

Drivers and Trends in Environmental Markets: Applications for Australia

Literature Review and Project Discussion Paper

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conservation governance for water quality

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ACRONYMS AND ABBREVIATIONS

CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism
CFI	Carbon Farming Initiative
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CYP	Cape York Peninsula
ERF	Emissions Reduction Fund
ES	Ecosystem Services
ETS	Emissions Trading Scheme
EU ETS	European Union Emissions Trading Scheme
GBR	Great Barrier Reef
GDP	Gross Domestic Product
GHG	Green House Gases
IMF	International Monetary Fund
IPA	Indigenous Protected Area
JCU	James Cook University
MA	Millennium Ecosystem Assessment
MBI	Market Based Instruments
MES	Markets for Environmental or Ecosystem Services
NAILSMA	Northern Australian Indigenous Land and Sea Management Alliance
NESP	National Environmental Science Programme
NGO	Non Governmental Organisations
NRM	Natural Resource Management
PES	Payments for either Ecosystem or Environmental Services
REDD	Reducing Emissions from Degradation and Deforestation
REDD+	REDD with explicit aims to improve forest conservation and establish sustainable management
RTP	Research Training Program
TEEB	The Economics of Ecosystems and Biodiversity
TWQ	Tropical Water Quality

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EXECUTIVE SUMMARY

There is increasing global recognition of the role that environmental markets can play in the sustainable use or rehabilitation of the environment and improving livelihoods. Theoretically, environmental markets are proposed as a market solution to an environmental problem. Consequently they potentially have vital relevance to Australia and the efforts to protect and restore the Great Barrier Reef through climate change mitigation and water quality improvement. Predicated on incentives, and conditional on outcomes, environmental markets have the ability to assist in driving improved land management practice and land use change while ensuring investment achieves its objectives. Recognising the funding gap between the Reef 2050 Plan and committed government investment, environmental markets may both encourage additional private investment and provide a mechanism to ensure that funds achieve economic efficiency, ecological effectiveness and social benefits.

This scoping literature review provides an analysis of the market-based approaches to environmental protection and restoration that have evolved since the late 80s. Market-based instruments are used to provide, protect and restore ecosystem goods and services such as biodiversity conservation, climate change mitigation or the securitisation of water quality or supply. The market-based approach encompasses a spectrum of instruments from precise exchange traded mechanisms designed to reduce point source pollutants, to fuzzy Payment for Ecosystem Services (PES) schemes with added social agendas such as poverty alleviation. It is, therefore, important to understand issues such as environmental market objectives, scheme design, limitations and the implications of trade-offs between cost efficiency, environmental effectiveness and social equity.

Theory and practice has largely reflected the global neoliberal agenda incorporating the concepts of the free market, privatisation and the use of prices as a means of allocating scarce resources. As the panacea of neoliberal economics is increasingly questioned, it is instructive to examine these trends in the environmental market literature. Through this lens, core pillars are explored such as free and competitive markets and the retreat of the state, alongside the actors that have emerged such as buyers, sellers and intermediaries and their access to knowledge.

A critique of the markets finds three schools of thought: environmental economics, ecological economics and those that reject the concept of commodifying nature. Examining flaws in the original theoretical model suggest that the market is far from operating in a free, stable and competitive state. Indeed, the literature often makes the assumption that because the term *market* has been employed it operates as a true market, while in reality markets are rarely found. Having examined the market, and critiqued theory and practice, it is instrumental to consider what a healthy governance system needs to incorporate. The paper explores issues such as the importance of knowledge access, property rights, linkages and connections, the technical aspects and risks of reducing complexity. Five current prominent authors' attempts to find alternative frameworks and the implications for theory and practice in this space are discussed.

The paper concludes with a theoretical analysis viewed through the neoliberal agenda of the last 40 years. Implications for the Great Barrier Reef region and Australia generally are analysed and conclusions drawn.

1.0 INTRODUCTION

1.1 Review Context

Environmental issues such as climate change, water scarcity, land degradation and loss of biodiversity are deepening global challenges. In Australia these challenges are manifested in their impact on the Great Barrier Reef (GBR). Reef degradation raised the potential for the GBR to be placed on the World Heritage 'in danger' list in 2013. Australia responded with the Reef 2050 Long-term Sustainability Plan (2015), followed by the Queensland Government Water Science Taskforce Report (2016) and Draft Water Quality Improvement Plan (2017). While each acknowledge climate change as the primary driver of Reef degradation they recognise and focus on the provision of improved water quality to ameliorate reef health. An Investment Framework underpins The Reef 2050 Plan outlining the Government's financial commitments of \$2 billion over the next decade. However, a costings report in 2016 across five catchments estimated achieving water quality targets would be \$8.2 billion (Skull et al., 2016). Incentivising improved land management practice and land use change through market-based incentives may be one potential solution to this shortfall. If market-based approaches are to form part of the GBR investment it is imperative to understand how these mechanisms can be designed and targeted so that they are ecologically effective, economically efficient and can be translated into social and ecological co-benefits.

Water quality is affected by land-based activities within the river catchments entering the GBR lagoon, including urban development and land management practices such as grazing, agriculture, vegetation clearing, fire management and feral animal damage. Considerable attention is currently being paid to water pollution 'hot spots' in areas of intense agriculture through initiatives such as the Major Integrated Projects in the Burdekin and Wet Tropics and the Queensland Government's purchase of Springvale Station in Far North Queensland. In contrast, catchments along the eastern coast of the Cape York Peninsular (CYP) which contain relatively intact landscapes are receiving considerably less attention. However, after the back-to-back coral bleaching events of 2016/17 which predominantly affected the reef adjacent to these catchments, policy and planning will increasingly need to address preserving and improving the contribution that these regions make to the health of the GBR through climate change mitigation, biodiversity conservation and good water quality.

CYP has a majority Indigenous population which is demographically young and expanding rapidly. Indigenous tenure is increasingly being recognised through initiatives such as handing back pastoral and other leases and the commercial purchase of pastoral leases, which combined with legislation such as the *Cape York Peninsula Heritage Act 2007* has resulted in over 40% of CYP being under Indigenous control. The combination of Indigenous controlled land, and a young and rising population set against socially-economically impoverished communities highlights the need for sustainable economic opportunities. Retaining the ecological integrity of these catchments at the expense of development opportunities is an ethical dilemma to which one solution may be compensatory ecosystem service market development.

As a response to these Indigenous livelihood and water quality drivers, the NESP Tropical Water Quality (TWQ) Hub Project 2.3.3 is targeted at *Building Indigenous livelihood and co-management opportunities in the Northern GBR – ecosystem services and conservation*

governance for water quality with a specific focus on ecosystem service market opportunities. While market-based initiatives have been shown to work well in areas of hot spot pollutants, one of the key challenges of this project is identifying market-based opportunities and development in relatively intact environments where cultural and biodiversity values are high. The competing paradigms of a market-based approach to environmental repair and restoration of degraded areas versus to the preservation and protection of pristine areas, while maintaining social equity and development rights is a central conundrum of the market-based approach generally and CYP specifically.

A literature review spanning global ecosystem service markets was considered a rigorous foundation for the project, both in scoping opportunities but also in learning lessons and understanding the impacts of global policies and initiatives. While it was appreciated at the start of the project that many ecosystem service market avenues were closed to the eastern catchments of CYP, it was considered important to understand the boundaries and barriers to all markets, why these boundaries and barriers exist, and the implications that changes to market-based policy and legislative foundations might have. Additionally, understanding the regional, state and national markets across the full remit of opportunities for Australia allows for more holistic policy recommendations to emerge from this project. As the Reef 2050 Investment Framework embarks on its expensive, yet inadequate, spend, it is prescient to research the global ecosystem service markets to see what can be learnt for Australia at such a poignant time. This literature review into the drivers and trends in environmental markets, therefore, has relevance to market-based initiatives for the CYP, within the boundary of governance of the GBR and Australia's climate change management initiatives nationally.

Market-based approaches to environmental governance through Payment for Ecosystem Services (PES) have been promoted as a panacea capable of achieving the win-win scenario of environmental protection and improvement while addressing societal issues such as poverty alleviation. Markets for Ecosystem Services (MES) are promoted as an efficient and cost-effective method of reducing point source pollutants through market signals. Since their inception, these initiatives have been implemented at a variety of scales from small watersheds to entire nations.

The roots of environmental markets lie in neoclassical economic theory with the promise of incorporating the efficiency and effectiveness of markets into environmental protection. Schemes have been developing steadily and rising in popularity since their inception in the late 80s. Uptake rose in the 90s, when market-based theories were prevalent and intersected with the neoliberal discourse in policy making. The rapid proliferation of PES and MES schemes in the last 20 years was spurred initially by the Millennium Ecosystem Assessment (MEA) in 2005 and The Economics of Ecosystems and Biodiversity (TEEB) in 2009. These initiatives drove a sea change in the use of market-based instruments (MBI) in an attempt to change human behaviour and protect the environment. PES and MES schemes provide financial incentives to induce land managers to change their land management practices to improve ecosystem service benefits. These might be improvements to water quality or quantity, carbon sequestration, green-house gas (GHG) emission reductions, or biodiversity conservation and landscape protection. It is also anticipated that environmental markets can enhance human wellbeing, aid in poverty reduction and promote climate change resilience.

Some mechanisms are well developed, such as MES for GHG emission reductions or PES for watershed protection. Other schemes, such as those designed to protect biodiversity, are more exploratory. The original models, policies and initiatives have been critiqued by both academics and practitioners, founded on both empirical and moral grounds. Observers critique the ability of schemes to achieve their stated goals while moral and ethical questions arise on valuing the environment. Current trends in the theory and practice of PES are growing in controversy and analysis of the origin and evolution of the market-based concept is an essential foundation for any new initiatives.

As a part of the NESP TWQ Hub Project 2.3.3, this report considers the relevance of environmental markets to generate opportunities for Indigenous provision of ecosystem services and associated conservation governance in the northern GBR. This is intended to provide a deeper understanding of the potential to improve environmental values and livelihoods through environmental market business development and Indigenous co-benefits. The success of the savanna burning Carbon Farming Initiative (CFI) projects in northern Australia has provided proof of concept for market-based Indigenous cultural natural resource management. The challenge is to build on this success in other arenas such as water quality, cultural and biodiversity services. The relevance of this literature spills over into current regional and national initiatives through the need for comprehensive policy and planning. This review forms a background document for the project and those interested in market-based approaches to protection and restoration of the GBR and climate change mitigation nationally.

1.2 Structure of This Review

Following a summary of project aims and the review methods in section two, the literature review begins in section three, with the historic origins of the environmental markets and the evolving economic conceptualisation of nature. The field of environmental economics began with the work of Coase (1960) and Pigou (1932), predicated on the internalisation of externalities to the market. The sustainability discourse and the emergence of ecological economics is explored.

In section four, the evolving conceptualisation of ecosystem services as a requirement for human development is discussed. The mainstreaming of ecosystem services in academic literature and the subsequent valuation into economic terms led to the advent of MBI. The section considers why PES schemes were embraced in Latin America. The influence of the MEA and TEEB studies on the market-based approach is reviewed.

Section five examines the first decade of environmental markets from 1990 and explores different typologies within the markets. Different definitions and classifications are discussed such as ecosystem service type, payment type or geography. The market-based approach in environmental policy is compared with other policy tools.

Section six is a critique of environmental markets today and introduces the school that rejects any form of valuation of nature as a false commodification. Flaws in the original model are examined from questions as to when payments are market-like, the market in disequilibrium and the extent of the retreat of the state. Using biodiversity offsets as an example, market expectations are shown to be over emphasised or exaggerated. Alternative discourses for PES

in Latin America are explored including poverty alleviation, subsidy replacement and social justice issues that arise when implemented.

The next section considers the governance of environmental markets drawing on lessons from the previous critique as well as fresh themes from the literature. Critical criteria emerge as the interactions and linkages between different stakeholders, property rights, access to knowledge, the challenges of managing the commons and the importance of adaptive governance. Transaction costs are found to affect the design of any scheme and can include tempering data costs through reducing complexity. Services can be bundled, or trade-offs can be made. Each of these will have risks and impacts on outcomes and the importance of designing the scheme to meet the desired objectives needs to be explicit.

Section eight examines five alternative frameworks for discussion and analysis put forward by leading scholars in the field. It considers how governance issues are incorporated through these alternative conceptualisations.

The final section draws the analysis together and considers analysis for the GBR region and Australian more widely, while project implications are addressed in the project final report 'Community-based evaluation, governance, and strategic planning for Indigenous Ecosystem Services in Eastern Cape York Peninsula (Barber et al., 2017).

1.3 Terminology

The terms *ecosystem* services and *environmental* services are used inconsistently and interchangeably in the current literature. Likewise, PES has many coexisting diverse definitions of what constitutes a PES scheme and the multifaceted term is used broadly and widely. Alternatively called Payments for *environmental* services, many authors consider that ecosystem services are a subcategory of environmental services, dealing exclusively with the benefits humans receive from these services. The term *environmental* services is preferred by some who consider that it can encompass the benefits derived from actively managed ecosystems such as sustainable agricultural practices. Environmental markets is preferred for these reasons, with MES and PES recognised as distinct subcategories.

The term *environmental market* is used as an umbrella terminology in this review and involves a market only in so far as there is a transaction, monetary or non-monetary, for a good or service. The term *market-based instrument* (MBI) is the mechanism the environmental market employs and spans biodiversity offsets, wetland banking, carbon trading schemes and PES schemes.

While recognising the limitations of markets, this paper uses the term MBI for the sake of continuity with previous literature. This is despite the lack of a consensual definition and clear delimitation of the term. This sits alongside observations that MBI is a flawed and problematic category due to the strong connotations that the term 'market-based' carries. The paper intends to make clear the need for more careful attention to nomenclature and subdivisions within the environmental markets to aid learning from theory and practice.

2.0 PROJECT AIMS AND REVIEW METHODS

2.1 Wider Project Aims

This review is a component of the two-year NESP Tropical Water Quality (TWQ) Hub research project *Building Indigenous livelihood and co-management opportunities in the Northern GBR –ecosystem services and conservation governance for water quality*. The focus of the project is scoping water and catchment management related environmental market opportunities and products in Cape York Peninsula (CYP) catchments flowing into the northern GBR. These opportunities and products need to be culturally, environmentally, economically, and politically suited to CYP. Ecosystem services focused on water and catchment management are a common component of environmental markets. Water quality ecosystem services are often known internationally as ‘nutrient offsets’, ‘watershed ecosystem services’ or under the umbrella term ‘Investment in Watershed Services’. The project focus is on developing water-oriented services and products that might deliver a range of additional services. These include biodiversity, cultural and socio-economic benefits and have the advantage of being both more effective in building Indigenous livelihoods and may also deliver a higher market value

The project is a collaboration between researchers at CSIRO and JCU, the local staff at Kalan Enterprises, and regional Cape York Partnership. The project is designed to underpin ecosystem service-based livelihood opportunities and explore the realisation of social co-benefits from Indigenous cultural natural resource management. Consequently, the project included an assessment of areas of environmental market opportunities for Kalan Enterprises and institutional framing for these opportunities.

2.2 Wider Project Partners

The TWQ Hub project partners are the CSIRO, James Cook University, Kalan Enterprises and Cape York Partnership. CSIRO is the national science agency. James Cook University is one of the leading research institutions focusing on the tropics in areas such as marine sciences, biodiversity, global warming and tropical ecology and environments. Cape York Partnership is an Indigenous development agency leading a comprehensive reform agenda (The Cape York Agenda). Cape York Partnership has grown rapidly over the last decade providing a range of governance, advocacy, policy, program and community services to Cape York Indigenous communities. Kalan Enterprises is a Traditional Owner-based organisation in Coen, CYP. Kalan Enterprises specialises in the delivery of best practice land management services to Indigenous land holders in the central CYP. Through these services, Kalan Enterprises provide employment and wider social outcomes. The TWQ Hub project team members have expertise in Indigenous water issues, wetland ecology, policy and governance, environmental markets, regional development, and the wider outcomes of natural and cultural resource management actions. Links with other projects and NESP hubs is covered in detail in Barber et al (2016).

2.3 Review Aims

An Interim Project Report and Discussion Paper (Barber et al., 2016) contained a preliminary assessment of some key literature, but also highlighted the need for a more comprehensive review of the origins, context and the wider development of PES schemes and market-based

approaches. As the project progressed, it became apparent that a review of the key features of environmental markets internationally was required. Of particular importance was:

- Key research literature focused on environmental markets, products, and concepts
- The policy, theory and practice for environmental markets internationally with implications for Australia and north Queensland.

Such a review would provide long term foundations for the project, and for CYP communities, to scope governance systems, policies, methods and processes for generating environmental market products. This review addresses these needs.

2.4 Review Methods

A research assistant initiated the research for this review in 2016 with a literature search. Research materials were located by searching for key words through the libraries of JCU, CSIRO, and the University of Queensland. Google Scholar was used to find material that might not appear in research institutional catalogues and databases. Google was used to search the key online and grey literature materials.

The search terms included:

- Market(s) for Environmental/Ecosystem/Watershed Services
- Payment(s) for Environmental/Ecosystem/Watershed Services
- PES
- Conservation governance systems supporting PES development.

Variations in terminology within the field of research resulted in this key word search forming an essential first phase. Reviewing the resulting list of references this author established the initial set of literature. Purposeful snowballing was applied as the references cited in this initial body was examined and the most frequently cited sought, tracking back to seminal work and landmark papers. The grey literature was also searched as schemes are often delivered in practice by Non-Governmental Organisations (NGOs). Also, market commentators had valuable insights. Once context had been established within the literature, the search was refined aiming for the most recent work since 2005. Highly cited papers and literature reviews were prioritised for analysis. This iterative process provided an understanding of the field and supplied additional supporting material.

3.0 THE HISTORICAL ORIGINS OF ENVIRONMENTAL MARKETS

This section charts the history of the economic conceptualisation of nature. Acknowledging the pre-classical, classical and neo-classic work, this review starts with the foundations of modern environmental economics in the 60s under the influence of Coase (1960). Entire bodies of literature exist examining the economic theory underlying the environmental markets (Farley & Costanza, 2010). For this review, it is necessary to only touch on the principles underlying the field of environmental economics. The subsequent development of the sustainability discourse in the 70s and the emergence of ecological economics in the late 80s is charted.

3.1 The Conceptualisation of Nature by Economists

'The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes' (Gómez-Baggethun, de Groot, Lomas, & Montes, 2010) provides an extensive historic analysis of how nature was abstracted into economics. The paper spans pre-classical, classical and neoclassical economics providing an important summary of the landmarks. Tracing the long-term trends in the economic analysis of the environment begins with Plato's observations in 400BC linking the desiccation of wells to deforestation and soil erosion. This proceeds through to the roots of modern environmental economics. An illustration from this paper summarises the critical landmarks and patterns of change in the concepts of natural capital and ecosystem services (Figure 1).

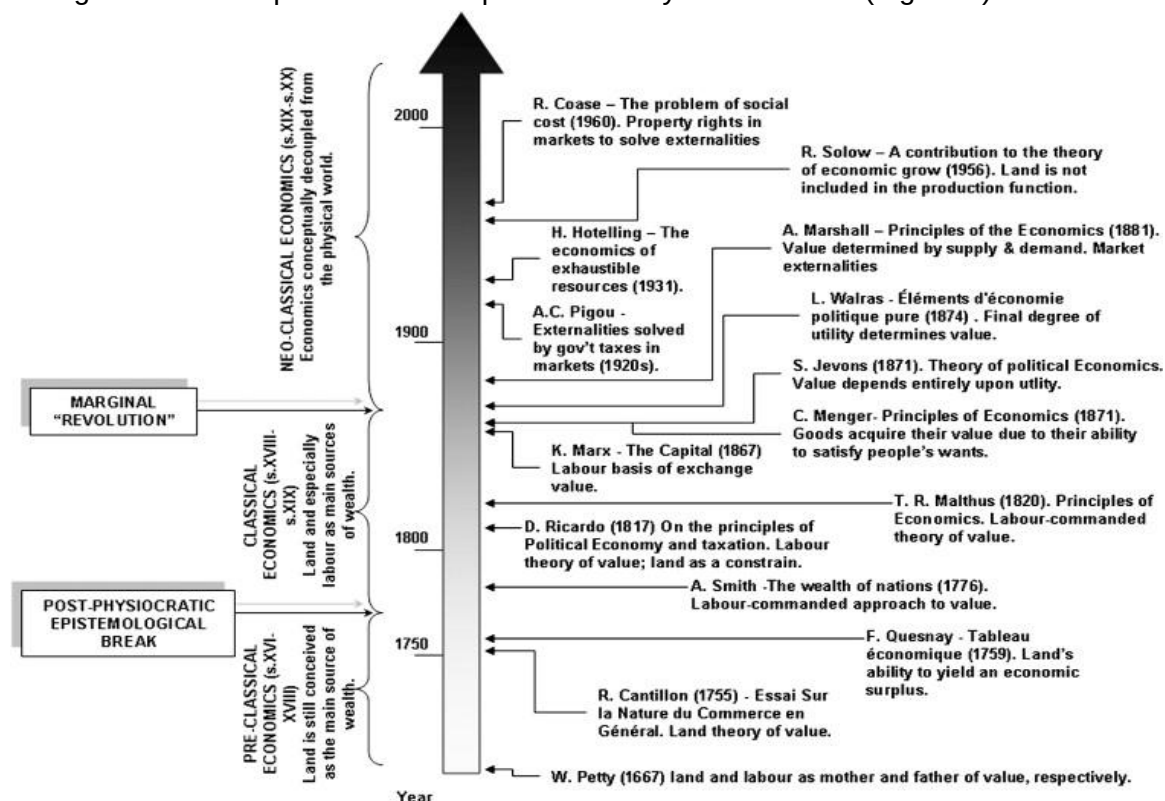


Figure 1: Landmarks in the evolving conception of nature by economics

Source: Gómez-Baggethun et al., 2010, p. 1210

3.2 The School of Environmental Economics

The roots of environmental economics lie in the formation of the Society of Environmental and Resource Economics in the 60s (Turner, Pearce, & Bateman, 1994). Central to environmental economics is the concept of *market failure* such that the market fails to allocate resources efficiently. While the use of markets is considered to be highly efficient at using priced resources, it fails in the efficient use of unpriced resources. Many environmental goods and services are public goods¹ and so available for all to use freely. As a public good, the environment is an unpriced commodity and external to markets. Externalities may be negative when they create a cost to society such as pollution, or positive as in the case of ecosystem stocks and services. Environmental economics attempts to develop methods to value and internalise economic impacts on the environment and incorporate these into decision making.

The origins of environmental economics started with the work of Coase using property rights in markets to solve externalities (see Figure 1). Pigou had already recognised the social cost of pollution and suggested that polluters should be taxed based on the estimated damage caused by their emissions (Pigou, 1932). Rather than taxation, the Coase Theorem emphasises the importance of property rights and negotiations between polluters and sufferers (Coase, 1960). The theorem states that if trade in an externality is possible and there are sufficiently low transaction costs, bargaining will lead to a Pareto efficient² outcome regardless of the initial allocation of property. Market failures are corrected through the internalisation of environmental or social costs into private costs and ultimately reflected in prices. Negative externalities such as pollution can be addressed through ‘the polluter pays principle’ while positive externalities follow the ‘provider gets principle’ (Gómez-Baggethun & Muradian, 2015).

Addressing externalities necessitates valuing natural resources by treating the environment as capital assets (Muradian & Rival, 2012a). Thus, a pricing mechanism is needed, and monetary values must be assigned to the negative or positive externalities being corrected. Consequently, effectiveness is considered dependent on assessing and enforcing the ‘right price’ to make the externalities visible. Valuation techniques have been developed and increasingly refined since the late 60s. Techniques include hedonistic pricing (using related market goods and services as proxies), revealed preferences (such as travel cost methods which use observed consumed behaviours) or stated preferences (expected consumer behaviour in hypothetical markets using surveys). Kumar et al. (2013) elaborates further on valuation methods. Through valuation the externality is acknowledged, measured and incorporated into public and private decision making processes (Gómez-Baggethun & Muradian, 2015).

Applying this concept for watershed protection under the ‘provider gets principle,’ is illustrated in Figure 2. The payment is the incentive motivating land owners to practice sustainable land management. The Coase Theorem anticipates internalisation through private transactions. Conversely, a Pigouvian conceptualisation would involve government taxation (Vatn, 2010).

¹ Goods with high difficulty of excluding beneficiaries

² When it is impossible to make one party better off without making someone worse off

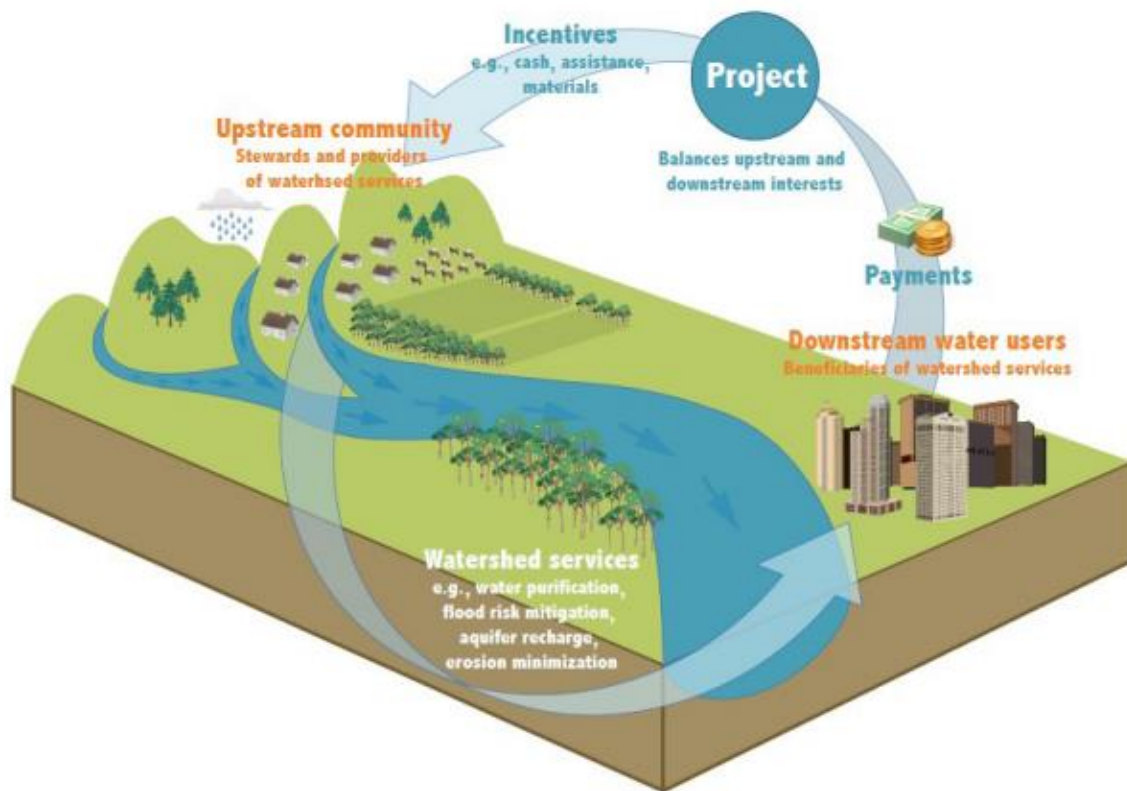


Figure 2: The Payment for Ecosystem Services concept

Source: Smith et al., 2013, p. 13

Bayon (2004) makes the important point that environmental economics does not seek to use markets to supplant government regulation, but that well designed markets may complement regulation. Indeed, the founder of market theory, Adam Smith, recognised that markets cannot incorporate public goods and argued that they must remain in the realm of government management. The extent of government involvement is a recurring point of discussion in theory and practice.

3.3 The Neoliberal Approach to Environmental Policy

The first generation of environmental policies to address externalities was legislation based. In the UK, The *Rivers (Prevention of Pollution) Act 1951* and the *Clean Air Act 1956* marked the beginning of regulation-based standards enforced by the state through command-and-control mechanisms. In the US, similar legislation was enacted through the *Air Pollution Act 1963* and the *Water Quality Act 1965*. Using the *Clean Air Act 1956* as an example, legislation views the atmosphere as a collective public good that is being infringed (polluted). Through 'command and control' governments establish a set of pollution rules to regulate pollution which are enforced through fines (Bayon, 2004). These are implemented by national governments, environmental agencies and intergovernmental organisations. These legal measures were not well accepted, however, and rarely applied in practice (Lapeyre, Froger, & Hrabanski, 2015).

Command and control techniques were not the sole tools used in this period, however. Before the advent of modern environmental markets, early forerunners were widely applied in developed countries in the form of public agro-environmental payments that induced farmers to change land-use practices (Wunder & Wertz-Kanounnikoff, 2009). In the 30s in the US the forerunner to the Conservation Reserve Program attempted to reduce the production of certain crops to protect soils and to prevent commodity surpluses (Baylis et al., 2008 cited in Schomers & Matzdorf, 2013). The European Common Agricultural Policy was a price based incentive to land managers to improve environmental quality and biodiversity (Gómez-Baggethun et al., 2010).

The beginning of a sea change in public environmental awareness occurred in the early 60s and 70s with seminal publications such as *The Silent Spring* (Carson, 1962), *The Population Bomb* (Ehrlich, 1968) and *The Limits to Growth* (Meadows, 1972). Emerging from this environmental awareness the sustainability discourse came to global attention in 1972 at the UN Conference on the Human Environment in Stockholm. The 1987 Brundtland Report, *Our Common Future* brought awareness that by ignoring our natural capital's economic importance we are living today at the expense of the poor and future generations (Brundtland et al., 1987).

Alongside the sustainability discourse a utilitarian framing of beneficial ecosystem functions began in order to increase the public's interest in biodiversity conservation (Braat & de Groot, 2012). The term *ecosystem services* emerged (Ehrlich & Ehrlich, 1981) with an explicit connection to the benefits humans receive (see Braat & de Groot, 2012 for a discussion of the ecological roots of the concept). In the 80s this 'ecological thinking' approach began to be applied to environmental management, framing societal dependence on ecosystem services (Gómez-Baggethun et al., 2010). Concurrently, environmental policy makers were searching for ways to prevent environmental degradation without significantly limiting economic and social development (Connor, Hatton MacDonald, Morrison, & Cast, 2008). Armed with increased ecological knowledge, economists started to consider the application of MBI to address environmental degradation. This was first demonstrated in the US when environmental economists sought new methods to strengthen the *Clean Air Act 1956*. Their work, Project 88, advocated emissions trading (Wirth, Heinz, & Stavins, 1988). This was the first environmental MBI, a cap-and-trade instrument for sulphur dioxide emission reductions (Boisvert, Méral, & Froger, 2013). Its success demonstrated market mechanisms could be used effectively to implement environmental policy (Bayon, 2004).

The shift to MBI in environmental policy was part of the neoliberal global trend of privatisation, marketisation, roll back of the state through deregulation, market friendly reregulation and the creation of markets (Castree, 2008). One particular school of thought contended that traditional government policies (taxes, subsidies, quotas, regulations, inefficient state enterprises, or through public projects with low economic returns and high environmental impacts) tended to add distortions to the market rather than correcting failures (Panavotou, 1993 cited in Muradian & Rival, 2012a). This school argued that policy reforms would remove the distortions and facilitate market conditions to incorporate environmental resources and services that were being undervalued or depleted by not being adequately accounted for in the markets (Muradian & Rival, 2012a). In this way, the state's role continued to be recognised but as a facilitator via re-regulations that supported markets and privatisation. The emphasis in the literature at this time was on the state's retreat (Hackett, 2015).

3.4 The Emergence of the School of Ecological Economics

A spilt from the Society of Environmental and Resource Economics in the late 1980s resulted in the formation of the Society and Journal of Ecological Economics. Ecological economics emphasises the human-nature interaction and challenges some of environmental economics' assumptions. The economic subsystem is conceptualised as an open subsystem of the ecosphere co-evolving with the social and ecological systems (Gómez-Baggethun et al., 2010). The proposed objective was to “envelop economics in an overall ecological framework” (Costanza & Daly, 1987, p. 7). Neoliberal economics with its focus on market-based efficiency is expanded to include the issues of equity, biophysical limits and development of methods to account for the physical and social costs involved in economic performance (Braat & de Groot, 2012). Key concepts were evident in *Small is Beautiful – A Study of economics as if People Mattered* (Schumacher, 1973) and Herman Daly's *Steady-State Economics* (Daly, 1977). Other influential figures were C.S. Hollings, H.T. Odum, and Robert Costanza.

A distinction identified by Gómez-Baggethun et al. (2010) between environmental economics and ecological economics is in their respective positions within the strong versus weak sustainability debate. This relates to the substitutability of natural capital (Neumayer, 1999 cited in Gómez-Baggethun et al., 2010). Gómez-Baggethun et al. (2010) explain that the weak sustainability approach assumes that natural capital can be substituted by manufactured capital, an assumption accepted by environmental economics. The strong sustainability course, advocated by ecological economics, maintains that natural and manufactured capital are complementary to each other, but not interchangeable.

A further component of the debate recognised by Farley is the existence of ecological thresholds beyond which regime changes may occur (Rocha, Peterson, & Biggs, 2015; Rockström et al., 2009; Steffen et al., 2015). These ecological regime shifts will, in turn, affect economic thresholds and human welfare. Farley's line of debate considers the limits to physical growth first postulated by Malthus. The strong sustainability debate, the existence of thresholds with high levels of uncertainty and limited understanding may have resulted in critical thresholds already having been crossed (Farley, 2012).

4.0 VALUING ECOSYSTEM SERVICES

The demonstrated success of sulphur dioxide offset trading to decrease pollution led to many of the market characteristics subsequently endorsed by the Kyoto Protocol. Likewise, the concept of ecosystem services as essential services for human wellbeing became firmly established in the 90s. The combination of market and ecosystem service concepts spurred the valuation of ecosystem services to facilitate market products. PES schemes were embraced in Latin America in the 90s and this section explores the reasons for this. A discussion on the influence of the Millennium Ecosystem Assessment and its operational sister The Economics of Environment and Biodiversity follows.

4.1 Ecosystem Services and Market Concepts

Mainstreaming of ecosystems began in academic literature in the 1990s. The relationship between natural capital and sustainable development was first discussed by Costanza and Daly (1992). At the same time, the connection between ecology and the economics of biodiversity loss was made by Perrings, Folke and Mäler (1992). It was Daily (1997) who first established that human wellbeing is inextricably linked to the function of these ecosystems.

Concurrently, the sustainability discourse was moving towards inclusion of market forces. The Brundtland Report introduced sustainable development but did not suggest how it could be put into practice. Gómez-Baggethun and Muradian note that global awareness of environmental sustainability emerged from the first Rio conference in 1992 with Principle 12 and 16 arguing in favour of an “open international economic system that would lead to economic growth and sustainable development in all countries” (2015, p. 219). While the Brundtland Report had made a case for “expansionary policies of growth, trade and investment”, the Rio Declaration advocated an “open international economic system that would lead to economic growth and sustainable development in all countries” (cited in Gómez-Baggethun & Muradian, 2015, p. 219). The US President’s Council on Sustainable Development in 1996 recommended that “Sustainable Development objectives must harness market forces through policy tools such as emissions trading, deposit/refund schemes and tax and subsidy reform” (cited in Gómez-Baggethun & Muradian, 2015, p. 219). The following year the ‘Next Generation Project’ called for “market mechanisms in environmental policy” (cited in Gómez-Baggethun & Muradian, 2015, p. 219). Following this trend, the Johannesburg Declaration on Sustainable Development (2002) pledged to “benefit from the opening of markets” and incentives for green investments should be provided alongside the “promotion of ‘sustainable development through the use of improved market signals’” (cited in Gómez-Baggethun & Muradian, 2015, p. 219).

4.2 Pricing Ecosystem Services

Environmental economics focuses the economic value of ecosystem services. In 1997 Costanza et al., estimated the global value of ecosystem services at around US\$33 trillion per annum; this was a figure significantly larger than the global Gross Domestic Product (GDP) (US\$18 trillion) and had profound impacts (Costanza, 1998; Costanza et al., 1997; Costanza et al., 2014; Polasky & Segerson, 2009). Hybridisation of the ecosystem literature with the valuation of ecosystem services reinforced extending economic incentives to natural resource management (Boisvert et al., 2013). There was a drive to use market-based valuation and

incentives to 'make conservation profitable' (Daily & Ellison, 2002 cited in Gómez-Baggethun & Muradian, 2015).

The Kyoto negotiations began in 1993 and culminated with the Kyoto Protocol in 1997. The Kyoto Protocol promoted and established MBI as the environmental policy tools to address energy, transportation, water and climate (Lapeyre et al., 2015). MBI were considered innovative alternatives to regulations which were judged bureaucratic, disconnected from reality and hampering technological innovation (Baumol et al., cited in Boisvert et al., 2013). The operational arm of the Kyoto Protocol was the Clean Development Mechanism (CDM). The CDM was designed specifically to develop projects which mitigated GHG emissions in developing countries on behalf of developed countries. The objective was a dual benefit, securing low cost emissions while providing additional social benefits through technology transfer (Lovell, 2010).

Bayon (2004) traces four Kyoto emissions trading schemes (ETS) that emerged: the ETS in the UK (2002); the European Union ETS (EU ETS) (2005); the Chicago Climate Exchange (CCX) (2003) and the proposed US ETS which failed to pass into legislation. Bayon (2004) also traces markets 'beyond carbon' including wetland mitigation in the US and renewable energy in Texas. Wetland mitigation trading set a price of \$44,000 per acre on preserved wetlands. Bayon points out that this allows the wetland's ecological goods and services to enter the economic markets and "one small environmental externality has been partially internalised" (2004, p.13). As part of this trend in 2006 the Stern Review on the Economics of Climate Change in used a global cost benefit analysis to frame global environmental problems in economic terms (Stern, 2006).

Valuing ecosystem services is dealt with in depth in Polasky and Segerson (2009) which reflects on the opportunities and challenges that arise when integrating economics and ecology. In particular, the authors' examination of the rapid growth in positive analysis provides insight and improved understanding of the linkages between the two disciplines.

4.3 Payments for Ecosystem Services: A New Paradigm for Latin America

The ecosystem service approach was particularly embraced in Latin America from the 1990s. Costa Rica, Mexico and Columbia, were early pioneers in both ecosystem services research and early government payment programs. The landmark program pioneered in Costa Rica in 1997, *Pago por Servicios Ambientales*, is frequently cited (Pagiola, 2008). The scheme was designed to decrease the high deforestation rates through establishing an economic value for environmental assets and financially compensating sustainable management (Barton et al., 2009). See Table 6 for a comprehensive list of the major schemes in South America that emerged in the 90s.

Since PES schemes are predicated on the 'beneficiary pays' principle, they are attractive when the providers are poor, marginalised landholders (Engel, Pagiola, & Wunder, 2008) and may contribute to poverty alleviation (Pagiola, Arcenas, & Platais, 2005). Policy makers such as (Stern, 2009) argued that developing countries were one of the most cost effective regions to actively address climate change. Others considered that these regions contain deep multifaceted poverty where the cost of ecosystem protection and preservation was expected

from those least able to afford it (Calvet-Mir, Corbera, Martin, Fisher, & Gross-Camp, 2015). The social development and poverty alleviation component of the schemes, therefore, became critical.

Proponents of PES argued that in their absence, natural habitats outside protected areas were likely to be destroyed through economic use, and PES were a more cost efficient approach to conservation than previous community based approaches (Rosendal & Schei, 2014). Governments, donor and conservation organisations anticipated the generation of new financial resources for forest conservation (Mahanty, Suich, & Tacconi, 2013).

4.4 The Millennium Ecosystem Assessment

In 2001, in recognition of the increasing pressure on ecosystems from sustained population growth and economic development, Kofi Annan³ called for the Millennium Ecosystem Assessment (MEA). The MEA assessed the consequences of ecosystem change on human wellbeing and established the scientific basis for actions that would enhance the sustainable use of these systems, and thus their contribution to human wellbeing (Derissen & Latacz-Lohmann, 2013). Involving 1,300 scientists, the four year study was particularly designed for policy makers (Costanza et al., 2014). Initial reports (2003) followed by the Synthesis Report (2005) found that both changes to ecosystems, and the degradation of ecosystems, were increasing at an alarming rate. Between 1960 and 2000 there was a decline in 60% of ecosystem services (Millennium Ecosystem Assessment, 2005).

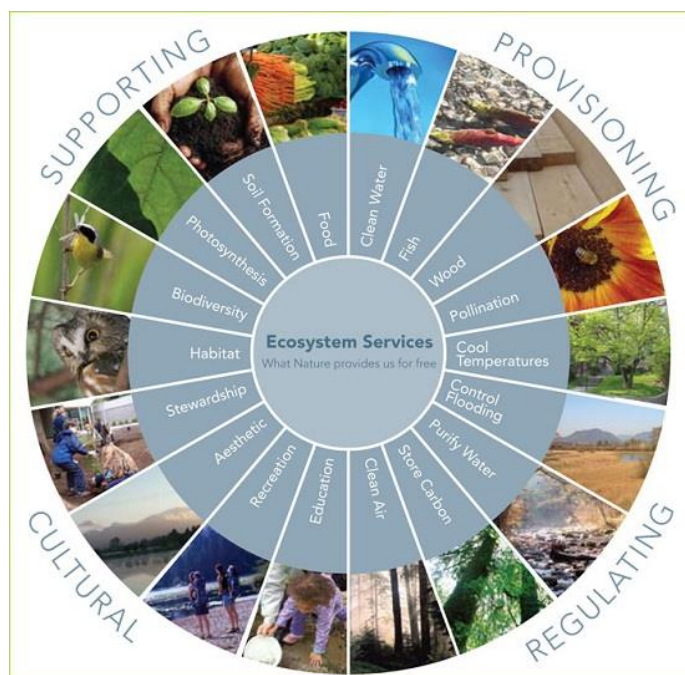


Figure 3: The Millennium Ecosystem Assessment organizes ecosystem services into four broad categories

Source: Diagram of Ecosystem Services, Metro Vancouver

The MEA divided ecosystem services into the categories of: provisioning (such as water and food); regulating (such as the regulation of drought, floods, disease and land degradation); cultural (such as spiritual, religious, recreational and other non-material benefits), and supporting functions (such as nutrient cycling and soil formation) (Derissen & Latacz-Lohmann, 2013). See Figure 3. This framing can be considered the MEA conceptualisation of the interaction of society and ecology. Importantly it recognised that the ecosystem and its services extend beyond the ecological realm and include economic and social considerations (Solazzo, Jones, & Cooper, 2015). Specifically, the MEA provided an interpretation of the relationship between ecosystem services and human wellbeing and

poverty reduction. It identified the direct and indirect drivers of change to these ecosystem

³ Kofi Atta Annan served as the seventh Secretary-General of the United Nations from January 1997 to December 2006

services and their interactions (Figure 4). This established that trade-offs exist between different ecosystem services (Bovarnick et al., 2010 cited in Balvanera et al., 2012). These trade-offs are particularly important when attempting to reconcile economic development and poverty alleviation with environmental conservation at regional levels (UNEP, 2010 cited in Balvanera et al., 2012). Through the recognition of societal reliance on ecosystem services, MBI started to gain traction in the biodiversity sector (Hrabanski, 2015; Lapeyre et al., 2015).

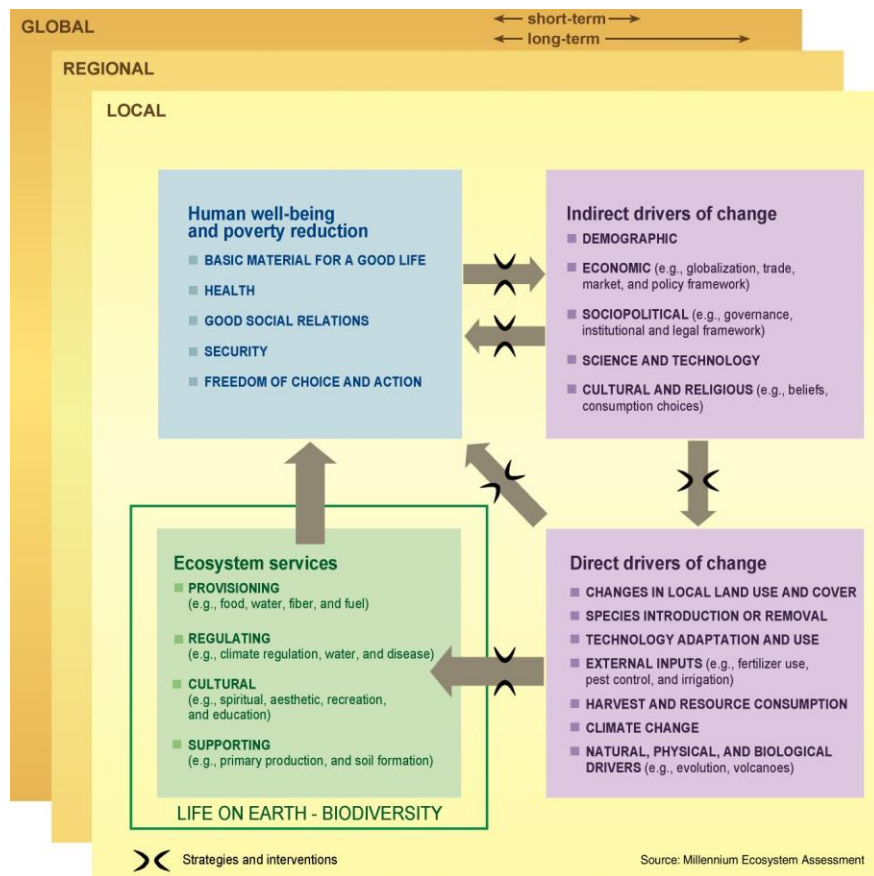


Figure 4: The conceptual framework of the Millennium Ecosystem Assessment

Source: The Millennium Ecosystem Assessment, 2005

<https://www.millenniumassessment.org/en/GraphicResources.html>

4.5 The Economics of Ecosystems and Biodiversity Study

The 'Potsdam Initiative' for biodiversity⁴ in 2007 called for a global study of "The economic significance of the global loss of biological diversity" (Braat, 2012, p. 1). The subsequent study, The Economics of Ecosystems and Biodiversity (TEEB) (TEEB, 2009) is considered the economic extension of the MA (Braat, 2012). TEEB was able to build on the large amount of research since the 1960s on the economics of ecosystems, their services and biodiversity (for an overview see Braat & de Groot, 2012). TEEB had two purposes. Firstly, to provide improved information to conventional economic policy on the impacts of economic development on ecosystem health and biodiversity. Secondly, to suggest how the valuation of ecosystem services could be mainstreamed into national and local planning, policies and business assessments to create awareness of their dependence on biodiversity and their economic impact (Kumar et al., 2013). The traction initiated by the MA for MBI to generate biodiversity

⁴ Proposed at a meeting of the G8+5 in Potsdam, Germany, in 2007.

conservation was bolstered by TEEB (Farley & Costanza, 2010; Gómez-Baggethun & Muradian, 2015).

The TEEB report formalised the rationale for MBI stating that:

Market-based instruments, such as taxes, charges or tradable permits can, if carefully designed and implemented, complement regulations by changing economic incentives, and therefore the behaviour of private actors, when deciding upon resource use. When set at accurate levels, they ensure that the beneficiaries of biodiversity and ecosystem services pay the full cost of ecosystem service provision. Experience shows that environmental goals may be reached more efficiently by market-based instruments than by regulation alone. Some market-based instruments have the added advantage of generating public revenues (Pirard, 2012, p. 59).

This report was a pivotal document for MBI and contains many of the key terms and issues that are relevant today (Pirard, 2012). It contained the methodological framework to: (i) identify and assess ecosystem services; (ii) estimate their values; and (iii) capture their values through MBI. (This is covered in more depth in Braat & de Groot, 2012). This MBI approach to biodiversity conservation increased the stakeholders interested in their application to include international organisations such as The World Bank, IUCN⁵, the Convention on Biological Diversity and the UN Environmental Program (Boisvert et al., 2013).

The evolution of the ecosystem services approach from its origins to inclusion in the regular policy agenda and decision making, are shown in Figure 5 by Gómez-Baggethun et al. (2010). It includes significant papers referred to earlier in this review and many of the landmark events through to 2010.

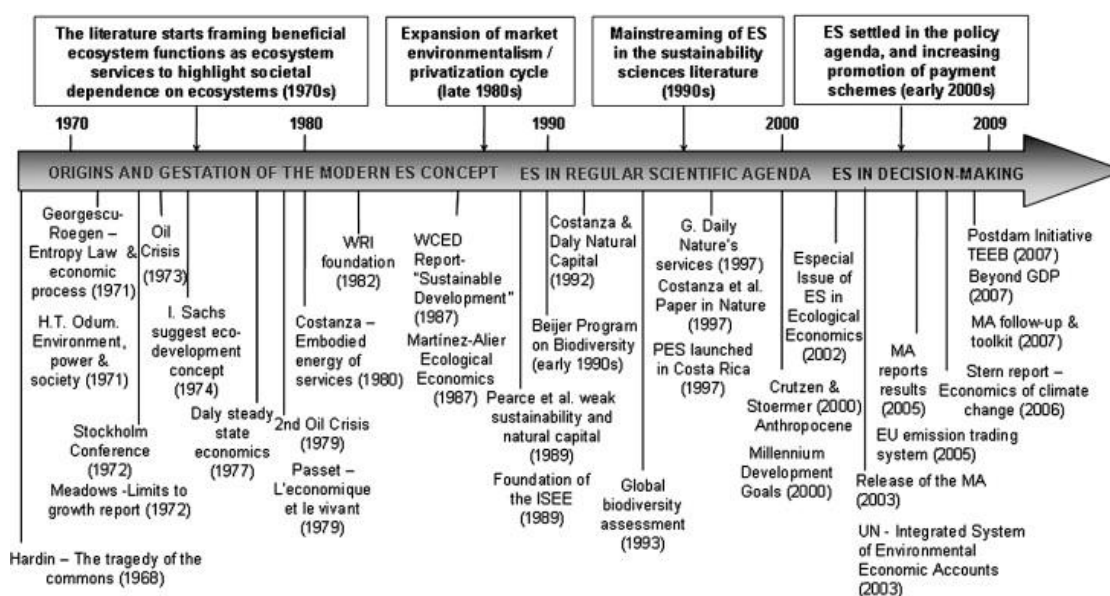


Figure 5: Stages in the modern history of ecosystem services

Source: Gómez-Baggethun et al., 2010, p. 1213

⁵ International Union for the Conservation of Nature

4.6 The Policy Logic Driving the Market-based Approach

The popularity and adoption of the ecosystem services framework to MBI can be attributed to a combination of two factors according to Gómez-Baggethun and Muradian (2015). Firstly, traditional environmental policy and the subsequent integrative approaches to reduce environmental degradation such as Protected Areas and Integrated Development and Conservation Projects (Campbell, Sayer, & Walker, 2010) were considered by many to have failed (Muradian & Gómez-Baggethun, 2013). Environmental markets, and PES in particular, were anticipated to provide a panacea for the trade-offs between development and conservation as their design was explicitly targeted and conditional on compliance. Secondly, Gómez-Baggethun and Muradian (2015) suggest that there is an alignment between the ecosystem services framework and MBI due to the utilitarian framing of ecosystem service functions and their division into discrete categories which can then be evaluated and commodified (Gómez-Baggethun & Muradian, 2015).

The provision of incentives is linked to the aspiration that environmental markets can be used to reconcile economic growth and social development with environmental protection (Froger, Boisvert, et al., 2015). The policy logic is that through an economically efficient market, solutions can be targeted to areas that have otherwise intractable policy problems with the potential to build improved livelihoods criteria for the ecosystem service providers (Lockie, 2013).

MBI are considered more cost effective and efficient than regulatory standards because they are designed to be flexible and performance based (Engel et al., 2008). Other authors reflect this view citing uptake due to the provision of incentives, better resource allocation and efficiency, and their capacity to fill the funding gap between existing and required funding (Pirard & Lapeyre, 2014; Vatn, 2015). Market logic anticipates that these mechanisms will discover and reveal the 'right price' (Pirard, 2012) offering a cost effective way 'to buy conservation' (Wunder, Engel, & Pagiola, 2008). Thus, they are anticipated to be efficient at incorporating resources from the private sector (Stavins & Whitehead, 1997 cited in Gómez-Baggethun & Muradian, 2015). The extent to which this is feasible and the trade-offs between economic efficiency, environmental effectiveness and social benefits has led to heated debates discussed further in section 6.

The rise of market-based approaches to environmental policy and conservation has continued despite a downturn in the popularity of markets since the Global Financial Crisis in 2008 (Gómez-Baggethun & Muradian, 2015). However, while there is a clear trend of increasing use of MBI in conservation and the ecosystem services framework continues to be promoted, the scope of applicability of MBI remains debated (Muradian, Corbera, Pascual, Kosoy, & May, 2010). Consequently, research on achieving effective outcomes is important and this is explored further in section 6. First, however, it is instructive to examine the first generation of environmental markets to understand their objectives, design, embedded features and the extent to which path dependency was set by the exchange value framework of the neoclassical economic paradigm.

5.0 MARKET GROWTH AND DIVERSIFICATION

By 2003 there were over 300 markets for ecosystem services around the world (Pagiola & Platais, 2003 cited in Duraipappah, 2006). Environmental market schemes can be classified according to the type of environmental services provided; the structure of the markets; the geographical scope, or the types of payments involved (Mayrand & Paquin, 2004). This section attempts to provide some insight and understanding of the first generation of environmental markets through classification by ecosystem service, examining the definitions employed, classification by payment type, geographical considerations and how MBI fit within the environmental policy toolbox.

5.1 Market Classification by Ecosystem Service

Classifying environmental markets through the type of ecosystem service according to Gómez-Baggethun et al. (2010, p. 1214) traditionally includes the following: “i) carbon sequestration in biomass or soils; ii) provision of habitat for endangered species; iii) protection of landscapes; iv) various hydrological functions related to the quality, quantity or timing of freshwater flows from upstream areas to downstream users.”

Examples of each of these services are provided in Table 1 below:

Table 1: Summary of ecosystem services classified by type
Constructed from Mayrand & Paquin, 2004

Water services	Biodiversity services	Carbon sequestration services	Landscape beauty services
Water flow regulation: maintenance of dry season flows and flood control.	Protection of ecosystems of particular value	Active sequestration of carbon through the growth of trees and other vegetation	Natural heritage sites Coral reefs
Water quality maintenance: sediment load control, nutrient load control; chemical load control; and salinity control	Protection of natural habitats Protection of species, genetic resources	Avoided emissions through the conservation of vegetative cover	Cultural sanctuaries Traditional livelihoods as part of a combined cultural/environmental landscape protection approach
Erosion and sedimentation control			
Land salinisation reduction/water table regulation			
Maintenance of aquatic habitats (e.g., maintaining water temperature, shading rivers/streams, ensuring adequate woody debris in the water			

5.2 Market Definitions and Characteristics

It is instructive to examine some of the definitions of environmental markets at this time as this will elucidate their objectives, which in turn, influence their design. The characteristics of environmental market schemes described by Rosa et al. (2004, cited in Mayrand & Paquin, 2004, p. 6) suggest:

- “It focuses on the use of economic instruments seeking the lowest possible costs for achieving environmental goals;
- It singles out ecosystem services (carbon sequestration, water regulation or filtration, or single species biodiversity);
- It shows a preference for simplified or large-scale ecosystems, preferably owned by few people to reduce transaction and monitoring costs; and,
- It seeks to secure private property rights and reward landowners.”

This definition emphasises cost efficiency, singling out a single ecosystem service, reducing complexity to minimise transaction costs and securing private property rights.

The following year a more concise definition by Wunder (2005, p. 3) and states that:

“A PES is:

1. a *voluntary* transaction where
2. a *well-defined* ES⁶ (or a land-use likely to secure that service)
3. is being ‘bought’ by a (minimum one) ES *buyer*
4. from a (minimum one) ES *provider*
5. if and only if the ES provider secures ES provision (*conditionality*).”

This definition is most frequently cited and is generally contracted within the literature to ‘voluntary and conditional transactions over well-defined ecosystem services between at least one supplier and one user’ (Wunder 2005). This definition accentuates the voluntary and conditional nature of the transaction. This definition set a benchmark although it has subsequently been criticised for being too limited and excluding many schemes that do not comply with all the criteria, particularly the voluntary aspect (Schomers & Matzdorf, 2013). These discussions are expanded in section 6.

Building on Wunder’s definition, in a landmark paper Engel, Pagiola and Wunder (2008) presented guidelines for efficient design using an orthodox neoclassical approach. These guidelines emphasise Coasean-based analysis to present the logic of translating nature’s non-market values into real economic incentives. The approach emphasises the economic efficiency of markets, the need for well-defined property rights and the absence of intermediaries. The guidelines include the need for *additionality* (not paying for activities that would have occurred anyway), *leakage* (shifting environmentally damaging activities to another jurisdiction), *permanence* (the ability to achieve long term improvements in ecosystem services) and the need for a careful assessment of the *baseline* conditions before the scheme is implemented. This baseline is used to ensure performance measures through *monitoring, verification and reporting*. This approach has formed the basis for many schemes including the Australian Emissions Reduction Fund (ERF) designed to reduce GHG emissions.

⁶ Ecosystem Service

5.3 Market Classification by Payment Type

An alternative to classifying by ecosystem service is based on the payment or transaction type. This facilitates an improved understanding of the design of the scheme. Public, private and trading schemes are identified (Fripp, 2014; Smith et al., 2013; Solazzo et al., 2015). The attributes for this distinction are shown in Table 2.

Table 2: Classification of PES by payment type
Generic examples sourced from Solazzo, Jones & Cooper (2015)

Payment Type	Main purchasing party	Example
Public schemes	Public institution, municipality, local or national government	Agri-environment scheme in which all farmers meet a minimum standard but may also obtain a stewardship payment if they farm in specified additional ways
Private schemes	Agreement between two or more private parties, e.g., companies or individuals	Parties negotiate and agree the services provided, how they are to be provided, the price, length of the contract etc.
Trading schemes	Multiple parties and payment, value correlates to demand	Cap and Trade model. A cap is established and permits allocated allowing trade between those who need more than their allocation and those who do not need all their permits

An assessment of case studies in a special edition of *Ecological Economics* in 2008 found that compared to government-financed schemes, private-financed schemes were better targeted, had improved match to local conditions and needs, improved monitoring and a greater willingness to enforce conditions attached to payments, as well as fewer ‘confounding’ side objectives (Wunder et al., 2008). Against this, many programs were recognised as hybrids such as Costa Rica’s *Pago por Servicios Ambientales* driven by government funding while including funding from service agencies, NGOs and international agencies. In addition, the voluntary nature of transactions was called into question when, for example, payments come through water utility companies from contributions by water users (Vatn, 2010). Wunder et al. (2008) observe that the borders between public and private transactions can become blurred while noting schemes often differ substantially from one another, reflecting adaptation to very different socioeconomic, ecological and institutional situations.

Public and private schemes are frequently illustrated by the three pioneering initiatives described in the Table 3 below:

Table 3: Watershed protection/restoration examples through public and private financing

Scheme type	Scheme name	Scheme description	Key references
Public PES Costa Rica 1997	Pago por Servicios Ambientales	Government initiative to pay land owners and managers in a country wide attempt to reverse the severe deforestation rates at that time	Pagiola (2008)
Public PES USA	Catskill Basin	New York City funded upstream farmers reduce agricultural pollution and improve production operation and management – the	Isakson (2001)

		payments were less than a quarter of the cost to build a water filtration system	
Private PES France 1993	Vittel paying for watershed conservation in the French Vosges Mountains	One buyer (Vittel) paying 26 sellers of ecosystem services consisting of water filtration, maintenance of nitrates in the plant sub-roots and covers 3,500ha	Perrot-Maitre (2006)

5.4 The Distinction Between MES and PES

Trading schemes are interchangeable with MES in the literature; driven by regulations derived from legislation and created by the application of appropriate property rights. Permits, or offsets are generated through the conversion of ecosystem services into a tradable commodity and associated market. The origination and evolution of MES is provided in the Table 4.

Table 4: Evolution of markets for environmental services
Compiled with data from Gómez-Baggethun et al., 2010

Country	Program/scheme	Policy	Commodified ecosystem	Key references
USA 1990	'Sox and Nox'	<i>Clean Air Act 1990</i>	Tradable permits issued to large scale emitters of Sulphur dioxide	Stavins (1998)
USA 2004	Wetland mitigation banking	<i>Clean Water Act 1972</i>	Developers issued with permits to allow damage to wetlands in exchange for creating or restoring large wetlands elsewhere Cost of wetland mitigation averaged \$45,000/acre	
UK 2000s	Emissions Trading Scheme (ETS)	Climate Change Agreement	Emissions trading can be used by participants to meet specific GHG emissions targets	Bayon (2004)
Private Company 2003	Chicago Climate Exchange (CCX)		Voluntary trading scheme between companies based on voluntary targets	Bayon (2004)
EU 2005	EU ETS	Kyoto Protocol	Trading mechanism for the six major GHGs	Barker, Kram, Oberthür, & Voogt (2001)

Alongside a regulatory GHG ETS there is voluntary demand for carbon offsets driven by companies and individuals. This voluntary market provides a testing ground for methodologies that later enter the compliant market, examples include methodologies that avoid deforestation or grow rice with a smaller carbon footprint. Furthermore, the voluntary market has been 'ahead

of the curve' in areas such as safeguarding community rights and biodiversity or 'nesting' smaller projects within national efforts in areas such as forest conservation. Voluntary prices have proved more resilient than international offsets although vulnerable to weak policy signals and dependent on corporate offsetting schemes (Hamrick, Goldstein, Peters-Stanley, & Gonzolez, 2015). Policy developments are considered by Hamrick et al.(2015) to be the single greatest determinant for the health of the voluntary market.

Unlike many authors Gómez-Baggethun et al. (2010) make a clear distinction between MES (after Bayon, 2004) and PES (after (Engel et al., 2008; Landell-Mills, 2002; Pagiola, 2008; Wunder, 2005). This is supported by Vatn (2010), who observes that MES require a well-defined environmental asset that has an active supply and demand side. MES is covered in depth by Bayon under the premise that "a market is a regular gathering of people (whether in person, on the internet, or via other forms of communication) for the purpose of buying and selling goods and/or services. The emphasis is on the term regular" (2004, p. 1). MES have proved to be efficient with point source pollutants (Graffton, 2005 cited in Greiner & Stanley, 2013) while diffuse impact measures such as biodiversity and water quality are better dealt with by PES type schemes (Lockie & Carpenter, 2009 cited in Greiner & Stanley, 2013). In PES schemes, the commodity is poorly defined and governments frequently act as intermediaries, mobilising resources from consumers to a fund which then distributes funding for land stewardship at a pre-determined price. This distinction between the nature of the ecosystem service and the appropriate design emphasises the value of using accurate terminology. The distinction is illustrated in Table 5.

Table 5: Examples of MES and PES
Source: Gómez-Baggethun et al., 2010, p. 1214

Mechanism	Commodified ecosystem service	Sites of application	References
Markets for Ecosystem Services	Emission trading of greenhouse gases	European Union	Barker et al.(2001)
	(atmospheric sink functions of CO ₂)	United Kingdom	Bayon (2004)
		Chicago	Bayon (2004)
	Sulphur dioxide emission trading (atmospheric sink functions of SO ₂)	USA through the US Clean Air Act of 1990	Stavins (1998)
	Wetland mitigation banking	USA	Robertson (2004)
Payments for Ecosystem Services	Watershed protection	Central America	Corbera, Kosoy & Tuna (2007)
		Ecuador	Wunder & Albán (2008)
		Bolivia	Asquith, Vargas & Wunder (2008)
	Carbon sequestration	Costa Rica	Pagiola (2008)

Mechanism	Commodified ecosystem service	Sites of application	References
		Ecuador	Wunder & Albán (2008)
	Habitat conservation / wildlife services	Bolivia	Asquith et al. (2008)
		Zimbabwe	Frost & Bond (2008)
	Bio prospecting	Costa Rica	Pagiola (2008)
	Agro environmental measures	European Union	Dobbs & Pretty (2008)
		US	Claassen, Cattaneo & Johansson (2008)

In a comparison of national schemes between industrialised and developing countries Schomers and Matzdorf (2013) found that schemes in developing countries tend to relate to reforestation and sustainable forest management practices to halt deforestation. Industrialised countries focus on agricultural practices and working landscapes. In Latin America the focus is agroforestry systems and silvopastoral practices, i.e., preservation of ecosystem services within agricultural systems (Schoomers & Matzdorf, 2013). Latin America was an early pioneer in early government programs as previously noted. The key programs and countries are summarised in Table 6.

Table 6: Latin America PES
Constructed from Balvanera et al., 2012

Country	Description	Motivation	Reference
Argentina	Early pioneer in ecosystem services research	Motivated by extensive conversion of natural fertile grassland and forests to agriculture in the 1990	Sala & Paruelo (1997)
Bolivia	Early work on the provision of timber and non forest timber products, more recently on the regulation of water quantity and quality, and on carbon sequestration	Triggered by - the number of indigenous communities that depend of non forest timber products for their livelihoods - laws regulating legal access to forests and their sustainable development - the needs of national and international institutions and projects	
Brazil		ES research in the Amazon Basin specifically for climate regulation	Davidson et al. (2012)
Costa Rica Pago por Servicios Ambientales	First country to establish a national PES	Growing importance of ecosystem services in the US	

Panama	Long history of research in ecology and success in preserving forest over throughout the country	Growing importance of ecosystem services in the US. Work from the Smithsonian Institution and US presence in the Panama canal watershed before 1999	
Puerto Rica	Long term ecosystem services research site which focused on impacts of reforestation, urbanisation and high population rates on ecosystem services, reflecting the agricultural abandonment and rapid urban development	Growing importance of ecosystem services in the US with assistance from the US forest service, the Environmental Protection Agency and the US Geological Society	Uriarte, Yackulic, Lim, & Arce-Nazario (2011)
Chile	Focus on water yield and water quality, freshwater native and introduced fish diversity and forest productivity under different forest management regimes	Conversion of native forests to fast growing plantations for export (pinus radiata and Eucaluptus sp.) plus steep terrain	Lara et al. (2009)
Mexico Pagos por Ambientales Hydrologicos	Promotion of the MA framework. ecosystem services supply and delivery assessed at the national scale	Personal involvement of several Mexican scientists	Millennium Ecosystem Assessment (2005) Balvanera et al. (2009) Maass et al.(2005)
Columbia	ES research hampered by only 1.6% of GDP allocated to research on ecosystem services	Interest growing from self organised buyers, sellers and intermediaries	Southgate & Wunder (2009)
Uruguay	Underdeveloped research		

5.5 Market Standards

Product verification standards are as important in environmental markets as in any other markets, ensuring that the product sold is what the purchaser expects. They assist in product development, ensuring a stable market results and that purchasers are satisfied. The environmental market has developed project-based standards since the inception of the CDM and the voluntary carbon markets. Standards are well developed in the carbon market and this section draws on the experiences of this market as an example. The area is covered in more depth by this author in the NESP project paper (Barber et al., 2017 pp. 63-72).

CDM projects had a remit under the Kyoto Protocol for both abatement and sustainable development. Compliant low-cost emissions were generated by developed countries through

sponsoring projects in developing countries. In practice, the CDM was found to have failed to consistently deliver on development and sustainability benefits (Kollmuss, Zink, & Polycarp, 2008; Olsen, 2007). Criticism was quick, from accusations of 'carbon colonialisation' to the more practical issues of accounting methods, lack of transparency, quality assurance and third party standards (Kollmuss et al., 2008). Forestry projects in the voluntary market without strong rules were criticised and struggled to find a market. Standards quickly emerged as a solution both in the CDM and voluntary markets (Merger & Williams, 2008). Standard certification formed a framework for project design, the incorporation of co-benefits, product compliance and thus marketing. In particular, stakeholder consultation and building sustainable development criteria into the project assisted transparency and accountability. In response, a dozen or so standards rose to prominence using third party verification to confirm the project's social and environmental benefits that go beyond the GHG reduction of offset projects.

Climate policy is the primary driver for projects delivering carbon offsets into either the compliant or voluntary markets resulting in rigorous accounting rules and associated methodologies for GHG abatement. Auditing by a third party ensures the project's design is validated and the project outcomes are verified, resulting in fungible emission reduction certification if criteria were successfully met. While the primary driver is the carbon offset generated, social and environmental co-benefits also result operating across multiple scales, sectors and time frames (Hamilton & Akbar, 2010). So, while focused on carbon, these projects may have sustainable development, employment, watershed management or biodiversity conservation outcomes. If these co-benefits are also accounted for, the offset may be more marketable or attract a higher price to the right customer. A recent study of voluntary forestry projects found that projects with co-benefits were preferred (Lee, Kim, & Kim, 2017). For some buyers the 'beyond carbon' benefits may be the prime driver (Goldstein & Ruef, 2016). Historically, this co-benefit verification has not been incorporated into the validation and verification process for carbon offsets and has been the domain of independent standard setting bodies resulting in a second 'add on' standard for the co-benefit component. In the voluntary market this is most frequently the Verified Carbon Standard combined with the Climate Community Biodiversity Standard. Another common standard for the social, economic and environmental co-benefits is Social Carbon. This process of using two standards has been recognised as inefficient which has recently led to new standards which cover both emissions reductions and co-benefits to increase efficacy (Spencer et al., 2017). The most notable of these is the Gold Standard.

Market developments and trends are considered in (Barber et al., 2017 p. 67-68). Three were identified: convergence of international agreement agendas; stacking multiple benefits and standards increasingly orientated to co-benefits. In 2015, the goals of the Paris Agreement and the 2030 Agenda for Sustainable Development showed a degree of convergence. Both have the goal of eliminating global poverty, achieving zero carbon and climate resilient development. Assessment of the alignment between the two agendas by the World Resources Institute found that implementing them together has the potential to generate significant mutual benefits (Northrop, Biru, Lima, Bouye, & Song, 2016). A second trend exposed in a report by Ecosystem Marketplace in 2016 was stacking multiple benefits attached to the carbon offset. The Gold Standard was identified as leading this trend (Goldstein, 2016). Thirdly, rather than being an 'add on' to carbon, co-benefits can become fungible in their own right, particularly when the verification process is aligned to data points that align with buyers own Key Performance Indicators. The same report by Ecosystem Marketplace identified that forestry projects were

likely to have co-benefits as the primary driver over carbon, and that such projects frequently assist in clarification of land tenure. The most common co-benefits were community involvement, water improvements and climate adaptation.

In Australia a study by NetBalance found that a co-benefit standard would be beneficial as an 'add on' to the emission reduction offsets generated by CFI projects (Salisbury, Edwards, & Silke, 2013). These findings are discussed in (Barber et al., 2017 p. 68-71). In 2011, a National Indigenous Climate Change research project explored the aptitude of Indigenous Australians to an Indigenous co-benefits standard (Robinson et al., 2011). The report outlines draft criteria as tools to assess Indigenous co-benefits which the authors consider offer a solid starting point for a co-benefit standard to sit alongside the CFI generated offset. This is discussed in more depth in (Barber et al., 2017 p. 71-72).

5.6 Current Environmental Markets

As has been evident in this report, environmental markets have been growing rapidly, especially over the last decade. This section draws on the market tracking literature to quantify the sectors and size of the current market. This is discussed in detail in (Barber et al., 2017, pp. 47-51) and is only briefly summarised in this section.

The major markets are compliant carbon, watershed investment (also called green infrastructure) and biodiversity conservation. Smaller markets exist in voluntary carbon offsets, ecotourism and Green Certified products. The World Bank tracks the size of the compliant carbon market under annual reports in the Carbon Pricing Watch series (Kossoy et al., 2015; World Bank, 2016; World Bank; Ecofys; Vivid Economics, 2017). Ecosystem Marketplace, an initiative of the non-profit organisation Forest Trends is a leading source of information on the other markets, most notably voluntary carbon (Hamrick & Gallant, 2017), forest carbon (Goldstein & Ruef, 2016), green infrastructure (Bennett & Ruef, 2016), biodiversity conservation (Hamrick, 2016) and co-benefits (Goldstein, 2016).

Compliant carbon dominates the environmental markets with a market of US\$52 billion in 2017. Watershed investment was half this value in 2016 once subsidies were taken into account (US\$25 billion). Watershed investment fell into two streams; green infrastructure and water trading schemes (Bennett & Ruef, 2016). The market in biodiversity conservation is more difficult to track but is growing fast (62% growth in the two years to 2015) and was estimated at US\$2 billion in 2015 (Hamrick, 2016). In contrast the voluntary carbon market was just US\$191.3 million in 2016 (Hamrick & Gallant, 2017). Ecotourism figures were more complex (turnover does not provide information about the component of revenue translated into biodiversity conservation) but was estimated at US\$3.2 in ten countries in Southern Africa collectively between 2000-2001 (Kruger 2005 cited in Hein, Miller, & de Groot, 2013). Green certified commodities such as Forest Steward Council and Rainforest Alliance result in more sustainable production. Green certified commodities and were estimated at US\$2.6 billion per year (Parker et al., 2012 cited in Hein et al., 2013). While these figures are compromised by covering different years and in some cases small geographic distributions, they do allow an understanding of the relative sizes of the markets. In addition, the markets are increasingly dynamic, driven by changes to government climate policy, for example, and the creation of new ETSs, corporate social responsivity increases private investment in biodiversity conservation or supply chain tracking drives avoided deforestation measures.

5.7 Summarising the Market-based Approach to Environmental Policy

Emerging from the first generation of markets, Figure 6 depicts market-based mechanisms sitting alongside regulation, provisioning of services by government and voluntary efforts in the environmental policy toolkit.

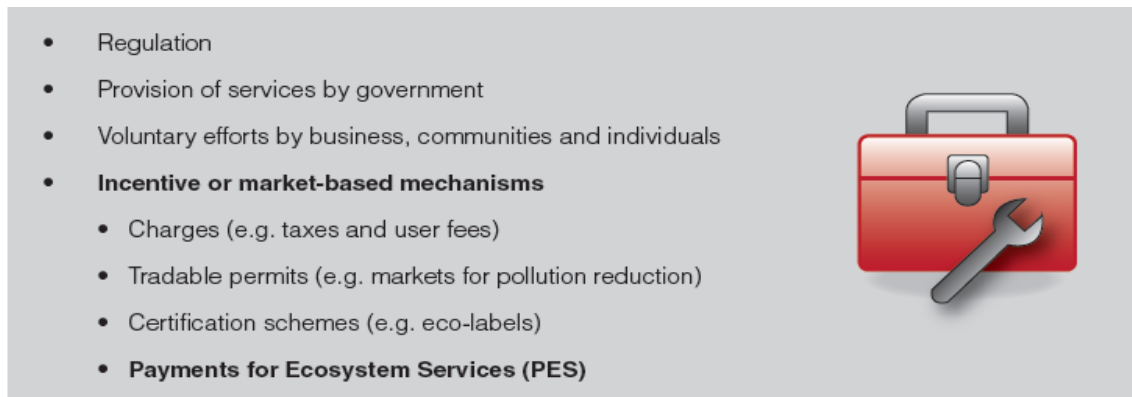


Figure 6: Components of the environmental policy toolkit

Source: Smith et al., 2013, p. 14

While in the diagram market-based mechanisms appear concise (charges, permits, certification schemes and PES), this review has demonstrated that the range of policy instruments considered market-based by the literature is very broad. The diverse array of market-based policies are described in some detail by Pirard (2012). Arguing that PES is a term that has gradually been emptied of meaning, Pirard (2012) develops a lexicon for MBI identifying six categories, their exclusive characteristics, specificities, relation to markets and examples of their application. The six categories and examples are direct markets (e.g., eco-tourism), tradeable permits (e.g., mitigation banking), reverse auctions (e.g., BushTender in Australia), Coasian-type agreements (PES after Wunder (2005)), regulatory price signals (e.g., agri-environmental measures) and finally voluntary price signals (e.g., forest certification). This approach is explored further in Pirard and Lapeyre (2014) and discussed in Section 8.

Charges or taxation such as carbon taxes, or subsidies such as agri-environmental measures, fall into fiscal policies. Taxation is designed to change relative prices following the principles of Pigou. Subsidies are a Pigouvian tax in reverse; targeting and rewarding positive externalities. Negative environmental externalities of production processes and activities require changes to a course of action through market signals. It can be the damage indirectly incurred through a unit of input such as units of fertiliser, or an area of land that is being developed, or more directly as units of carbon dioxide equivalent that are emitted.

Tradable rights or permits can be exchanged amongst users of a resource, usually after regulations have constrained full potential use. The objective is to search for an optimal solution where producers and landowners who are most effective at ecosystem service provision through low production costs and higher profitability prospects are encouraged at the expense of less successful producers and landowners. Examples are: cap and trade for point source emissions; Individual Transfer Quotas for fisheries; mitigation banking; and transferable development rights.

Certification schemes use existing markets to promote goods and services with positive environmental externalities. Improved practices are rewarded by greater market share through certification. PES relate to the definition by Wunder (2005) as voluntary, conditional transactions where a well-defined ecosystem services is bought by a minimum of one seller by a minimum of one buyer. Any transaction in favour of the service provider, including subsidies, can be considered a PES.

With the maturation of these schemes it is now possible to assess empirically in Section 6 how the theoretical design has been implemented and the extent to which these schemes have meet their objectives.

6.0 A CRITIQUE OF ENVIRONMENTAL MARKETS

As MES and PES have been adopted and have matured the focus has moved away from raising public awareness of the need for biodiversity conservation towards an emphasis on incorporating ecosystem services as commodities into economic markets. Through these mechanisms the ecosystem services concept has become embedded in government policy, the not-for-profit, private and financial sectors. Some authors have noted that PES were adopted quickly and often without adequate critical discussion across the conservation policy debate. An increasing body of literature is now examining early PES case studies and finding that the outcomes are not straight forward, and the panacea of PES illusory.

Earlier sections established that the environmental economics approach defined by Wunder (2005) with guidelines provided by Engel et al. (2008) place ecosystem services into a market model and prioritises economic efficiency. Ecosystem services are treated as externalities; the marginal costs are brought into better alignment with the marginal benefits, resulting in an increased economic surplus.

A later ecological economics approach, currently led by Muradian et al. (2010) emerged which focuses on multiple goals and both market and non-market-based mechanisms described as; “a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources” (Muradian et al., 2010, p. 1205). The goals are ecological sustainability, just distribution and economic efficiency (Farley & Costanza, 2010). This is discussed in more detail in Section 8.1.

This review has not to date recognised that there is a school that rejects the market-based approach as a false commodification of nature. Section 6.1 examines this important perspective. The subsequent sections, accepting that economics is an older field and environment will be incorporated in some form or other, continues by putting this to one side and exploring some of the flaws in the original market-based theoretical design, exploring the myths and reality. It considers an emerging view that a hybrid form of governance falls between markets and hierarchies. Using the example of biodiversity offsets, the expectations of market characteristics are considered and the main criticisms of a market-based approach touching back to a reformist vs rejectionist agenda are examined. Within the sphere of PES, alternative discourses are explored such as poverty alleviation or as a subsidy replacement. The political nature of PES schemes is discussed. The rejectionist view is picked up again in section eight in the context of examining some of the commonalities of neoliberalism after the work of Castree (2010a, 2010b, 2011).

6.1 Rejection of ‘the commodification of nature’

Debate over the controversy of ‘the commodification of nature’ is not new and can be recognised from the beginning of capitalism and the Industrial Revolution in England. That is not to diminish the debate, which is more relevant than ever, but to establish its foundations and provide context to the neo-Marxism framing. The literature today at first appears polarised, with one school vehemently arguing against the ‘neoliberalism of nature’ (Castree, 2008) and rejecting any structuring of the environment into alienable market goods vs other scholars who believe a market-based approach can provide solutions to environmental problems. On closer

inspection the debate can be conceptualised as a spectrum of issues between these two poles. Environmental markets fall in the field of political ecology and it is the political that is frequently paramount in the discourse.

While well beyond the remit of this review, it is helpful to lay out a very simplified summary of the relationship of nature and capitalism as context for the concepts in the current debate. Perhaps the first obvious case of the commodification of nature was the enclosure of the commons in England and Scotland between 1760 and 1820, essentially the privatisation of land and its removal from communal use. Thinkers such as Bentham and Malthus considered that the privatisation process resulted in better stewardship of the land, echoes still reverberating in 1968 when Hardin wrote 'The Tragedy of the Commons' arguing that privatisation or State control over common goods was necessary if the tragedy was to be averted. Karl Marx (1818–1883) identified the contested, and often violent process of enclosure in the 18th century as the driver changing a feudal system to one of capitalism. Enclosure changed the function of land from a means of sustenance to one of profit through the commodity markets; wool in the case of the UK. With this change of the environment from a 'use' value to an 'exchange' value people were disposed from their land, resulting in the diaspora from Scotland and Ireland and providing the 'free' wage labourers, (Castree, 2010a) necessary for the Industrial Revolution in England. This change from 'use' to 'exchange' value set the path for monetarisation as the single exchange value, a key issue in the environmental market literature today.

Prominent thinkers such as Karl Marx and Karl Polanyi (1886–1964) can be recognised as prescient in their thinking at the time. Predicting globalisation, Marx argued in the Communist Manifesto that 'the need of a constantly expanding market for its products chases the bourgeoisie over the entire surface of the globe' (Marx & Engels, 1967 p. 3). Further, Marx argued that capital converts nature into 'an appendage of the production process' and introduced the term 'commodity fetishism' arguing that the productive origins of commodities are routinely forgotten (Billig, 1999). Polanyi saw nature as being 'subsumed' to capitalist accumulation losing its independent capacity and approaching the archetype of a pure commodity (Bugra & Agartan, 2007). Polanyi was concerned that nature's commodification would lead to its pollution, overuse and eventually imperil human life (see Castree, 2010b).

Putting a value on natural resources such as timber or minerals is fundamental to the market system. Markets require competition which drives innovation and growth making the system expansionary. With the continual expansion of the depth and breadth of capitalism, particularly over the last decades of globalisation we see a 'new wave of enclosing the commons' (Harvey, 2003) moving from the traditional markets in mining and agricultural processes to new 'commodity frontiers' such as ecotourism and bioprospecting (Castree, 2010a).

Within the environmental market literature heated debates exist about the extent that a market system can contribute to greater justice and equity within biological conservation, as evidenced by the Corbera Matulis debate (Corbera, 2015). The 'neoliberalism of nature' discourse in the environmental market literature contests the logic of 'trying to sell nature in order to save it' (McAfee & Shapiro, 2010). Apart from being contradictory, McAfee (2012) suggests it neglects addressing the ultimate causes of environmental degradation. Splash (2011, as cited in McAfee, 2012), discusses the conceptual flaws in neoclassical environmental valuation and suggests the economic reasoning may be misleading, justifying schemes that may be

ineffective or even counterproductive in their ecological outcomes. In the often-quoted words of Norgaard on ecosystem service framing: “What started as a humble metaphor to help us think about our relationship to nature has become integral to how we are addressing the future of humanity and the course of biological evolution” (2010, p. 1219). Sullivan, critiquing the green economy, questions the presentation of nature as a service provider ‘for rekindling health in the earth’s psychosocial and eco-systems?’ (2009, p. 26). This school argues that the simplicity of the stock flow framework blinds scholars and practitioners to the true complexity of the ecological, economic and political challenges. It criticises environmental markets for the erosion of motivation, the effects of commodification and the equity issues that arise. Kosoy and Corbera (2010) consider three ‘indivisibilities’, following a converse line of reasoning to TEEB. Firstly, in the commodification of an ecosystem service, secondly in simplifying the complexity of natural ecosystem services, and thirdly through the focus on a single exchange-value which masks the social relations embedded in the exchange of services between buyer and seller. Simply put, they hold that pricing biological and cultural diversity is not the same as valuing it.

The critique that environmental markets contribute to an unwelcome commodification of nature argues that reducing ecosystem services to a single service has considerable technical difficulties (Kosoy & Corbera, 2010; McAfee, 2012). Kosoy and Corbera (2010) use Marx’s term ‘commodity fetishism’ to reflect the reduction of a single ecosystem service into a single tradable good, which they claim obscures the social relations involved in producing and selling ecosystem services. This school contends that assigning a single exchange value for trading denies the multiplicity that can be attributed to ecosystem services.

A further consideration is that a market-based approach can erode the intrinsic motivation for conservation, referred to as ‘crowding-out’ (Bowles, 2008 cited in Gómez-Baggethun & Muradian, 2015). Farley and Costanza (2010) point out that strict conditionality can lead to perverse outcomes by reducing the willingness ‘to do the right thing’ and monitoring may decrease motivation if the payment is seen as inadequate. Wunder counters that ‘crowding-in’ is just as possible as ‘crowding-out’ in PES schemes and is more likely when applied to regions where collective conservation is failing (Wunder, 2013). Both choose examples to suit their case suggesting this aspect should be a place-based design consideration when contemplating implementation. A final critique is that environmental markets promote unequal access to land and resources by favouring those with an ability to pay (Corbera et al., 2007). This aspect is explored further in Alternative discourses section 6.4.

The polarised views need to be viewed through sociological contributions to the current pressing environmental problems according to Redclift (2009). Firstly, polarisation is exemplified by the division between realism and constructionism. The realism approach is from those ‘who take an approach grounded in the achievement of science, a broadly critical realist position, and [on the other] those who approach the environment from the perspective of social constructivism, who locate themselves within a more hermeneutic⁷ tradition.....their approach does not deny the materiality of non-human entities (“nature”) but argues that we cannot separate their material existence from our knowledge of them/it’ (Redclift 2009 p. 374 cited in Pellizzoni, 2016). So, a realism approach considers environmental issues as self-evident or scientifically derived facts. Constructivism considers how human relationships with

⁷ a method or principle of interpretation

nature change according to the environmental problem-definition and solution-devising dynamics (Pellizzoni, 2016). Redclift then recognises a second view of the polarisation as between those who hold that a 'green' version of the capitalist market system is capable of incorporating environmental costs that have been neglected in the original model—a reformist view. On the other side of the spectrum are those scholars who take the view, usually from a Marxist perspective, that in the last decades the expansion and intensification the commodification of nature is exacerbating ecological problems and contributing to inequalities and social injustices. Summarised as the contrary logic of 'selling nature to save it'.

The environmental reform perspective believes that while globalisation has resulted in exacerbating environmental problems, reform is now addressing institutional arrangements and social practices resulting in improved environmental governance. Much of this review has centred on the reformist agenda with its decrease in command and control regulation and the rising prominence of a market-based approach supported by increased stakeholder participation and advancing science and technical abilities. The contrary Marxism perspective believes this fails to address the root of the problem and calls for an exit to the capitalist system as exemplified by the title of Naomi Klein's book 'This Changes Everything: Capitalism vs the climate' (Klein, 2015).

6.2 Flaws in the Market-based Concept

6.2.1 Market Expectations Overrated

The differences between MBI and other policy tools are not always obvious. Throughout the literature the terms 'economic instruments', 'market-based mechanisms', 'environment markets', 'MBI' and others overlap substantially, in essence becoming a substitute for 'monetary' or 'economic' (Pirard & Lapeyre, 2014). As a result, the boundary between what is considered market-based and other non-market instruments used in environmental policies is blurred. It has been suggested that MBI can actually be considered a problematic term due to the confusion and expectations that the term 'market-based' has created (Gómez-Baggethun, Kelemen, Martín-López, Palomo, & Montes, 2013).

The only common characteristic for MBI according to Pirard (2012) is that a price is attributed to nature in different ways and to different degrees. This does not mean that economic valuations are applied in order to set a price, or that the valuations actually value the benefits obtained from the environment—they may be targeted at production costs or opportunity costs for example. It simply predicates a monetary value is associated with nature, either in a market or direct deals (Pirard, 2012). Continuing this logic Pirard and Lapeyre (2014) contend that the term market should be applied for more specific reasons than valuing environmental commodities This is built on by Gómez-Baggethun and Muradian who suggest that MBI core characteristic "is the expectation that they can entail economic efficiency gains when attaining environmental goals as compared to so-called "command-and-control" instruments due to their expected higher degree of flexibility" (2015, p. 217).

Boisvert et al. (2013) consider that the introduction of the term 'MBI' marks a new view of regarding and grouping existing environmental policy tools. Rather than a new instrument, the term reflects new representations and expectations of existing tools. Boisvert et al. (2013)

contend that viewing MBI as more market-based than they are, restricts how they work and the actors that are involved.

6.2.2 The Dynamic Market in Disequilibrium

While modern economics suggest that the market model can produce an efficient equilibrium, an alternative view is that the market is dynamic and is often in disequilibrium as it drives the behaviours of buyers and sellers. The market needs a clearly defined asset to trade, while a frequent critique is that environmental services are not fully defined. Schemes may be implemented without establishing a clear cut causal relationship between land use practices and the expected enhancement of targeted environmental service. Consequently, the market can be an inappropriate mechanism if prices or competition are absent and the traded entity poorly defined. On the discussion of large scale government led PES schemes it is recognised by Wunder (2013) that competitive market forces only operate in exceptional cases.

Price mechanisms can involve transaction costs that can outweigh advantages. The time and effort required to obtain relevant information, locate buyers and sellers or discover prices and negotiate contracts may render the scheme prohibitively expensive. Uncertainty about transactions and outcomes may lead to market inefficiencies while reducing uncertainty can be costly (Bevir, 2012). Some of the key empirical characteristics of environmental markets which do not follow market theory include that the buyers of the ecosystem services are often public agencies, there are high transaction costs and intermediaries are frequently involved in price setting (Vatn, 2010). As low transaction costs are illusionary for most environmental goods, Vatn suggests the Coasian model is applicable in only a small number of cases and PES should be seen as different mixes between Coase and Pigou. Farley observes that there are very few examples that meet the criteria for market mechanisms and that these instruments are better described as market-like (cited in Braat & de Groot, 2012).

Real markets do occur, however, which reinforces the necessity to use accurate terminology within the literature and distinguish between MES and PES. The EU ETS is an actual market, dependent on trading the commodity of carbon, where prices are influenced by project design (e.g., transaction costs), by the existence of CDM and other generated credits, and price is driven by changes in relative demand for energy and the costs of the coal, oil and gas (Kosoy & Corbera, 2010).

6.2.3 Regulation and Institutions Retained in the Market-based Approach

In markets with a weaker market component such as PES the state often plays a vital role in setting levels and conditions necessary for any monetary transactions (Gómez-Baggethun & Muradian, 2015). In MES where the trading component is most visible, it is the regulatory role of public bodies and the institutional arrangements that facilitate the market. The environment is protected by the element of command that defines the liability or the politically set environmental target, not by the market element (Vatn, 2015). Despite the increasing use of mandatory carbon markets, there is a corresponding increasing involvement by state authorities partly because payments through the market mechanism cannot work without a framework of rules to govern their operation and penalise non-compliance (Higgins, Dibden, Potter, Moon, & Cocklin, 2014). It is the cap that protects the ecosystem services through the regulatory limit on emissions (carbon trading), fish harvesting (fishing quotas), water extraction (tradable water extraction rights) or land use change (biodiversity offsets) (Gómez-Baggethun

& Muradian, 2015). The market's intended role is to facilitate a more cost-effective way of meeting those targets than alternative methods. Cost effectiveness is dependent on the specific market, the feasibility of accurate measurement and the potential to keep transaction costs low (Vatn, 2010).

Drawing lessons on the use and creation of markets Bayon (2004) concludes that for markets to function, government participation is essential. Strong governments are required to firstly set limits on the use of ecosystem services, and secondly grant, protect and uphold property rights to enable the market to function. In the 'lessons learnt' section of Bayon (2004) the importance of government regulation and enforcement is noted through the empirical example that an offset trading on the CCX at that time was US\$1 while on the UK ETS and EU ETS it was valued between 7 – 15 euros. This is attributed to the voluntary nature of the CCX and the lack of government legislation and regulation. The success of the sulphur dioxide cap and trade market in the late 80s Bayon attributes to the power of the US government to regulate and enforce sulphur dioxide emission property rights. This is demonstrated by the carbon dioxide market which remains compromised by the global inability to set and enforce limits.

6.2.4 Hybrid Governance Models

While theoretically a market-based approach is regarded as forming an alternative to hierarchical or community governance, in practice it depends fundamentally on both state regulations and community engagement (Vatn, 2010). Thus, the public-private dichotomy is overly simplistic (Ostrom, 2008). Recent literature increasingly takes the view that environmental markets are not 'real' markets but 'hybrid' forms of governance that sit between markets and hierarchical command based mechanisms (Muradian & Rival, 2012a; Pirard & Lapeyre, 2014; Vatn, 2015).

This school argues that hybrid governance regimes are suitable due to the challenges associated with ecosystem services due to their complexity and common good nature. An emerging reality is that while the market structure has been used as a theoretical model to guide design (Raes, Loft, Le Coq, Van Huylenbroeck, & Van Damme, 2016) geopolitical context hybridises or complicates the use of MBI such that the environmental markets tools that have emerged no longer fit into the neat typologies that the literature once theorised (Hackett, 2015).

This is an example of where in practice *institutional blending* occurs; an amalgamation of governance strategies emerges such that state, market and community governance strategies combine in novel ways to address environmental problems at a variety of scales (Higgins et al., 2014). At the design level, environmental markets are reshaping the market-based policy instrument to render them workable and practical for the on the ground realities, which is described as *contextual adaptation* by Higgins et al. (2014).

6.3 The Example of the Biodiversity Offsets Governance System

Compensation for environmental damage as the final step of the environmental impact mitigation hierarchy⁸ was integrated into regulations through biodiversity offsets. An influential paper on compensation mechanisms for biodiversity by Ten Kate, Bishop and Bayon (2004)

⁸ Avoid, minimise, and mitigate (restore and offset)

contributed to the enthusiastic uptake of biodiversity offsets as a broadly defined concept. However, while intended as a final recourse, in practice, compensation has been incorporated into mainstream development and promoted by international organisation and conventions, NGOs, think tanks, and private organisations (Lapeyre et al., 2015). The increase in innovations for biodiversity offsets has led to new coalitions between practitioners and policy entrepreneurs in the sector such as the Business and Biodiversity Offsets Program⁹ (Hrabanski, 2015). Voluntary and regulatory compensation programs exist in 23 countries, through 39 existing programs with another 25 under development or investigation (Madsen, Moore Brands, & Carroll, 2010).

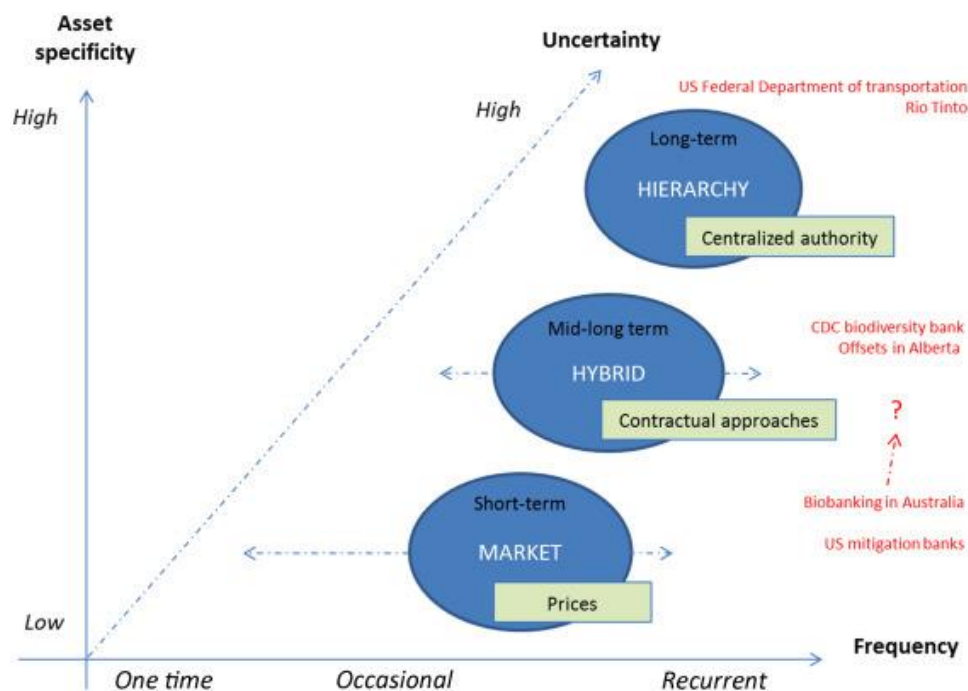


Figure 7: Market, hybrid and hierarchical examples of governance
Source: Lapeyre et al., 2015

As an example of terminology creating market type expectations, biodiversity offsets have been quantified and portrayed by market vocabulary (credits, banks, payments) without any serious questioning of their relationship to market economics (Lapeyre et al., 2015). Indeed 'biodiversity offsets' is an umbrella term encompassing compensatory mitigation, mitigation banking, habitat banking, species banking or wetland mitigation amongst others. These can operate at different scales and different forms (regulatory, voluntary etc.), and the institutional arrangements are varied (Lapeyre et al., 2015). Lapeyre et al. (2015) contend that biodiversity offset programs are characterised by limited features of market governance and in reality a variety of different heterogeneous policy and institutional arrangements operate (see Figure 7). Hybrid governance is shown in relation to hierarchy and markets. Hierarchical models involve a single user such as a corporation or state agency who establish their own bank to offset their own projects. An example given is Rio Tinto while other examples explored by Bidaud, Hrabanski and Meral (2015) include mining companies in Madagascar and Missouri

⁹ An international collaboration between companies, NGOs, financial institutions, and government agencies committed to developing the conditions necessary for biodiversity offsets

Botanical Gardens where bilateral agreements secure long term offsets. Rather than having a monetary component they are site and human specific.

In contrast, US mitigation banks meet the characteristics of market governance. They are commercial operations managed by entrepreneurs selling credits to buyers (developers) who require compensation credits (Froger, Ménard, & Méral, 2015). The rules and regulations that the developer must follow to comply with the mitigation activity shape the governance of the market. A case study of biodiversity offsets in Alberta oil shales found that despite language that suggests the scheme follows market principles, the scheme that has actually emerged could be considered an industry-NGO corporate social responsibility program that has been constrained by the provincial government (Hackett, 2015). Hybrid models of governance such as this are more common in practice and although they might be named MBI, they use bilateral long term contracts, specific to the principals involved, location and legal requirements (Lapeyre et al., 2015).

Criticism of biodiversity offsets in the literature identified by Hrabanski (2015) fall into two schools summarised in Table 7.

Table 7: Reformist vs radical critique of biodiversity offsets
Constructed from Hrabanski, 2015

Reformist critiques	Radical critiques
Lack of monitoring and under reporting on failed projects	The 'commodification of nature' - opposed to asserting that capitalism can have a positive effect on the environment
Difficulties in assessing biodiversity offset projects	The ability to 'pretend you can trade places'
The simplification of metrics to create a fungible product in attempting to replicate biodiversity values and the inaccuracy this creates	The profit sector of the industry that has emerged around biodiversity offset
Facilitates a focus on compensation rather than on avoidance and mitigation	The lack of efficiency
The use of offsets weakens existing legislation	Negative impacts of biodiversity offset on local communities
The displacement of biodiversity from people and communities	Biodiversity offsets offer a permit to destroy.

The first is 'reformist' and relates to risks alongside suggestions for mitigation. The second is 'radical' and calls for a conceptual change. The first school addresses technical issues which can be addressed through political and social remedies. The second requires a revision of moral and social values and reflects the 'selling nature to save it' school which rejects the current conceptual frameworks used by markets.

6.4 Alternative Discourses for PES

PES, similar to biodiversity offsets, have been depicted as markets in the large body of literature generated over the last decade. This has been promoted particularly by terminology or through unrepresentative examples such as Vittel in France (Gómez-Baggethun & Muradian, 2015). Contrary to Wunder's (2005) definition ecosystem services are rarely well defined (Farley & Costanza, 2010), fully voluntary (Vatn et al., 2011) or conditional on verified additional ecosystem services (Naeem et al., 2015 cited in Gómez-Baggethun & Muradian, 2015).

A study of 16 cases of PES schemes from Andean and Mesoamerican countries encompassed governance schemes from small markets to almost completely hierarchical models of governance (Raes et al., 2016). It analysed the schemes since their incorporation to determine if they had assimilated increased market governance or taken a more hierarchical form through reliance on command based mechanisms. The results showed that over time the schemes had incorporated hierarchical governance characteristics, mostly by governments acting on behalf of users and using taxes or tariffs. At the core of most schemes were contractual arrangements, either bilaterally negotiated or set by intermediaries, and the providers were mainly individuals or communal landholders. Intermediaries, usually national or local governments, were found to be important actors who organised or represented users. In conclusion Raes et al. (2016) found that schemes were increasingly complex rather than converging into a market for ecosystem services.

Likewise, a PES scheme in Vietnam, promoted as a market-based forest conservation project with a win-win for conservation and development objectives was studied. The study found that the scheme did not follow the predicted theoretical PES design. Although led by a consortium of international NGOs, donors and government officials the study found that the use of MBI did not achieve retreat of the state or commodification of ecosystem services (McElwee, 2012).

Returning to the potentially contrary logic of selling nature to conserve it and the argument that capitalist markets cannot be the solution to their own ecological contradictions, there are lessons to be learnt from a study of the Maloti-Drakensberg Transfrontier Project PES scheme. This is an important site for water and biodiversity in southern Africa and one in which Büscher (2012) contests that an environmental market is feasible and desirable. The paper argues that the popularity of PES facilitated an expedient way for the implementers to side-step socio-political and institutional pressures. The author suggests that neoliberal political economic realities caused the environmental and social problems, and asserts that when the same mechanism is used to present a solution, it may actually strengthen, rather than alleviate the dynamics causing the issues.

6.4.1 Subsidy Replacement

It is increasingly clear that while a few environmental markets act as real markets, many function as policy instruments to subsidise environmental stewardship (Gómez-Baggethun & Muradian, 2015; Kosoy & Corbera, 2010). Most PES schemes are run by states, governed by public policy regulation frameworks such as those in Costa Rica, China, Mexico or Ecuador, which are funded by taxes and fees collected by public authorities. The payments to land managers are determined by opportunity costs and negotiated with the stakeholders providing

the ecosystem service. Government financed schemes politically often attempt multiple side objectives such as poverty alleviation, regional development or electoral motives (Wunder et al., 2008). This suggests that MBI, when used as part of a PES scheme, are not raising money from the private sector. Indeed, Vatn (2015) notes that public funding in PES schemes amounts to 90%, and rises to 99% in the case of schemes delivering public goods. The Costa Rica example, long considered the epitome of a market approach to conservation, has been described recently as ‘a subsidy in disguise’ by Fletcher and Breitling (2012, cited in Pirard & Lapeyre, 2014). It has been suggested that the scheme may be the result of an International Monetary Fund (IMF) agreement in 1995 to ban the government from paying subsidies to productive sectors which included the forestry sector. Using the rational of a MBI instrument the Costa Rican government was able to continue to pay the forestry sector under an innovative PES scheme (Boisvert et al., 2013; Froger, Boisvert, et al., 2015).

6.4.2 Poverty Alleviation

MBI were not necessarily originally designed to relieve poverty, but PES have been increasingly used to achieve poverty reduction goals or to incentivise alternative livelihood strategies. It is estimated that 150 million low income households may be participating in a PES scheme by 2030 (Milder et al., cited in Adhikari & Boag, 2013). In Ecuador, the Socio Bosque program is a national conservation agreement which is part of a clear government policy to integrate ecosystem conservation with poverty alleviation. A transparent and straight forward process which incentivises and monitors local socio-economic investment is considered to have generated nation-wide participation of Indigenous and farmer households (de Koning et al., 2011).

Reflecting on 10 years of PES programs, demonstrating that in practice poverty alleviation clashes with market efficiency, suggests that further initiatives such as REDD¹⁰ will face the same contradictions. Further, it is contended by McAfee (2012) that neoclassical economics will result in a net upward redistribution of wealth from poorer to wealthier classes and from rural regions to distant, and particularly the capital accumulation centres in the northern hemisphere.

The social outcomes of a scheme are complex and multifaceted. Cook, Kristensen and Liu, (2016) suggest this makes it difficult to know when a payment is correct to ensure adequate provision of the service, as neither the service provider nor the buyer may have adequate information about the ecosystem values to negotiate the correct pricing. Consequently, PES schemes with a poverty alleviation design component may involve a trade-off between cost effectiveness and ecological objectives.

6.4.3 Social Justice

Considering policy tools as market-based tends to obscure the power relations underlying them and the regulatory framework within which they often take place. Economic narratives may be used to justify the adoption of MBI and build on alleged rather than actual characteristics of schemes, associated with theoretical archetypes rather than existing institutional arrangements (Froger, Boisvert, et al., 2015).

¹⁰ Reducing Emissions from Degradation and Deforestation

Social justice issues are most evident in Latin American PES schemes. While Mexico's PES programs were originally conceived under the logic of market-based conservation, instead the scheme is a hybrid of market like mechanisms, state regulations and subsidies (McAfee & Shapiro, 2010). The authors examine the process through which a national rural social movement led to hybridisation of the policy and its implementation, rejecting the neoliberal logic and favouring development goals. The scheme targets the payments in the interests of Indigenous communities and small farmers giving historical stewardship greater prominence (McAfee & Shapiro, 2010; Shapiro-Garza, 2013).

However, even when poverty alleviation is an explicate objective, equity issues may still arise with poorer households marginalised; land tenure issues may exclude some sectors of society, in particular poor small landholders. Limited land endowments may cause exclusion from the scheme (Muradian et al., 2013). In the case of the Cosa Rica program it is found that the PES payments generally go to larger land owners and may exclude certain types of smallholders despite state efforts to include the rural poor (Lansing, 2014).

A study of a Cambodian PES scheme suggests that the scheme is not a market per se, but a powerful intervention 'masquerading' as a market (Milne & Adams, 2012). Contracts for avoided deforestation and biodiversity conservation were explored in the five communities where they were implemented. Three inherently political aspects were explored: (i) the engagements of the community as a single entity entering into the contract; (ii) the simplification of resource rights and land management practices; and (iii) the voluntary aspects of the contracts. The study found that these components of the scheme worked broadly and practically to silence some community members and favour others.

Examining forest carbon projects in developing countries Osborne (2015) contends that the anticipated win-win solution of climate change through cost effective emissions reduction in the north and sustainable development in the south has failed to materialise. Co-benefits and sustainable development had not been achieved for forest dwelling communities. Osborne found that forest governance had been reshaped, undermining the social and ecological benefits often associated with common property management mechanisms. This was due to centralisation of forest governance and decision-making shifting to project implementers and brokers, the need for legal property rights and boundaries, and the technical requirements for carbon monitoring, verification and reporting.

Likewise, a study in Guatemala's Highlands using a political ecology approach found that non-market forestry incentives had greater flexibility to meet smallholder needs and that market-based programs brought state development funding for a limited period of time and mainly to the male head of the household (Hedemann & Osborne, 2016).

6.5 Conclusion

Rejectionism and Kosoy and Corbera's three indivisibilities have led to discussion on the commodification of nature and commodity fetishism, with criticism including that it can erode motivation and cultural identity whilst obscuring social relations linking buyers and sellers. Flaws in the market-based concept are suggested by market expectations being over rated and the term 'MBI' problematic due to the expectations it has raised. The dynamic market in disequilibrium raises questions around uncertainty, high transaction costs, public agencies as

buyers and intermediaries setting prices. The key role of the state through regulations and institutions, settling levels and conditions in PES and facilitating MES was demonstrated. Environmental markets were shown to exhibit hybrid governance sitting between hierarchical command-and-control and market governance. Novel combinations of state, market and community governance are referred to as institutional blending which place based solutions can be considered contextual adaptation.

Biodiversity offsets were used as an example to demonstrate the use of terminology decoupled from market realities, empirical examples of market, hybrid and hierarchical governance systems, while a critique of biodiversity offsets lead back to rejectionist. Alternative discourses for PES led to discussion on their role as tools for subsidy replacements, their varying degree of poverty alleviation and the social justice issues often associated with their implementation. These issues were not inconsequential.

7.0 GOVERNING ENVIRONMENTAL MARKETS

It is worth recognising that while environmental market instruments have gained considerable leverage on the environmental policy agenda since the MA, they are still not the dominant policy strategy for biodiversity conservation and environmental protection. Additionally, as they are relatively new concepts, many systemic governance problems limit the development of effective policies, programs and products (Muradian & Rival, 2012a). Pre-MA environmental conservation focused on trade-offs between human economic development and conservation of ecosystems, advocating protected areas free of human activity (Sunderland, Ehringhaus, & Campbell, 2007). Post-MA, with a focus on the utilitarian relationship between the benefits that people receive from ecosystems and the actors involved in the provision or degradation of these services, environmental markets can facilitate the creation of novel partnerships between local communities, corporate entities and civil society organisations (Lemos & Agrawal, 2006). The system of governance driving the capacity of these actors and the relationships and linkages between them are fundamental to the success of environmental markets.

From a policy perspective, the objective of using a market-based approach to environmental management has two components. Firstly, it aims to relieve the tension between economic development, biodiversity conservation and Indigenous culture over the productive use of an ecosystem's services or function. Secondly, to achieve this, it is necessary to influence the decisions made by the users of an ecosystem so that they are induced to change their land management practices to the benefit of recipients of the ecosystem's service or function. Thus, environmental markets facilitate incentives to land owners and other stakeholders to implement environmental management practices designed to produce environmental benefits. To achieve this Muradian and Rival (2012b, p. 94) suggest two broad policy objectives must be met; one in the ecological sphere and another in the social. Firstly, governance systems driving environmental market development must "acknowledge and communicate the dependency of economic processes on ecosystem functions through quantified measurements, amongst others". Secondly, the linkages between the various stakeholders involved in environmental market development and delivery must be made explicit. This suggests that purely top down or normative policy approaches will fail to deliver effective outcomes. In particular, it needs to be fully recognised that the consumers of ecosystem services need to acknowledge the critical importance of those landholders who provide ecosystem services. Linkages between the various layers of stakeholders with an interest in the demand and supply of ecosystem services products need to deal with and enhance the complex social, cultural and economic interdependencies. If poorly managed, the linkages among stakeholders could result in negative changes to the use or property rights of landholders who provide the ecosystem services.

Ostrom observes that the track record of using panaceas in environmental policy is one of repeated failures (Ostrom, 2007) and the environmental markets are no exception. Muradian et al. (2013) call for more context specific policy framing, observing that payments are one of a diverse set of potential solutions and there may be better ways to tackle socio-environmental challenges. Further, Farley and Costanza (2010) observe environmental markets will be most effective if they form part of a coherent package of policies that address ecosystem service use and management rather than a policy suite with opposing incentives such as the

subsidised use of water or energy. Thus it is essential to understand critical criteria and when a market-based approach is appropriate and for it to be likely to succeed.

7.1 Critical Criteria

Muradian and Rival (2012a) suggest that the policy agenda for environmental governance has moved from a focus on the right environmental regulations for conservation to the right price for ecosystem services. They consider this a false dichotomy and call for proper attention to the right set of tools (rules and instruments) along multiple governance layers. They suggest nested polycentric institutions have a role to play in the complex governance systems involved in providing ecosystem services, particularly stressing the need for central government to engage with the other social actors to ensure effective performance arrangements.

The success of any scheme may be considered in terms of efficiency (cost effectiveness), environmental outcomes and social equity. This is a function of the scheme's objectives, design, transaction costs and participation. The objectives may be discrete, for example lowering carbon or nitrogen point source emissions, or complex such as hydrological service schemes that have social and ecological components. Schemes that incorporate efficiency, effectiveness and equity will need trade-offs between the socio-ecological goals. Consequently, an important challenge may be understanding the conditions for successful schemes and their desired outcomes over time. Social, political, institutional and economic factors need to be considered. Success criteria may include participation, incentive structure and poverty alleviation (Adhikari & Boag, 2013).

Design delineates the service to be traded and how it is delivered. This involves political decisions around targeting the users of the ecosystem, the conditions that must be met for payment, the amount to be paid and the overall goal of the policy. How costly it is to coordinate interrelated actions determines transaction costs. This may include defining buyers and sellers, building trust, incorporating agents, evaluating the trade for all parties, negotiating contracts and monitoring, verification and reporting compliance (Vatn, 2010). Bayon (2004), focusing on MES, stresses the importance of property rights, equity in their allocation, competition, trust alongside the potential for unintended consequences.

Environmental markets frequently operate in complex conditions and the design and implementation of the scheme needs to accommodate: uncertain markets and costly information; efficiency and distribution as interdependent goals; and social embeddedness, perceptions and power relations (Muradian & Rival, 2012b). The authors emphasise that cooperation is required between the users and the beneficiaries of ecosystem services. They also recognise the need to incorporate the high levels of complexity in ecosystem service functions, the high levels of uncertainty and the imperfect and asymmetric information between transacting parties. Alongside this they identify cognitive barriers in assessing the service itself, for example the extent to which the service has been supplied.

Establishing governance systems that can effectively navigate these issues requires careful environmental market system design and economic valuation of the ecosystem service products. The creation of a tradable commodity, or fungible product, requires compartmentalising the ecosystem service being used. Carbon sequestration, biodiversity

conservation, water quality and/or quantity downstream are inherently complex services. Any compartmentalisation or simplification creates inherent risks.

A conceptual framework, *The Benefit Flows and Property Rights Matrix* developed by Lockie (2013) considers the distribution of benefits arising from ecosystem service provision, the rights and duties associated with resource access and the fitness for purpose of various policy instruments. Lockie (2013) builds on the discussion of design proposing that appropriate market-based policy instruments will depend on “a range of additional conditions including inter-changeability of supply, scalability, lack of corroboration, adequate information, financial capacity, clarity of property rights, clarity of resource access-related duties and institutional capacity” (Lockie, 2013, p. 90). Accordingly ensuring an effective mechanism is utilised goes beyond design and is a factor of moral judgement, political decision-making and social learning.

Critical criteria identified by Duraiappah (2006) include the environmental effectiveness, economic efficiency or production costs and the institutional efficiency and transaction costs of the MBI (Duraiappah, 2006). Extrapolating further includes the jurisdiction compatibility between the MBI and the level of government responsible for the economy or environment affected, the demand and supply distributional effects of the use of the MBI, harmonisation with other instruments, incentives and competitiveness or loss of competition as a result of the market-based approach.

When studying governance systems Vatn (2010) uses classical institutionalism to divide the normative and the technical aspects of coordination. The normative determine the distribution of rights and the rules that govern the interaction between parties. The rights and rules include the buyers, sellers and intermediaries, knowledge asymmetry, property rights, the challenges of common pool and public goods and adaptive governance. The technical aspects determine how the transactional costs affect the implementation and choice of scheme. Technical aspects include the cost of data, the risk of reducing complexity, bundling and trade-offs in services, temporal and spatial considerations and payment methods.

7.2 Interactions, Rights and Rules

7.2.1 Buyers, Sellers and Intermediaries

In any scheme there are buyers, sellers and often intermediaries who provide services to facilitate the process. Intermediaries provide a variety of functions that may include service and information providers, mediators, arbitrators, equalisers, representatives, watchdogs, bridge builders and developers of methodologies or standards. Thus, intermediaries are important actors who may be government agencies, NGOs, international agencies, local organisations or professional consultancy companies. Intermediaries may prove essential in the establishment phase (Pham, Campbell, Garnett, Aslin, & Hoang, 2010). Participation of land managers is an obvious, important component of a scheme's success. Adhikari and Boag summarise that the factors that affect a household's decision to participate in a scheme can include education, debt, income, landholding size, opportunity costs, technical knowledge, politics and the experience of the land managers (Adhikari & Boag, 2013).

7.2.2 Knowledge Access

Ecosystems service markets may create new hierarchies affecting social dynamics and power relations. Buyers, sellers and intermediaries may have different levels of power so that equity in access to the scheme, decision making in the design, operation and outcome of the scheme may be difficult and impact its success. There is a high risk that actors with better access to information can exploit the poor and so intermediaries are needed to address this asymmetric access (Pham et al., 2010). It is vital that intermediaries are neutral, professional and capable (Pham et al., 2010) which Vatn (2010) is concerned is not being met. High information asymmetry may be a risk when MBI are applied to complex ecosystems. Often there are few buyers and many sellers, with access to information and resources more accessible to buyers making them more powerful (Adhikari & Boag, 2013). Gómez-Baggethun and Muradian (2015) put this reason forward for low income sellers accepting lower compensation. Poor people may be forced to sign contracts that the more affluent could avoid; while markets in theory are based on equal parties, in reality the capacity to pay is decisive (Vatn, 2010). Assessing information asymmetry from the buyer's perspective Muradian and Rival (2012a) suggest the environmental protection of the Costa Rica is impaired as the government has insufficient information about the effectiveness of monetary transfers to influence behaviour.

7.2.3 Property Rights

Ownership of an ecosystem may be private, public or communal. There are several sets of rights involved: land ownership; land use rights; and the right to commercialisation of the services generated (Muradian et al., 2010). This may include access to the ecosystem, how income from the ecosystem is distributed, and the rules that allow cost shifting between the users (Vatn, 2010). This spectrum follows the principle of 'polluters pay' vs 'provider gets' (Vatn, 2010). Well defined property rights, or equally tenure security is critical in facilitating a landowner's participation in a scheme (Corbera et al., 2007; Landell-Mills, 2002).

Studying MES, Bayon (2004) observes that the allocation of new forms of property rights is the most important and difficult aspect of designing a market. Property rights over a public good need to be allocated equitably and fairly. The study notes that the sulphur dioxide trading platform was facilitated by the US government creating a new property right; the right to emit. In the case of wetlands offsets, the right to develop is effectively being traded. Other examples of development rights include the right to exploit fisheries (New Zealand), the right to develop beach front property (Puerto Rico), watershed development rights (Chile) and the right to damage endangered species (several US states) (Bayon, 2004). Likewise the Catskill water market in New York created private rights for the water purification ecosystem service (Duraiappah, 2006).

7.2.4 The Governance Challenge of Common Pool and Public Goods

The ecosystem service addressed by markets is usually within the type of goods that are either common pool resources or public goods. Markets, however, tend to be most effective when dealing with private goods. Hence, a market-based approach may be impaired through the public nature of most ecosystem services. Ecosystem services typically cover a wide geographic range and it is, therefore, typically difficult to exclude beneficiaries of ecosystem services. This results in free riding and other opportunistic behaviour rendering the market element less effective (Muradian & Rival, 2012a).

Markets generally operate effectively for single products. Channelling ecosystem services through markets may involve trade-offs, resulting in changes to the functioning of the ecosystem. For example, a market focused on carbon may distort the relationship between carbon and biodiversity within an ecosystem. Locally supplied ecosystem services may have beneficiaries in distant locations or in different social groups resulting in the need for governance systems that encompass different geographic and governance scales, including the global level (Muradian & Rival, 2012a).

7.2.5 Adaptive Governance

Long term sustainable policy solutions to highly complex problems is increased using adaptive governance (Cook et al., 2016). Adaptive governance is a process of refinement or modification of policies and their implementation to improve performance (Cook, Liu, Murphy, & Lonsdale, 2010). Cook et al. (2016) suggest that adaptive governance may provide guidance on designing environmental markets to achieve multiple objectives over different spatial scales rather than localised results for service providers. Lateral information flow aligned to incentives might shape the scheme to allow the coordination of ecosystem service priorities across different jurisdictions. Cook (2016) suggests that a polycentric environmental market governance framework with environmental targets set at relatively small spatial scales, but coordinated at larger scales will result in outcomes that are relevant for both local economic development and global ecosystems. Adaptive governance has been represented by Nelson, Howden and Smith (2008) shown in Figure 8.

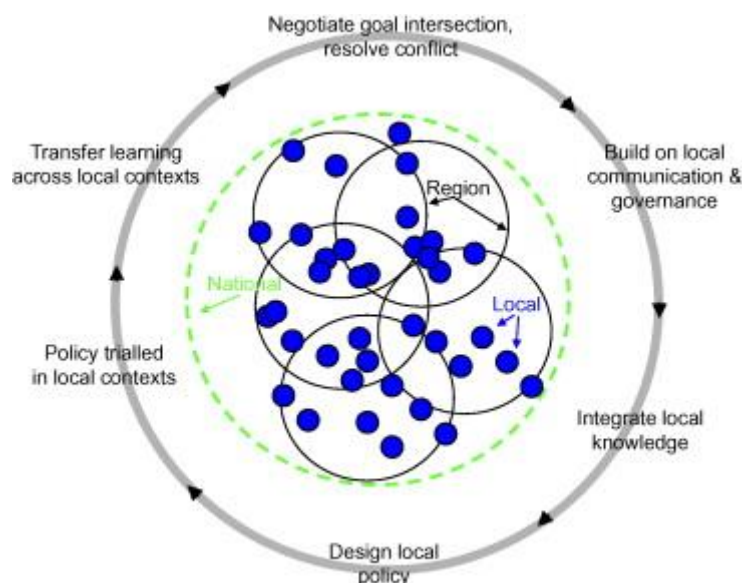


Figure 8: An adaptive model for PES schemes

Source: Nelson et al., 2008

Ecosystem service measurement, valuation and monitoring will always be characterised by high levels of uncertainty requiring continuous inflow and integration of information to both learn and adaptively govern (Cook et al., 2016). Adaptive governance and management has been proposed as a central principle of environmental markets with priority given to reducing uncertainty through continuous collection and integration of data (Farley & Costanza, 2010). Conversely, Muradian and Rival (2012a) suggest that the commodification process may reduce the capacity for adaptive management due to the inherent loss of flexibility through

commodification. They further consider that the process may promote management practices based on overly simplified or potentially misleading assumptions about land use, ecosystem function and services.

7.3 Technical Aspects

For a market to function it needs to identify what is being traded and verify that the services are contractually delivered. The traded good requires the identification and commodification of usually a single ecosystem service such as a tonne of carbon dioxide equivalent, a biodiversity offset or a specific reduction of nitrate or sediment in water. Transaction costs and the commodification process influence the design, outcomes and trade-offs. Common to each technical aspect is the view from Ruhl (2007 cited in Pirard, 2012, p. 62) that “Ecosystem services, while clearly of tremendous value, are ecologically, geographically and economically more complex than any other kind of commodity or service, which had made tapping into the value a challenge that has yet to be made.”

7.3.1 The Cost of Data

Information gathering is costly due to ecosystem services being dependent on the context of both the ecosystem and the local socio economic situation (Muradian & Rival, 2012a). Ecosystems and their functions are intrinsically complex due to their multidimensional, multi-scale and non-linear characteristics (Wilson, 2006 cited in Muradian & Rival, 2012a). This complexity and cost of gathering the data needed to understand the relationships between land use, ecological function and services in part explains why there is inadequate data about the link between conservation interventions and the condition of ecosystems (Muradian & Rival, 2012a). The lack of data is pervasive with inadequate understanding of ecosystem service production a barrier to effective programs, particularly those incorporating multiple products (Farley, Anderson, Bremer, & Harden, 2011). Recognising the cost of data, there is often a trade-off between the design of markets and the transaction costs involved in establishment (Muradian et al., 2010). To combat this, Vatn (2010) suggests that transaction costs may be reduced through hierarchies such as the power of representative bodies or increasing social capital (trust and engagement) in communities. As well as prohibiting the full commercialisation of services, monetary transfers with imperfect information may result in ineffective outcomes.

7.3.2 Risks of Reducing Complexity

The relationships between different payment schemes and commodification is illustrated in Figure 9. Markets require a high degree of commodification compared to rewards and traditional incentives. The commodification of ecosystem services in the context of high uncertainty may promote management practices that are based on an over simplification of the assumptions about the relationships between land use and ecosystem function and service (Muradian & Rival, 2012a). This may undermine the ability to manage these functions effectively which may impair outcomes (Norgaard, 2010). Furthermore, program evaluation is challenged by the need for environmental markets to establish accurate business as usual baselines and effective monitoring, verification and reporting (Hrabanski, 2015).

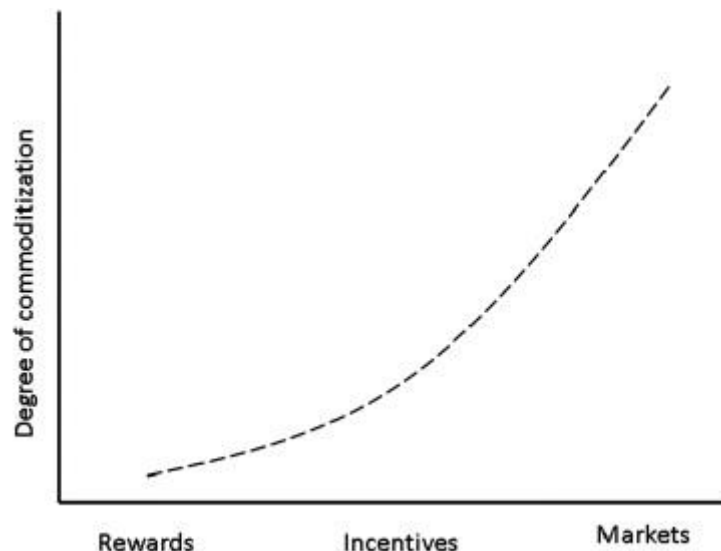


Figure 9: Relationship between monetary transfers and the level of commoditisation

Source: Muradian & Rival, 2012a

7.3.3 Bundling Services and Trade-offs

Markets are normally unable to deal with multiple services at the same time and prefer the identification and commodification of single services. Additionally, transaction costs may be prohibitively high for multiple services. This encourages trade-offs between the provision of different services (Rodríguez et al., 2006) such as carbon and biodiversity (Kanowski & Catterall, 2010) or carbon and water provision (Jackson et al., 2005). Consequently, markets focused on single services may negatively affect ecosystem resilience. Carbon sequestration may increase the likelihood of disruptive fires (Johnstone et al., 2010). The current dominance of carbon markets may result in neglect of non-forested ecosystems, or the less well understood tropical and other forests (Putz & Redford, 2010). Set against this, recognising that ecosystems produce multiple services Farley and Costanza (2010) recommend that while the rates of production of the service will vary by site and over time, services should be bundled in order to avoid perverse incentives and to maximise the benefits to society.

7.3.4 Temporal and Spatial Considerations

There is a lack of synchronicity between the timetables of markets and ecosystem functions and consequently time frame risks are likely to emerge. Regime shifts, may not be noticed for relatively long periods of time, for example extinction cascades due to the removal of apex predators (Muradian & Rival, 2012a). Biodiversity or carbon sequestration offsets may trade today but not reach their potential until a future date. While biodiversity banking in the US avoids temporal loss this is not the case in Europe where there is a focus on 'one off' or 'do it yourself' schemes.

Farley and Costanza (2010) recommend that the temporal and spatial scale of ecosystem services should be matched by the scale of the institution managing them. Local, regional and international institutions operating over short, medium and long-term time scales would thus be necessary. These institutions should be designed to ensure the information is disseminated between scales to ensure costs and benefits are fully internalised (Farley & Costanza, 2010).

7.3.5 The Scale of Internalisation of Externalities

Counteracting profitable but highly environmentally damaging activities with incentive payments is tied to the opportunity costs of foregoing the economic activity. The protection of ecosystems may become costly or unjustifiable if the cost of compensation becomes more costly than alternative policies. The commodity boom of the last decade has outpaced the price of carbon sequestration and other ecosystem services. While the cost of commodities stays high, it is unlikely that markets for ecosystem services will be able to halt the expansion of commodity production into natural ecosystems (Muradian et al., 2013).

A generalised internalisation of all the positive externalities would lead to economic collapse as it would be too costly. A study of the valuation of ecosystem services on Cape York Peninsular at AUD \$130 billion per annum exemplifies this point (Preece, van Oosterzee, Dungey, Standley, & Preece, 2016). Policy makers must be aware that that commodification is only possible at the margin of these services and that there are limits to the generalisation and upscaling of ecosystem services (Muradian & Rival, 2012a).

7.3.6 Payment Methods

Payment negotiations will be a factor in initial scheme participation and influence the downstream long-term socio-ecological outcomes. An essential part of the negotiation process is identifying a socially and culturally acceptable, fair payment method (Van Hecken et al., 2012 cited in Adhikari & Boag, 2013). While payments are important, so too are technical assistance and the ability to access and grow markets (Van Hecken et al., 2012 cited in Adhikari & Boag, 2013). Payment may be in the form of in-kind productive capital which may avoid the problems associated with cash influxes into a community and be more effective at supporting long term sustainability (Suvanto et al., 2007 cited in Adhikari & Boag, 2013). Payment structure should consider payment type, amount, timing, duration as well as performance indicators and targeting (Zabel & Engel, 2010 cited in Adhikari & Boag, 2013).

7.4 Governance Systems Summary

An observation by Farley and Costanza (2010, p. 2064) pertinent to the governance system of environmental markets is that “As economic institutions can be changed while in most cases the physical characteristics of ecosystem services cannot, we must adapt the former to the latter, and not vice versa.” Fundamental are the objectives, design, transaction costs and participation. Success is a function of efficiency, environmental outcomes and social equity but the relationships and trade-off between these is determined by the schemes objectives. The normative aspects of coordination are the distribution of the rights and rules that govern the interactions between the parties. In reviewing the importance of the respective roles of buyers, sellers and intermediaries, consideration must be paid to the importance of knowledge symmetry, property rights, and the governance challenges of common pool and common goods. Polycentric governance systems that encompass different geographic and governance scales, including global governance, brings the creation of new and novel linkages between stakeholders. Adaptive governance is considered both an essential requirement and a challenge given the complexities of ecosystems set against the need for markets to reduce complexities.

This inherent complexity of ecosystem services combined with the market's need for more simplistic scenarios is fundamental to the technical aspects which in turn are fundamental to transaction costs. The cost of gathering data in order to understand the relationships between social ecological systems is prohibitive in many cases leading to the need to reduce complexity. MES require a high degree of commodification focusing on a single, or at most, a few services. Reducing complexity has inherent dangers and may promote land management practices based on an oversimplification. Temporal and spatial considerations further complicate this. A technical aspect is participation and the role of payment structure. It is important to reflect that markets can only operate at the margins and full internalisation of environmental costs would lead to economic collapse.

The most important challenges to environmental markets may be debates about their nature and typology, conditions required to be effective and their social implications. These debates are compounded by the 'analytical lens' applied by different disciplines such as economists, ecologists and political scientists considering the relative importance of criteria such as economic efficiency, environmental effectiveness or social justice. This has resulted in some authors proposing alternative frameworks to assess the market-based approach.

8.0 ALTERNATIVE FRAMEWORKS

It is clear that complexities characterise the majority of environmental markets. Ecosystem properties evolve from the interplay of biological, physical and social interactions. Current ecological knowledge is still insufficient to accurately understand land use and the provision of ecosystem services. In practice, there is a lack of well-functioning markets. As a consequence, a number of authors have attempted to articulate alternative theoretical frameworks to aid theory and practice in the conceptualisation and analysis of environmental markets.

8.1 The Ecological Approach

The ecological approach advocated by Muradian and colleagues (Muradian et al., 2010; Muradian & Rival, 2012a, 2012b) uses an analytic lens which conceptualises payments for ecosystem services as *incentives* for collective action rather than the Coase Theorem approach to solving market failures. The implications are conceptual (the way the problem of environmental degradation is understood and analysed) and affects policy, practice and the way programs are designed. Rather than being technical tools for getting the price of ecosystem service payments right, they contend that market-based mechanisms are political tools, which are embedded in complex institutional and ecological contexts. Some authors have used the case study in Mexico (McAfee & Shapiro, 2010; Shapiro-Garza, 2013) to argue that incentives are more constructive than markets or rewards. Incentives, they contend, add extrinsic monetary considerations to other motivations the land managers may have to enhance the provision of ecosystem services. Markets, incentives and subsidies are recognised as just one of the multiple drivers steering behaviour. Incentives may take the form of additional investments in public goods such as technology, infrastructure or planting that may be beyond the budgets of land managers. Thus, the incentives may become the ‘tipping point’ in changing practices and behaviour. The shift from internalising market externalities to creating incentives for environmental protection has the advantage of reducing the importance of economic valuation. It shifts the focus from the relationship between land management and ecosystem service and function, to designing incentives, understanding motivations and how incentives affect behavioural changes over time (i.e., in the short run compared to long-term changes).

This perspective departs from Wunder’s five rules (*voluntary and conditional transactions over well-defined ecosystem services between at least one supplier and one user*). It recognises that payments may not be forthcoming *voluntarily* for services with public good characteristics but may need to be coerced and obtained through taxes or mandatory service charges; dealing with Vatn’s often cited troublesome water users. The approach recognises that empirically, the *conditionality* criteria is often not met. Many initiatives are only loosely monitored or not monitored at all. Instead payments are made up front and in good faith. Rather than *well-defined ecosystem services* the approach accepts that when monitoring does occur it is more frequent that land management practices were changed, rather than enhanced environmental services received. While the degree of commodification of the environmental service may be precise (nitrate content in water, for example) this approach recognises that it may also be fuzzy (shared beliefs in the provision of a service for example). While *at least one buyer* is always necessary it may be that the buyer is an institution and a regulator rather than a service provider.

This approach recognises that not all market-based approaches would fall into a strict definition of markets and highlights that state and community engagement is required. Consequently, schemes are not voluntary market transactions but a reconfiguration of the state-market-community relationship with the focus on using the capacities and funds of states and communities rather than abandoning them (Vatn, 2010). The ecological approach draws on the lessons from natural resources management that can be applied to the ecosystem services management. Managing the commons, which has trouble excluding potential users, stresses that solving social dilemmas is more effective if the governance system is built on local knowledge and trust, incorporates high levels of involvement of stakeholders in the design and enforcement of rules and includes monitoring and sanctions (Ostrom, 2011, 2012). This involves a process of negotiation (ideally) between parties with a goal of equity and efficiency. It also recognises that efficiency and equity are intertwined and contends that rather than poverty alleviation forming a welcome side product or co-benefit it may be specifically designed within the scheme.

This approach seeks a more inclusive and reflective dialogue between scholars and practitioners to mitigate practitioners' frustration at attempting to design and apply schemes based on theoretically consistent but difficult to apply conceptualisations. By attempting to integrate the different sources of complexity embedded in the environmental markets, Muradain et al. (2010) anticipate this will facilitate practitioners. Muradian's approach asserts that what is most important is how the institutional arrangements fit the local ecological conditions, how rules are firstly developed and subsequently adapted over time, and finally if these rules are judged to be fair and legitimate. Through developing local and regional institutional frameworks that can cope with complexity and diversity, and integrating schemes within existing regimes of rural development and other policy instruments for environmental protection would place environmental market decision making process and trade-offs in the centre of any analysis (Muradian et al., 2010).

8.2 Institutional Analysis

An approach adopted by Vatn analyses the characteristics and functioning of environmental markets using institutional theory (Vatn, 2010). This recognises that establishing markets is a demanding process of social and political construction. Instead, Vatn focuses on governance and institutional structures. Following Paavola (2007) governance is about social priorities, resolving conflicts and enabling human coordination. Institutional structures determine how goals are established, how the rules to reach those goals are defined and how the outcomes from these rules are controlled. Thus, using classical institutionalism there are three dimensions to the governance of the environmental markets identified by Vatn (2010). The first is the rights and rules that govern interactions between the agents involved in the scheme. The second is the technical aspects of coordination which relate to the transaction costs and how these influence the scheme design and function. The final dimension is how different motivations are supported by specific scheme design and the consequent outcomes in practice.

Institutional theory identifies three types of governance structures: hierarchies, markets and community management. Vatn (2010) argues that analysis of case studies demonstrates that while in theory market schemes are an alternative to hierarchical or community governance, in practice they depend fundamentally on state and community governance. Few real-world

systems are based on one type and that they typically co-exist and may even depend on each other. For example, markets depend on property rights, and the resolution of contractual conflicts; structures which are determined by hierarchies. Public involvement is essential in clarification of property and management rights over the land that delivers the ecosystem service. Likewise, community participation facilitates the creation of markets for environmental services and is crucial. As a result, strengthening hierarchies and community participation may be important for the market element.

According to Vatn (2010), the literature illustrates that the existing institutional context is important in determining the success of a scheme. If an ecosystem service payment is created for a good that is traditionally seen as shaping cultural identity, then a value conflict may emerge. Establishing schemes may reinforce conflicts over access and control of resources. Schemes may require cooperation between different groups of land managers rather than competition between them. Building trust and participation may counter some of these problems. Consequently, understanding how the existing institutional structures facilitate cooperation and building this into the design is important.

Vatn (2010) observes that having reviewed case studies what is most noticeable is the effort that is necessary to create a market: from definition of property rights, commodification of the ecosystem service delineated, to specifying the users and providers, which is particularly hard as exclusion is difficult. This results in high transaction costs for environmental markets which effects price setting. Vatn (2010) reasons this is also why intermediaries are so important, whether state, firms or NGOs, as they may take on the task of defining the good, establish who should be involved and may also set the price. If an intermediary is influential in price setting, then this is a further departure from market governance.

Transaction costs may be greater than the potential benefits a scheme brings. Existing organisations and their standing locally may be vital agents when establishing schemes. Intermediaries may be vital in their role of reducing transaction costs and may explain the differences between user and government schemes. User-based schemes focus on single services and are small while government schemes are magnitudes of scale larger and cover multiple services. Hence, schemes may create or reconfigure the roles of public bodies and communities as intermediaries or buyers.

There is also the danger that schemes may strengthen existing inequities, whether through lack of land title or where small parcels of land are required wholly for subsistence and, therefore, have prohibitive opportunity costs. If property rights are communal or land title is not fully formalised, buyers may demand formal title is established. Alternatively, people with land held in common may use involvement in a scheme to strengthen their land right claims. These motivational aspects may introduce perverse incentives. Allocation and clarification of property rights may actually help secure Indigenous access to land and subsequently facilitate mobilising the land for agricultural uses. This may enhance the level of payments needed to secure environmental services. Additionally, if the value of land increases, so too does the incentive for 'land grabbing'. In considering land management rights, Vatn observes that in practice the "providers' of environmental services seem to be implicitly and exclusively granted the right to the status quo uses - i.e. a form of 'provider gets' with rarely no discussion about whether these uses are legitimate" (Vatn, 2010, p. 1248).

Vatn (2010) explores the motivational aspect of the payment itself. A substantial part of the pay is captured by intermediaries and verifiers, often more than fifty percent. While the motivation of intermediaries may be the good cause of the scheme, there is also the potential to earn money given they sit between the buyers and sellers and control the information flow. Developing this further, Vatn (2015) observes that power is given to intermediaries in a market, and due to informational asymmetries trade can be maintained as an end in itself so that actors may live off transaction costs. The motivation for trading may be profit for both buyers and sellers, not environmental protection, and hence there exists a motive to under deliver to increase profits. Secondly, Vatn (2010) explores how the payments are perceived by the participants. Incentive and payment may vary according to delivery. It may be a fair reward for acting responsibly. It might be compensation for the costs related to ecosystem service provision beyond what is reasonably expected for the provider to manage on their own resources. Vatn (2010) reflects that payments are not the only motivation for land stewardship. Introducing payments may change the logic from doing what is appropriate to starting to think in instrumental terms.

8.3 A Classification Based Framework

A classification framework advanced by Pirard and Lapeyre (2014, p. 106) and shown in Table 8, attempts to answer the research question “How are MBIs for ecosystem services defined, reflected and assessed?” Through analysis of 106 peer reviewed articles a typology map was generated of existing instruments based on Pirard (2012), although it was recognised that their multidimensionality was challenging. It found that there was a great diversity of research methods and evaluation criteria as well as terms used. It was noted that many articles did not use scientific methods for new data and resorted to mere advocacy. In the authors’ view the lack of a common theoretical or empirical framework makes it difficult for practitioners to draw strong policy relevant results. Harmonised assessment methods to better defined categories of MBI would facilitate more robust evidenced based policies in the authors’ opinion.

Table 8: Market-based instruments for ecosystem services: A theory-based typology

Source: Pirard & Lapeyre, 2014, p. 109, based on Pirard, 2012

Category	Exclusive characteristics	Specificities	Relation to markets
Direct markets	A market where an environmental product can be directly traded between producers and consumers (or processors)	Can be framed at the international level with specific rules for each country and a great variety of deals (genetic resources), or as a more classical market with more or less processed products (Non Timber Forest Products for example)	Proximity to the market definition depends on cases and the degree of commodification
Tradable permits	An ad-hoc market where users of an environmental resource need to purchase “permits” that can be further exchanged among resource users, thereby creating artificial scarcity	Designed to either serve a clear environmental objective (with bio-physical indicators) or based on acceptable social costs (market price for carbon)	Creation of a specific market for a given environmental objective, information are expected to be revealed

Reverse auctions	A mechanism whereby candidates to service provision set the level of payment (if accepted) in response to a call by public authorities to remunerate landholders	Aimed at revealing prices and avoiding free-riding and rent seeking	Creates an auction-based market that favors competition among bidders for achieving cost-efficiency
Coasean-type agreements	Ideally spontaneous transactions (free of public intervention) for an exchange of rights in response to a common interest of the beneficiary and the provider	Requires clear allocation of property rights, highly site-specific and difficult to replicate on a large-scale	Usually not following market rules, more of a contractual nature
Regulatory price changes	Consists in regulatory measures that lead to higher or lower relative prices	Part of a fiscal policy (including subsidies) with environmental objectives and complete control by public authorities	Based on an existing market
Voluntary price signals	Consists in schemes whereby producers send a signal to consumers that environmental impacts are positive (in relative terms) and consequently gain a premium on the market price	Still limited as an incentive for action due to relatively low willingness to pay by consumers	Uses existing markets to identify and promote virtuous activities

Pirard and Lapeyre (2014) argue that a more robust classification for MBI is needed for three primary reasons. Firstly, they provide examples of where the side effects of market rhetoric are causing confusion, such as the misconception that PES are markets which they suggest is leading to denunciation of ‘new colonialism’ and ‘nature commodification’. Secondly, sound policy is built on good dialogue and communication and impaired when agreed definitions and understanding is lacking. Thirdly, they suggest that some of the confusion may be a conscious effort to rebrand policies that lost favour such as taxes and subsidies.

Pirard and Lapeyre (2014) call for comparative research to provide more robust conclusions and associated recommendations to policy makers and advocate promotion among researchers of agreed terms referring to similar objects. Using the example of PES as a vague category they suggest more precise terms that depend on the genuine characteristics of the policy instrument being assessed. For example, ‘direct negotiated payments’ (Coasian agreement category) or ‘subsidy programs’ (regulatory price changes category).

Suggestions are also made to distinguish between instruments based on their objectives suggesting the three broad distinctions: “(i) funding methods that aim at generating new sources of finance (e.g., carbon markets, water funds and biodiversity offsets), (ii) incentive mechanisms that aim at orientating agents towards environmentally-friendly behaviours (e.g. subsidies or certification), and (iii) allocation mechanisms that aim at ensuring the cost-effectiveness of measures (e.g., reverse auctions)” (Pirard & Lapeyre, 2014 p. 113).

This would assist in researchers understanding the impacts, positive prospects and risks of MBI. This would also discourage generalisation of impacts, and assist in the use of the same methods to assess specific impacts.

8.4 A Definition-based Framework

Through comparison of the environmental and ecological economic perspectives Tacconi (2012) addresses questions on the role of environmental markets in ecosystem conservation and rural development. The key questions driven by this approach are: “What is an appropriate definition of PES, grounded in the theory and practice underlying it? What are the key design elements of PES? What should the scope of PES be given the possible trade-offs between efficiency and equity?” (2012, p. 29).

Tacconi accurately observes that the environmental economic school has over-emphasised the role played by Coasian transactions while the ecological economics school, has over-emphasised this reliance on the Coasian Theorem. Through a comparison of these perspectives, Tacconi attempts to develop an improved definition, a better comprehension of the key design elements, and their possible role in the provision of biodiversity conservation and economic development. While these vary from Muradian’s school the author suggests they do sit within the ecological economics perspective. Tacconi attempts to break out of the polarisations of the two debates and seek overlap. In attempting to seek this overlap, Tacconi considers the criteria that need to be incorporated within the scheme.

The first criteria is identifying, at the appropriate scale, the environmental service to be maintained, or the proxy land management actions that are shown to contribute to the provision of the service. Secondly, the scheme needs to have a process for selection of the geographic area and participants, setting up contracts, specifying the conditions, rewards and penalties, monitoring compliance and reviewing the performance of the scheme. Important characteristics are additionalilty, transparency and conditionality while voluntary participation of the sellers is preferred. Trade-offs between efficiency and equity may be incorporated and must address both intra and inter-generational equity and the relationship with efficiency. Unlike Muradian, Tacconi suggests that schemes designed for poverty alleviation should be designed for that purpose while the environmental markets should focus on efficiency with equity as a co-benefit using best practice design features (2012).

Tacconi’s new definition is “a PES scheme is a transparent system for the additional provision of environmental services through conditional payments to voluntary providers” (2012, p. 35). The author admits that it is a broader definition than Wunder’s but more specific than Muradian’s, and would encompass schemes from REDD to pure Coasian schemes. The voluntary component is intended to emphasis its importance compared to cost effectiveness.

Definitions have played a prominent role in discussions in the literature, while often used to frame discussions they have also equally been used pedantically. Tacconni’s weakening of the definition may add little to the debate. Indeed Wunder (2013) calls for analysts and practitioners to be open minded in their assessment and looking beyond ideological analysis when PES schemes so frequently diverge from the original.

8.5 The Role and Reach of a Market-based Approach

Bringing together views from economics, political ecology, institutional theory, moral philosophy and environmental science Gómez-Baggethun and Muradian (2015) attempt to establish the role and reach of MBI for global environmental governance. They recognise that the green economy and the Sustainable Development Goals will shape the form of environmental and economic policies in the coming years. The analytical lens through which the environment is viewed will determine the key assumptions.

Technical issues such as fungibility, substitutability, rivalry and excludability are important guiding criteria but essentially the question is a political dilemma regarding the type of institutional arrangements societies want to adopt to secure the sustainable governance of the environmental commons. In the case of environmental economics then, money and markets are the overarching system of reference defining what is internal and external to the method of societal choices. Framing these choices as externalities embeds markets as the overarching framework, while suggesting that the solution is within the technical domain. Gómez-Baggethun and Muradian (2015) contend that institutional, ethical and political and biophysical analytical lenses are also needed. These have a decisive role in the way ecosystem service decline and biodiversity loss is framed and solutions proposed.

MBI as an umbrella term encompasses actual markets (carbon trades), mixes of trade and regulatory (biodiversity offsets) and instruments where the trade component is not there at all (PES). While the market element can increase cost effectiveness, it depends on the specific conditions at stake (such as the feasibility of accurate measurement) and the transaction costs. It is recognised that in most payment schemes the services are rarely well defined. The lack of acknowledgement about the complexity of ecosystem services has allowed the debate about the scope and limits of these instruments in ecosystem service governance to be displaced to the virtues and vices of markets. The tension that has emerged about the supposed relationship between the commodification of nature and MBI is a reflection of this displaced debate. Gómez-Baggethun and Muradian (2015) point out that most PES do not qualify as markets and so do not represent any complete or even advanced form of commodification. The extension of mis-placed market-orientated logic, values and language into novel environmental domains may, Gómez-Baggethun and Muradian (2015) claim, drive the symbolic and discursive changes that characterise the early stages of commodification process. Gómez-Baggethun and Muradian (2015) advocate an approach that recognises that the blunt divide between market and state is a false dichotomy.

8.6 Synthesis of the alternate frameworks

The introduction to section eight suggested that the five alternative frameworks sought to aid theory and practice in the conceptualisation and analysis of environmental markets. This synthesis will use the commonalities both identified from within this literature review and others from the broader nexus of neoliberal and environmental governance as a lens to guide discussion on the alternative frameworks.

The literature review has recognised some commonalities around the issues that arise when creating an environmental market. The first is practical; the biophysical and technical issues that arise converting nature into a commodity. The second arises on moral grounds; the ethical

implications of commodification. The third is the consequential; the consequences to nature of commodification.

In a series of three papers Noel Castree investigates the ‘neoliberalism of nature’, a term frequently associated with the ‘commodification of nature’ in the environmental market literature and co-opted by the rejectionist view. However, Castree’s work does not focus on this slant but examines both ‘the neoliberalisation of nature’ and ‘the nature of neoliberalism’. Castree synthesises the work of a growing school of critical geographers who draw on political economists to theorise and critically analyses empirical examples of ‘neoliberal environments’ (biophysical).

In the first paper, Castree (2010a) distinguishes between the definition of ‘neoliberalism’ and the process of ‘neoliberalisation’ and censures against conflating the two terms. The definition recognises seven criteria, five of which are familiar to this review: privatisation; marketisation; roll-back of the state; the strong encouragement of ‘flanking’ mechanisms in civil society; and market friendly reregulation¹¹. While the seven principles may define neoliberalism the paper recognises that neoliberalisation or ‘actually existing neoliberalism’ (Brenner & Theodore 2002 cited in Castree, 2010 p.1726) never results in this pure model. Instead path dependency and contingency hybridity create different variants of neoliberalism. These are dependent on the hybrid nature of contemporary policies and programs, incorporating multiple and contradictory aspects of neoliberal spaces, techniques and subjects (Larner 2003 cited in Castree, 2010b).

Castree’s second paper; ‘theorising the neoliberalism of nature’ (Castree, 2010b) draws upon the work of Karl Marx (1818-1883), Karl Polanyi (1886-1964) and James O’Connor (1936-2017). Castree uses Marx’s capitalism system as the ‘operating hardware’ with Polanyi’s analysis of classical liberalism and O’Connor’s interpretation of capital-nature relations based on Marx and Polanyi to develop a theory. This theory is then applied in the third paper (Castree, 2011), ‘putting theory into practice’ to identify commonalities in otherwise discrete studies of neoliberal environments. These commonalities are of interest to this literature review and are summarised in the table below.

Table 9: Commonalities found in the neoliberalism of nature (After Castree, 2011)

1.	There is often a large gap between neoliberal theory and practice
2.	Nature’s neoliberalisation often encounters social barriers
3.	Nature’s neoliberalisation often faces biophysical obstacles
4.	Nature’s neoliberalisation must be highly tailored to local social and biophysical circumstances in order to work
5.	Nature’s neoliberalisation tends to disadvantage the poor and the wider public
6.	Nature’s neoliberalisation can have positive environmental and social outcomes
7.	Nature’s neoliberalisation has not been successfully resisted by those who dispute it

¹¹ The remaining two are the use of market proxies in the residual government sector and the creation of self-sufficient individuals and communities

8.	The process and outcomes of nature's neoliberalisation are geographically constituted
9.	The theoretical insights of Marx, Polanyi and O'Connor are analytically useful

The environmental market literature agrees with the first commonality; there is often a large gap between theory and practice. Environmental markets follow a theoretical market structure model. We have seen Wunder's (2005) definition and the guidelines developed by Engel et al. (2008) heavily critiqued in the literature. This follows Castree's observation that actual existing neoliberalism deviates from the definition of neoliberalism. Section six in particular discussed these deviations; market expectations being over rated, particularly in terms of efficiency over traditional command and control approaches or generating new sources of income. It was shown that market forces only operate in exceptional circumstance, that low transaction costs are illusory and the Coasian model operates in a small number of cases. Regulations and institutions are retained in the market-based approach. The role of the state has continued to be vital; creating the regulator cap, facilitating market regulation, protecting property rights. The market has been shown to depend on both state and community governance.

The second commonality; 'nature's neoliberalisation often encounters social barriers' has been clearly born out in the literature. The critique of biodiversity offsets (section 6.3.) provided an example of the reformist (or critical realist) approach vs the radical (or social constructivism) view. The social constructivism pole identified by Redclift (2009) views the human relationship with nature changing according to the problem-definition and solution-devising dynamics. The 'trying to sell nature in order to save it' school contends a market-based approach does not address the causes of degradation, instead the commodification of nature is exacerbating ecological problems and contributing to inequities and social injustices. As globalisation expands the depth and breadth of capitalism nature is subsumed to capitalist accumulation. This was reflected in research from scholars such as (Büscher, 2012) in South Africa, (McElwee, 2012) in Vietnam and (McAfee & Shapiro, 2010) in Mexico.

The path dependency set by a single exchange value embedded in the ecosystem service framework and valuation techniques is contested, taking the view that 'pricing the environment is not the same as valuing it'. Through this lens GHG offsets are a right to pollute and biodiversity offsets are the right to destroy. In themselves they do not improve the ecological conditions; at best it remains neutral, in reality the ecological condition is further impaired given temporal and spatial considerations. Critiquing PES in section 6.4. Alternative discourses, the literature identified social injustice and equity issues arising from PES schemes in Latin America. The suggestion of 'carbon colonisation of the global south', poverty alleviation considerations and social justice concerns were revealed. Where market-based approaches were implemented, the literature critiqued issues such as 'crowding out' (the erosion of motivation), 'commodity fetishism' (the productive origins of commodities frequently forgotten) or the simplicity of the stock flow model blinding scholars to the true complexity of ecosystem services and political context. Castree's observation that those who suffer as a result of neoliberalism have been able to halt its progress is borne out (commonality eight) with the rare example such as (McAfee & Shapiro, 2010) changing the design to reflect the aspirations of a social movement in Mexico.

The third commonality; biophysical barriers, moves into the realm of the critical realist in market-based approaches, where biophysical and technical issues exist but a green version of the capitalist market system is capable of reform to achieve positive outcomes. The biophysical barriers are the complexity and uncertainty associated with ecosystems which translate into technical aspects discussed in section 7.3. Ecosystem services are complex and compartmentalisation into discrete services for commodification is not straightforward. Consequently, environmental services are not fully defined while a clear-cut causal relationship between land management practice change and ecosystem service provision is rare. One risk of reducing complexity may be promotion of land management practices based on simplification or mistaken assumptions. The market may distort ecosystem function, favouring carbon sequestration over biodiversity, in turn increasing fire risk. The technical solutions to biophysical barriers results in trade-offs in design between objectives and practicality.

These social and biophysical issues lead to the fourth commonality; 'solutions must be highly tailored to local social and biophysical circumstances in order to work' while bringing in the eighth; 'the process and outcomes are geographically constituted'. The literature has shown that schemes frequently differ substantially from one another reflecting adaptation to different socio-economic, ecological and institutional solutions. The literature has recognised schemes operate in areas of highly complex ecological, social, cultural and economic interdependencies. The objective of the scheme brings moral judgement into the mix, dependent on blends of political decision making and social learning. These objectives entail trade-offs in economic efficiency, ecological effectiveness and social criteria. Contextual adaptation occurs so while the market structure may be the theoretical design, the geopolitical context hybridises or complicates the use of the MBI so that they no longer fit the neat typologies predicted (Hackett, 2015). Institutional blending of state and community governance amalgamates to combine in novel ways to address environmental problems at a variety of scales (Higgins et al., 2014).



Figure 10: Diagram conceptualising some of Castree's commonalities

These commonalities lay out the foundations, with subsequent commonalities a function of this foundation. Perhaps the relationships between Castree's commonalities applied to environmental markets may be shown more clearly conceptually.

The alternative framework suggested by Muradian's ecological approach explicitly addresses the gap between theory and practice through the aspect of tailored solutions (Muradian et al., 2010; Muradian & Rival, 2012a, 2012b). Specifically, a more inclusive and reflective dialogue between scholars and practitioners is sought, recognising the gap to ensure the design takes into consideration the ecological, institutional and social components. The approach recognises that a market-based approach uses political tools embedded in complex institutional and ecological contexts. The focus is on incentives to change land management practice change, focusing on ecological, institutional and social aspects to address social justice and equity issues which are recognised as a trade-off with ecological outcomes. Likewise, Tacconi addresses changes to the design principles of PES in ecosystem conservation and rural development (Tacconi, 2012). Focusing on a refined definition of PES, Tacconi attempts to cut through the ecological and environmental economic schools division. The objective is the definition would aid the design resulting in improved social equity issues.

The institutional theory and analysis framework of Vatn builds on the institutional cog in the diagram above (Vatn, 2010, 2015). Vatn seeks insight into institutional findings that will enable improved scheme performance. Vatn is concerned with the existing institutional arrangements and understanding how this is built into the design of schemes. In particular, he identifies considerations such as the importance of building trust, building on state and community

governance, how to decrease transaction costs and the role of intermediaries. Vatn uses institutional theory to explore moral issues such as 'crowding out' and the knowledge and power of intermediaries as well as social justice issues when the institutional framework changes as a result of a schemes implementation.

The classification based framework of Pirard and Lapeyre (2014) is a response to a lack of a common theoretical framework. Operating within the 'gap between theory and practice' cog the authors aim to narrow this gap. This they argue would make strong evidence-based policy recommendations possible. They also suggest that a stronger classification of market-based approach would dispel some of the market rhetoric and misconceptions allowing a more constructive conversation on the moral use of the market-based approach.

The role and reach of markets framework moves the debate back to the political and institutional cog (Gómez-Baggethun & Muradian, 2015). Perhaps most importantly, this lens recognises that technical issues are only guiding criteria. The question is not how effectively ecology can be squeezed into a market-based approach, suggesting a technical solution is within reach. Instead the authors recognise it is a political dilemma and the discussion needs to move towards the institutional arrangements society want to adopt to secure sustainable environmental governance.

Exploring Castree's remaining commonality, that 'the theoretical insights of Marx, Polanyi and O'Connor are analytically useful' would appear to have only been used predominantly by scholars arguing against the use of environmental markets on moral grounds. Extending this discussion more broadly through searching the literature and applying the theory developed in Castree's second paper (Castree, 2010b) would be an analytically useful exercise.

9.0 ANALYSIS AND IMPLICATIONS

Two reasons were presented for undertaking this literature review into the drivers and trends in environmental markets and their implications for Australia. One reason was the need for a growing Indigenous land tenure and population to secure ecosystem service economic pathways as compensation for inaccessible traditional economic development opportunities. Bleaching events on the reef adjacent to CYP catchments over the course of this project has increased the importance of maintaining largely intact landscapes in eastern CYP. This intensifies the imperative of exploring potential ecosystem service market opportunities to maintain and restore the landscape. A second reason was the commencement of considerable government investment in water quality initiatives over the coming decade and the need to understand the opportunities market-based mechanisms may present. The opportunity may be attracting additional private finance and/or enhancing targeted investment that is effective, efficient and can be translated into social and ecological co-benefits. The emphasis on adaptive management built into the Reef 2050 Plan allows for experimentation and learning as Australia attempts to address the ecological crisis of the GBR. Consequently, anything this literature review can add to the debate is valuable for policy and practitioners alike.

The conundrum of comparatively simple and successful hot spot pollutant market-based opportunities vs opportunities in intact landscapes with high cultural and biodiversity values has been evident in this review. During the course of this project this conundrum has become more evident with the hot spot pollutant issues on the Burdekin and the Johnstone/Tully being addressed by Major Integrated Projects and the associated market-based Reef Credit initiative. Initiatives for ecosystem service markets in CYP catchments have received much less attention under the Reef 2050 Plan and Taskforce recommendations. Where action has been taken, such as the Queensland government purchase of Springvale station on CYP, the focus is again on a pollutant hotspot rather than socio-economic opportunities. This review attempts to inform this conundrum, highlighting appropriate responses through designing place-based solutions. Deciding which ecosystem services need prioritisation determines how incentives are designed and implemented. Put simply understanding the priorities determines which market-based systems get traction and which do not. Anything that this literature review can add to aid scholars and practitioners alike is relevant and critical.

This literature review has examined the current literature and market analysis to reach findings that are relevant to the NESP project (Project 2.3.3), wider initiatives within the GBR governance domain and to Australia's national market-based efforts. The theoretical findings and analysis of relevance to the GBR region and Australian are discussed below. Project implications were fed into the final project recommendations and published in 'Community-based evaluation, governance, and strategic planning for Indigenous Ecosystem Services in Eastern Cape York Peninsula'. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited (Barber et al., 2017).

9.1 Theoretical Analysis

A neoliberalism agenda has been directing the global economy and society for the last four decades. Since the 80s this paradigm has been responsible for encouraging deregulation within economies, opening national markets to trade and capital, and urging the retreat of the state while shrinking government through austerity or privatisation. Post the Global Financial

Crisis market appeal is fading in some arenas and the term has moved beyond pro-market policies and taken on a political connotation of recrimination by the left of the right. Looking beyond this, the neoliberal discourse provides a lens with which to retrospectively view the evolution of the environmental markets. Understanding the wider socio-economic trends and trajectories and viewing the analysis and critique of environmental markets through this lens may enable a clearer understanding of the difference between discourse and practice and enable better theoretical learnings.

Application of the neoliberal concept to create environmental markets from the work of Coase has formed an enduring backdrop. Discussion has tended to focus the extent to which the Coasean approach has held in theory and practice. As observed by Tacconi (2012), those in the environmental economic school have a tendency to overly stress their reliance on the Coase Theorem, compounded by the ecological economist school overemphasising this reliance. Wunder summarises this with some frustration.

Obviously, once a convenient straw man of PES has been built, one can scorn it and shoot it down – in some cases apparently again and again. But to the extent that the straw man consistently diverges from the original, the criticism risks looking like a rebellion without a cause (2013, p. 235).

Using the lens of neoliberalism, the free market is a human invention promoted by the language of the commodity markets; that of completion, perfect information and rational behaviour. Prices are a means of allocating scarce resources efficiently, according to wants and needs, governed by supply and demand. Conceptually, market forces operate spontaneously given the state provides a fixed neutral legal and regulatory framework. The epistemological claim is that the market has a way of knowing that exceeds the capacity of any individual mind. The extent to which it is appropriate to consider the environment a commodity and treat it in a market manner has led to debates ranging from moral and ethical arguments to practical and technical difficulties. One of the clearest findings of this review is how rarely market-like schemes emerge.

Literature in this review has shown two contrasting schools. One in which the social constructivism is the political discourse generated by the use of market mechanisms in arenas considered inappropriate. The other gives reality to the tools and models that have evolved with ecological economics considering how they can be used in a more equitable, efficient and ecologically sustainable manner. This school accepts that environmental markets are hybridised structures, embedded in political, economic and cultural contexts and values at the site of enactment. An emerging reality is that while the market structure has been used as a theoretical model to guide design, the geopolitical context hybridises or complicates the market-based approach such that the environmental markets that have emerged no longer fit into the neat typologies that the literature once theorised, requiring more complex typologies as advocated by Pirard and Lapeyre (2014).

The global neoliberal trend may be responsible for the over emphasis in the literature of the extent and role of 'markets' in the policy tools that have arisen since the 80s. The literature has shown consistently that market expectations are overrated. Few cases of prices and competition operating freely have surfaced and the importance of state led regulation and institutions has continued or grown. This has resulted in the emergence of intermediary

governance arrangements that fall between hierarchies and markets. The term *hybrid governance* is prevalent in the literature and it would be constructive to compare with the literature of polycentric, adaptive and collaborative governance scholars.

Inconsistency of terminology is apparent, in particular papers critiquing PES which on closer reading includes schemes which are actually MES. This makes analysis both confusing and difficult. Calls from scholars such as Pirard, Lapeyre, Muradian and Gómez for more precise terminology could aid future discourse and analysis resulting in more robust policy recommendations. The resistance to more precise terminology may once more be viewed through the lens of neoliberalism. The political expediency of repackaging tools in terminology that is in vogue to enable policy acceptance was noted particularly in Latin America. The alternative discourses have shown that in practice, PES are frequently political constructs designed to alleviate poverty or implement subsidies with social justice outcomes. The MBI packaging allows side-stepping of socio-political and institutional pressures by masquerading as markets. These masquerades have led to political pushback by the 'global south'. Ironically much of the criticism of commodification of ecosystem services concerns PES policies, programs and projects where the market component is weakest or non-existent. While true markets such as carbon or water trading, where commodification is highest, face less criticism.

Moving beyond neoliberalism, while commodification and markets are human constructs they are also the constructs that operate in society and allow decision making. This paper takes the view from Farley and Costanza (2010, p. 2060) that "ecosystem services are essential, non-substitutable and poorly understood, and that there are real costs for their provision and protection. Someone must pay these costs." As the authors point out, few economists suggest that voluntary payments are used for common good services such as fire departments or national defence. On the commodification of nature debate this paper takes the stance in line with Kumar et al. (2013) that "the losses from not taking better account of the economic values of nature are more threatening than the damage possibly done attaching a value to ecosystem services which can be perceived as invaluable" (Kumar et al., 2013, p. 79).

9.2 Australian Implications

The literature has shown that debates concern the nature and typology of environmental markets alongside the conditions required to be effective and their social implications. These debates have been shown to be compounded by the analytical lens applied by different disciplines such as economists, ecologists and political scientists, considering the relative importance of criteria such as economic efficiency, environmental performance or social equity. It is clear that clarifying objectives are a vital preliminary step when designing any policy, program or project.

Australia's social conditions may be considered more polarised than in many other countries. While Australia is affluent by global standards, it contains areas of serious deprivation, particularly in Indigenous communities. Thus, social equity and development issues may be key objectives in areas of social and economic deprivation. Likewise, Australia is a continent characterised by contrasts between regions of high environmental values and severe environmental degradation. Multiple cumulative environmental threats from issues such as historic farming practices, invasive species, infrastructure development and climate change exacerbate this degradation. Thus, the environmental objectives of schemes may be

paramount in some places. Furthermore, on a continent as vast as Australia, economic efficiency through economies of landscape scale will always be important criteria. Thus, it may be considered that in Australia it is just as, if not more, important to consider the schemes' relative objectives and trade-offs in terms of social and cultural development, environmental performance or economic efficiency. These objectives inform the design of any scheme. The review has demonstrated some objectives and ecological characteristics lend themselves to discrete, precise schemes such as MES. Others with complex and fuzzy ecological criteria alongside social development and poverty alleviation objectives have followed a path of PES as exemplified in Latin America.

Well-functioning trading schemes are already established in Australia for point source pollutants such as the Hunter Salinity Trading Scheme for water quality or GHG emission abatement in the land sector. Australia holds a unique position recognising the land sector as an important source of carbon sequestration or emissions reduction through land management practice change. The CFI focuses on the ecosystem services of 'active sequestration of carbon through the growth of trees and other vegetation' and 'avoided emissions through the conservation of vegetative cover' (Table 1) or land management practices that reduce GHG emissions. The resulting market complies with Wunder's (2005) definition of voluntary and conditional transactions over well-defined ecosystem services between at least one supplier and one user. Engels' guidelines are followed through CFI methodologies which prescribe how the land based practice change is undertaken and how permanence is ensured, baselines constructed, additionality ensured, and monitoring, verification and reporting are addressed (Engel et al., 2008). The buyer of the GHG offsets generated is primarily the federal government through the ERF reverse auction process. The MES that results from the trade in the offsets generated is driven by a reverse auction process with the government effectively the single buyer. This approach sits most comfortably in the environmental economics' school. It would be instructive to examine the range of activities and participants that are undertaking carbon farming projects and apply the governance criteria discussed in section seven. While the environmental economics' approach may sit well with, say, methane emissions reductions from piggeries, it would be instructive to analyse if more complex activities such as savanna burning might benefit from a more ecological economic approach. This is exemplified by the current discussion of standards to recognise social co-benefits within savanna burning projects undertaken by ranger programs.

The ecological school contends that the market-based approach is designed to relieve the tension between economic development, biodiversity conservation and Indigenous culture over the productive use of an ecosystem's services or function. The Australian Government has not chosen to explicitly take the PES path to achieve social and cultural development or relieve poverty. However, viewing the federally funded ranger program for Indigenous Protected Area (IPA), management through the PES lens might find parallels and the alternative discourses discussed in section six may have relevance.

The ecological approach recognises the complex social, cultural and economic interdependencies within the ecosystem service, supply and demand stakeholders. Understanding these interdependencies and the linkages between the various stakeholders has been shown to be of paramount importance. The normative and technical aspects or coordination are now well described and discussed in the literature providing the foundations of what a healthy governance system needs to incorporate. The normative distribution of rights

and the rules may be particularly pertinent to northern Australia, where native title rights, Indigenous Land Use Agreements, the growing number of IPAs alongside uncertain or new carbon property rights result in a dynamic arena. Sellers may be new to a market-based approach making the role of intermediaries both particularly pertinent and powerful. Intermediaries, such as international NGOs, may be experienced bridge builders acting in a neutral and professional way to facilitate a market-based approach. However, other intermediaries may be new to the arena themselves and have their own knowledge, skills and governance issues, opening up the potential for Vatn's fears of commercial exploitation. Adaptive governance will be particularly pertinent in developing a market-based approach to both new social and ecological arenas. It may be particularly relevant in the 'commodification' versus 'risks of reducing complexity' nexus as monitoring and verification informs land practice changes. Market-based approaches to cultural activities may create value conflicts when payment is received for a good that is seen as shaping cultural activities. Incorporating these activities into a project-based structure may shift decision making from the community to project implementers and brokers and other equity issues identified by authors such as Osborne (2015). The governance of incentives and payments may potentially be a new challenge for communities. Examination of trade-offs between ecosystem services needs to be viewed in the light of the Australian landscape with its propensity for fire risk and unique biodiversity.

Australia's rich Natural Resource Management (NRM) legacy and deep research and development sector archives may have positive implications for the cost and availability of data. Likewise, existing institutions such as NRM bodies and ranger groups may assist in Vatn's advice to build on existing institutions to build trust and capacity. The strengthening of community and state governance to strengthen the market component may be particularly relevant in Australia with strong Indigenous and NRM communities. Critical criteria for a healthy governance system were identified in Section 7 and included attention to the right set of tools (rules and instruments) to multiple governance layers. This has resonance for Australia with a lead in operating NRM at a catchment scale through its NRM bodies. Polycentric governance is thus well advanced compared to some countries which took longer to recognise the value of addressing environmental issues regionally. The literature emphasises the need for federal government to engage with other social actors to ensure effective performance arrangements. Recognition of complexity and the risks of reducing complexity through transaction cost considerations or cognitive challenges is a clear issue when designing market-based approaches. This emphasises the need to learn from past models and data collection, constantly refining and adaptively governing the market-based approach.

The Australian scholars and practitioners of market-based approaches are in a relatively immature environment when set against MES initiatives in the US and Europe or the PES schemes set up in the 1990s in Latin America. Consequently, the alternative frameworks set out by Muradian, Vatn, Pirard, Tacconi and Gómez-Baggethun could each inform Australian initiatives, aiding scholars and practitioners alike. The ecological approach focuses on developing local and regional institutional frameworks that can cope with complexity and diversity, and integrates schemes within existing regimes of rural development and other policy instruments. Institutional analysis enables an understanding of these existing regimes and the value of strengthening existing governance to enable the market component particularly through trust and cooperation. A classification approach embedding accurate terminology would enable more robust discussion, conclusions and associated policy recommendations.

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