Restoring mangrove forests in Indonesia's Tanjung Panjang area through the use of market-based incentives: Lessons learned from international case studies

by

Jeremy Corbin

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Author: Jeremy Corbin

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Abstract

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Indonesia's Tanjung Panjang area has experienced an unprecedented loss of mangrove habitat over the past few decades, due largely to illegal aquaculture practices know as *tambak* farming. This is of particular concern as the communities surrounding this area depend on the many ecosystem services provided by mangroves. Despite strong efforts by Indonesia's Ministry of Forestry to stop *tambak* farming and return Tanjung Panjang's mangrove habitat to its pristine state, mangrove deforestation due to *tambak* farming continues to be a major problem. Many studies have investigated the role of market-based incentive (MBI) programs in achieving both environmental and social benefits; however, few focused on the conservation of coastal environments. As such, a market-based solution known as the Rehabilitating Blue Carbon Habitats (RBCH) program has been proposed for the Tanjung Panjang site. The present study evaluates the suitability of an MBI program in Tanjung Panjang and aims to strengthen the ongoing development of the RBCH program by addressing several key unknowns. Through a critical review of 28 international MBI programs, this study finds that a modified payment for ecosystem services agreement, coupled with funding from government, private companies/intermediaries, and donor agencies, and a community-based payment distribution model, is the most suitable approach to market-based environmental management in Tanjung Panjang. Above all, the present study demonstrates that the success of any MBI program is highly context specific and often requires a combination of one or more finance mechanisms, investor groups, and payment distribution models. The results from the present case study analysis provide valuable insight for coastal managers, government, NGOs, and all those involved in the development of the RBCH program, and may also serve as guidance for the development of MBI programs elsewhere.

Keywords: market-based incentive, finance mechanism, payment distribution model, investor, PES, REDD+, environmental tax, payment for ecosystem services, blue carbon, mangrove forest, Indonesia, Tanjung Panjang.

List of Defined Terms and Acronyms

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CHAPTER 1: INTRODUCTION

1.1 The Climate Crisis and International Climate Change Policy

With the acknowledgement of global climate change in recent decades, the international community of governments and scientific researchers have recognized the need to curb our increasing level of greenhouse gas (GHG) emissions (Boer, Flato & Ramsden, 2000; IPCC, 2007; Marland, Boden, Andres, Brenkert & Johnston, 2003; Soloman, Plattner, Knutti & Friedlingstein, 2009). For many years, it was commonly believed that the only way to mitigate the climate change crisis was for countries to impose national restrictions on large corporations, forcing them to reduce their GHG emissions. Although strategies involving emission mitigation are common, scientists and policy makers have recently recognized the potential of emission offsetting projects as a tool for managing climate change and for providing a source of sustainable livelihood. These emission offsetting projects work whereby some form of environmental stewardship results in the direct uptake of GHGs in order to compensate for emissions that were released elsewhere (Chomitz, 2000) – very often as a result of industrial activity (Allwood, Cullen & Milford, 2010). It was from the formation of emission offsetting projects, combined with elements of economic theory, that an alternative market-based approach to reducing atmospheric GHGs has emerged (Gilbertson & Reyes, 2009).

In 1997, the Kyoto Protocol was set forth during the third Conference of the Parties (COP 3) meeting of the United Nations Framework Convention on Climate Change (UNFCCC) to reduce the level of GHGs emitted by industrialized countries by 5% relative to 1990 levels. To meet their emission reduction targets, the Protocol provided three subsequent ‘Flexibility

Mechanisms' aimed at facilitating the transition to lower emissions. The first of these mechanisms, known as Emissions Trading, allowed corporations to sell emission permits in the event that they exceeded their emission reduction targets, or buy emission permits from other corporations in the event that they did not meet these targets. The remaining two mechanisms, Joint Implementation and the Clean Development Mechanism, allowed corporations to account for a portion of their emissions by investing in sustainable emission offsetting projects in industrialized and developing countries, respectively (Sada, 2007).

In 2005, a promising new carbon offset initiative known as REDD+ (reducing emissions from deforestation and forest degradation) was proposed under the Kyoto Protocol's Clean Development Mechanism (CDM) (Murray & Vegh, 2012). REDD+ recognized the importance of maintaining healthy forest ecosystems for combating climate change. It works by compensating those developing countries that reduce deforestation and/or other activities responsible for forest degradation. Funding for REDD+ projects is typically derived from the carbon market whereby industrialized countries purchase carbon offsets, or 'carbon credits', from developing countries that practice sustainable forest management (Murray & Vegh, 2012). REDD+ projects not only represent a cost effective means of reducing greenhouse gases associated with deforestation, but also promote economic sustainability and the conservation of natural forest ecosystems. Projects approved under the REDD+ scheme have traditionally focused on conserving inland forests (Murray & Vegh, 2012). However, given their ability to capture and store higher levels of carbon dioxide (CO_2), coastal vegetation – mangrove forests in particular – represents an appropriate transition into the marine environment for carbon-based finance mechanisms such as REDD+.

Payment for ecosystem services (PES) represents another finance mechanism with the potential to promote the conservation of coastal wetlands. The PES concept gained momentum after the 1992 United Nations Convention of Biological Diversity (UNCBD) as a means of conserving healthy ecosystems (Wunder, 2005). PES projects recognize the value of ecosystem services[1] (*e.g.* a wetland's ability to filter water or a forest's ability to slow climate change by sequestering CO_2) by providing economic incentive to individuals or communities that make a conscious effort to maintain these services through conservation (Bracer, Waage & Inbar, 2008). Wunder (2005) provided one of the most widely accepted definitions of what constitutes a PES project. He defines a PES project as one where a voluntary transaction is made between a minimum of one service buyer and a minimum of one service provider, if and only if the provider secures the provision of the ecosystem service in question.

The PES mechanism has been plagued by a number of major challenges, namely an inability to accurately quantify ecosystem services, linking payments to desired outcomes, and providing sufficient compensation for environmental stewardship (Fisher et al., 2008). Still, this mechanism has had many notable successes. One particular example is Costa Rica's PSA (Pago por Servicios Ambientales) program which focuses primarily on preserving water quality, but has also had some progress improving biodiversity and carbon sequestration potential of tropical rainforests (Redondo-Brenes & Welsh, 2006). This program has been partly credited for helping Costa Rica achieve a net reduction in deforestation by the early 2000s (Pagiola, 2008). Like

[1] Ecosystem service can be defined as an ecosystem function that provides explicit benefit to humans (Egoh, 2007).

REDD+ initiatives, many PES projects have in the past focused on conserving terrestrial environments and corresponding ecosystem services.

Though not directly linked to the use of market-based incentives, another environmental management tool that has gained widespread acceptance over the past few decades and certainly merits an introduction is integrated coastal zone management (ICZM). This concept was first introduced in the US Federal Coastal Management Act of 1972 and can be defined as:

"a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones...[which] *uses the informed participation and cooperation of all stakeholders to assess the societal goals in a given coastal area, and to take actions towards meeting these objectives. ICZM seeks, over the long-term, to balance environmental, economic, social, cultural and recreational objectives, all within the limits set by natural dynamics"* (European Commission, 2000).

ICZM has been especially important in managing coastal resource in light of the present climate change (Misdorp, 2011) and, in theory, provides a much more holistic and adaptive approach to managing coastal resources. Although ICZM is not the direct focus of this study, it is important to note as a unique and highly useful tool in the field of coastal management.

1.2 The Management Problem

The coastal environment plays a significant role in the sequestration and long-term storage of atmospheric CO_2. It also provide a number of additional ecosystem services, such as water purification, shoreline stabilization and protection, and important fishery habitat, among others (Climate Focus, 2011). As the global human population continues to rise, cities expand and coastal populations grow, placing the ecosystem services provided by coastal vegetation under serious stress. As a result, it has been estimated that these coastal habitats are being lost at a rate of 0.7% and 2% each year (Murray, Pendleton, Jenkins & Sifleet, 2011).

Mangrove forests, in particular, have been facing unprecedented destruction in recent decades and have been disappearing at an alarming rate (Valiela, Bowen & York, 2001). Globally, upwards of 35% of mangrove habitat has been lost since the 1980s, and it has been estimated that mangroves continue to disappear at a rate of 1-2% annually (FAO, 2007; Valiela et al., 2001). Luther and Greenberg (2009) estimated that a minimum of 40% of the animal species that inhabit mangrove ecosystems and have been evaluated by the International Union for Conservation of Nature (IUCN) are at an elevated risk of extinction due to the loss of mangrove habitat. Mangrove habitat loss often results from over-exploitation for fuel wood, charcoal and timber production, development of land to accommodate aquaculture/agriculture, urban development, and pollution (Cheevaporn & Menasveta, 2003; Valiela et al., 2001). Naito and Traesupap (2006) suggested that unless the value of mangroves is acknowledged and significant attempts are made to conserve these habitats, deforestation rates will continue to increase with coastal population growth.

The impacts of mangrove destruction are already quite apparent, especially in a number of low-lying tropical and sub-tropical nations (Granek & Ruttenberg, 2007; Misdorp, 2011). A classic example of the protective capacity of mangrove forests became apparent after the 26th of December 2004 tsunami, which devastated a number of Asian and African countries. Several studies conducted after this disaster concluded that areas with coastal tree vegetation, which in this area was predominantly mangrove forests, were markedly less damaged than areas without (Dahdouh-Guebas et al., 2005; Danielsen et al., 2005; Kathiresan & Rajendran, 2005).

Kathiresan and Rajendran (2005) recommended that in areas that are vulnerable to extreme climatic events, human development should not be encouraged closer than one kilometer from the coastline and that a dense mangrove forest buffer should be left for coastal protection.

Indonesia is another coastal nation with a high vulnerability to the impacts of climate change that has, in recent years, recognized its own dependence on mangrove forests and corresponding services. Despite this, Indonesia has experienced an unparalleled level of mangrove deforestation and has lost an estimated 1.586 million ha (46.7%) of its mangrove forests over the past 30 years - primarily through logging and shrimp aquaculture (Wilkie, Fortuna & Souksavat, 2002)[2]. In particular, the Tanjung Panjang area of Gorontalo Province, Sulawesi, Indonesia, has shown a heavy reliance on mangrove forests for coastal protection as well as for sustenance and livelihood (Cameron, 2013a). Despite a government-issued moratorium on mangrove deforestation in Tanjung Panjang and the designation of this area as a protected nature reserve, this area's mangrove forest continues to be degraded by unsustainable aquaculture practices. Moreover, there has been little cooperation from aquaculture operators in this area with regard to slowing mangrove deforestation or improving the sustainability of aquaculture practices. Recent attempts to conserve Tanjung Panjang's mangrove forests have shifted focus to the use of a market-based strategy. An initiative known as the Rehabilitating Blue Carbon Habitats (RBCH) program is currently undergoing preliminary planning and aims to restore this area's mangrove habitat by incentivizing conservation efforts and providing alternative conservation-based livelihoods.

[2] Indonesia had an estimated 4,254 million ha in total mangrove coverage in 1980, which has declined to an estimated 2,268 million ha (a loss of 1.586 million ha) by 2010 - assuming that the average rate of loss recorded between 1980 and 2000 remained constant for the following decade (2000-2010) (Wilkie, Fortuna & Souksavat, 2002).

1.3 Research Objectives and Outline

A market-based incentive (MBI)[3] approach based on carbon sequestration and other ecosystem services offered by mangrove forests may provide the financial incentive needed for the long-term conservation of Tanjung Panjang's mangrove forests. Still, there exists several unknowns concerning the development of a successful MBI program in Tanjung Panjang, namely, under which finance mechanism it will operate, what or who will be its main source of revenue, and how will it redistribute that revenue within communities to ensure maximum socio-economic benefit. Answering these unknowns is of great importance to the success of MBI programs (Waage et al., 2008) and will surely prove critical to the success of Tanjung Panjang's RBCH program.

The objectives of this project are to firstly investigate the current role of market-based incentive programs in funding environmental conservation initiatives that support sustainable employment alternatives for communities with historically resource exploitation-based livelihoods, and secondly, to identify the most appropriate model for generating and distributing funds to the communities surrounding the Indonesia's Tanjung Panjang area. The following four questions will guide this research:

(1) What finance mechanisms presently exist that can be used to promote the conservation of mangrove forest while providing sustainable livelihood opportunities for communities?

(2) What type of investors are typically involved in financing market-based incentive programs?

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[3] In the present study, the term 'market-based incentive' will be used to describe something that motivates or encourages a desired behavior through the provision of monetary compensation. This term will most often be used with regard to a program or project that uses market-based incentives to achieve environmental goals.

(3) What payment distribution models are presently utilized to guide the transfer of payments from market-based incentive programs to communities?

(4) How can these findings be used to inform the development of a successful market-based incentive program in Tanjung Panjang, Indonesia?

The present study represents a descriptive and interdisciplinary analysis combining elements from management, science, policy, economic theory, and law. Through an extensive review of the literature combined with the use of qualitative analytical tools, each subsequent chapter will address the preceding research questions in the order outlined above. Chapter 2 will demonstrate a wider appreciation for mangrove forests and blue carbon, as well as the present state of mangrove forest management in Indonesia and, more specifically, the case study site of Tanjung Panjang. Chapters 3 and 4 will address research questions 1, then 2 - 3, respectively, wherein each of these chapters will consist of a thorough description of the research question(s) and surrounding literature, the analytical approach used to address the question(s), the results obtained along with subsequent deliberation, and a summary of the findings. Chapter 5 will use the findings from the preceding chapters to form recommendations and/or guidelines for developing a successful market-based incentive program – including the most appropriate finance mechanism(s), investor(s) and payment distribution model(s) for the Tanjung Panjang context. Finally, Chapter 6 will conclude with a summary of this project's findings and a discussion of their broader implications. Figure 1 illustrates the present study's research design.

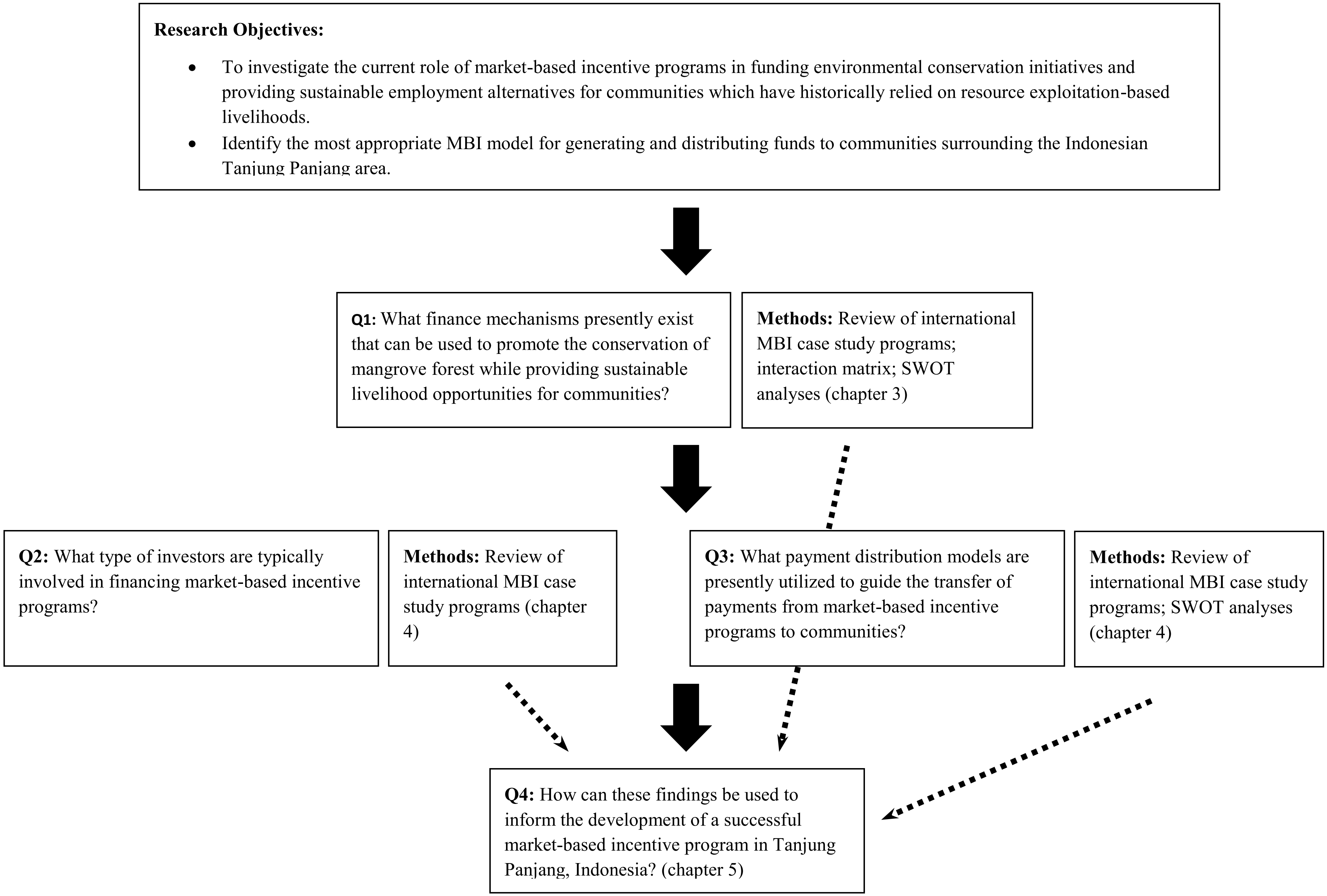

Figure 1: diagram illustrating the research design of the present study. The solid arrow indicates the order by which the research questions are addressed; the dotted arrow indicates that the results from research questions 1-3 will be used to answer research question 4.

CHAPTER 2: MANGROVES, BLUE CARBON, AND INDONESIA

2.1 Preface

This chapter is divided into three main sections and provides background information on 1) the ecology of mangrove forests, including discussion on their biology, geographic extent, and the ecosystem services that they provide, 2) the ‘blue carbon’ concept, drawing connections to GHG emissions and international climate change policy, and 3) the Indonesian context, namely its geographic location, mangrove forest coverage, and climate change status, as well as an overview of the Tanjung Panjang case study.

2.2 Mangrove Forests

Mangroves can be described as a type of tree, shrub, palm or ground fern that grows above the mean water level in the intertidal zone of marine, coastal, or estuarine environments (Lutz, 2011). They cover an estimated 15.2 million hectares (ha) of land in 123 countries and territories (FAO, 2007) and can typically be found along coastlines between latitudes 30°N and 30°S (Spalding, Blasco & Field, 1997). Mangroves have evolved a number of distinct physiological adaptations that allow them to survive in environments characterized by highly variable and sometimes extreme external conditions. Many of these adaptations centre around their ability to persist in a highly saline environment. Some species are able to absorb water despite strong osmotic pressures created by varying ion concentrations; others are able to take up salts, but excrete them through glands in their leaves; others are able to transfer and store salt in their bark; still, others are able to regulate their water consumptions so as not to consume a lethal level of salt. Additional morphological specializations include a complex lateral root system that anchors the trees in the loose sediment, exposed aerial roots for gas exchange, and viviparous water-dispersed seeds (Kathiresan & Bingham, 2001).

Mangrove forests have been acknowledged as one of the most productive ecosystems on the planet (Bhatt & Kathiresan, 2012; Chmura et al., 2003) with a net primary productivity of up to 26 tons (t) biomass per hectare (ha^{-1}) per year (yr^{-1}) (Komiyama, Ong & Poungparn, 2008). They very often consist of a multi-species forest, with a dense, complex forest canopy, which lies over top of a nearly indistinguishable network of trunk and root networks - the latter of which is known for storing a large portion of the mangrove's biomass (Kauffman & Donato, 2012). Mangroves typically grow in muddy or sandy anoxic sediments and often host a variety of epibenthic, infaunal, and meiofaunal invertebrates (Ellison & Farnsworth, 1990; Gee & Somerfield, 1997; Schrijvers, Camargo, Pratiwi & Vincx, 1998). A mangrove's root system often supports communities of phytoplankton, zooplankton, (Kathiresan & Bingham, 2001) and provides habitat for many juvenile coral reef and pelagic fishes (Dorenbosch, Van Riel, Nagelkerken & Van der Velde, 2004; Nagelkerken et al., 2000). Additionally, a high number of insects, crustaceans, reptiles, amphibians, birds, and mammals live throughout mangrove root networks and canopies, contributing to the unique biodiversity of these habitats (Kathiresan & Bingham, 2001).

Mangrove forests provide a wide range of ecosystem services (Kathiresan & Bingham, 2001), which have an estimated global worth of US$161 billion annually (Martínez, Intralawan, Vázquez, Pérez-Maqueo, Sutton & Landgrave, 2007). Foremost is their unique ability to store large quantities of CO_2 in the form of organic carbon (C) for long periods, both within their biomass and in the sediments in which they grow. Donato et al. (2011) estimate that high productivity tropical mangrove forests store an average of 1020 tons of organic carbon per hectare ($tC\ ha^{-1}$), equivalent to 3,754 $tCO_2\ ha^{-1}$. This compares to coastal salt marshes and seagrasses which store 362 to 2,012 $tCO_2\ ha^{-1}$ (Chmura et al. 2003) and 66 to 1,478 $tCO_2\ ha^{-1}$ (Mateo et al., 1997; Vichkovitten & Holmer, 2005), respectively. Furthermore, this compares to tropical rainforests which store an average of 377 $tC\ ha^{-1}$ (Cummings, Boone Kauffman, Perry, & Flint Hughes, 2002) (measurements represent the total aboveground measurements for dense tropical rainforests). The capacity of mangrove forests for carbon sequestration is similar to that of terrestrial forests despite the global area of mangrove forests coverage being one to two orders of magnitude less than that of terrestrial forests (Mcleod et al., 2011). This is a result of high rates of primary productivity, high rates of net soil carbon capture, and low rates of soil respiration (Komiyama et al., 2008). In addition, mangrove forests are highly efficient sediment traps, capturing suspended organic carbon during tidal fluctuations. Carbon in these sediments is stored indefinitely (Mcleod et al., 2011). Like peat soils, however, when mangroves are disturbed through deforestation and destruction, their high carbon sediment is exposed to the atmosphere resulting in decomposition and high rates of greenhouse gas emissions (Donato et al., 2011). Consequently, the capacity for carbon storage in these ecosystems diminishes and the organic carbon that was once contained in the sediment may contribute to a net increase in global greenhouse gas emissions. This is a particular concern as the sediment beneath mangrove forests is thought to store thousands of years' worth of carbon (Lutz, 2011).

Mangrove forests provide a number of additional ecosystem services for which they are valued highly as a tool for climate change mitigation. In particular, mangroves typically grow along the coastal fringe and act as a natural barrier between the marine and terrestrial environments. A study by Alongi (2008) showed that mangroves are able to reduce the impact of oncoming waves on the coastline by upwards of 90%. This is especially important given the expected increase in frequency and severity of extreme climate events that have been predicted to occur with the onset of climate change (Ali, 1996; Bender, et al., 2010). Additionally, mangroves typically give rise to extensive root systems which act to stabilize the sediment and help combat coastal erosion (Quarto, 2005). They have also shown to increase the resilience of coastal ecosystems to external pressures, such as climate change, by providing a unique and diverse habitat for a number of coastal species and supporting a high level of biodiversity (Bosire et al., 2008; Brander, 2007). In addition, mangroves offer a number of services that have shown to increase the wellbeing of coastal communities, such as providing a range of natural products (wood, honey, medicine), ecosystem activities (birding, kayaking, wildlife viewing), support for fisheries, and improved water quality through sediment filtration (Lutz, 2011).

2.3 Blue Carbon

The burning of fossil fuels has, over the past century, resulted in an unprecedented level of harmful, ozone depleting greenhouse gases being released into our atmosphere. This has resulted in a drastic change in the composition of our atmosphere; most notably, CO_2 levels have increased from 280 parts per million (ppm) during pre-industrial times to nearly 400 ppm today (Brewer, Hoffman, Silver, DiLeonardo, Henderson, & Vigil, 2012). While much of this CO_2 remains in the atmosphere, a significant portion of it gets absorbed into the marine environment and is used for an assortment of biological and geological processes (Smith, Hofmann & Mosby, 2013). It is this carbon that is absorbed into the marine environment that has recently become known as ‘blue carbon’ (Pendleton et al., 2012).

Blue carbon sinks differ from other carbon sinks in a number of distinct and important ways. Foremost is its distinction from carbon that is sequestered in the terrestrial environment. It has been estimated that about 55% of the carbon in the atmosphere that becomes sequestered into natural systems is cycled into the marine environment (Nellemann & Corcoran, 2009). More specifically, blue carbon most often refers to the carbon that is being sequestered in vegetative coastal environments such as salt marshes, seagrass beds, and mangrove forests. This latter distinction is particularly important because these environments are responsible for storing up to 70% of the carbon permanently stored in the marine environment (Nellemann & Corcoran, 2009). One final, yet highly important distinction between blue carbon sinks and 'green' or terrestrial-based carbon sinks is that the former represents a relatively untouched, but highly promising tool for mitigating the present climate change crisis (Laffoley & Grimsditch, 2009; Murray & Vegh, 2012). Despite the high potential of blue carbon stores for offsetting the recent rapid growth in GHG emission, most national and international climate change policies and strategies focuse predominantly on terrestrial carbon sinks (Murray & Vegh, 2012).

To date, REDD+ represents the closest tie between mangrove forests and the development of a carbon mitigation strategy for blue carbon. REDD+ was first introduced during the 2005 COP 11 meeting in Montreal as part of the UNFCCC regime to address the increasing level of GHG emission from deforestation and forest degradation. It was originally proposed as a method of promoting a reduction in deforestation and forest degradation through the provision of monetary incentives and was intended primarily for the conservation of tropical rainforests. However, with an increasing understanding of the role that mangroves play in offsetting carbon emissions, discussion regarding the inclusion of mangroves in the REDD+ scheme has begun. In 2011, the Clean Development Mechanism Executive Board[4] approved the first methods for afforestation

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[4] *"The CDM Executive Board supervises the Kyoto Protocol's Clean Development Mechanism under the authority and guidance of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP)"* (UNFCCC, n.d.).

and reforestation of degraded mangrove habitats (Murray & Vegh, 2012). Up until this point, only one other case of mangrove reforestation had been approved under the CDM, which had historically focused on avoided deforestation. A number of major challenges currently face the inclusion of mangrove forests into climate change management strategies. In particular, the costly and time consuming nature of measuring, reporting, and verifying (MRV) the capacity of mangroves as carbon stores – as is obligatory under Kyoto and subsequent mechanisms – presents a major obstacle (Murray & Vegh, 2012). Furthermore, there exists very little financial incentive to conserve mangrove habitat, especially in poor countries whose livelihoods are based predominately on resource exploitation. This problem is especially prevalent in Indonesia, where environmentally degrading livelihoods have led to the large-scale loss of mangrove habitat (Sukardjo, 2012).

2.4 Indonesia

2.4.1 Geographic context

Indonesia is an archipelagic nation consisting of more than 17, 500 islands and 81,000 kilometres (km) of coastline (Sukardjo, 2012). Indonesia's has the longest coastline of any country and, with an exclusive economic zone of 6.1 million km^2, claims right to an area of ocean more than three times its land area (Yusuf, 2010). Indonesia is home to more than 235 million inhabitants, most of which live in coastal regions. Although it is considered to have one of the fastest growing economies in Southeast Asia, many of Indonesia's inhabitants continue to face extreme poverty, particularly in its rural regions. According to a report by Yusuf (2010), poverty incidence in Indonesia was at 14.15% in March of 2010. That same report suggests that if a more decent $2 poverty line was considered as reference (*i.e.* one that would allow for a 'decent' standard of living), then the poverty incidence in Indonesia would be over 50%.

2.4.2 Climate change

Indonesia, like many nations located in Southeast Asia, is among the countries that are most at risk from the impacts of climate change. Yusuf (2010) explains that when discussing Indonesia in the context of climate change, one must consider four key issues: 1) Indonesia is among the most vulnerable to the impacts of climate change, 2) Indonesia is the third largest contributor of global GHG emissions, largely from deforestation and land use change, 3) Indonesia has the fourth largest population of any country and therefore has the potential to become among the largest carbon emitters from energy consumption, and 4) Indonesia continues to struggle economically.

A 2009 study by the Asian Development Bank concluded that all of Southeast Asia - Indonesia being the largest country - will lose approximately 6.7% of its GDP by 2100, three times what has been estimated as the global average. This may be in part due to the inevitable mass-scale relocation of a significant portion of this region's population. With such a large and densely populated coastline, Indonesia is particularly vulnerable to sea-level rise and coastal erosion. Dasgupta et al. (2007) estimated that a one-meter rise in sea level could displace as many as 10 million people in Indonesia.

According to a 2007 report from the Department of International Development and the World Bank, Indonesia is among the top three emitters of greenhouse gases in the world, emitting an estimated 3,014 million tons of carbon dioxide equivalent annually ($MtCO_2e$). In 2005, Indonesia contributed an estimated 5.9% to global emissions - more than any of the industrialized countries (Yusuf, 2010). About 23% (750 $MtCO_2e$) and 18% (580 $MtCO_2e$) of these emissions were derived from deforestation and the burning of peatland, respectively (Elson, 2011). Emissions from Indonesia's forestry sector may account for a total of 60% of its total emissions if land-use change practices are included (Boer et al., 2009). The conversion of tropical rainforest into palm oil plantations is also responsible for a significant portion of emissions in Indonesia. In 2005, Indonesia generated an estimated 1,459 $MtCO_2$ from land use change related activities, contributing about 27.1% of all land use change related emissions on the planet. Furthermore, deforestation in Indonesia is expected to worsen, owing to the government's plan for increasing pulp and palm oil production, the need to feed a growing population, and a generally increasing demand for wood products in construction and bioenergy (Yusuf, 2010). Given the high rate of mangrove loss in Indonesia as well as the high capacity of mangrove forests to sequester and store carbon, mangrove deforestation surely represents a considerable contributor to GHG emissions in Indonesia.

2.4.3 Mangrove deforestation

Before widespread coastal degradation had occurred, Indonesia was home to the highest mangrove coverage of any country at approximately 42,550 km^2 – almost 50% of all mangroves in Asia (Spalding et al., 1997). Moreover, Indonesia stakes claim to the highest mangrove diversity on the planet with 48 of all 73 known mangrove species being found in the Indo-Malaysia region (Duke, Ball & Ellison, 1998). Unfortunately, Indonesia's mangrove forests, not unlike its tropical rainforests, have been facing unprecedented destruction over the past few decades. In 1982, mangrove coverage in Indonesia was estimated at 4.25 million ha or 27% of all mangroves on the planet (DG of Fisheries, 1982 as cited by Sunaryanto, 2004). In 1987, just five years later, mangrove coverage was estimated at just 3.23 million ha (Sievius et al., 1987 as cited by Sunaryanto, 2004), and in 1993 only an estimated 2.49 million ha of mangroves remained (Giesen, 1993). Recent estimates suggested that Indonesia has lost upward of 50% of its original coverage of mangrove forests (Brown, 2009; Giesen, Wulffraat, Zieren & Scholten, 2007).

In many regions throughout Indonesia, the loss of mangroves is primarily in response to the development of brackish-water aquaculture ponds, otherwise known as *tambak* (Macintosh, Mahindapala, & Markopoulos, 2012; Sukardjo, 2002). In the early 1990s, the Indonesian government encouraged *tambak* development as it contributed to the much-needed economic growth experienced throughout the country. Since then, *tambak* have been developed extensively along Indonesia's coastline and, by 1993, covered an estimated 268,743 ha (Sukardjo, 2012). As this estimate is outdated, the current coverage of *tambak* in Indonesia is likely much greater.

Tambak farming provides much-needed economic support to coastal communities throughout Indonesia. Moreover, 'traditional' *tambak* practices are typically viewed as ecologically sustainable. Areas throughout East Java, Indonesia, have been operating *tambak* sustainably for several generations, owing in part a more integrated livelihood approach which involves *tambak* farming and mangrove forest silviculture (Davie & Sumardja, 1997). However, over the past few decades *tambak* farming has taken a more industrialized form and has become a less sustainable and more environmental degrading form practice.

In addition to the wide-spread loss of mangrove forests, the primary concerns of unsustainable *tambak* farming have been described as soil salinisation (Flaherty, Szuster & Miller, 2000), the depletion of wild fish stocks from excessive inputs of fish meal and fish oil in commercial shrimp feed (Naylor et al., 2000), biological pollution, eutrophication, and the dispersion of chemicals into the environment (Kautsky, Rönnbäck, Tedengren & Troell, 2000). Employment through unsustainable *tambak* farming is short-lived as *tambak* ponds typically have a lifespan of 5-10 years, after which a decreased water quality and an increased incidence of disease render the water unfit for aquaculture operations. Unusable *tambak* are then abandoned in favour of new ponds thus further degrading mangrove habitat (Van Lavieren et al., 2012). Consequently, *tambak* farming can be considered an unsustainable practice.

2.4.4 Acknowledging a problem

In 2008, the government of Indonesia promised to reduce national emissions by 26% or, with foreign assistance, 41% – with 14% of these emission reductions set to be achieved in the forestry sector alone (Brockhaus, Obidzinski, Dermawan, Laumonier & Luttrell, 2012; Wedhaswary, 2009). Indonesia has since demonstrated a serious commitment to fulfilling these emission reduction targets through a number of actions. In 2011, its government implemented a two-year moratorium on all deforestation with the intent of conserving its peatland and primary forests, and drastically reducing its emissions from this sector (Brockhaus et al., 2012). Furthermore, Indonesia has been maintaining a proactive role in the international negotiations on climate change, particularly those regarding the CDM and REDD+. Between 2008 and 2009, Indonesia became one of the first countries to develop a comprehensive legal framework to support REDD+ initiatives and issued three policies within this regard.[5] Since then, it has become one of the first countries to generate carbon credits under the Verified Carbon Standard (VCS) for saving rainforest and reducing GHG emissions from deforestation under the REDD+

[5] Laws include Ministry of Forestry Regulation No. P 68/Menhut-II/2008 on the Implementation of Demonstration Activities (DA) of Reducing Emissions from Deforestation and Forest Degradation, Ministry of Forestry Regulation No. P 30/Menhut- II/ 2009 on Mechanism of Reducing Emissions from Deforestation and Forest Degradation, and Ministry of Forestry Regulation No. P 36/Menhut-II/2009 on the Mechanism for Issuing Licenses for the Utilization of Sink and/or Carbon Storage in Production and Protected Forest.

scheme. Despite such a keen interest in sustainable forest management by the Indonesian government, many communities throughout Indonesia continue to face widespread mangrove deforestation.

2.4.5 Case study site

Tanjung Panjang is an alluvial, low-lying expanse of land located in Pohuwatu District, Gorontalo Province of Sulawesi, Indonesia (Figure 3). This region was originally comprised of more than 7,500 ha of pristine, diverse mangrove habitat with canopy heights reaching up to 30 meters – a forest which provided much in terms of natural resources to the local communities. Over the last 25 years, Tanjung Panjang has experienced a substantial influx of migrant workers from South Sulawesi who were attracted by government incentives to increase aquaculture, or *tambak*, production. For many years, *tambak* farming represented a significant source of income in Tanjung Panjang (Figure 2), but eventually lead to the loss of about two-thirds (5,000 ha) of this area's mangrove habitat. In 1995, as part of the Indonesian government's attempt to protect its coastal resources, the Tanjung Panjang site was designated a nature reserve. In 2011, when it became clear that the new nature reserve status was having little effect, the legislative body in Pohuwatu District enacted a local moratorium on the creation of new *tambak* and *tambak* farmers within the protected forest reserve were then asked to vacate. The Indonesian government has since committed to restoring Tanjung Panjang back to functioning mangrove ecosystems through reforestation and afforestation. However, despite all efforts, unsustainable *tambak* farming and deforestation of mangroves continues in Tanjung Panjang. A lack of sustainable livelihood alternatives in the region has been identified as a potential contributor to this problem.

A market-based incentive program may offer solution to this problem as it has the potential to provide alternative livelihood opportunities to *tambak* farmers, while slowing the overexploitation of the mangrove forests. Most recently, the Indonesian government has been engaging with a number of organizations local to Tanjung Panjang, as well as with researchers from Charles Darwin University's Research Institute for the Environment and Livelihoods (Australia), over the discussion of an MBI program in Tanjung Panjang known as the Rehabilitating Blue Carbon Habitats program. This program, though still in its developmental stages, aims to promote sustainable mangrove forest management through the provision of economic incentives and alternative livelihood opportunities.

Figure 2: Areal view of *tambak* ponds in Tanjung Panjang, Indonesia. Loss of mangroves has drastically increased this region's vulnerability to climate change via exposure to sea level rise, and decreased the availability of ecosystem services provided by mangroves. (Image source: Cameron, 2013a).

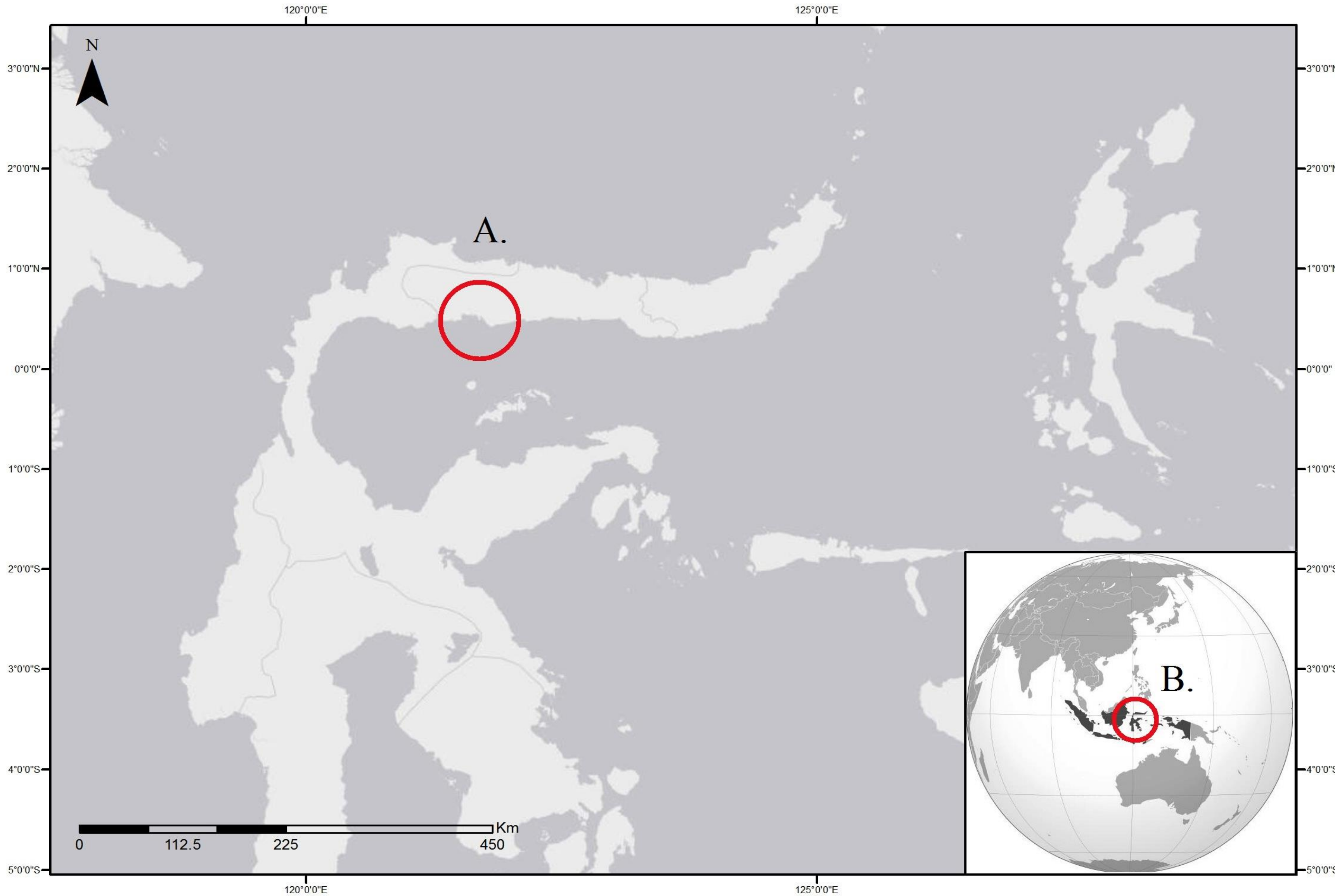

Figure 3: Map illustrating the geographic positioning of A) Tanjung Panjang, an alluvial, low-lying expanse of land located in the Gorontalo Province of B) Sulawesi, Indonesia.

The Tanjung Panjang area represents an ideal study site for the implementation of a MBI program centered around the conservation and rehabilitation of disturbed mangrove habitat. Foremost, this site originally consisted of a large expanse of mature, pristine mangrove forest that has in recent years succumbed to 'industrial scale' *tambak* farming. Here, because of a lack of livelihood opportunities, *tambak* aquaculture has been prominent and has resulted in the large scale destruction of much of this area's mangrove forests (Cameron, 2013a). Despite this, this site continues to give rise to about 2500 ha of pristine mangroves which continue to benefit surrounding communities through the provision of various ecosystem services and functions. These undisturbed mangroves provide an ideal baseline or reference area that could be used to quantify the net primary production (NPP) and carbon storage capacity of the area - a key requirement for REDD+ initiatives. Furthermore, there is a strong government commitment to restore this area back to a functioning mangrove ecosystem through reforestation and avoided deforestation. Also, the four communities surrounding Tanjung Panjang (Patuhu, Siduwonge, Palambane, and Limbula) and the local non-government organizations (NGOs) (Japesda, Blue Forests, Mangrove Action Project) have demonstrated a high level of community support and dedication to the recovery of mangrove habitat in this area (C. Cameron, personal communication, June 15, 2013). Developing strong community support will play an important role in ensuring ample participation in an MBI program in Tanjung Panjang. Lastly, as is common throughout much of Indonesia, land tenure in the Tanjung Panjang area is a highly complex issue (C. Cameron, personal communication, June 15, 2013). Migrant workers operate *tambak* ponds illegally on land owned by Indonesia's Ministry of Forestry and in some cases claim *de facto* property rights. This presents a serious issue for the development of an MBI program in Tanjung Panjang because strong property rights are often integral to a successful market-based approach (Swallow, Meinzen-Dick & Van Noordwijk, 2005). A list of key attributes of the Tanjung Panjang site for can be found in Table 1. These issues are likely to be representative of numerous coastal settlements across Indonesia.

Table 1: Key attributes of Tanjung Panjang, making it an ideal case study for the implementation of a market-based incentive program.

Attributes
Originally gave rise to large expanse of pristine mangrove forest
High reliance on the ecosystem services provided by mangrove forest
Exploitation seen here is typical of rest of Indonesia
Tambak and pristine forest adjacent to one another (ideal for data collection)
Land tenure in region is poorly defined, as is common throughout Indonesia
High level of community, NGO, and academic support
Strong government commitment to reforest National Reserve
Limited livelihood opportunities

2.5 Summary

Mangrove forests are increasingly being acknowledged as a tool for mitigating the impacts of climate change. Further, they provide a number of ecosystem services that have proven highly valuable for the sustenance and wellbeing of coastal communities, particularly those of developing countries. Most recently the notion of ‘blue carbon’ has sparked interest in the use of market-based incentive programs as a tool for conserving mangrove forests. This is apparent in Tanjung Panjang, Indonesia, where the Rehabilitating Blue Carbon Habitats program proposes to end environmentally degrading aquaculture practices and restore this areas natural pristine mangrove habitat through the use of a market-based approach. However, a number of uncertainties threaten the success of the RBCH program, namely, under which finance mechanism it will operate, what or who will be its main source of revenue, and how will it redistribute that revenue within communities surrounding Tanjung Panjang. The following chapter begins to address the first of these unknowns through a review of international MBI case study programs.

CHAPTER 3: IDENTIFYING AND ANALYZING FINANCE MECHANISMS

3.1 Overview

A number of finance mechanisms have shown potential for driving sustainable economic development through the provision of alternative conservation-based livelihood opportunities (Gordon et al., 2011; Gutman & Davidson, 2007). Many of these mechanisms, particularly PES and REDD+, have been the topic of extensive discussion and it has become apparent that different mechanisms may be better suited for particular contexts. For example, in some cases a supplementary tax on emissions may prove to be an effective method of targeting excessive polluters. However, it may be less effective or less ethical to implement this same tax in a marginalized community as its members may be physically unable to afford paying it. In another example, implementing an entrance fee to a national park or heritage site would in theory help to generate revenue which could be used towards further conservation efforts. However, implementing an entrance fee would unlikely have the same effect if for a non-pristine environment or one that was undergoing reclamation efforts as the public may be less willing to pay to see a degraded environment. As these two examples demonstrate, when selecting a finance mechanism for a particular MBI program, the context in which it will be implemented must be given consideration.

Given that most finance mechanism to date have focused largely on conserving inland ecosystems, identifying a finance mechanism that suits the unique characteristics of mangrove forests is also of great importance. The following chapter aims to address this study's first research question, namely, what finance mechanisms presently exist that can be used to promote the conservation of mangrove forests while providing sustainable livelihood opportunities? To address this research question, this chapter relies predominantly on a review of international MBI case study programs. Results from this analysis may provide insight into the identification of a suitable finance mechanism for the Tanjung Panjang context. The following section outlines the analytical approach adopted to address this central research question. Next, an overview the MBI case study programs as well as an evaluation of the identified finance mechanisms through the scope of multiple SWOT analysis occurs. This is followed by a brief summary of this chapter's findings. Discussion specific to the implementation of various finance mechanism in Tanjung Panjang can be found in Chapter 5.

3.2 Methods

This chapter relied predominantly on multiple SWOT (Strengths, Weaknesses, Opportunities and Threats) analyses to address its central research question. The SWOT analysis was chosen as an appropriate analytical tool for addressing the present research question for three main reasons. First, comparing finance mechanisms is not entirely unlike comparing business models, which is where SWOT analyses have traditionally been used (Wu, Tseng & Chiu, 2012). Second, the data collected to address the central research question was likely to be of a highly descriptive and qualitative nature. Third, SWOT has been used successfully in the past within the context of forest management (Hong & Chan, 2010).

A review of academic publications as well as government and non-government reports was conducted to identify various MBI case study programs that have been or are being implemented with the intent of environmental conservation. Special attention was given to studies that focused on forest conservation, particularly those cases involving ecosystem services that are also provided by mangrove forests, such as carbon sequestration, biodiversity, and hydrological services. Furthermore, cases in countries that shared political or socio-economic commonalities with Indonesia were also given special attention. It should be noted that article selection was non-random and as a result the present sample case studies are not necessarily representative of all MBI programs in existence.

Once finance mechanisms were identified, they were then assessed for their potential effectiveness or suitability given the Indonesian context as described in section 2.4.5. This was achieved using ten criteria, 1) capacity to provide sufficient/sustainable alternative income, 2) capacity to avoid environmental leakage[6] 3) ability to generate start-up funding, 4) promotes environmental sustainability, 5) promotes temporal sustainability (of MBI program), 6) promotes community engagement, 7) capacity to improve social conditions, 8) just distribution of benefits, 9) evidence of past success, and 10) accompanied by government support. It should be noted that, although government support may not always be critical to the success of MBI programs, it is especially important for the Tanjung Panjang case study given the heavy involvement of Indonesia's Ministry of Forestry in the restoration of this site. Furthermore, criteria were identified from the literature as characteristics of successful MBI programs and it was inferred that they would be equally pertinent for the Indonesian context. An interaction matrix was used to illustrate this evaluation, where row one (finance mechanisms) was evaluated against column one (criteria). An interaction was given a checkmark (√) and deemed positive if the finance mechanism were generally able to assist in achieving that particular criterion. Alternatively, the interaction was given an "x" and deemed negative if the finance mechanism was generally

[6] For the purpose of the present study, the term 'environmental leakage' is being used as a modification of the term 'carbon leakage', which is usually defined as the increase in emissions outside a region as a direct result of an attempt to reduce emission in that region (Reinaud, 2008). In this study, environmental leakage refers to the geographic transferal of any form of environmental degradation resulting directly from an attempt to conserve an environment or the ecosystem services within a particular area.

unable to achieve the criterion in question (Table 2). Once completed, the number of positive interactions was then determined for each finance mechanism and the three highest scoring finance mechanisms were then further evaluated using SWOT analyses. Information used for the following SWOT analyses was derived primarily from the MBI case study programs identified. Findings from this present analysis will provide a valuable reference for assessing the implementation of conservation-based finance mechanisms in Tanjung Panjang.

3.3 Results

A total of 28 different MBI case study programs were identified from 22 different countries (Figure 4), spanning in year of implementation from 1985 to 2008 (Table 2). From these case studies, five different finance mechanisms were identified: PES, REDD+, government and private sector-issued subsidies, or subsidy based programs, environmental tax programs, and community conservation programs. The majority of programs were implemented at the sub-national level and spanned in spatial scale of implementation from 115 ha with Indonesia's Bantam City mangrove reforestation/afforestation project to 14.5 million ha with the US Conservation Reserve Program.

Figure 4: Map illustrating the geographic positioning of all identified MBI case study programs as summarized in Table 2. A total of 28 programs were identified from 22 countries.

3.3.1 Finance mechanisms used by MBI case study programs

PES was identified as the most commonly implemented finance mechanism and was adopted in 21 of the MBI programs analyzed (Table 2). The next most commonly implemented mechanism was the government or private sector issued subsidy, identified in 13 of the payment programs. Furthermore, REDD+ was adopted by nine, environmental tax programs by two, and community conservation programs by two of the MBI programs identified. It should be noted that very few of the programs were strictly limited to a single finance mechanism; many MBI programs implemented a combination of two or more finance mechanism. For example, the Payments for Hydrological Environmental Services program in Mexico was self-identified as a PES program. However, this program relied heavily on subsidies from a number of entities including the Mexican government (Alix-Garcia, de Janvry & Sadoulet, 2005). Given the definition of a true

PES scheme as one where "[a] well-defined environmental service…[is] 'bought' by at least one buyer " (Wunder, 2005), Mexico's MBI program can not be considered a true PES program, but instead a hybrid - one that relies on both PES and government subsidies. Another example of a similar inconsistency is a PES project in Madagascar known as the Menabe Habitat Management Competition. Though formally known as a PES project, this program shares few characteristics in common with the strict PES scheme and instead relies heavily on an annual inter-community competition which has biodiversity conservation as its focal point (Sommerville, Jones, Rahajaharison & Milner-Gulland, 2010). Although it may seem trivial, it is important to make these distinctions when evaluating each case study if the strengths and weaknesses of varying finance mechanisms are to be identified.

In each of the case studies, the ecosystem service for which conservation efforts were focused were clearly identified. A total of eight different environmental services were identified from the 28 MBI case study programs as being of primary concern. These include hydrological function, biodiversity, carbon sequestration, aesthetic value, agroforestry services, fire protection, landscape and wildlife habitat, soil quality, and protection from climate change. Again, it is important to note that a number of the case studies identified multiple ecosystem services as being of primary concern and that in cases such as forest reclamation, multiple services (*e.g.* forest hydrology, carbon sequestration, and biodiversity conservation) may be addressed simultaneously. This was observed in Costa Rica's Payment for Ecosystem Services program, which since 1997, has attempted to conserve multiple ecological services including hydrological function, biodiversity, carbon sequestration, and aesthetic value. Rather than addressing each service individually, this program attempts to address all four using a more holistic approach, one that focuses primarily on reforestation and forest conservation (Pagiola, 2008).

Each of the case studies identified a number of distinct challenges or obstacles that were experienced during the program's planning or implantation stage. The most common of these challenges was identified as a lack of sufficient, long-term or sustainable funding. Many programs had acquired sufficient start-up funding, typically through government or private sector subsidies, and in some cases these funding sources even extended beyond the start-up phase. However, programs where income was self-generating through the sustainable sale of ecosystem services were much less common. Almost all programs expressed lack of funding as a major concern. Other financial challenges included high transaction costs[7], high monitoring costs, and difficulty in providing maximum social benefit. Other non-financial challenges included a lack of trust from local communities, inadvertent discrimination between gender and/or and social class, land tenure issues, and managing external threats to conservation efforts such as forest fires and grazing. Table 2 summarizes the key characteristics of the MBI programs identified and groups them in an alphabetic order by country name.

[7] For the purpose of the present study, the definition for 'transaction cost' will be taken from Wunder's 2005 report as the cost of doing business. More specifically, this includes all costs associated with setting up and running an MBI program as well as those which arise from the transaction between ecosystem service provider and buyer, or ecosystem service provider and the institution hosting the MBI program.

Table 2: Key characteristics of 28 different MBI case study programs.

Country of implementation	Finance mechanism	Case/program name	Environmental services targeted	Year initiated	Spatial scale	Challenges	Source
Australia	PES	Wimmera	Hydrological services	2005	28,000 ha	Unknown	Shelton & Whitten, 2005
Bolivia	PES/subsidy	Los Negros (Bees and Barbed Wire for Water)	Hydrological services, biodiversity	2003	Sub-national (2774 ha)	Lack of trust; lack of local funding; low water user payments; land tenure issues; and achieving clear service-provision additionally	Asquith, Vargas & Wunder, 2008
Bolivia	REDD+ (Voluntary Carbon Market)/ subsidy	Noel Kempff Mercado Climate Action Project	Carbon sequestration, biodiversity	1997	Sub-national (642,184 ha)	Legal complications in selling credits	Cenamo, Pavan, Campos, Barrow & Carvalho, 2009; Virgilio, 2009
Brazil	REDD+ (Voluntary Carbon Market)/ subsidy	Juma reserve REDD Project	Carbon sequestration, biodiversity	2006	Sub-national (589,612 ha)	Unknown	Sustentaval, 2008
China	PES/subsidy	Sloping Land Conversion Program	Hydrological services	1999	14.7 million ha	Local governments retain farmer payments; lack of mechanisms to ensure permanence	Bennett, 2008
Costa Rica	PES/ environmental tax/subsidies/REDD+	Payments for Environmental Services	Hydrological services, biodiversity, carbon sequestration, aesthetic value	1997	National (270,000 ha)	Lack of long-term funding; knowledge of land-use-service links	Pagiola, 2008
Ecuador	PES	Pimampiro	Hydrological services	2000	Sub-national (496 ha)	Monitoring costs; linking land use to services	Wunder & Albán, 2008
Ecuador	PES	PROFAFOR	Carbon sequestration	1993	Sub-national (22,300 ha)	Fires, grazing	Wunder & Albán, 2008

France	PES	Vittel	Hydrological services	1993	Sub-national (5100 ha)	Integrating non-agriculture sector (golf courses, *etc.*); estimating costs and benefits of PES	Perrot-Maître, 2006
Germany	PES	Northeim Model Project	Biodiversity	2000	Sub-national (288 ha)	Service property rights; monitoring costs	Bertke & Marggraf, 2004
India[1]	REDD+ (Voluntary Carbon Market)	Nature Environment & Wildlife Society	Caron sequestration, Biodiversity, Protection from climate change and salt water intrusion	2008	2,150 ha (up to 6,000 ha)	Lack of documentation and monitoring mechanisms	Dey & Kar, 2013
Indonesia	PES	Cidinau watershed PES scheme	Hydrological services	2005	Sub-national (22,260 ha)	Locating funding or industries willing to pay into PES program voluntarily	Leimona, Pasha & Rahadian, 2010
Indonesia[1]	REDD+ (Voluntary Carbon Market)	Bantam City mangrove reforestation/ afforestation project	Carbon sequestration	2006	Sub-national (115 ha)	Unknown	United Nations Framework Convention on Climate Change, n.d.
Indonesia	REDD+ (Voluntary Carbon Market)	Rimba Raya Biodiversity Reserve Project	Carbon sequestration, biodiversity	2008	Sub-national 91,215 ha	Unknown	Bolick, Lemons, Procanik, Reece & Faud, 2011
Madagascar	Community-based PES project (habitat management competition)	Menabe Habitat Management Competition	Biodiversity	2003	Sub-national	Potential discrimination against communities with smaller forests	Sommerville, Jones, Rahajaharison & Milner-Gulland, 2010
Mexico	PES/REDD+/subsidy	Carbon sequestration, Biodiversity and Agro-forestry Services	Carbon sequestration, biodiversity	2004	National	High transaction costs; maximizing social benefit; limited funding/investments due to US dropping Kyoto	Corbera, Soberanis & Brown, 2009
Mexico	PES/subsidy	Payments for Hydrological Environmental Services	Hydrological services	2003	National	Implementing tax or water fee in marginalized communities	Alix-Garcia, de Janvry & Sadoulet, 2005

Mozambique	REDD+ (Voluntary Carbon Market)	Nhambita Community Carbon Project	Carbon sequestration	2002	2000 ha	Woman-headed and poor households did not appear to receive much direct benefit from the project	Hegde & Bull, 2011
Nicaragua, Colombia and Costa Rica	PES/subsidy	Regional Integrated Silvopastoral Ecosystem Management Project	Carbon sequestration, biodiversity	2003	Sub-national/ Internationa l	Technical difficulty of adopting silvopastoral practices; lack of participation from poorer households	Rios & Pagiola, 2010
Philippines	PES/subsidy	No Fire Bonus Scheme	Hydrological services, fire protection	1996	Sub-national	Effective monitoring of conservation efforts	Soriaga & Annawi, 2010
South Africa	PES/environmental tax	Working for Water	Hydrological services, biodiversity	1995	National	Increasing voluntary payments for hydrological services; monitoring change; linking payments to service delivery	Turpie, Marais & Blignaut, 2008
Senegal[1]	REDD+ (Voluntary Carbon Market)	*Plante ton arbre*	Carbon sequestration, biodiversity	2008	>6,000 ha	Continuing reforestation efforts while ensuring long-term protection of mangrove habitat and making mangrove resources economically viable for local communities (*i.e.* the need for integrated management)	Sall & Durin, 2013
United Kingdom	PES/subsidy	Environmentally Sensitive Area Scheme	Landscape and wildlife habitat, biodiversity	1986	640,000 ha	Reduced participation in some cases (smaller farms), environmental leakage	Dobbs & Pretty, 2008
United Kingdom	PES/subsidy	Country Stewardship Scheme	Hydrological services, biodiversity	1991	530,620 ha	Reduced participation in some cases (smaller farms), environmental leakage	Dobbs & Pretty, 2009
USA	PES/subsidy	Conservation Reserve Program	Hydrological services, soil quality, biodiversity (wildlife protection)	1985	Sub-national (14.5 million ha)	Unknown	Claassen, Cattaneo, & Johansson, 2008; Baylis, Peplow, Rausser, & Simon, 2008

USA	PES/Subsidy	Environmental Quality Incentives Program	Hydrological services, soil quality, biodiversity (wildlife protection)	1996	Sub-naitonal	High administrative and transaction costs	Claassen, Cattaneo, & Johansson, 2008; Batlis, Peplow, Rausser, & Simon, 2009
Vietnam	PES	PES pilot in Dong Nai River Basin	Hydrological services	2008	Local watershed	Forest ownership by "communities" needs further legal definition	Peters, 2008
Zimbabwe	PES/ "community conservation" (CCP)/ Subsidy	CAMPFIRE	Aesthetics, biodiversity, wildlife habitat	1989	14.4 million ha	Power struggle; lack of monitoring; limited poverty alleviation	Frost & Bond, 2008

[Γ] MBI programs focusing on mangrove forest conservation

3.3.2 Criteria for successful finance mechanism

Some variation existed between the five finance mechanisms identified in section 3.3.1 and corresponding numbers of positive interactions with selected criteria (Table 3). PES and environmental tax programs yielded the highest level of positive interactions with a total of seven out of ten possible points. REDD+ programs came in second, yielding a total of six positive interactions. Subsidy-based programs and community conservation programs scored lowest with a total of five positive interactions each. It is important to note that the evaluation of mechanisms, though based entirely on literature, was done in a highly qualitative manner. Also, mechanisms were assessed collectively; that is to say, when considering a mechanism with respect to a particular criterion, all programs utilizing that mechanism were considered collectively rather than considering each program individually, which would have made for an overly complex analysis. The results identified in Table 3 should not be considered as universal truth, but instead represent generalized findings from the 28 case studies and should therefore be considered as such. Any significant anomalies present in these results will be discussed in a subsequent section. Future studies may benefit from a more quantitative approach to comparing finance mechanisms.

Table 3: Interaction table comparing five conservation-based finance mechanisms (PES, REDD+, subsidy-based programs, environmental tax programs and community conservation programs) with respect to ten criteria for successful finance mechanisms as identified in the literature.

Criteria for successful finance mechanisms	**Source**	**Finance mechanisms**				
		PES[1]	**REDD+**[1]	**Subsidy**	**Tax**[1]	**CCP**
Provides sufficient/sustainable alternative income	Pagiola, 2008	√	x	x	√	x
Avoids environmental leakage	Wunder, 2005	x	x	x	x	√
Ability to generate start-up funding	Waage et al., 2008	x	√	√	√	√
Promotes environmental sustainability	Gutman & Davidson, 2007	√	√	√	√	√
Promotes temporal sustainability	Waage et al., 2008	√	x	x	√	x
Promotes community engagement	Hegde & Bull, 2011	√	√	x	x	√
Capacity to improve of social condition	Asquith et al. 2008	√	√	√	√	x
Just distribution of benefits	Waage et al., 2008	x	x	√	x	x
Evidence of past success	Pagiola, 2008	√	√	x	√	x
Government support	Corbera et al., 2009	√	√	√	√	√
Total =		**7**	**6**	**5**	**7**	**5**

[1] Finance mechanisms identified for subsequent SWOT analyses.

3.3.3 SWOT analyses of three different finance mechanisms

The three finance mechanisms analyzed using SWOT (PES, REDD+, environmental tax programs) were found to share a number of commonalities. First of all, each of these mechanisms were found to have an overall positive influence on the environmental and socio-economic condition of the project area, albeit the method of achieving this benefit often varied considerably. Further, each of these mechanisms was found to garner the support of government either in the form monetary or in-kind support. In many cases, either local or national level governments showed heavy involvement in the planning and/implementation of these programs. Despite these commonalities, there also exists a number of key distinctions between each mechanism. The following sections outline these key distinctions by discussing the strengths, weaknesses, opportunities, and threats inherent to each finance mechanism.

3.3.4.1 Payment for ecosystem services (PES)

Other than environmental tax programs, PES was the only finance mechanism found to have the potential to provide a sufficient/sustainable level of alternative income. One unique example of this comes from Ecuador's PROFAVOR program, which since 1993 has reclaimed approximately 22,300 ha of forested land for the purpose of carbon sequestration (Wunder & Albán, 2008). This particular program works whereby landowners agree to reforest and manage their land in a way that does not compromise its capacity to store carbon. In exchange, the land owner receives a single payment of US$100-150 per hectare – 75% of which is received in the third year after the success of forest plantation has been demonstrated and the remaining 25% at the end of the contract if the landowner agrees to reforest after harvesting. What is unique about this program is that during the plantation cycle, the landowner is also entitled to any proceeds generated through the sale of by-products from thinning, felling or otherwise maintenance of the forested land. Even more, the landowner is also entitled to the income generated from the sale of the harvested trees at the end of the plantation cycle. A combination of payments from PROFAVOR, income generated through sustainable maintenance of reforested land and the provisional proceeds from harvesting the land at the end of the contract period make this PES agreement a potentially sufficient and long-term source of income for its participants.

PES projects have shown a great propensity for engaging communities through the provision of either monetary or in-kind incentives. Nearly all PES projects outlined in this study were able to achieve some community engagement. However, it should be noted that in many cases PES projects were directed towards specific groups (*e.g.* landowners or homeowners) and arguably showed discrimination towards other groups such as community members in poorer socioeconomic classes who are unable to afford property. This issue was prominent in the United Kingdom's Country Stewardship Scheme where, despite not being designed to target farms of a certain size, a disproportionately high level of participation from farms larger than 300 ha in size were recorded (Dobbs & Pretty, 2009). Similar findings were observed in a program from Madagascar known as the Menabe Habitat Management Competition. This program consists of an annual competition whereby different communities are given the task of conserving local wildlife habitat through sustainable forests management practices (Sommerville et al., 2010). At the end of each year, winning communities are announced and awarded with various in-kind incentives (*e.g.* electric generators, building materials, cooking supplies, bicycles, and cows). However, participants of this competition believe that smaller communities with less potential forest to conserve are at an unfair disadvantage thus making it difficult for their community to achieve the benefits of the program. It is this sort of discrimination – even if only inadvertent -

that brings into question the ability of PES projects to address the social inequality that is experienced in many developing countries.

Despite having developed a great deal of government support and community engagement in the past, PES projects are often accompanied by great hesitation, particularly from those community members who are asked to pay for the services being protected. This hesitation can be especially prominent when payments become mandatory rather than voluntary or when marginalized communities are being asked to make payments. Furthermore, community hesitation may also be partly due to a limited understanding of the value of ecosystem and their services or because the link between land use and ecosystem provision is poorly understood (Wunder, 2005). Education and public participation presents two major opportunities for increasing public support for these types of projects. Moreover, continued research into the services provided by ecosystems may lead to increased government support and further legislations regarding the conservation of ecosystem services. Gaining public trust and support is likely to help increase the level of available funding for PES programs, thus making environmental stewardship a more financially viable livelihood option.

Finally, it is important to recognize that PES projects continually face a number of external threats. Likely the most significant of these is the threat of increasing opportunity costs (*i.e.* the missed income from alternative, more environmentally destructive livelihood opportunities such as logging). The main objective of PES projects is to conserve ecosystem services, be they carbon sequestration, biodiversity or hydrological in nature, through the provision of monetary incentives. However, considering the generally poor socio-economic condition of many undeveloped countries as well as the strong financial incentives of alternative land-use practices, creating sufficient incentive for environmental conservation is becoming increasingly difficult.

Pagiola, Arcenas and Platais (2005) explained that landowners with high-productivity land are less likely to participate in a PES program, as their opportunity cost is much higher. Further, the persistently poor socio-economic condition of many developing countries disincentivizes participation in these types of programs. Other external threats facing the progress of PES programs include a myriad of naturally occurring phenomenon such as forest/grass fires, storms, drought, flooding, and grazing, among others. A complete list of strengths, weaknesses, opportunities and threats of the PES mechanism can be found in Table 4.

Table 4: SWOT analysis of the PES mechanism.

Payments for ecosystem services (PES) SWOT ANALYSIS	POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS** • Potentially sufficient/sustainable alternative income • Promotes long-term environmental conservation • Promotes community engagement • Has shown capacity to improve social condition • Long history of successful PES projects • Government support and international recognition	**WEAKNESSES** • Limited start-up funding • Limited interest in purchasing services • Often charges already marginalized communities • High transaction costs/costs of monitoring/cost of training • Often a lack of trust for programs by communities • Inadvertent discrimination based on social class
EXTERNAL	**OPPORTUNITIES** • Increasing understanding of ecosystem services • Increasing legislation regarding environmental stewardship • Increasing understanding of value of ecosystem services	**THREATS** • Missed opportunity costs of environmentally destructing livelihood options • Poverty • External threats such as fires and grazing • Environmental leakage

3.3.4.2 Reducing emissions from deforestation and forest degradation (REDD+)

One of the main causes of global climate change is the over-exploitation of forest ecosystems through logging and other harmful forestry practices (Baccini et al., 2012; FAO, 2006). REDD+ offers potential relief from these practices by providing a market-based approach to sustainable forest management (Murray & Vegh, 2012). Although it is a relatively new concept, REDD+ has shown serious potential for reclaiming forest ecosystems and improving social conditions in developing countries. One particular success story comes from the Nhambita Community Carbon Project in Mozambique. This project, which was implemented in 2002, promotes carbon sequestration through small-scale agro-forestry practices. Participating farmers plant trees on their land, either along its borders or in mixed rows with crops and accumulate carbon credits over 25 year contracts. Credits generated through these practices are then purchased by industry through the voluntary carbon market and the proceeds from these sales go back to the farmers (Hegde & Bull, 2011). In a similar example, the Noel Kempff Mercado Climate Action Project in Bolivia has been generating carbon credits through forest conservation efforts since 1997. By selling carbon credits through the voluntary carbon market, Bolivia's Friends of Nature Foundation has been able to protect a buffer of forest around the Noel Kempff Mercado National Park while supporting community projects aimed to improve local socio-economic welfare (Cenamo et al., 2009).

The REDD+ scheme has been gaining a great deal of international attention and support in recent years. Discussion regarding various new projects methodologies as well as the inclusion of non-conventional forest types, such as mangroves, has been growing (Murray & Vegh, 2012). Still, funding for REDD+ projects continues to be insufficient and unreliable at best. Nzunda and Mahuve (2011) explained that the minimum amount of funds needed to suffice global REDD+

requirements is about US$5 billion per annum. However, funding available for REDD projects has come far short of these requirement. Between the Global Environmental Facility and the replenishment fund, just under US$5 billion has been raised between 1991 and 2010 for climate change initiatives (Corbera, Estrada & Brown, 2009; Freestone, 2009; GEF, 2010).

Out of all finance mechanisms, REDD+ may perhaps be the most susceptible to environmental leakage. When forest resources become protected under a REDD+ project, the need for forest products (e.g. wood, charcoal, etc.) do not simply disappear. Instead, exploitive forestry practices are often taken up in a different area and the emissions from harmful forestry practices go unaddressed. To overcome the issue of environmental leakage, REDD+ project participants would have to be provided with alternatives for all of their forest needs (Angelsen & Wertz-Kanounnikoff, 2008; Olsen & Bishop, 2009). This could include the provision of more fuel-efficient cooking stoves or even alternative, more sustainably derived building materials.

One of the main obstacles facing the successful implementation of REDD+ projects is the current low market value of carbon credits. Williams, Peterson, and Mooney (2005) suggested that market value of carbon credits is directly dependant on both the demand by consumers and availability of credits. Further, they explained that demand by consumers is also dependant on external factors, namely policy or legislation regarding GHG emissions. The implementation of policies calling for emission reductions will likely increase demand for and the price of credits (Williams et al., 2005). However, in some major polluting nations (*e.g.* United States), there are no binding emission targets and as a result, the market value of credits in these countries and surrounding countries is low (*e.g.* US$5.90 in 2012 for voluntary carbon credits in US) (Peters-Stanley & Yin, 2013; Young, 2003). As such, REDD+ projects in are often financially marginal. Ongoing revisions of international climate change policy, in addition to an increasing appreciation of potential climate change impacts may provide the push needed for governments to adopt carbon market-based environmental management strategies. Moreover, additional research into carbon sinks, blue carbon, and remote sensing technologies are needed to provide accurate and relatively inexpensive methods for verification and accounting of carbon sequestration and storage and may help to promote emerging markets for certified, thus more valuable, emission reduction credits.

REDD+ projects are subject to a number of external threats, which include poor governance, political instability, limited binding international policy and the resulting volatile state of the carbon market, as well as a negative public perception of carbon credits. Poor governance can be an important driver of deforestation and forest degradation and can also impact the design, development, and implementation of REDD+ projects (Nzunda & Mahuve, 2011). In the REDD+ context, poor governance can encompass a number of problems, including corruption, inequality in distribution of benefits, lack of transparency, poor law enforcement, and land-use conflicts. Many of these issues were apparent in the presently analyzed case studies. An example of poor governance was evident in the Nhambita Community Carbon Project in Mozambique. Though considered a success story, this project originally showed bias toward male-headed households with regard to the distribution of benefits. This was thought to be due in part to the lower level of income and smaller land holding in women-headed households in this region (Hegde & Bull, 2011). Political instability also presents a major threat to REDD+ projects, both at the national and international levels. First, the instability of international relations can affect a country's willingness or, more likely, its ability to support or implement REDD+ initiatives. An example of this comes from Mexico's Payments for Carbon, Biodiversity, and Agro-forestry Services (CABSA) program. This program, which was established in 2004, aimed to generate revenue through the sale of carbon credits from forest plantations. Money generated through the sale of carbon credits was distributed to local landowners and was meant to help improve local socio-economic conditions. However, after the United States rejected its commitment to the Kyoto Protocol in the early 2000's, Mexico's CABSA program has a hard time identifying buyers for its carbon credits and has, in recent years, relied largely on subsidies form the Mexican government (Corbera, Soberanis & Brown, 2009).

Political instability can make it difficult to develop successful long-term REDD+ initiatives and can also be linked to the volatile state of the carbon market as well as the public perception of carbon credits. Governments understand that the carbon market is still very young and volatile and that public perception of this may not always be positive. Consequently, the politicians may be hesitant to invest in REDD+ initiatives out of fear of loosing their public support and their political positions. Although this may sometimes be the case, the growing number of REDD+ projects internationally suggest an improving public perception and increasing government support for REDD+ initiatives. A complete list of strengths, weaknesses, opportunities and threats for the REDD+ mechanism can be found in Table Five.

Table 5: SWOT analysis of the REDD+ mechanism.

	Reducing emissions from deforestation and forest degradation (REDD+) SWOT ANALYSIS POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS** • Promotes sustainable forest management • Government support and international recognition • Promotes some community engagement • Has shown capacity to improve social condition • Potential to generate income	**WEAKNESSES** • Limited government support • Short history • Unreliable funding • Low value of carbon credits
EXTERNAL	**OPPORTUNITIES** • Increasing opportunity for community engagement • Growing international recognition • Increasing value of carbon credits • Further research on carbon sinks (blue carbon) • Emerging markets for certified emissions credits • Increasing need to mitigate climate change	**THREATS** • Volatile carbon market • Poor governance • Political instability • Public perception of carbon credits • Environmental leakage

3.3.4.3 Environmental tax programs

Like PES and REDD+, environmental tax programs have shown great potential for generating revenue to support both environmental conservation and improved social welfare (Pagiola, 2008; Turpie et al., 2008). Moreover, as these programs are typically implemented by the government, they are usually accompanied by ample government support. Though projects funded through environmental tax programs may need supplementary start-up funding, a major advantage of these types of programs is that they often have the capacity to become a sustainable, long-term funding option for conservation initiatives and therefore also have the capacity to promote the long-term improvement of community welfare (Turpie et al., 2008). Additionally, because tax payments are usually mandatory, funding derived from this mechanism can be more reliable than funding derived from other mechanisms such as REDD+ or PES, which is usually sourced from voluntary payments. One particularly successful environmental tax program is Costa Rica's Payments for Environmental Services program (CRPES). This program, which was implemented in 1997, aims to address the loss of hydrological services, biodiversity, and carbon sinks through conservation efforts. Unlike REDD+ and PES programs, this program relies heavily on a fossil fuel tax implemented by the Costa Rican government for the bulk of its revenue – approximately US$10 million a year is being derived from nearly 3.5% of the nationally implemented sales tax (Pagiola, 2008). Today, this program is regarded as a major success and has been partly credited for helping Costa Rica transition from having one of the highest deforestation rates to achieving negative net deforestation in the early 2000s.

Environmental tax programs are arguably the most contentious of all finance mechanisms as they are often burdened by high transaction and administrative cost and are rarely accompanied by public support (Pagiola, 2008) – problems which were apparent in Costa Rica's CRPES program. Because these programs rely on mandatory payments from the public, their administrators have an even greater responsibility to link payments to the services being provided. Furthermore, unlike other finance mechanisms, environmental tax programs can be applied indiscriminately within communities or even whole countries rather than focusing specifically on resource users. This can place a disproportionate amount of pressure on marginalized communities rather than contributing to poverty alleviation. This problem was identified for Ecuador's Pimampiro project where 1,350 families of a marginalized community were asked to pay an additional 20% water consumption fee/tax on top of their water bill to support the conservation of hydrological services (Wunder & Albán, 2008). This water fee was applied seemingly without discrimination - that is to say that the government did not make any distinction between wealthier and poorer water users.

Increasing environmental awareness coupled with a growing world economy may drive future opportunities for the growth of environmental tax programs, as well as other finance mechanisms. The first of these opportunities is particularly important as it marks a changing public perception towards the adverse impacts humans have on this planet. Even more, it perpetuates a need or desire to correct these impacts through mitigation efforts. This is to say that, when people understand a problem they may be more likely or more willing to address it. The second of these opportunities speaks to the capacity of humans to lessen their adverse environmental impacts. Without necessary resources it can be difficult to implement conservation efforts as they can often be expensive. This can be seen in any of the presently reviewed case studies that identifies a lack of funding or resources as a hindrance to conservation efforts. This having been said, a growing economy does not necessarily imply a willingness for environmental conservation efforts. It is a combination of an increasing environmental awareness and the availability of resources that enhances our ability manage the environment effectively.

Finally, one must recognize the external threats facing environmental tax programs, some of which include political and economic instability, political corruption, poor governance, and poor public perception. Political instability plagues environmental tax programs in a similar way to which it does REDD+ projects, albeit less so at the international level as tax programs typically operate at the national or sub-national levels. Politicians are generally weary of implementing new tax programs out of fear of not being re-elected (Cremer, De Donder & Gahvari, 2004). They understand that public perception of increased taxes is generally negative and often run political campaigns centered around the promise to reduce taxes. Political corruption can also bring unwanted negative attention to these types of programs. One mild example of this was China's Sloping Land Conversion Program where farmers participating in a PES program were, in some cases, being deprived of the payments they earned through their conservation efforts. Instead, payments were either being held by the government to pay back taxes or spent on various other services related to the PES project (Bennett, 2008). This resulted in a general public distrust for the program. Until public perception and trust for environmental taxes improves, imposing these types of programs may be seen as too risky a political manoeuvre to be adopted more widely. Fullerton, Leicester and Smith (2010) explained that an environmental tax is not a fix-all solution and that implementing a tax program cannot guarantee a particular environmental impact. Polluters are ultimately unpredictable. In some cases, imposing an environmental tax may induce positive 'green behaviour'. On the other hand, an environmental tax may lead taxpayers to believe that they are entitled to pollute, which may lead to undesired results. Ultimately, all MBI programs, regardless of the type of finance mechanism being implemented, depends on public support and willingness to participate in conservation efforts. A complete list of strengths, weaknesses, opportunities, and threats for environmental tax programs can be found in Table 6.

Table 6: SWOT analysis of the 'environmental tax program' mechanism.

Environmental tax programs — SWOT ANALYSIS	POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS** • Potential to provide sustainable income • Typically has government support • Promotes environmental conservation • Has shown capacity to improve social condition • Long history of taxation programs • Mandatory payments	**WEAKNESSES** • Often very little support from community • Indiscriminant taxation; potential to impact marginalized individuals the most • High transaction/administrative costs • Inability to link payments to services
EXTERNAL	**OPPORTUNITIES** • Growing economies • Increasing need or desire to mitigate climate change • Improve public perception of environmental tax programs	**THREATS** • Political instability • Political corruption • Economic instability • Poor governance • Public perception

3.4 Summary

In recent decades, Indonesia has experience a rapid decline in its mangrove forest coverage - due in large to excessive logging and the development of aquaculture ponds known as *tambak*. This is of particular concern as Indonesians rely heavily on the services provided by mangroves, namely coastal protection and the provision of numerous forest products. Through a review of 28 international MBI case study programs (Table 2), this chapter identified five different finance mechanisms. These mechanisms, which consisted of PES, REDD+, subsidy-based programs, environmental tax programs, and community conservation programs, were evaluated on the basis of 10 criteria (Table 3). Subsequently, the three highest scoring of these mechanisms (PES, REDD+, and environmental tax programs) were further analyzed for their strengths, weaknesses, opportunities, and treats. It is hoped that the findings from this present analysis should provide a valuable reference for the development of an MBI program in Tanjung Panjang. Discussion regarding the application of various finance mechanisms in Tanjung Panjang can be found in Chapter 5.

CHAPTER 4: IDENTIFYING AND ANALYZING POTENTIAL INVESTORS AND PAYMENT DISTRIBUTION MODELS

4.1 Overview

Ultimately, the success of any market-based incentive program is dependant on a number of external factors. Not the least of these is the ability to establish adequate funding through various investors. In a 2008 report, authors Waage et al. explain that the development of a MBI program follows four core steps - the first of these steps is in part dedicated to the identification of potential buyers. The authors explain that potential buyers may include private companies or intermediaries, governments, donor agencies, NGOs, or private individuals, and that each of these investors are driven by a unique set of motivations. They then explain that in order to better understand who the potential buyers or investors of a particular project may be, one must identify the beneficiaries of the services in question and/or those that may experience problems due to a diminished availability of these services (Waage et al., 2008). This is likely to vary tremendously depending on the type of ecosystem or service(s) being targeted.

Also of great significance to the success of a MBI program is the ability to identify an appropriate payment distribution model (*i.e.* the method by which payments are distributed among communities) (Harlan, 2000; Waage et al., 2008). The effectiveness of a payment distribution model may vary greatly depending on a number of factors, including social, political, and economic context, land tenure issues and even the type of ecosystem services being targeted. Furthermore, designing a model that is equitable for both ecosystem service buyers and sellers is critical to the long-term success of MBI programs. Fairness must be inherent to the payment distribution model for it to work. If a payment model does not fairly compensate the sellers or satisfy the buyers, the proposed partnership will unlikely be successful (Asquith, 2007; Harlan, 2000).

Two main challenges facing the implementation of a payment program in Tanjung Panjang are the identification of sufficient, long-term funding sources, and development of an equitable payment distribution model. The following chapter aims to address these challenges by answering research questions two and three. First, this chapter identifies the types of investors that are typically involved in funding MBI programs with the goal of environmental management. Second, the different types of payment distribution models that are presently utilized to guide the transfer of funds from service buyers to service providers are identified. The following section provides an outline of the analytical approach adopted to address these central research questions. Next, an overview of the results is provided as well as an evaluation of the identified payment distribution models through the scope of multiple SWOT analysis. This will be followed by a brief summary of this chapter's findings.

4.2 Methods

4.2.1 Potential investors

To determine what type of investors are typically involved in financing MBI programs, the MBI case studies summarized in chapter three were further analyzed and the key characteristics relating to ecosystem service transactions (*i.e.* service buyer/seller, payment distribution model, ecosystem service beneficiaries) were identified. Once identified, investors were sub-categorized into five groups. It should be noted that these groups correspond with the five main categories of investors as identified by Waage et al. (2008) and include (1) private companies or intermediaries, (2) government, (3) donor agencies, (4) NGOs, and (5) private individuals. It should also be noted that many programs identified multiple investors and that, whenever possible, the programs' primary investor(s) was identified to provide further insight into the nature of ecosystem service buyers. Furthermore, Waage et al. (2008) explains that the beneficiaries of ecosystem services may also represent potential investors. For this reason, the primary beneficiaries of the maintained ecosystem services were identified for each of the MBI programs.

4.2.2 Payment distribution models

To uncover potential payment distribution models, this chapter further reviewed the MBI case studies first presented in chapter three and identified the corresponding strategies used to guide the transfer of funds from investors to service providers. Once identified, distribution models were then divided into three separate categories: (1) direct financial payments to individuals, (2) financial support for specific community goals, and (3) in-kind payments. Distribution models were then assessed to determine which model is most common or has most frequently been adopted by the MBI programs analyzed. Lastly, multiple SWOT analyses were performed to evaluate the different distribution models with respect to their strengths, weaknesses, opportunities, and threats.

4.3 Results

4.3.1 Potential investors

Five separate investor categories were identified from the 28 MBI case study programs, as previously indicated. Private companies/intermediaries were most commonly identified as the primary investor type and were identified as such for 11 (39%) of the MBI case study programs (Figure 5). Governments were a close second and were identified as primary investors for 10

(36%) of the MBI programs. The remaining investor types, namely private investors, donor agency, and NGOs, were progressively less prominent and were identified as the primary source of funding for four (14%), two (7%), and one (4%) of the MBI programs, respectively (Figure 5).

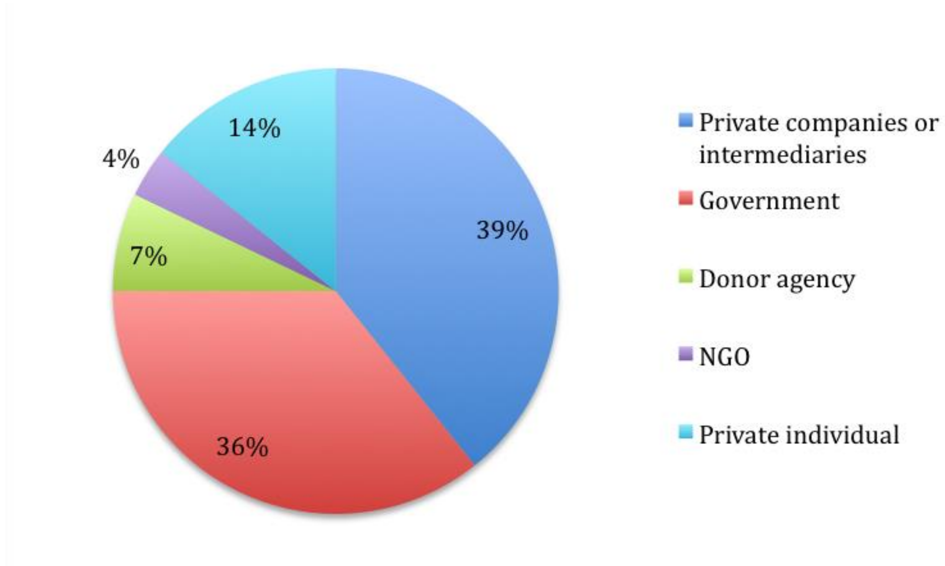

Figure 5: The percentage of programs for which each of the five investor groups were identified as a primary investor, or buyer of the ecosystem service being targeted.

The beneficiaries of the programs were almost always identified as resource users and varied depending on the ecosystem service being targeted. In one particular example, Vittel – a French bottled water company owned by Nestlé – paid upstream farmers to reduce the level of nitrates they released from farming practice to ensure the high quality of the drinking water the company removed from the river (Perrot-Maître, 2006). In this case, Vittel represented both the service buyer/investor and the primary resource user. However, any downstream water user could also be considered a beneficiary of this project and could, in theory, also represent a potential investor. Additionally, a number of the programs focused on conserving carbon sinks (*e.g.*

rainforests, mangrove forest, *etc.*), either through reforestation, afforestation, or avoided deforestation (Table 2). These cases are unique in that the main beneficiaries/investors were not confined strictly to the immediate region or even the program's country of origin. Given the international nature of climate change, projects aiming to conserve carbon sinks or avoid unnecessary GHG emissions often acquire funding from international sources (Dey & Kar, 2013; Sall & Durin, 2013; Sustentaval, 2008). In one example, Brazil's Juma Reserve REDD+ project generated income through the sale of carbon credits to the international Marriott Hotel chain (Sustentaval, 2008). In this case, Marriott represents the 'buyers' of the services being conserved (*i.e.* carbon sequestration) as well as international beneficiaries of this program.

4.3.2 Payment distribution models

Three different payment distribution models were identified from the 28 MBI programs. The most common of these distribution models was one in which financial payments were made directly to the individuals responsible for conserving ecosystem services. This model was present in 21 (75%) of the case studies (Figure 6). Most often, landowners, homeowners, or farmers were identified as the recipients of these payments. However, in some cases the task of conserving or managing these services was contracted out to qualifying community members rather than being offered directly to landowners (Turpie et al., 2008). The second most common distribution model was one in which financial payments were made at the community level, either to some sort of community fund or directly towards the procurement of communal resources such as electric generators, building materials, cooking supplies, *etc.* This model, which was present in 11 (39%) of the case studies, was more common for programs that took a more collaborative or communal approach to resource management, as opposed to the individual property owner-based approach. Lastly, in-kind payments were the least common of all payment distribution models and were the primary means of compensation for only two (7%) of the programs analyzed. In many cases, regardless of the payment distribution model being utilized, a portion of the revenue generated from service buyers was cycled back into the project to promote further conservation activities. A list of all MBI case study programs and corresponding investors and payment distribution models can be found in Table 7.

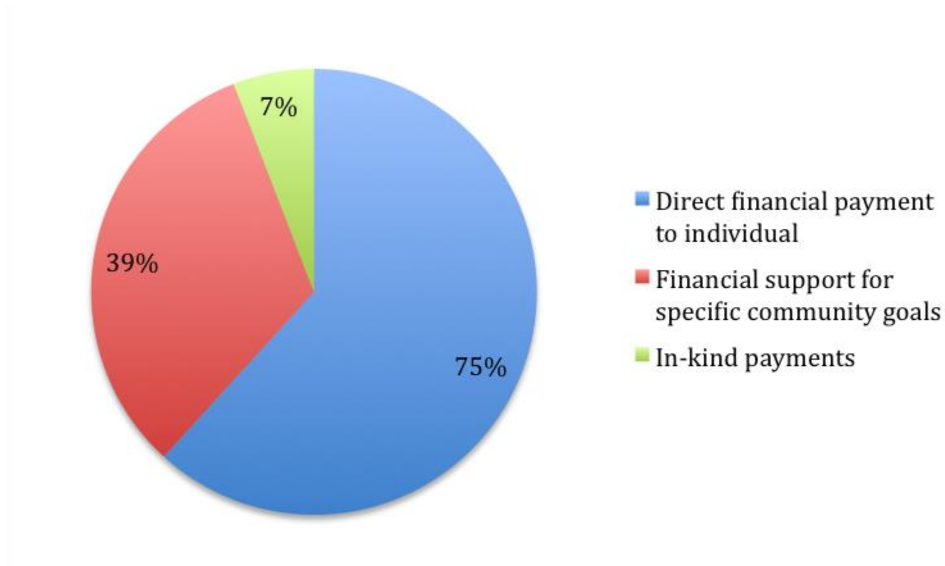

Figure 6: Relative percentage of three different payment distribution models as identified in the 28 MBI case study programs. Direct financial payments to individuals were the most commonly adopted model, whereas in-kind payments were only adopted by two of the MBI programs.

Table 7: Key characteristics of 28 different MBI case study programs.

Country of implementation	Finance mechanism	Case/program name	Buyer/Investor	Seller	Distribution model	Beneficiary	Source
Australia	PES	Wimmera	Australian government[2]	Landowners	Direct payments to landowners	Water users	Shelton & Whitten, 2005
Bolivia	PES/subsidy	Los Negros (Bees and Barbed Wire for Water)	Pampagrande Municipality, US Fish and Wildlife Service[2], local irrigators/ downstream water users	Upstream landowner/ farmers	Direct payment to upper-watershed landowners/ farmers, both monetary and in-kind payments	Downstream water users/ irrigators	Asquith, Vargas & Wunder, 2008
Bolivia	REDD+ (Voluntary Carbon Market)/ subsidy	Noel Kempff Mercado Climate Action Project	Bolivian Government, (American Electric Power, BP America, and PacifiCorp)[2]	Friends of Nature Foundation	Direct payments to communities and further conservation efforts	Beneficiaries of services provided by forested land	Cenamo, Pavan, Campos, Barrow & Carvalho, 2009; Virgilio, 2009
Brazil	REDD+ (Voluntary Carbon Market)/ subsidy	Juma Reserve REDD Project	Brazilian government, FAS, Bradesco Bank, Coca-Cola Brazil, Marriott[2]	Amazonas Sustainable Foundation (FAS)	Direct payments to FAS; community benefits; some individual payments	Beneficiaries of services provided by forested land	Sustentaval, 2008
China	PES/subsidy	Sloping Land Conversion Program	Central government[2]	Households	Direct payment or in-kind support to farmers	Water users, timber consumers	Bennett, 2008
Costa Rica	PES/ environmental tax/subsidies/REDD +	Payments for Environmental Services	FONAFIFO, fossil fuel tax[2], World Bank, Energía Global	Landowner, indigenous communities	Direct payments to landowners	Water users, tourism industry	Pagiola, 2008

Ecuador	PES	Pimampiro	Forest Absorbing Carbon Emission (FACE)[2]	Landowners of the Nueva América Cooperative	Direct payments to landowners (from water fee)	Water users/ irrigators	Wunder & Albán, 2008
Ecuador	PES	PROFAFOR	Forest Absorbing Carbon Emission (FACE)[2], Dutch electricity companies	Landowner	Direct payments to landowners	Beneficiaries of services provided by forested land	Wunder & Albán, 2008
France	PES	Vittel	Vittel[2] (Nestlé Waters)	Dairy farmers	Direct payments to dairy farmers	River basin agency, water users	Perrot-Maître, 2006
Germany	PES	Northeim Model Project	Private foundation[2]	Farmers	Direct payment to farmers	Recreational users	Bertke & Marggraf, 2004
India[1]	REDD+ (Voluntary Carbon Market)	Nature Environment & Wildlife Society (Sundarbans)	*Groupe Danone* (Livelihoods Fund)[2]	Community groups	Direct payments to community groups	Farmers, those at risk from the impacts of climate change	Dey & Kar, 2013
Indonesia	PES	Cidinau watershed PES scheme	Water users[2]	Landowner	Direct payment to landowners/ farmers	Water users	Leimona, Pasha & Rahadian, 2010
Indonesia[1]	REDD+ (Voluntary Carbon Market)	Bantam City mangrove reforestation/ afforestation project	YL Invest CO[2], *Groupe Danone* (Livelihoods Fund)	YL Invest CO	Direct payment to YL Invest CO; indirect community benefits	Users of services provided by mangrove forests	Project Design Document Form, n.d.
Indonesia	REDD+ (Voluntary Carbon Market)	Rimba Raya Biodiversity Reserve Project	Voluntary Carbon Market[2]	PT Rimba Raya Conservation	Payments cycled back into project and into community initiatives	Beneficiaries of services provided by forested land	Bolick, Lemons, Procanik, Reece & Faud, 2011

Madagascar	Community-based PES project (habitat management competition)	Menabe Habitat Management Competition	Durrell Wildlife Conservation Trust[2]	Communities	Direct payment to communities	Beneficiaries of services provided by increased biodiversity	Sommerville, Jones, Rahajaharison & Milner-Gulland, 2010
Mexico	PES/REDD+/ subsidy	Carbon sequestration, Biodiversity and Agro-forestry Services	Mexican Forestry Fund[2], Voluntary carbon market	Landowners, communities	Direct payments to landowners and communities	Users of services provided by forested land	Corbera, Soberanis & Brown, 2009
Mexico	PES/subsidy	Payments for Hydrological Environmental Services	Mexican Forest Fund, Water fees paid by communities[2]	Landowners, communities	Direct payments to landowners and communities	Watershed and aquifer users	Alix-Garcia, de Janvry & Sadoulet, 2005
Mozambique	REDD+ (Voluntary Carbon Market)	Nhambita Community Carbon Project	Voluntary Carbon Market[2], European Union	Farmers, communities	Direct payments to farmers and communities	Beneficiaries of services provided by forested land	Hegde & Bull, 2011
Nicaragua, Colombia and Costa Rica	PES/subsidy	Regional Integrated Silvopastoral Ecosystem Management Project	Global Environment Facility[2] (World Bank)	Households	Direct payments to households	Beneficiaries of services provided by forested land	Rios & Pagiola, 2010
Philippines	PES/subsidy	No Fire Bonus Scheme	Local government[2]	Communities	Direct payments to communities to support community projects	Watershed and aquifer users, beneficiaries of fire protection	Soriaga & Annawi, 2010
Senegal[1]	REDD+ (Voluntary Carbon Market)	Casamance delta	*Groupe Danone*[2] (Livelihoods Fund), Insolites Bâtisseurs	Community members; non contractual; paid per ha of mangrove replanted on communal land	Direct payments to those responsible for reforesting	Fishers, farmers, those at risk from the impacts of climate change	Sall & Durin, 2013

South Africa	PES/environmental tax	Working for Water	Water users (water tariff)[2], fundraising	Contractor	Direct payment to contractors	Water users	Turpie, Marais & Blignaut, 2008
United Kingdom	PES/subsidy	Environmentally Sensitive Area scheme	UK government[2], European Union	Farmers	Direct payments to farmers	Natural resource users (water, recreation)	Dobbs & Pretty, 2008
United Kingdom	PES/subsidy	Country Stewardship Scheme	UK government[2], European Union	Farmers	Direct payments to farmers	Natural resource users (water, recreation)	Dobbs & Pretty, 2009
United States	PES/subsidy	Conservation Reserve Program	US government[2]	Farmers	Direct payments to farmers	Natural resource users (water, recreation)	Claassen, Cattaneo, & Johansson, 2008; Baylis, Peplow, Rausser, & Simon, 2008
United States	PES/Subsidy	Environmental Quality Incentives Program	US government[2]	Farmers	Direct payments to farmers	Natural resource users (water, recreation)	Claassen, Cattaneo, & Johansson, 2008; Batlis, Peplow, Rausser, & Simon, 2009
Vietnam	PES	PES pilot in Dong Nai River Basin	Local water supply companies[2], hydropower companies, ecotourism company	Landowners	Direct payment to government, 13 largest landowners, and to homeowners	Water users	Peters, 2008
Zimbabwe	PES/ "community conservation"/ Subsidy	CAMPFIRE	Rural District Council[2], Private safari operators and international donors	Communities	Direct payments to communities into community fund	Natural resource users, global conservation community	Frost & Bond, 2008

[1] MBI projects focusing on mangrove forest conservation
[2] Investor group which has been identified as primary source of funding

4.3.3 SWOT analyses of three financial distribution models

Three different payment distribution models were identified and evaluated through the use of multiple SWOT analyses. These models included direct financial payments to individuals, financial payments directed toward community funds for the attainment of specific community goals, and in-kind payments. Three commonalities exist between the three distribution models. First, the analysis found that providing adequate compensation was a common challenge regardless of the payment model adopted and that increased funding may help to increase participation by providing additional compensation to participants. Second, it was also found that increasing awareness about ecosystem services through public education programs may also help to increase public participation, regardless of the payment model being utilized. Third, MBI programs operating under any of the payment models were found to be vulnerable to fluctuating opportunity costs. In addition to these commonalities, there also exists a number of key distinctions between each payment model. The following sections outline these differences by discussing each distribution model's corresponding strengths, weaknesses, opportunities, and threats.

4.3.3.1 Direct financial payment to individuals

The main advantage for MBI programs operating under the 'direct financial payment to individual model' is that they are able to compensate those participants who are directly responsible for management efforts. Moreover, programs operating under this model are better able to accommodate each participant's individual level of participation through varying levels of compensation. This is particularly important for projects measuring management effort on a per hectare basis. For example, REDD+ projects typically report results in terms of sequestered or stored tons of CO_2 per hectare (ha^{-1}) per year (yr^{-1}) and allocate compensation to individual landowners based on the type and maturity (*i.e.* biomass) of forest they own (Cenamo et al., 2009). Additionally, because this distribution model promotes one-on-one transactions, programs utilizing it may be more able to develop long-lasting relationships with participants. This is critical when trying to establish trust with participants or when attempting to generate increased community participation. This having been said, a number of case studies operating under this model continue to identify a lack of trust as a major challenge (Asquith, Vargas & Wunder, 2008) (Table 2), thus further emphasizing a serious lack of community trust for MBI programs.

One major disadvantage of this distribution model is that in some cases it has shown to promote discrimination amongst participant groups. For example, Hegde & Bull (2011) describe a case where a small-scale agro-forestry-based carbon sequestration project partners with members of the Nhambita community, Mozombique, to integrate tree planting with farming practises. In their evaluation of this community project, Hegde & Bull (2011) explain that because women of the Nhambita community are often less educated and own less land, they tend to participate less in the program and experience fewer benefits than male participants. Furthermore, because payment programs have often shown to target landowners, farmers, or homeowner (Bertke & Marggraf, 2004; Dobbs & Pretty, 2009; Perrot-Maître, 2006; Wunder & Albán, 2008), their ability to benefit those most in need of social assistance is questionable. Another disadvantage of this model is that is tends to focus on individual participation rather than community-wide engagement. Projects of this type, where contracts are signed by individual landowners or farmers, may not promote community-wide management practices, but instead, promote fragmented and disconnected conservation efforts. A management approach of this design can be particularly ineffective in cases of wildlife conservation. Many studies have highlighted the importance of maintaining habitat connectivity for allowing the exchange of individuals between populations. Perhaps the most notable of these projects is the North American Yellowstone to

Yukon Conservation Initiative, which is one of the world's longest continuous wildlife corridor and spans the Rocky Mountain chain from Yellowstone National Park in Wyoming, United States to Yukon, Canada (Merrill, 2005). However, the necessity for spatially continuous ecosystem management practices may not be as critical for maintaining other ecosystem services such as carbon sequestration. Other potential weaknesses associated with this payment model may include an inability to improve social condition at the community level, higher transaction costs associated with one-on-one interactions and an increased sensitivity to land tenure issues.

There are a number of opportunities for MBI programs operating under this model, including increasing funding, education programs, and trust building. A number of the programs identified a lack of funding as a major challenge (Asquith et al., 2008; Corbera, Soberanis & Brown, 2009; Leimona, Pasha & Rahadian, 2010; Pagiola, 2008). Given that a lack of funding is likely to be felt most notably by service providers (*i.e.* program participants) through decreased compensation, an increase in program funding may help to increase public participation by providing additional financial incentives. In addition, an increase in community education aimed at informing the public of the importance of conserving ecosystem services, may help to increase participation in conservation initiatives and may also serve as a means of building trust within communities.

Lastly, there exist a number of external threats facing the success of MBI programs operating under this payment distribution model. First, these programs may have a greater potential for environmental leakage. As noted previously, projects operating under this approach may have a decreased capacity for community-wide management. Conservation in one area may result in overexploitation in another area (environmental leakage) unless a community-wide management approach is taken. This is because community needs do not disappear in light of new conservation efforts; they simply become displaced (Nzunda & Mahuve, 2011). When community-wide management practices are not implemented, overexploitation of new areas may decrease the ecosystem's overall resilience or increase its vulnerability to external pressures (Elmqvist et al., 2003). Lastly, complex land tenure issues present a major obstacle for programs operating under this payment model. In cases where land tenure is poorly defined, understanding who should be compensated for conservation efforts (*e.g. de jure* landowner vs. *de facto* landowner) can be complicated. This problem was prominent in Bolivia's Bees and Barbed Wire for Water project. Property rights in Bolivia are loose at best and typically consist of overlapping, contradictory, and unsupported claims (Asquith et al., 2008). However, over time, and with much collaboration with local community members, Bolivia's Bees and Barbed Wire for Water project helped to establish property rights in the Santa Rosa region, which was necessary for its successful implementation (to be discussed further in a subsequent section).

Table 8: SWOT analysis of the ‘direct financial payment to individual’ model.

	‘Direct financial payment to individual’ distribution model — SWOT ANALYSIS — POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS** • Compensates those directly responsible for management efforts • Customize compensation/ incentive deals • Builds long-lasting, trusting relationships with landowners	**WEAKNESSES** • May be subject to participant discrimination • May not promote community-wide management practices • May provoke conflict within community • Not aimed at improving social condition at community level • Higher transaction costs • Sensitive to land tenure issues
EXTERNAL	**OPPORTUNITIES** • Increased project funding may help to increase participation • Increased awareness through education may increase participation • Building trust through long-lasting relationships • Reduced opportunity costs	**THREATS** • Environmental leakage • Management efforts may be less resilient • Increasing opportunity costs more enticing at individual level • Complex land tenure

4.3.3.2 Financial support for specific community goals

There are a number of advantages of employing a payment distribution model that directs payments to the community level rather than to the individual level. Most notable is the ability to impose community-wide management practices rather than a fragmented management approach adopted by a lesser number of landowners scattered throughout a community. This may be especially important for projects aiming to improve socio-economic conditions at the community-level as well as those targeting certain services such as biodiversity or watershed protection. This also ties in with a potential to reduce environmental leakage. Because programs operating under this model typically practice community-wide environmental management, they may also be less likely to result in environmental leakage. Still, this is not to say that regional, or inter-community environmental leakage would not be an issue for these programs. Another benefit of this model is the potential to limit participant discrimination. The community-based payment model helps to ensure that all community members have equal opportunity to participate in conservation efforts and share equally in the program's benefits. Still, inter-community discrimination may still be a problem for programs operating under this model. This was observed for the Menabe Habitat Management Competition, where larger communities were being favored because they had a greater land area and thus the potential for larger scale management efforts (Sommerville et al., 2010).

Another advantage of this model is the potential for lower transaction costs. Programs employing this framework benefit from not having to make individual agreements with each participating landowner/homeowner. Instead, project coordinators typically develop a relationship with a community association (e.g. Nhambita Community Association) and direct payments to a community trust where the funds can then be allocated to the attainment of community objectives. Lastly, programs operating under this model are less vulnerable to complications related to poorly defined land tenure. This is because they typically employ conservation initiatives at the community level and allow communities to decide how to equitably distribute payments.

This payment model also has a number of distinct disadvantages. Foremost is its tendency to not always compensate those that are directly responsible for management efforts. For example, an MBI program adopting this type of mechanism typically relies on a community fund or association to distribute compensation equitably. However, depending on how funds are distributed within the community or if they are used to support some sort of community project, project participants may not always feel like they have been fairly compensated. Sommerville et al. (2010) describe a case where revenue generated through an MBI program was used to purchase community services that could then be used by all members of the community despite whether or not they had participated in the program. Although a net benefit was experienced at the community level, individual participants, particularly those experiencing high opportunity costs, were less likely to consider the project to be beneficial at the family level. This suggests an inequitable distribution of benefits among community members and therefore highlights a potential flaw in the community-based payment model.

There presently exists a number of opportunities for payment programs operating under a community-based payment model. Most notably, an increase in funding and environmental education through the implementation of various education programs may help to provide additional incentive for community participation and may also help to increase community awareness about the importance of preserving ecosystem services. Programs operating under this model may also benefit from improved intra-community relations and collaboration. Community-based conservation initiatives can have many complex and interconnected components. Improving intra-community relations may help to improve the effectiveness or efficiency of community management efforts by reducing redundancy in conservation efforts.

Lastly, significant challenges remain for the community-based payment model. Community-driven conservation programs thrive on community participation and rely on the ability or capacity of a community to effectively manage its resources. Also, these programs function on the assumption that communities are able to collaborate and work together to achieve community goals. In regions characterized by unstable community relations, a community-based payment model may not be the most effective approach. A community-based model is likely to be most effective in a community with positive intra-community relations. It should also be noted that a community-based model does not address individual opportunity costs and programs using this model may have difficulty incentivizing individual behaviour (Sommerville et al., 2010).

Table 9: SWOT analysis of the community-based payment model.

Community-based payment model — SWOT ANALYSIS	POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS** • Promotes community wide management practices • Improves social condition at community level • Inclusive of all community members • Builds community bonds • Lower transaction costs • Community benefits unaffected by land tenure issues	**WEAKNESSES** • Does not always compensate those directly responsible for management efforts • Participants may not feel compensated fairly • May not promote relationships with individual participants • Limited poverty alleviation • Some community level discrimination
EXTERNAL	**OPPORTUNITIES** • Increased project funding may help to increase participation • Increased awareness through education may increase participation • Reduced opportunity costs • Improving community relationships	**THREATS** • Community population decline • Regional leakage • Increasing opportunity costs • Unstable community relations • Incentivizing individual behavior

4.3.3.3 In-kind payments

Although not entirely common amongst the MBI programs evaluated, the in-kind payment approach has at least three readily apparent advantages. The first of these being that compensating participants with services or products helps to ensure that revenue generated through the MBI program is allocated toward improving the social wellbeing of its participants. Furthermore, this type of payment model has the potential to provide access to previously unattainable services or products and, unlike the community-based payment model, this model compensates those that are directly responsible for management efforts. The most notable case study of in-kind payments for ecosystem services was Bolivia's Bees and Barbed Wire for Water program where farmers were rewarded with one beehive and training in honey production for every ten hectares of water-producing cloud forest that they protected (Asquith et al., 2008). This was approximately equivalent to $US3 a year per hectare and was paid upfront to voluntary participants. In this example, the program provided an alternative livelihood source rather than simply requiring farmers to stop farming. Moreover, farmers insisted on in-kind payments rather than cash, explaining that cash payments are likely to be spent right away, whereas beehives and training will contribute to an alternative, sustainable livelihood (Asquith et al., 2008).

On the other hand, MBI programs implementing the in-kind payment approach are subject to a number of distinct disadvantages. As Waage et al. (2008) explain, an equitable payment program is one where both the service provider feels adequately compensated and the buyer feels satisfied with the transaction, and that an equitable transaction is important to the long-term sustainability of a payment program. It is important that management incentives offset opportunity costs for transaction to be fair. When participant compensation is done through in-kind payments, it is possible that the participants may feel unfairly compensated for their efforts and consequently may be less inclined to participate. Additionally, when payments are made through in-kind services rather than monetary compensation, the program – which is meant both as a tool for ecosystem management and improving social well being - only indirectly contributes to poverty alleviation. This is not to say that in-kind payments do not have the capacity to improve social wellbeing. As was demonstrated by Bolivia's Bees and Barbed Wire for Water program, in-kind compensation can indirectly contribute to poverty alleviation through the provision of alternative livelihood options. Lastly, it should be noted that programs implementing the in-kind payment approach are not immune to the type of participant discrimination seen with other payment distribution models. In Bolivia's Bees and Barbed Wire for Water program, contractual agreements were made with community members of the Santa Rosa region on the basis of land ownership. Under this agreement, owners of larger land areas were able to experience more benefits from the program than owners of smaller land areas, as benefits were distributed on a per hectare basis. Although it may have been done inadvertently, this particular program's design perpetuated participant discrimination on the basis of land ownership.

The in-kind payment model shares a number of commonalities with the 'direct financial payment to individual' model with regard to external opportunities (*e.g.* increased funding/education, building trust, reduced opportunity costs). Most, if not all MBI programs would stand to benefit from an increased public awareness of the value of ecosystem services. However, for programs operating on the in-kind payment model, creating awareness about the benefits of in-kind services rather than monetary payments also presents a challenge. This may involve discussion about the importance of alternative, sustainable livelihood options or even training to facilitate alternative livelihoods as was seen in the Bolivian case study. Additionally, building trust in communities may promote the success of programs operating under this model. For any payment program, it is important that all parties involved feel satisfied with the transaction. However, this may be especially challenging for projects where participants are not compensated financially. For this reason, building a trusting relationship with communities and ensuring them that they are being fairly compensated despite the lack of direct financial incentive is critical to the success of this model.

Lastly, MBI programs operating under the in-kind payment model are subject to many of the same external threats as previously outlined for the other models. These threats include environmental leakage, increasing opportunity costs, vulnerability to poorly defined land tenure, and a decreased resilience to external pressures such as forest fires or droughts due to the absence of a community-wide management approach. It should be noted, however, that in the case of poorly defined land tenure, this payment model has shown some promise. The Bolivian Bees and Barbed Wire for Water project was able to partly overcome poorly defined land tenure issues by providing community members with barbed wire fencing as partial payment for management efforts. In 2006, project participants requested compensation in the form of barbed wire rather than the typical payment, which had been beehives and training in honey production. They explained that in addition to keeping their cattle out of environmentally sensitive areas, the barbed wire also assisted in reinforcing property rights (Asquith et al., 2008). Although programs operating under this model may have a high sensitivity to poorly defined property rights, this particular project demonstrates how in-kind payments can actually be used to strengthen property rights in some cases.

Table 10: SWOT analysis of the in-kind payments model.

In-kind payment model — SWOT ANALYSIS	POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS** • Ensures money is allocated toward improving social wellbeing • May provide access to previously unattainable services or products • Provides incentive to those directly responsible for management efforts	**WEAKNESSES** • Participants pay feel like not being compensated fairly/less incentive for participants • Indirect contribution to poverty alleviation • May be subject to participant discrimination
EXTERNAL	**OPPORTUNITIES** • Increased project funding may help to increase participation • Increased awareness through education may increase participation • Building trust through long-lasting relationships • Reduced opportunity costs	**THREATS** • Environmental leakage • Management efforts may be less resilient • Complex land tenure • Increasing opportunity costs

4.4 Summary

Two major challenges facing the success of any MBI program are the ability to establish adequate funding through various investors and the ability to identify an appropriate payment distribution model specific to both the type of finance mechanism and the context in which it is being implemented. This chapter identified several types of investors as being common amongst market-based incentive programs, including private companies or intermediaries, governments, donor agencies, NGOs, and private individuals. Furthermore, three payment distribution models were identified amongst the MBI programs. These include direct financial payments to individuals (usually landowners or farmers), financial payments directed to community funds to support community goals, and payments made in in-kind services to project participants.

Additionally, multiple SWOT analyses were conducted to identify the strengths, weaknesses, opportunities, and threats associated with using each distribution model. The results of the SWOT analyses suggest that identifying an appropriate payment distribution model for a particular project can be challenging as models can be highly context specific. Building on these findings, chapter five discusses which of these investor categories and distribution models would be the most appropriate for the Tanjung Panjang case study.

CHAPTER 5: DEVELOPING A SUCCESSFUL MARKET-BASED INCENTIVE PROGRAM IN TANJUNG PANJANG

5.1 Overview

The preceding chapters have outlined five separate finance mechanisms, each aimed to promote environmental conservation through the provision of financial or in-kind incentives to communities. In addition, they have also identified five general investor types and three different payment distribution models, each with their own advantages and disadvantages. Although many of the MBI case study programs have focused on conserving terrestrial ecosystems and corresponding services, much can be learned from these examples for conserving coastal environments such as mangrove forests.

The objective of this chapter is to identify how the preceding findings can be used to inform the development of a successful market-based incentive program in Tanjung Panjang. Currently in Tanjung Panjang, an MBI program known as the Rehabilitating Blue Carbon Habitats program is undergoing preliminary planning. This chapter provides a number of recommendations aimed to inform and strengthen the development of the RBCH program. To begin, the first section identifies the most suitable finance mechanism for the Tanjung Panjang context, giving consideration to the political, socio-economic, and environmental realms. The next section identifies potential investors specific to the Tanjung Panjang case study based on the five investor types previously identified. The following section proposes a payment distribution model that is able to provide equitable distribution of benefits from the RBCH program and promote socio-economic development in this region despite its poorly defined property rights. This chapter also provides an estimated cost of implementing and operating a mangrove restoration project in Tanjung Panjang (*i.e.* the Rehabilitating Blue Carbon Habitats program) as well as the projected financial returns from this project based on the sale of carbon credits through a voluntary carbon market. Finally, this chapter finishes by proposing an integrated approach to coastal zone management in Tanjung Panjang area - one that prioritizes mangrove habitat conservation, but also takes into account the need for sustainable development and the social welfare of the *tambak* farmers.

5.2 Case-specific Finance Mechanism

Conservation-based finance mechanisms, such as REDD+, PES, and environmental tax programs each present a unique set of advantages and disadvantages. It therefore stands to reason that some mechanisms may be more or less suitable given a particular context. For this reason, it is important to be mindful of these advantages and disadvantages when considering a market-based approach to environmental management. The present paper gives consideration to three primary finance mechanisms for their suitability to the Tanjung Panjang context and, more specifically, the RBCH program.

REDD+ projects are unique in that they recognize the importance of sustainable forest management by providing compensation to those who actively conserve forest carbon stocks. Out of all the finance mechanisms, REDD+ is most in tune with the goals of the RBCH program, which are to restore Tanjung Panjang's mangrove forest and regain its many ecosystem services, including its ability to sequester and store CO_2. Additionally, Indonesia has had a great deal of experience with the REDD+ and has one of the highest numbers of REDD+ and other forest carbon projects of any country (Center for International Forestry Research, 2010). Furthermore, given that such a large portion of Indonesia's emission reduction targets is to be achieved through sustainable forest management practices (~14%) (Yusuf, 2010), it only seems appropriate that the REDD+ mechanism be used to support the goals of the RBCH program.

However, in many ways the REDD+ mechanism is an unsuitable choice for the RBCH program. REDD+ has yet to fully recognize mangrove forests under an accredited project type and continues to focus predominantly on inland tropical forests (Murray & Vegh, 2012). The lack of mangrove-based REDD+ initiatives has been attributed largely to the need for additional research and an easier and more cost-effect means of monitoring, reporting, and verifying carbon stores. Furthermore, REDD+ currently recognizes avoided deforestation projects and gives little attention to reforestation and afforestation initiatives (Murray & Vegh, 2012). Although the Tanjung Panjang site host about 2500 hectares of mangrove forest, the main focus of the RBCH program is to restore this area's *tambak* mangrove forest through reforestation efforts (Cameron, 2013a). Because these efforts would not be covered under this mechanism, revenue generated by the RBCH program if it were to adopt the REDD+ approach would be marginal.

A number of recent studies have suggested that advances in remote sensing technology may make measuring and monitoring mangrove distribution and even biomass more achievable (Liu, Li, Shi & Wang, 2008; Rana, Tokola, Holm, & Kauranne, 2011; Wicaksono, Danoedoro, Hartono, Nehren, & Ribbe, 2009), which could aid their inclusion into international emission reduction strategies. However, international progress regarding climate change management has been historically slow, suggesting that the inclusion of blue carbon sinks into emission reduction strategies will not happen overnight. Until mangrove forests are incorporated into international emission reduction strategies, namely the Kyoto Protocol and the CDM, the sale of verified carbon credits on a voluntary market may present a potential opportunity for financing mangrove conservation in Tanjung Panjang.

Environmental tax programs represent a more traditional means of generating revenue for conservation initiatives and have shown to be highly successful in some cases (Pagiola, 2008;

Turpie et al., 2008). However, this would be an unsuitable means of financing mangrove conservation in Tanjung Panjang given this region's extremely poor socio-economic status. Furthermore, because an environmental tax would target property owners instead of those who are responsible for mangrove deforestation (*i.e.* migrant *tambak* farmers), implementing this type of finance mechanism in Tanjung Panjang could be considered counterintuitive. As *tambak* farmers are not considered permanent residents in this area, they are unlikely to be effected by an environmental tax. Perhaps a more appropriate option would be the development of a tax program that targets only *tambak* farmers or those responsible for mangrove destruction. Revenue generated from this tax could be directed towards neighbouring conservation efforts or could even go towards the development of more sustainable aquaculture practices in this area.

When considering the implementation of an environmental tax, one must also consider the potential to achieve undesired consequences. As Fullerton et al. (2010) explain, those paying an environmental tax may feel that they are entitled to pollute which may result in more severe environmental degradation. Furthermore, it is the Indonesian government's ultimate objective to stop all aquaculture operations in Tanjung Panjang. Although an environmental tax may help to finance mangrove restoration initiatives, it will unlikely drive a reduction in *tambak* farming; but instead, it would just penalize those responsible for mangrove degradation.

The PES model likely represents the most suitable option for restoring and conserving mangrove forest in Tanjung Panjang. PES is well established as an effective tool for promoting sustainable management and has had a great deal of success conserving ecosystem services such as water quality and biodiversity (Pagiola, 2008; Perrot-Maître, 2006; Sommerville et al., 2010). Furthermore, over the past few decades the PES framework has garnered a great deal of support from both governments and communities. However, it should be noted that community trust and government corruption continue to represent major obstacles for projects operating under this mechanism (Asquith et al., 2008; Bennett, 2008; Sommerville et al., 2010). The PES framework is able to accommodate a wide variety of ecosystem services, as opposed to other mechanisms (*e.g.* REDD+), which tend to focus on one particular service (carbon sequestration). This is ideal for an MBI program in Tanjung Panjang as mangrove forests offer a variety of highly valuable services and functions related to both water quality and biodiversity (Bosire et al., 2008; Lutz, 2011). Although carbon sequestration is important, it represents only one of the services that could potentially be targeted by the RBCH program.

As previously discussed, MBI programs operating under the PES framework are subject to a number of limitations. Wunder (2005) explains that a PES project is one where a financial transaction occurs between a minimum of one ecosystem service buyer and a minimum of one ecosystem service provider. If taken verbatim, this definition presents a particular problem for the Tanjung Panjang case study as it suggests that communities (service buyers) would have to compensate *tambak* farmers (service sellers) for discontinuing environmentally degrading aquaculture practices. Because *tambak* farmers are operating illegally in Tanjung Panjang, this option is unlikely to garner support from the surrounding communities. Weak property rights also present potential complications for the PES model. In most cases throughout Tanjung Panjang, those operating *tambak* ponds do not have legal property rights. This can make it difficult to assign management responsibilities or penalize those responsible for the degradation of mangrove habitat. With market-based incentive programs, well-defined property rights are often seen as a necessary pre-condition for binding contracts (Swallow et al., 2005). Asquith et al. (2008) explained that property rights may be strengthened by using technology to reinforce hand-written bills of sale/purchase and to measure and demarcate forest conservation plots with a hand-held GPS receiver, or by installing trails, signs, or wire fencing. In any case, it is apparent that a strict PES agreement may not be suitable for Tanjung Panjang. However, a modified PES framework or a combination of multiple frameworks may be more appropriate for this particular case. Preferably, the finance mechanism would be one where funding comes from a suite of sources (*e.g.* government, donor agencies, private corporations, *etc.*) or a combination multiple finance mechanisms, such is often the case for these types of MBI programs (Table 2).

5.3 Case-specific Investors

Finding adequate funding is a challenge for any market-based incentive program (Waage et al., 2008). Ensuring that participants feel fairly compensated for their efforts and are able to attain a quality of life equivalent or superior to that enabled through opportunity costs are essential to their success (Asquith, 2007). The present study identifies five dominating investor types for MBI programs and demonstrates that it often requires a combination of two of more investor types to provide adequate funding. This section identifies several potential investors for each of these five investor categories, specific to the Tanjung Panjang case study. It also recognizes that some of these investor types may not be appropriate or realistic given some of Tanjung Panjang's socio-economic and political limitations.

Private corporations and intermediaries represent the most plausible investor types for the RBCH program. There are several key motivations for companies wishing to invest in conservation initiatives, namely, to maintain the supply of a particular natural resource, to reduce some aspect of operational costs by investing in ecosystem services, to improve their corporate image, or to either voluntarily or involuntarily offset their emissions (Waage et al, 2008). Australasia hosts a number of major airline and energy (oil and gas) corporations, both of which are major GHG emitters and therefore have great potential to reduce emissions. Moreover, as energy companies are driven offshore in search of oil and natural gas, they are becoming even more prominent fixtures along our coastlines and thus have a growing stake in coastal resources. Other private corporations, such as the *Groupe Danone* and the Macquarie Bank, have shown a great deal of support for community development and environmental restoration projects in developing countries (C. Cameron, personal communication, June 15, 2013). Even more, the *Groupe Danone* already has an active presence in Indonesia and has invested in several blue carbon projects (Dey & Kar, 2013; Sall & Durin, 2013). Both corporations have been engaging in conversations with members of the RBCH program as of late. Lastly, several voluntary carbon markets have also been identified. These markets aim to facilitate the sale of carbon credits from their source (conservation projects) to either individuals or corporations looking to voluntarily offset their emissions. These markets, particularly the Australian-based Carbon Trade Exchange or the China-based Tianjin Climate Exchange, may provide a medium by which to contact potential investors for the RBCH program.

Both the Indonesian and Australian governments present a potential source of support for the RBCH program. Indonesia's Ministry of Forestry has been heavily involved in the designation of Tanjung Panjang as a National Park and has committed to restoring this area's mangrove habitat. Additionally Indonesia's Ministry of Marine Affairs and Fisheries has been actively involved in the planning of a national blue carbon strategy and may offer a potential source of in-kind support in the future. Lastly, the Australian Agency for International Development (AusAID) is a department under the Australian government whose main priority is to help improve the lives of those living in developing countries. As of recent, AusAID has signed an AUS$40 million climate change agreement with the Indonesian government under which AusAID will distribute funds to projects aiming to mitigate the impacts of climate change or improve adaptive capacity of communities (Cameron, 2013b). Efforts are currently under way to acquire funding for Tanjung Panjang's RBCH program through AusAID.

A number of international and national donor agencies have been identified as potential investors for the RBCH program. Many of these agencies specialize in financing projects that focus on social development, poverty alleviation and environmental restoration. Furthermore, a number of these agencies have demonstrated support for projects like the RBCH program in the past. For example, the World Bank has been cited as a major financer of Costa Rica's Payments for Environmental Services program, which focuses on conserving biodiversity, carbon stores, hydrological services, and aesthetic value of natural environments (Pagiola, 2008). A major advantage for projects searching funding through donor agencies is that they are not restricted to local investors as many donor agencies work and support various projects internationally (*e.g.* World Bank, United Nations Development Program, Global Environmental Facility, *etc.*).

On the other hand, non-government organizations (NGOs) tend to operate at a more local scale and are often able to take a more hands-on approach to community issues. However, given that NGOs usually operate on small budgets, they may be more inclined to support community projects in-kind rather than providing financial assistance. In Tanjung Panjang, several NGOs have shown support for a mangrove restoration and have formed an active partnership with the RBCH program, namely Blue Forests, Japesda, and the Mangrove Action Project (MAP)-Indonesia. Blue Forests – an NGO local to the Pohuwatu District – has offered assistance during the mangrove reforestation process. They also conduct 'Fish Farmer Field Schools' for the local *tambak* farmers to teach them about sustainable aquaculture practices, such as the use of organic inputs (*e.g.* chicken manure) instead of expensive and more environmentally harmful fertilisers. Japesda is another local NGO which has offered to assist the RBCH program with matters concerning government liaison and policy analysis. Japesda is a grass roots environmental organization that recognizes the importance of ecosystem services and environmental management. Moreover, they have established strong ties with the communities surrounding

Tanjung Panjang and may play an integral role in establishing community trust for the RBCH program. MAP-Indonesia – an offshoot of the US Mangrove Action Project – has been the in-country organization responsible for mangrove reforestation efforts and capacity building when it comes to community involvement with mangrove restoration initiatives. MAP-Indonesia also offers a number of community resources, not the least of which is the 'MAP Toolkit' which aims to provide communities with ideas, projects, and activities from which they can draw upon and adapt to local conditions to improve their socio-economic wellbeing (Mangrove Action Project, n.d.).

Lastly, there are four main communities surrounding the Tanjung Panjang site (Patuhu, Siduwonge, Palambane, and Limbula). These communities stand to benefit the most from an MBI program in this area and represent the main beneficiaries of the ecosystem services being targeted. Members of these communities have shown support for the restoration of Tanjung Panjang's mangrove forest and will likely play an integral role during the RBCH program's implementation and monitoring phases. However, given their generally poor socio-economic status, individual investors from within these communities are unlikely to play a major role in financing conservation efforts such has been a main source of funding for other PES and environmental tax-funded programs. On the other hand, migrant *tambak* farmers have shown little support for mangrove restoration efforts and have been unresponsive to all attempts to restore mangrove habitat in this area. It is therefore unlikely that *tambak* farmers will play a supportive role in the development of the RBCH program. A list of potential investors specific to the RBCH program can be found in Table 11. This is by no means a exhaustive list of potential investors, but is meant to provide direction for the identification of additional funding sources.

Table 11: Potential investors for the RBCH program categorized into five categories: private companies and intermediaries, government, donor agencies, NGOs, and private individuals.

Investor type	Potential investors for RBCH program (Tanjung Panjang)	Notes
Private companies and intermediaries	Oil and gas corporations (*e.g.* Chevron Australia, Inpex, Santos Limited, Total, Australian Worldwide Exploration Ltd., *etc.*)	Oil and gas corporations are significant contributors to GHG emissions and are often primary stakeholders in the coastal environment. Australia and Indonesia host a number of major energy corporations – some of which have previously invested, or shown interest in supporting environmental conservation/research initiatives. Inpex, for example, an oil and gas company with several operations based out of the Northern Territory, Australia, has already established a research partnerships with CDU regarding mangrove forest carbon sequestration.
	Groupe Danone	The *Groupe Danone* is a French-based food products multinational corporation which has demonstrated environmental consciousness and has in the past invested in several mangrove reforestation projects (Dey & Kar, 2013; Sall & Durin, 2013), among other projects relating to social and environmental development. The *Groupe Danone* already has an active presence in Indonesia and discussion between them and MAP-Indonesia has begun.
	Macquarie Group Foundation	A branch of Macquarie Bank, which has shown support for a variety of community programs, often involving community capacity building. Macquarie has supported programs in Asia and Austrasia in the past and has been engaging in conversations with members of the RBCH program as of late.
	Airline corporations (*e.g.* Jetstar, Virgin Australia, AirAsia, Tiger Airways, Qantas, *etc.*)	Airline corporations are a major contributor of GHG emission and therefore have a great potential for emission reductions. Australasia is home to a number of airline companies, many of which have already developed emission offsetting programs. A great example is Qantas's Fly Carbon Neutral program where a portion of ticket sales goes toward funding one of several community development programs located throughout Southeast Asia.
	Voluntary carbon markets (*e.g.* Carbon Trade Exchange, European Climate Exchange, Montréal Climate	A number of international voluntary carbon markets have been developed over the past decade. These markets aim to facilitate the sale of carbon credits from their source to

	Exchange, Tianjin Climate Exchange, *etc.*)	either individuals or corporations looking to voluntarily offset their emissions. The success of these markets has been unstable.
Government	Ministry of Forestry	Indonesia's Ministry of Forestry has committed to reforesting Tanjung Panjang's protected mangrove park and has offered some financial assistance for the restoration phase of the project.
	Ministry of Marine Affairs and Fisheries	Indonesia's Ministry of Marine Affairs and Fisheries is developing a national blue carbon strategy. If implemented, the RBCH Program will likely represent one of the core mediums through which this strategy will operate. Although, it has not been a source so financial support as of late, the Ministry of Marine Affairs and Fisheries offer a potential source of in-kind support.
	Australian Agency for International Development	A department under the Australian government whose main priority is to help improve the lives of those living in developing countries. As of recent, the Indonesian government and AusAID have signed an AUS$40 million climate change agreement. Under this, AusAID will distribute funds to projects aiming to mitigate the impacts of climate change or improve adaptive capacity.
Donor agencies	Indonesia Climate Change Trust Fund United Nations Development Program Department for International Development Swedish International Development Cooperation Agency The World Bank Asian Development Bank Global Environmental Facility Swiss Agency for Development and Cooperation	A number of international and national donor agencies have been identified. These agencies specialize in financing projects aimed at improving social welfare and environmental conditions in developing countries. Some of these agencies have supported similar project in the past. Even more, some have been engaging in conversations with members of the RBCH program about potential sponsorship.
NGOs	Japesda	Japesda is a local NGO which has offered to assist the RBCH program with matters concerning government liaison and policy analysis. Japesda has established strong ties with the communities surrounding Tanjung Panjang and may play an integral role in establishing community trust for the RBCH program.

	Blue Forests	Blue Forests is an NGO local to the Pohuwatu District and has offered assistance during Tanjung Panjang's mangrove reforestation stage. They also conduct 'Fish Farmer Field Schools' to teach local *tambak* farmers about sustainable aquaculture practices.
	Mangrove Action Project-Indonesia	MAP-Indonesia has been the in-country organization responsible for mangrove reforestation efforts and capacity building when it comes to community involvement with mangrove restoration initiatives. They also offers a number of community resources, including the 'MAP Toolkit' which provides communities with ideas, projects, and activities from which they can draw upon to improve their socio-economic wellbeing
	Climate Friendly	One of many international NGO carbon credit intermediaries. Has offices throughout Australia, but is involved with projects throughout Southeast Asia. Has unique partnership Qantas (airline company) whereby they facilitate the sale of carbon credits to Qantas passengers hoping to reduce their carbon footprint. May present potential source of contact for RBCH program.
Private individuals	Villages of Patuhu, Siduwonge, Palambane, and Limbula	These are the four main villages surrounding Tanjung Panjang. Given the generally poor socio-economic status of these communities, they will unlikely play a major role in financing conservation efforts such has been a main source of funding for some environmental tax funded programs. Members of surrounding communities have shown support for mangrove restoration initiatives and may be a potential source of in-kind support for RBCH program.
	Tambak farmers of Pohuwatu District	*Tambak* farmers in Tanjung Panjang have been unresponsive to mangrove conservation efforts and are unlikely to support the RBCH program.

5.4 Case-specific Payment Distribution Model

The way in which an MBI program delivers compensation to its participants bears weight on the success of that program. Surely, a payment model that does not compensate those directly responsible for conservation efforts is less likely to gain much community support. The present study identifies three different payment distribution models amongst international case studies of market-based incentive programs and demonstrates that the success of each model is dependant on the specific context in which it is implemented. For Tanjung Panjang, poorly defined property rights and illegal *tambak* farming make identifying an appropriate payment model under which to operate difficult.

The individual payment model, whereby financial payments are made directly to those landowners or homeowners that are responsible for management efforts, would be a unsuitable choice for an MBI program in Tanjung Panjang. Though it has shown to have some capacity for poverty alleviation, this model tends to target those who hold *de jure* property rights. In Tanjung Panjang, property rights are weak and the majority of *tambak* ponds are operated illegally on land owned by the Indonesian government. In this context, the individual payment model would imply that payments from a MBI program would go directly to those *tambak* farmers who discontinued unsustainable farming practices. However, because the government has already asked these farmers to leave and they are now operating illegally, it seems unfitting that they should now be rewarded for discontinuing these unsustainable aquaculture practices. Moreover, this type of payment model is unlikely to gain much community support and may even compromise community trust for the RBCH program. Alternatively, a payment model where individual payments were directed toward true landowners might prove more successful in this region. However, as *tambak* farmers are unlikely to benefit from this alternative model, they would unlikely cooperate in efforts to conserve mangrove habitat, thus rendering the conservation efforts ineffective. In general, the individual payment model has the greatest potential to fairly compensate project participants, but given Tanjung Panjang's complicated land tenure, it represents an unsuitable payment distribution model for the RBCH program.

Similarly, the in-kind payment model works by compensating those who are directly responsible for conservation efforts. But instead of financial payments, it provides participants with in-kind services or support. Though this model may ensure that money is being allocated to the improvement of social wellbeing rather than just being wasted, as was observed for the Bolivian Bees and Barbed Wire for Water program (Asquith et al., 2008), it still faces the same challenges regarding weak property rights as was previously discussed. A report by Asquith et al. (2008) suggests that in-kind payments can in some cases help to strengthen property rights by providing the equipment and supplies needed to demark property boundaries. However, given that the *tambak* farmers in Tanjung Panjang have so far been unresponsive to mangrove management efforts, it seems unrealistic that strengthening property rights in this region would help to achieve their full cooperation. Overall, the in-kind payment model may have the potential to improve social wellbeing of the communities surrounding Tanjung Panjang. However, a lack of financial incentive associated with this model, unrelenting aquaculture operations, and poorly defined property rights make this payment distribution model a poor choice for the RBCH program.

Alternatively, a community-based payment model likely represents a more practical option for distributing payments for the RBCH program. Like the other payment models, a community-based model would help to improve social wellbeing in the surrounding communities through poverty alleviation, but would do so at the community level. One of the major advantages of a community-based model in Tanjung Panjang would be its ability to improve social wellbeing despite poorly defined land tenure. Rather than basing conservation efforts on landownership, the RBCH program could use this model to promote community-wide environmental management and could distribute funds accordingly. This model aligns with the Indonesian Ministry of Forestry's goals in this area, which are to implement a community-wide moratorium on aquaculture operations and to restore the entire Tanjung Panjang Nature Reserve. To achieve this objective, having the support of the entire community, rather than just some of the largest landowners would prove critical. Furthermore, when community incentives are based on community-wide success rather than individual success, there may be added pressure on *tambak* farmers from the surrounding communities to discontinue *tambak* operations or improve the their overall sustainability. A potential disadvantage of this payment model is that it may leave project participants feeling unfairly compensated for their efforts, especially for those participants with high opportunity costs. However, this would unlikely be the case for the RBCH program as the majority of potential participants would likely be from surrounding communities, would not rely on *tambak* farming as a primary source of income, and therefore would not experience a loss of livelihood as a result of the RBCH program.

Overall, a community-based payment model is the best option for the RBCH program given this regions complex land tenure issues and the unwillingness of *tambak* farmers to participate in mangrove restoration efforts. However, unlike the other payment models, a community-based model would likely require the development of a community association to facilitate cooperation between the surrounding communities and the RBCH project coordinators. A potential solution may be for one of the local NGOs (*e.g.* Blue Forests or Japesda) to take on this responsibility and coordinate interactions between an MBI program and community members. Once payments were made to the community association, community meetings could then be held to decide on which community goals or projects to spend the money. The following section outlines the estimated costs and potential financial returns from an MBI program Tanjung Panjang, thus providing the financial basis for the RBCH to operate.

5.5 Rehabilitating Blue Carbon Habitats Program

Estimate Project Costs vs. Projected Carbon Returns

The costs of implementing and operating a market-based incentive program in Tanjung Panjang have been estimated (Cameron, 2013c). These costs were then compared to the projected financial return based on the sale of carbon credits at a low market value. It should be noted that all figures presented are based on desktop research and that whenever possible conservative estimates were applied. Furthermore, estimated carbon return was partly based on the measured rate of CO_2 sequestration for *Rhizophora* spp. as described by (Alongi, 2011; Inoue et al., 1999). Though the mangrove forest in Tanjung Panjang consists primarily of *Rhizophora* spp., future estimates for carbon return would benefit from in-field analysis of carbon sequestration and storage for this site.

Project costs:

The cost of mangrove habitat rehabilitation has been estimated to be approximately AUD $871 ha^{-1}. This cost is inclusive of a series of five-day mangrove rehabilitation community training sessions, local government liaison and coordination, community organizing, in-country staff salary (members form Blue Forests and Japesda), the physical act of restoration, and the development of initial carbon/biodiversity estimates. It should be noted that estimates are on the high side and may vary depending on a number of technological factors (*e.g.* whether an excavator is required to fill in *tambak*). Furthermore, estimates are based on restoring the historic hydrological function of the site and allowing mangroves to regenerate naturally. This has proven to be the most successful approach in the past (Figure 7). For the sake of simplicity and the potential for unforeseen costs, mangrove rehabilitation has been rounded up to an estimated AUD $1000 ha^{-1}.

Partners of the RBCH program (Blue Forests and Japesda) estimate that with enough support it would be possible to rehabilitate 500 ha per year for a total of eight years to achieve the total goal of 4,000 ha of rehabilitated mangrove forests. This figure equates to AUD $500,000 per year for a total of AUD $4,000,000 over 8 years. Additionally, set up costs of AUD $100,000 and an annual operation cost for non-Blue Forests and Japesda staff of AUD $100,000 bring the total project cost to an estimated AUD $5,000,000. These estimates are based on rehabilitation costs not commencing until the second year of operations. An outline of projects costs can be found in Table 12.

Table 12: Estimated cost of restoring 4,000 ha of mangrove habitat in Tanjung Panjang.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Set-up costs	100k	0	0	0	0	0	0	0	0
Restoration	0	500k	500k	500k	500k	500k	500k	500k	500k
Operation costs	100k	100k	100k	100k	100k	100k	100k	100k	100k
Totals	200k	600k	600k	600k	600k	600k	600k	600k	600k
Grand total	AUD $5 million								

Estimated carbon returns:

A mangrove restoration project of this size would result in an estimated offsetting of between 21.83 and 28.16 tCO_2 ha^{-1} yr^{-1}. Over a 30 year project time frame, this would offset a total of between 3.38 and 2.62 million tCO_2. This estimate is inclusive of carbon stored in the form of above and below ground mangrove biomass and soil carbon burial, and also accounts for the 'capping' of carbon emissions that are actively being released by the *tambak* from decomposing organic material. At a low voluntary carbon market price of AUD $6 per tCO_2, these offsets are worth an estimated AUD $15 - $20 million over the project's lifetime.

A project of this size and capacity to address both environmental and social issues has much to offer for corporate organizations looking to offset their emission. Efforts are now underway to identify potential investors for the RBCH program. Project coordinators have begun contacting corporate sponsors, and the Indonesia government has already indicated that they may be willing to help with some of the initial costs and contribute to the cost of forest restoration. The majority of the income generated through the sale of carbon credits will be used to payback corporate sponsors. However, under a PES framework, a portion of this revenue (~10-20%) could be used to finance social programs and services in the communities surrounding Tanjung Panjang and provide employment opportunities to local residents. Overall, the RBCH program may contribute to an improved social wellbeing for the communities surrounding Tanjung Panjang while ensuring sustainable management for its mangrove forests.

Figure 7: Before and after a similar mangrove rehabilitation project in Tiwoho, North Sulawesi. The project aimed to rehabilitate what was historically a mangrove forest by restoring hydrological functions in area, rather than traditional methods, which rely primarily on mangrove reforestation (Image source: Brown, 2009).

Source of all estimates: Cameron, 2013c)

5.6 Integrated Coastal Zone Management

Although gaining some recognition, the use of market-based incentives for the purpose of environmental conservation is still a relatively new concept. Funding for these types of programs remains inadequate and unreliable at best. Furthermore, given the high opportunity costs associated with environmental conservation and the extremely poor socio-economic condition of Tanjung Panjang, an MBI program is unlikely the cure-all solution needed to conserve this region's mangrove forests. Likely, a more integrated management approach, whereby both mangrove conservation initiatives and sustainable coastal development are able to coincide, will be needed.

Integrated coastal zone management (ICZM) offers a unique solution to managing coastal environments. In short, ICZM aims to integrate the interests of all coastal users and promotes the long-term, sustainable use of coastal resources (Post & Lundin, 1996). Moreover, it has been recognized as a dynamic approach to managing a highly dynamic environment and, as such, ICZM has had some success managing coastal resources in light of the present climate change (Misdorp, 2011; Post & Lundin, 1996). In theory, ICZM in Tanjung Panjang would allow for the coexistence of a market-based incentive program and the sustainable development of *tambak* aquaculture. Additionally, it would also promote the development of alternative sustainable livelihood options, such as small scale bivalve (oyster, clam, mussel) aquaculture, seaweed production, and even eco-tourism based around the Tanjung Panjang Nature Reserve (Mangrove Action Project, n.d.). This would help diversify the income of surrounding communities and may also help to relieve some of the exploitation pressure on mangrove habitat. Under an ICZM approach, it is also important that *tambak* farmers adopt new more sustainable standards to ensure that the mangrove habitat is not degraded any further. Blue Forest's Fish Farmer Field Schools may prove helpful in instructing *tambak* farmers about new, more sustainable aquaculture practices. Increasing the capacity of *tambak* farmers is especially important if the government wishes to relocate *tambak* farmers. Otherwise, doing so may simply result in the transferral of environmental degradation to a new location (*i.e.* environmental leakage). Once *tambak* farmers are trained in the new sustainable aquaculture practices, widespread relocation programs could be initiated to bring migrant farmers back to their traditional fishing grounds in South Sulawesi, where they could then continue to use their newly attained skills. An integrated approach would allow the Indonesian government to slowly phase out *tambak* ponds in Tanjung Panjang and restore its once pristine mangrove habitat by increasing the capacity of *tambak* farmers and providing alternative livelihood opportunities. Most importantly, ICZM in Tanjung Panjang could help to improve this area's resilience and adaptive capacity to the impacts of climate change, thus allowing the surrounding communities to better cope with threats such as sea level rise, salt water intrusion, and cyclones.

It is important to note that Indonesia was an early supporter of integrated coastal zone management. In fact, with the help of several international donors, Indonesia adopted its own ICZM policy for the first time in 1987 through the Community-Based Coastal Resources Management Project. However, beyond 1999, Indonesia's ICZM efforts have proven unsuccessful - due in large to poor planning - and in many regions throughout Indonesia, the ICZM approach has been abandoned (Farhan & Lim, 2010). Reconsidering an integrated management approach may help the Indonesian government achieve its conservation objectives in Tanjung Panjang.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

Market-based incentive programs have attracted a great deal of attention in recent years as a unique approach to addressing both socio-economic and environmental issues. A number of different tools under the blanket of 'market-based incentives' (*e.g.* PES, REDD+, *etc.*) have been identified and are becoming increasingly popular methods of preserving valuable ecosystem services. Case studies such as Costa Rica's Payment for Environmental Services Program and Bolivia's Bees and Barbed Wire for Water program serve as exemplary models of successful MBI programs and have much to offer in the way of informing the development of an MBI program in Tanjung Panjang. Still, much can also be learned from unsuccessful attempts at market-based environmental management.

In Tanjung Panjang, poor socio-economic conditions and the rapid deforestation of mangrove habitat due to unsustainable *tambak* farming have prompted the consideration of a market-based solution. The communities surrounding Tanjung Panjang rely heavily on its mangrove forests for an array of forest products and as a natural coastal barrier. Moreover, their reliance on the latter will undoubtedly increase with the progression of the present climate change. With sea level rise and an increasing severity and frequency of extreme climatic events, mangrove forests are being valued increasingly as a tool for protecting coastal communities. Conserving Tanjung Panjang's mangrove habitat represents a direct attempt to improving this area's resilience and adaptive capacity to the impacts of climate change. Despite considerable effort by the Indonesian government to conserve this area's mangrove habitat, namely the designation of Tanjung Panjang as a nature reserve and the placement of moratorium on *tambak* farming and mangrove deforestation in the region, *tambak* farming in this area continues to threaten the mangrove forests and, consequently, the welfare of the surrounding communities.

The Rehabilitating Blue Carbon Habitats program, which represents a collaborative partnership between the academic, government and non-government sectors, has made significant preliminary effort to address the loss of mangroves in Tanjung Panjang using a market-based approach. However, given this area's unique political and socio-economic context, its poorly defined land tenure issues, and the regionally high dependence on resource exploitation-based livelihoods, developing a successful and effective market-based environmental management regime for Tanjung Panjang will undoubtedly be a complicated task. Through a review of international MBI case studies, the present study attempts to strengthen the ongoing development of the Tanjung Panjang's RBCH program and addresses three major unknowns in this regard.

Overall, the present review of MBI case studies demonstrates that designing a successful MBI program is a complex task and is highly dependant on the unique context in which it is being implemented. In particular, this study finds that a modified PES agreement has the greatest potential to provide social benefit at the community level and is less vulnerable to a number of external threats that have proven problematic for others finance mechanisms (*i.e.* REDD+ and environmental tax programs), and therefore recommends its adoption for the RBCH program. This study also identifies five general investor categories and determines that government funding, private companies or intermediaries, and donor agencies are the most suitable investor types for the RBCH program. Lastly, this study identifies a community-based payment distribution model, whereby revenue generated from the sale of ecosystem services is distributed to a community association and then allocated towards the attainment of community goals/services, as the most suitable approach for the RBCH program given this region's complicated land tenure issues and seemingly uncooperative *tambak* farmers. Furthermore, a community-based payment model may also help limit participant discrimination and promote community-wide conservation and ecosystem connectivity. To facilitate interactions between the RBCH program coordinators and members of the surrounding communities, this study recommends that one of the NGOs local to Tanjung Panjang (*e.g.* Blue Forests, Japesda, or MAP-Indonesia) take on the role of community liaison officer. Once payments are made to the community association, community meetings could then be held to decide on which community goals or projects to spend the money (*e.g.* infrastructure, health care, more efficient fuels for cooking and heating, *etc.*). Above all, the present review of international MBI case studies demonstrates that the success of MBI programs is highly context specific and that it often requires a combination of one or more finance mechanisms, investor groups, and payment distribution models. Additionally, the success of any MBI program is inevitably dependant on the ability to fairly compensate project participants, or at least offset opportunity costs, as well as the ability to build trust with communities. This having been said, an MBI program is unlikely to be a cure-all solution for the Tanjung Panjang case study. Likely, a more integrated management approach, whereby both conservation initiatives and sustainable coastal development coincide, will be needed. This could encompass the reinstatement of more 'traditional' and sustainable *tambak* practices in this area. The lessons learned from the present case study analysis provide valuable insight for coastal managers, government and all other parties involved in the management of the Tanjung Panjang Nature Reserve, and may help to ensure the success of the RBCH program.

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