of debt may force a landholder to exploit a remnant they would otherwise have conserved;
- *Changes in technology and markets:* New markets and technologies may emerge making it profitable to develop land that was previously not economic;
- *Environmental attitudes:* An individual's attitude to conservation is subject to change as experiences and information modifies their behaviour.

For these reasons, when the design of management agreements the contracting organisations should try to anticipate changes in motivation and seek to step in to resolve any outstanding issues as they emerge.

There are however, a number of ways in which landholders can be provided with strong incentives to maintain their commitment to an agreement (CSIRO Wildlife and Ecology, 2001). One is to reward good performance. Where ongoing payments are made for management activities, these should be tied to performance wherever practical. For example, payment might be based on the continuing presence of particular species in an area protected by a covenant. In this way, the landholder has a strong incentive to report and seek advice on problems as they emerge. Other way is tying penalties to rehabilitation of damaged land. Penalties associated with breaching agreements are best tied to the costs of any rehabilitation works required on the site. In this way, the landholder will not be able to wilfully break the conditions of an agreement for financial gain, because full rehabilitation of the site will preclude any development of the site;

8.2.4 *Issue 4*

Global biological resources have decreased by about 30% since 1970, this has set in motion a number of powerful drivers such as pressure and activism by NGOs, increased regulations such as laws, strengthened liability regimes, scrutiny of a company's supply chain practices and shifting consumer preferences that are leading to a growing relevance of biodiversity to businesses. Certain sectors are more exposed to biodiversity business risks than others. According to Mulder (2007) these include:

1) *Companies having (high) impacts on ecosystems.* These can be subdivided into companies with *direct footprints* on ecosystems, such as the oil & gas, mining, and construction, as well as sectors that have *significant impacts through their supply chains,* such as the food retail sector.
2) *Companies depending on ecosystem services.* These include for example the tourism, fisheries, forestry and the agricultural sector.

New biodiversity business models may also help reduce rural poverty. While employment and skills development are a normal part of every business, biodiversity business has the added benefit that it often stimulates a flow of funds from relatively wealthy urban centres to the countryside, as well as from industrialised to developing nations. Growing markets for ecosystem services and for biodiversity-friendly energy, food, fibre and recreation should provide ample opportunities for rural entrepreneurship and employment (Bishop *et al*, 2008).

If markets can be created, this would allow individual firms to make decisions in light of all relevant information about the costs and benefits of commercial as well as environmental investments. This would give firms incentives to invest in environmental management and to discover cheaper ways of achieving environmental outcomes. In other words, the environment would become part of the mainstream economics system and incentives would be provided for investments in environment goods and services in the same way as they are for the rest of the economy.

Those markets include biodiversity offsets, wetland mitigation, conservation easements and biodiversity banking. Such businesses can be based on either legislation or voluntary commitments that oblige companies to minimise the biodiversity loss resulting from their activities and to offset (compensate) for residual losses by restoring or enhancing comparable sites. Emerging experience in Australia, Brazil, South Africa and the United States has shown that such approaches can make a significant contribution to conservation efforts and generate substantial business opportunities for offset providers, although there are concerns about the environmental effectiveness of offsets (Bishop *et al*, 2008).

In this instrument it is very important that the business sector participate actively, but on a voluntary basis. The project will start with as much private investment as possible, but the goal is that private capitals comprise 70% of the total investment in this instrument. The idea is that progressively, more companies join the instrument to sponsor the management actions, or to offset the impacts of their activities. This instrument is very plain and transparent regarding the management plan of each landowner, all the activities and milestones, intend outcomes are identified, this can provide companies a credible and reliable option for their investment or offsetting.

This progressive change from public to private funds is also important because public funds are scarce, so it is important to release as much as possible in order to allow the development of other projects.

Currently there is an initiative in Portugal, called the Business and Biodiversity Initiative, involving several companies of very different activities, that aims public commitment of companies to disclose their behaviour on biodiversity and to a continued integration of biodiversity in different aspects of business management and decision-making processes. This type of initiatives can be a good vehicle to approach companies, to establish partnerships, but also to gather financial support and more public exposure.

8.3 Implementation program/schedule

The following framework illustrates the steps needed to put in practice this instrument, and the timeframe for each one.

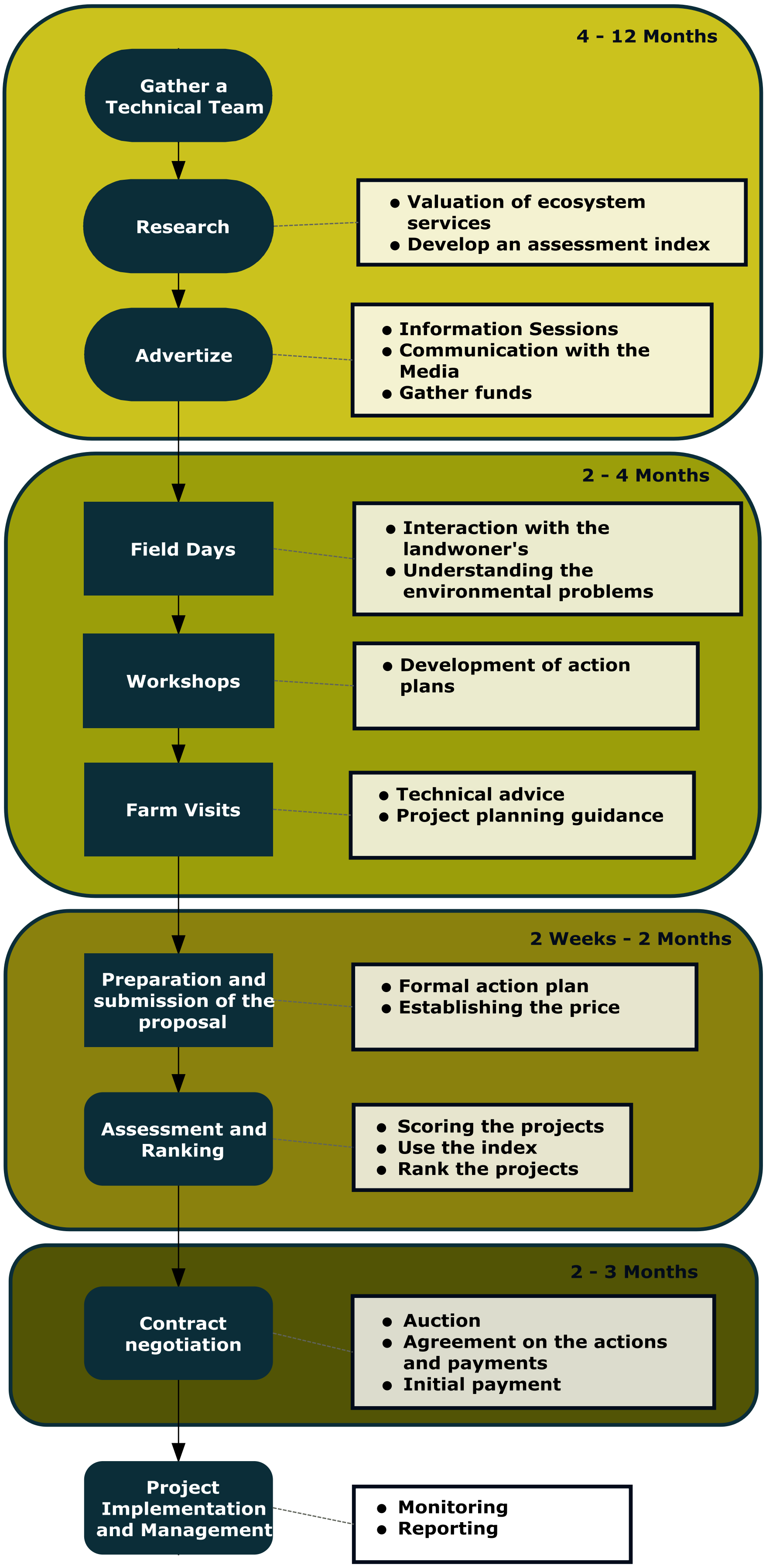

Figure 8.2 - Framework of the implementation program/schedule

The total time needed to complete this instrument, from initial concept to final award of contracts, can range from 10 to 21 months.

The amount of funding allocated to on-ground works can vary substantially. Auctions/tenders already developed have ranged from $140 000 to $1.8m depending on the outcomes sought, target area, management activities, available funding and existing infrastructure and expertise in the region. The proportion of total project funds allocated to administration costs versus on-ground work also varies, but previous experience indicates 20–70 per cent distribution. Past experience also suggests that the relative funding for on-ground works increases in proportion with the total size of the project fund.

8.3.1 *Resource requirements*

Successful design and implementation of MBIs requires skilled and experienced economists, scientists and field officers. Strong links between these disciplines are vital to ensure that biophysical modelling, metrics, contracts and mechanism design are cohesive and appropriate. For example, the changes that the mechanism induces on the ground (the actions that are taken to reduce environmental damage) must define the scale and scope of the science used in applying the mechanism.

Labour costs associated with auctions/ tenders are typically high, specialist labour skills affecting the success of the process include project management, event organisation, community liaison, field and technical knowledge and database management. Many regional bodies will need to seek advice about the design or use of site assessment metrics, development of tender evaluation methods and documentation (e.g. application forms), analysis of economic efficiency relative to alternative funding schemes, or other technical input. These skills are not usually available in-house. Universities, private consultants, and state government agencies are common sources of expert advice.

Robust scientific data is needed to inform the bid selection process and assist with priority development and planning. While appropriate data often exists, impediments such as poor cross-agency linkages, limited compatibility or uncertainty often mean that fresh data must be collected. Data collection is a critical consideration at the planning stage of an auction. It must be appropriately targeted and large enough in magnitude to allow the ecological benefits to be accurately measured. An on-going monitoring program is also important to track the longer-term benefits of a project. It is important to note that any evidence-based assessment of value for money will have a cost for data collection, management and analysis. The auction system typically requires high level of Geographic Information System (GIS) analysis and modelling expertise for evaluating and comparing site environmental characteristics (biodiversity, vegetation, water quality, land degradation), and for producing aerial photographs/maps to assist landholders with their tender development.

CHAPTER 9 – Conclusions and Future Developments

Ecosystems produce a range of services that benefit individuals both directly and indirectly. With few exceptions, though, these ecosystem services are neither prized by markets nor protected by the law because they have been taken for granted or are not amenable to market commoditisation. Market failure for goods and services provided by biodiversity is one of the main reasons behind their unsustainable use and the high losses of biodiversity currently being experienced.

Market Based Instruments (MBI) are increasingly discussed in the political debate over future strategies for biodiversity conservation. The reasons for this are twofold. Firstly, MBIs offer policy-makers new ways to reach conservation objectives in the most effective and efficient way, as MBIs use market forces to pass on incentives. Secondly, MBI can complement traditional regulatory measures, for example, by generating revenue to fund public conservation management. However, its relatively limited application is mainly due to the fact that biodiversity components are very heterogeneous in their value, the lack of knowledge about successful examples, the lack of experience in responsible administrations, and because off the scepticism from conservationists due to ethical objections to the concept of valuation of the lives of animals and plants.

The main goal of this work is to propose a market-based instrument for biodiversity conservation, particularly in protected areas, able to preserve the ecological values without prejudice to the economic development and social stability of the landowners, considering current theoretical and experimental results. It is also intended to assess the potential of Portugal to the implementation of this type of instruments. To accomplish this, it is developed a thorough research on the different types of existing MBI, and several examples of their implementation are analysed. Numerous countries have already developed numerous MBI, however Australia is a country where its implementation is very well documented and almost all the different types of MBI were already tested. This experience is very important to understand how this schemes work in practice, to reduce uncertainties and to avoid mistakes.

The first step is to analyse a long list of MBI already implemented in Australia. To standardize that procedure and to allow comparability between the case studies it is proposed an assessment methodology. After that methodology are described some features and principles that are essential for the design of an MBI, because one thing is assessing an already implemented case study, and other is to design one. Designing requires understanding some basic principles of market instruments, but it also needs to be closely tailored to fit the context and needs of the implementation area.

In this study only three Australian case studies are illustrate, their selection obeyed to several criteria, that can be arguable, but the main goal is to offer different types of MBI approaches. The analysis of the Australian experience allows taking conclusions on how MBI works and what is important on its design and implementation. The three analyzed case studies reveal that a key to the successful application of MBIs is that they recognise that landholders possess information, individually and collectively, that can be used to more effectively deliver desired environmental and natural resource management outcomes. Landowner participation, monitoring and enforcement of landholder's actions, well-developed communication strategies and adequate testing prior to implementation are also extremely important in the implementation of this type of instruments.

Having more knowledge about the advantages of these instruments and the keys elements for success, it was time to assess the potential for its implementation in Portugal. This assessment was based on a review of the use of MBI in Portugal, to date, and on the current environmental management of private land in protected areas. From that evaluation it is recognizable that the possibilities that MBIs offer for biodiversity conservation haven't been yet explored. The implementation of MBI in Portugal is an opportunity to introduce new mechanisms for preserving biodiversity values and to enhance landowner's participation in that effort. Knowing this existing potential, the next step of this work is to select a target area for implementing a MBI.

To choose a target area it is important to look not only to the ecological values, but also the economic and social characteristics and needs, in local and regional contexts. Studying the distribution of Portuguese protected area in the territory, and the economic and social reality of those areas, it is possible to recognize that factors such as the proximity to urban areas, the activities developed inside the protected area, resident population and their education level, influence the capability of the park managers to develop conservation projects, and to gather funds and sponsorship to finance their projects. The implementation of an MBI in rural protected areas could be a solution to tackle the economic and social difficulties of these areas. This type of instrument is a source of income for rural landowners, improving their living quality standards and the competiveness of their activities. This contribution can have a positive impact on the economic growth of those areas and can also help to prevent human abandonment. The use of MBIs also improves the knowledge and technical skills of the landowners, and enhances a sense of community and social responsibility.

The selected area for potential implementation area is the National Park of Guadiana Valley, because it fits the profile, it's a park in rural areas, in a region with poor economic development and suffering from human abandonment.

The design of the instrument it is based on the modification of one of the previously analyzed Australian case studies, the Liverpool Plains Scheme. This option reduces uncertainties and offers more information about the likely costs and benefits. The modifications intend to improve the original instrument and to adapt it to the Portuguese context and needs.

The Liverpool Plains Scheme is the instrument chosen to apply to the National Park of Guadiana Valley mainly due to its auction approach. Compared with other approaches, auctions/tenders appear to offer the greatest potential for cost savings, offer the lowest risk to landholders, and most readily fit in to existing institutional arrangements and practice. These advantages match the characteristics of the park, namely, there aren't many financial resources available, the landowners are not entrepreneurs and do not have high economic power, and the management of biodiversity and conservation goal are establish by the park managers and Land-use Plan. This type of MBI is the one that better fits in this target area.

With the modifications done to the instrument it is expected a change in the way private properties are managed, managing properties in a coordinated way across landscapes rather than as independent units, because environmental management requires an ecosystem approach that goes far beyond private property. The calculation the environmental benefit index, which will rank the proposals of the landowners, will use an ecosystem service approach, and it will fit on the conservation priorities of the protected area. The length of the contracts is changed in order that the time-scale of scheme is short enough to be attractive to participants but long enough to have the desired effects on biodiversity. The funding of the scheme will include private companies, in a sponsorship or offsetting basis, private capital should finance the management actions, reaching a maximum value of 70% of the total investment.

These modifications will provide positive gains to the MBI, such as, an environmental index that assesses more accurately the existing biodiversity values, more sources of funding for the project and new approaches for managing private properties in order to meet the conservation strategy and goals of the park managers. These modifications can increase the transaction costs, causing a reduction on the cost-effectiveness of the scheme. However, the expected ecological benefits obtained with these modifications justify its application.

According to this design of the MBI and the characteristics of the target area it is proposed an implementation program and schedule, to illustrate the steps needed to put the instrument in practice and average time required. The technical skills and resources are also described to give an idea of the likely costs and personnel needs. This is a general framework, which needs to be flexible because its real implementation on the field always requires adjustments and improvements. The availability of funds will limit the entire process, but the lack of funding will affect mainly phase two of the scheme, regarding the farm visits, workshops, and field days, because delivering information, the visits to the properties and scientific support have a big weight on the total costs.

By the end of this work it is possible to conclude that Portugal has a strong potential for the use of market-based instruments, and that this proposed instrument can be an effective tool for biodiversity conservation in Portugal, but also leverage the economic growth and social development of rural areas.

9.1 Future Developments

For the development of Markets for Ecosystem Services in Portugal is necessary to gather information about the value and function of ecosystem services; to identify potential policy mechanisms available including market creation and other options; and to develop potential MBI mechanisms to achieve an experimental stage. This phase will include identifying important sources of transaction costs and whether these are likely to be overcome at reasonable cost.

In this thesis it was also interesting to have conducted the valuation of ecosystem services using economic techniques such as choice modelling to assess the total economic value. For estimates of biodiversity values to be widely respected and applied there is need to improve the scientific expertise on two fronts: improving the performance of economic valuation techniques and our understanding of the impacts on biodiversity of human activities.

The improvement of the communication of valuation techniques used in policy making would also be a good place to start. It is difficult to convey complex techniques in meaningful ways without over simplifying the issues. Practitioners of valuation techniques need to work together to promote the merits of estimating the values of biodiversity to improve decision making; to develop simple messages for the media using measurements that are specific and meaningful; and to develop a series of demonstration projects that will build grassroots credibility for valuation studies and form the focus of a communications exercise.

The potential to link offsets with auctions (which reduce transaction costs on the supply side) also deserves further investigation.

The final and biggest challenge is to put the proposed MBI in practice.

CHAPTER 10 - References

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Appendices

Appendix 1 - Biobanking

Project tasks to establish BioBanking schemes in NSW

No.	Task
1	Consult with key stakeholders on the broad details of the BioBanking scheme – as set out in this document – including the Nature Conservation Trust, Councils and Catchment Management Authorities
2	Develop a background paper, which: • documents case studies of bilateral (site-specific) biodiversity offset programs that have been negotiated to address the biodiversity impacts of specific developments • documents biodiversity offset/banking schemes used elsewhere in Australia (e.g. BioMetric and threatened species tools for Property Vegetation Plans) and internationally (e.g. Wetland Mitigation Banking and Conservation Banking) • highlights the issues that the above programs and schemes encountered, and the lessons that might be useful for developing a scheme in NSW • examines options • documents the costs associated with the above, where possible. • examines the tax implications of the offset scheme.
3	Develop a tool to assess the biodiversity impact of a development and the benefit of offset measures, taking into consideration the Property Vegetation Plans BioMetric tool and the threatened species tool developed for the property vegetation planning process.
4	Demonstration phase – establish demonstration BioBank sites to test assessment tool.
5	Document: • the offset principles and how they will be achieved under the scheme • how the scheme would work • how developers and private conservation stewards could participate in the scheme • the administration of the scheme and the responsibilities of the scheme manager • how the scheme manager will get the best biodiversity outcomes with the funds available • how the scheme manager would work with Catchment Management Authorities and other relevant bodies • how accountability and transparency would be ensured.
6	Develop model conservation agreements for private conservation stewards.
7	Develop a Rulebook for the scheme; this would set out the requirements of all participants in the schemes.
8	Release Rulebook for public consultation.

Appendix 2 – Liverpool Plains Scheme

Understanding and using the Environmental Benefit Index system

In keeping with the Liverpool Plains Investment Strategy ideals of market-based assessment of value, efficiency and innovation in project funding, the LPLMC developed an Environmental Benefit Index (EBI) system. This essentially is a method of objectively assessing and scoring individual tenders to value the 'ecological worth' of a proposed on-farm project. And importantly, it enables the pool of landholders' tenders to be ranked.

It is a proven method of balancing scientific reasoning and practical operations to deliver the best projects for the catchment and the community.

The Liverpool Plains approach has been to individually calculate biodiversity, water quality and salinity benefit scores, add these together to give an Environmental Benefit sum then divide by the project bid price to arrive at an EBI. A series of tables, parameters and a mathematical model* have been developed which requires simple input of core data by staff to obtain the indices. These include: location, rainfall, soil type, water quality measures (eg salinity, turbidity), topography, current and proposed land use, management, groundcover type and condition, weeds, scale of project and length of agreement.

The process of calculating the EBI score is:

1. Environmental Benefit Sum = salinity benefits + biodiversity benefits + water quality benefits totals
2. Environmental Benefits Index
   score = $\frac{\text{Environmental Benefit Sum}}{\text{Tender Price}}$

In simple terms, a project EBI indicates the environmental benefit per dollar. When each project is assessed for EBI and ranked – and 'ground-truthed' – the funding Committee can create a ranked list of competitive projects, to be 'owned' and delivered by landholders under a business model with clearly defined contractual milestones.

A range of factors are considered to enable the calculation of environmental benefit. In all cases current conditions are recorded and final project conditions are estimated. Biodiversity benefit scoring includes health, rarity and size of the remnant as well as distance to, and health of, adjacent remnants. Salinity benefit scores consider the priority of the sub-catchment and LMU, soil water holding capacity, average rainfall, salinity occurrence on the property and in the catchment along with current and planned landuse. Water quality benefit considers streambank and buffer zone vegetation, groundcover, erosion, grazing management and weeds, adjacent landuse, distance of stream to be managed and connection to a major river.

By way of example, a selection of the Environmental Benefit working tables for the three key objectives of Biodiversity, Salinity and Water Quality are shown below, with their apportioned ratings for various events and outcomes, both before and after the project.

BIODIVERSITY RATINGS

Rating

Condition	v low	low	m low	med	m high	High	Before	After
Size	0	1	2	3	5	8		
Width	0	1	2	3	5	8		
Trees	0	1	2	3	5	8		
Understorey	0	1	2	3	5	8		
Grasses & Forbs	0	1	2	3	5	8		
Litter	0	1	2	3	5	8		
Health	0	1	2	3	5	8		
Rocks, logs, hollows	0	1	2	3	5	8		
Protection	0	1	2	3	5	8		
Connectedness	0	1	2	3	5	8		
Proximity to water	0	1	2	3	5	8		

Health Adjacent Remnant	Rating
High (>50)	15
Medium (25-50)	7
Low (<25)	3

Distance Adjacent Remnant (m)	Rating
>1,000	1
<1,000	1.5
<500	1.75
<200	2

Status	Rating
Rare	15
Unusual	7
Common	3

Management

Management Score	Rating
Excellent	10
Good	8
Average	4
Fair	2
Poor	1

Length of Agreement

Years	Rating
10 years	15
7-10 years	8
4-6 years	5
3 years	1

Technical Merit

Merit	Rating
Excellent	10
Good	8
Average	4
Fair	2
Poor	1

SALINITY RATINGS

Salinity Occurrence (discharge)	Rating
None	1
Outbreaks occur in landscape	5
Outbreak(s)at project site:	
severity rating S1	6
S2	8
S3	10
Outbreak(s)in landscape:	
severity rating S1	3
S2	5
S3	7

Proximity to drainage line (m)	Rating
> 1,000	1
< 1,000	1.5
< 500	1.75
< 200	2
Riparian	5

Size of outbreak (ha)	Rating
< 0.5	0.7
0.6 – 1	1
>1	1.5

Ec	Rating
High	1.6
Medium	1.2
Low	0.8

Annual Rainfall (mm)	Rating
500 - 650	3
650 - 720	7
> 720*	15

Land use	Rating
Long fallow cropping	0.25
Annual cropping	0.50
Opportunity cropping	6.00
Degraded pasture (poor ground cover)	1.50
Pasture - annual dominant	3.00
Pasture - perennial dominant	7.00
Open woodland / per. pasture	12.00
Opt. spaced trees and shrubs	12.00
Thick regrowth	12.00
Scald	0.01

* Cropping is avoided at average annual rainfall >720 mm because risk of groundwater recharge increases markedly

Management

Management Score	Rating
Excellent	10
Good	8
Average	4
Fair	2
Poor	1

Overall Technical Merit

Merit	Rating
Excellent	10
Good	8
Average	4
Fair	2
Poor	1

Length of Agreement

Years	Rating
10 years	15
7-10 years	8
4-6 years	5
3 years	1

WATER QUALITY RATINGS

Riparian Zone Vegetation

Vegetation type	Condition					
	0	1	2	3	Before	After
Grasses	None, sparse, only annuals	Predom. single species	2 or more spp., range	Good species range, growth season & habit		
Semi-aquatic plants	Raw bank	Very few, scattered	Scattered, one or two species, limited toe protection	Good species range & good toe protection		
Shrubs	None	Very few, limited species	Some, one or two species	Good species range & habit		
Trees	None	Scattered	Scattered, little regrowth	Optimal, good regrowth		
				Total		

Stock Management

Access	Rating	Access	Rating	Before	After
Set stocked	1	Strategically Grazed	7		
Rotationally grazed	3	Never Grazed	7		

Width of Buffer Zone

Width (m)	Rating	Before	After
<5	0.75		
6-10	1.00		
11-15	1.50		
16-20	3.00		
20-50	6.00		
>50	10.00		

Groundcover

Cover (%)	Rating	Before	After
<20	0.60		
20-49	1.20		
50-69	2.40		
70-90	6.00		
>90	8.00		

Length of Stream to be Managed

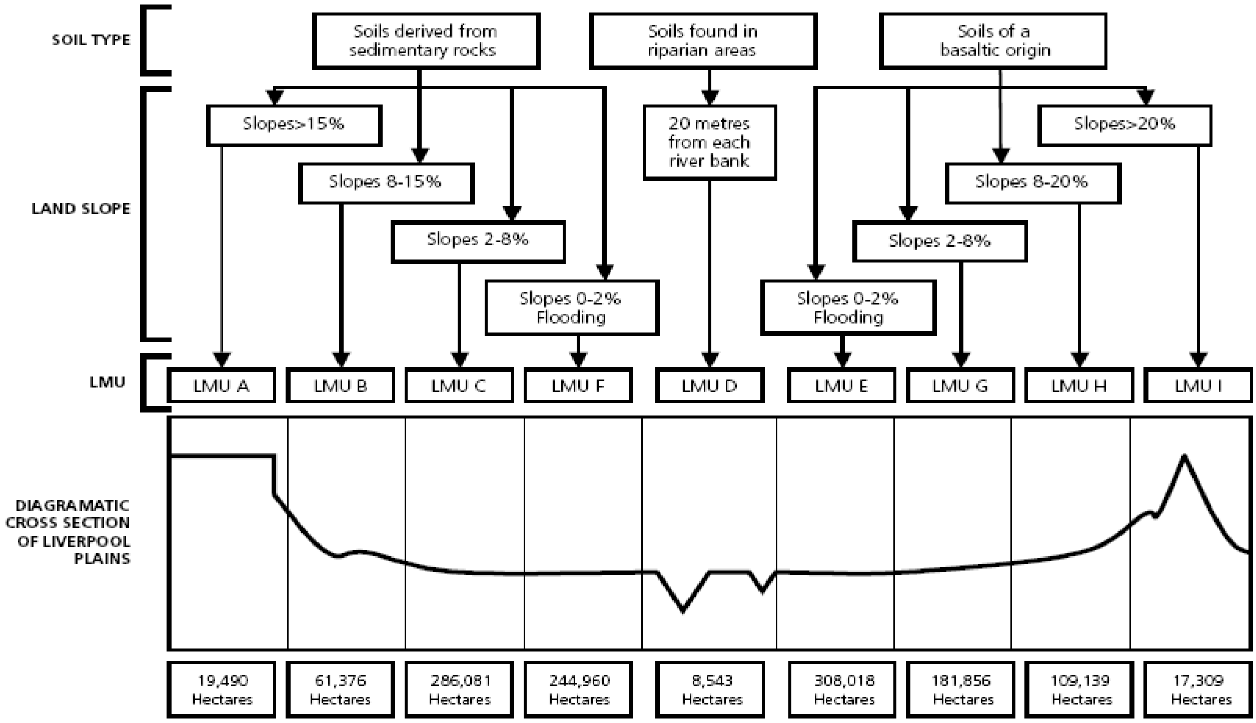
Cover (%)	Rating	Rating
Length	One bank	Both banks
Points per km	4	8

Land Management Units explained

Land Management Units have been used extensively in the Land Management Tenders. They were derived from prior analysis of the region's geography and geology by State and Federal government agencies, CSIRO and universities. By classifying individual land classes and types and then cross-referencing those with topographic maps, soil surveys and satellite images, the characteristics and size of each land unit can be described.

This cross-section representative diagram describes the 9 Land Management Units (LMUs) found across the Liverpool Plains catchment – they range from Sedimentary Hills through Alluvial Floodplains and Riparian Corridors to Volcanic Hills.

The LMUs enable a 'common language' to be used in assessing and managing land types for their agricultural capacity and environmental sensitivity. The LMUs also provide a means of targeting priority areas. Landholders are strongly encouraged to be familiar with LMUs and the environmental issues that relate to them, and the recommended best practices that relate to the LMUs on their farm. This information is critical for their property planning and Land Management Tender proposals.



Summary of Land Management Actions for sustainable management of: - salinity - erosion - biodiversity - water quality - flooding	Sedimentary hill tops steep slopes (>15%)	Sedimentary slopes (8-15%)	Sedimentary slopes (2-8%)	Mixed alluvial plains (0-2%)	Riparian corridor	Floodplain (0-2%)	Colluvial black earths (2-8%)	Volcanic slopes (8-20%)	Volcanic hills (>20%)
LMU	A	B	C	F	D	E	G	H	I
AREA (Ha)	19,490	61,376	286,081	244,960	8,543	308,018	181,856	109,139	17,309
Cropping acceptable if based on opportunity cropping use of soil water and appropriate soil management and conservation*	No	No	Yes if <720 mm	Yes if <720 mm	No	Yes if <720 mm Not on floodway	Yes if <720 mm	No	No
Tree cover optimum and any less (eg rotational harvesting) would require local justification and very good pasture cover	80%	75%	25%	15%	70%	5%	20%	40%	60%
Groundcover minimum (grass, herbs or crop residue) with any less for short periods in locally justified circumstances	80%	70%	70%	70%	90%	90%	70%	70%	70%

Application Form

PROJECT SUMMARY

Project title	Streambank management for riparian zone protection and watercourse stabilisation, salinity abatement, native grassland restoration and re-connecting woodland remnants in Janeys Creek, Liverpool Plains.	
Contact person Business Name	Name: Bill Donerson Address: "Janeys Creek" via Kelvin, NSW	
Project Location	Kelvin East	
Project Duration	Start: month/year 03.03.03	End: month/year 03.03.13
Briefly describe reasons for proposed activities, management changes and expected outcomes on farm and catchment wide: Janeys Creek is a tributary of the Namoi River and hence the Darling System. Water quality is deteriorating due to salt load from the Upper Janeys catchment, where land use change has seen dryland salinity outbreaks, erosion, tree and native grass decline, biodiversity loss and overall farming system sustainability decline. It is expected remediation works and land-use changes on our farm will significantly contribute to catchment health and demonstrate to the community the benefits that can accrue.		

PROPERTY MANAGEMENT ASSESSMENT CHECKLIST

Element	Yes	No	Comments
Have you mapped the Land Management Units (LMUs) on your property?	✓		
Have you compared your current management practices against the management recommendations in the Investment Strategy (as outlined in the LMU fact sheets)?	✓		Comparison indicates some current on-farm practises conflict with LPLMC Investment Strategy
Is the proposed project working toward the Strategy?	✓		
Are plans in place to maintain ground cover above critical levels on:	✓		
- Cropping Paddocks?	✓		Stubble burning to stop and move to direct-drilling
- Grazing paddocks?	✓		70% cover to be regarded as management minimum
Are plans in place to manage tree cover to maintain the resource and biodiversity?	✓		Bush lots to be fenced and connected with tree lines
Are plans in place to improve native grass coverage?	✓		Native plants to be sown along watercourse corridor
Are plans in place to manage riparian areas? (rivers, creeks and watercourses)	✓		Riparian zones to be fenced off
In the management of your land, how will you deal with:	✓		
- Dryland salinity?	✓		Deep-rooted perennials to use soil moisture
- Erosion?	✓		Revegetate eroded areas & fence off
- Biodiversity (plant species, animals, etc)?	✓		Fence off and connect bush lots with tree lines
- Water quality?	✓		Reduce salinity loading and turbidity
- Effects of flooding?	✓		N/A
- Riparian zone condition?	✓		Remediate and revegetate

Give details of preparations, on ground actions, materials to be used and ongoing management.
(please list operations and management in a logical fashion for each aspect of your project)

When	Activity or Operation	Size, scale and materials
By January 04	Janeys Creek	Fence off to allow crash grazing, spray weeds. 1.9 km electric fence
By March 03	Remnant	Erect fence – 600m electric. Spray galvanised burr. Exclude stock to encourage regeneration
By March 03	Grassland	Subdivide 100 ha paddock into 4 cells to enable cell grazing. 4 km three wire electric fence
By March 03	Salinity patch	Already revegetated. Will be monitored to ensure it remains under control. Will re-fence if necessary

Please include (securely packaged) your farm photo/ farm plan/farm map and any other photos, documents that help explain your proposal. We will take a copy of these and return them after tenders have been assessed.

Declaration

I declare that the information I have given on this form is complete and correct. I understand that a report outlining expenditure and progress of the project will be required at each milestone point as a condition of funds being made available.

Signature of applicant	Bill Donerson
Date	1.12.02
Address	"Janeys Creek" via Kelvin, NSW
Phone	014 61 334 010
Fax	014 61 334 101
E-mail	

The project will be undertaken in 2 stages.

The first stage is implementation of the on-ground works (up to 3 years).

The second is the management of those on-ground works (up to 10 years from the date of agreement).

On-ground implementation will take 3 years.

I am prepared to manage project as outlined in the schedule for 10 years from date of the agreement.

Tender Price	**$12,500**

Your business is registered for GST YES ☐ NO ☐

Before lodging your form:

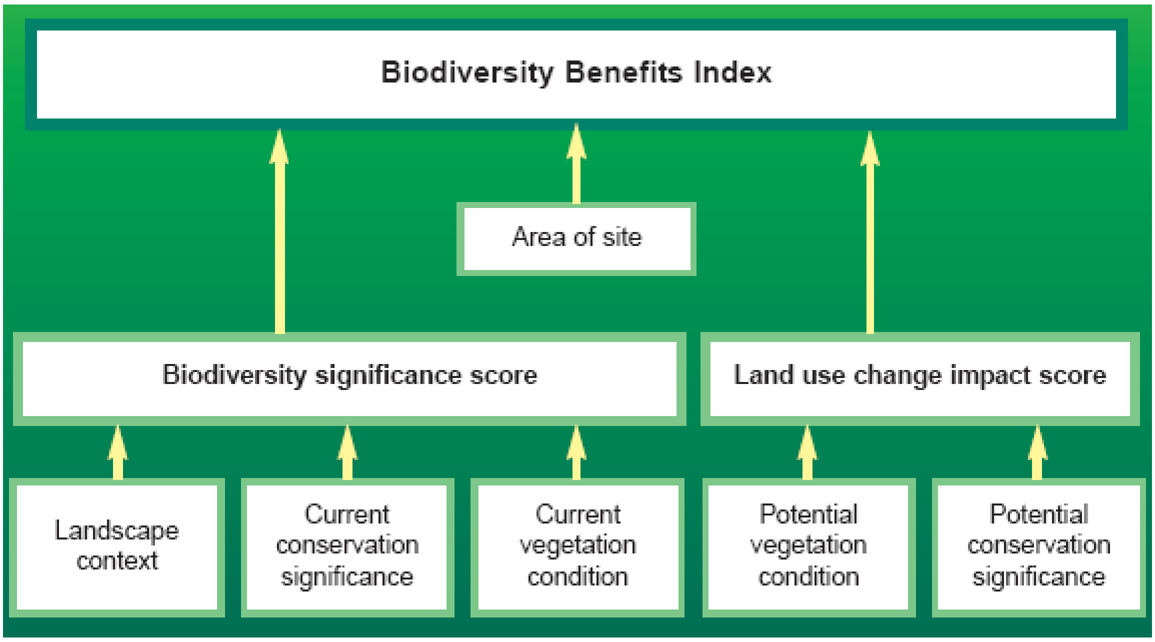
- Check that you have answered all questions.
- Make a copy of the application for your records.
- Securely fasten all the pages together.
- Enclose your farm photo or plan (we will return this when the assessment process is complete)

Please send your tender to:
The Executive Officer
Liverpool Plains Land Management Committee
GUNNEDAH NSW 2380

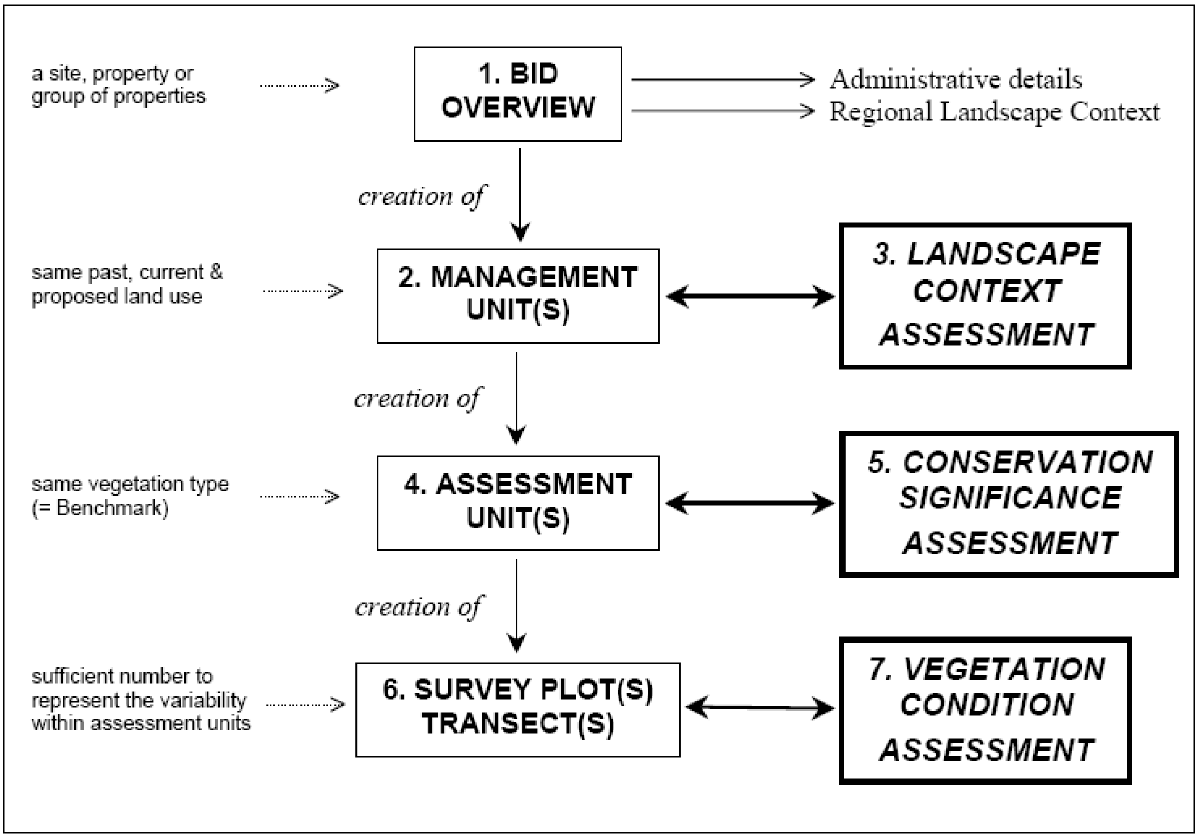
Liverpool Plains Land Management Committee reserves the right to accept or reject tendered proposals.
Successful tender proposals shall be funded to the extent that funding allocations allow.

Appendix 3 – Environmental Services Scheme

The conceptual framework

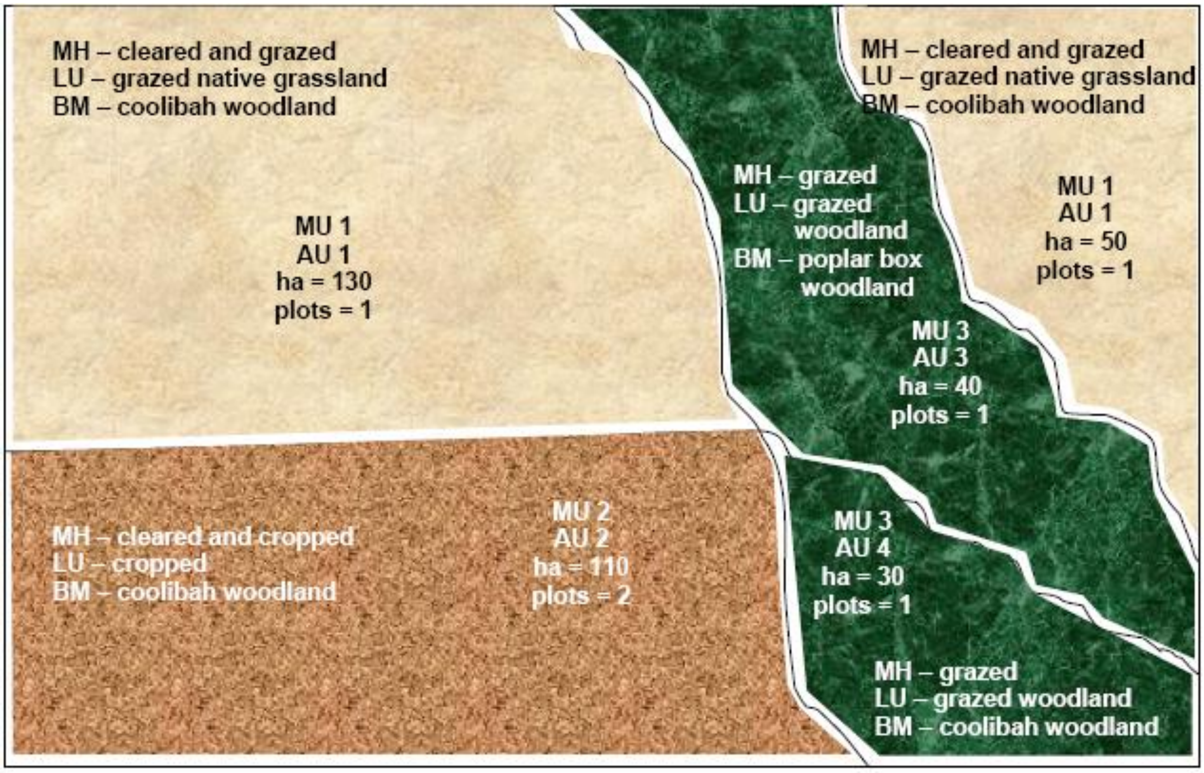


Overview of the steps involved in the use of the Biodiversity Benefits Toolkit Application



Specifying management and assessment units

Management Unit (MU) and Assessment Unit (AU) specification



MH = management history LU = current land use BM = Vegetation Condition Benchmark
ha = hectares Plots = minimum number of survey plots required