FINAL

POLICY GUIDANCE FOR ENVIRONMENTALLY SENSITIVE AREAS

REPUBLIC OF MAURITIUS

Prepared for:

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Executive Summary

This final policy paper is part of a Study of Environmentally Sensitive Areas in Mauritius and Rodrigues carried out by NWFS Consultancy for the Ministry of the Environment for Mauritius. The Study provides a typology, survey and delineation of environmentally sensitive areas (ESAs) on Mauritius and Rodrigues, including the wetland areas of Grand Baie. The third and final portion of the Study is an examination of the policies and legislation necessary to protect and manage the areas identified as ESAs. The final legislative report and draft ESA legislation are complementary documents that should be consulted along with the current paper in order to understand the full set of policies and legislation that the NWFS team has identified for the protection and management of these ESAs.

The objective of this report is to provide the necessary background, information and analysis to underpin a series of policies for governing ESAs. A thorough review of relevant and associated national policies, principals, instruments and processes was conducted as background to the analysis. A global review of actual and potential policy instruments that form the basis for a policy framework for ESA protection and management is used to identify the universe of instruments that could be used in support of an ESA Policy. The result of this research and evaluation is as follows:

- policy principles and objectives that emerge from both the existing policies and strategies, and the consultations conducted with public, private and NGO sectors

- policy instruments that emerge based on the adaptation of international best practice to the Mauritian context

- derivation of a generic ESA logic model that ties successful achievement of ESA conservation targets to outcomes, target audiences, activities and resources/partnerships.

- the application of this logic model, and the full set of principles, objectives and instruments, to each and every ESA type, in order to define the precise policies and conditions required in each case

These are summarized below.

Policy Principles

Sustainable development – meeting the needs of the current generation without sacrificing the needs of future generations – is a powerful concept that reflects the principle of intergenerational equity. The policy principles advanced here provide a more detailed description of what sustainability means in the context of Mauritius and ESAs.

The primary policy principle needed to underpin an ESA policy is that of strong (or environmental) sustainability. This means that ESAs are generally regarded as not substitutable with other forms of capital. In practical terms this means that the any

development, use or alteration of an ESA must be considered as an exception from the rule. The starting point for the policy is no loss or adverse impacts on ESAs, not whether there is the possibility or not of reducing environmental capacity and building other types of capacity ("weak" sustainability)

Unfortunately, there are areas designated as ESAs, whose environmental value must be regarded as limited due to past degradation and use. So the policy criteria of *no loss* or *no adverse impacts* is not independent of the quality of the ESA. However, the burden of proof for actions with regard to ESAs will rest with the proponent– to substantiate that no adverse impacts are occurring or that limited impacts are warranted. However, even in the case of lesser quality ESAs the strong sustainability argument carries weight in that any adverse impact to one ESA must be compensated with a corresponding investment in another ESA or an ESA elsewhere in the country.

Equity in the here and now and not just for future generation is a second, important, policy principle. ESAs are distributed between private and state lands. It is not clear that there is a need or an interest in redistributing ESAs so that lower income groups can have a greater share in the benefits of these ESAs. However, the case of campements and Integrated Resort Schemes present two cases where efforts to "privatize" ESAs may lead to regressive impacts on the broader population. A policy of equitable distribution therefore remains vital with regard to ESAs in Mauritius. Still, adherence to equity as a policy principle does not necessarily lead to prohibitions on this leasing of state lands and environmental assets. Rather it leads to the imposition of an additional criterion. In addition to developers demonstrating that their actions in ESAs are environmentally sustainable, the government must demonstrate to Mauritians that these developments will not be given away and that Mauritian rights of access to ESAs will not be abridged.

Environmental sustainability – for future and current generations – as a condition of sustainable development is thus the only policy principle necessary to underpin the substance of an ESA Policy. Subsidiary principles such as the importance of participation, empowerment, transparency and accountability may also be deemed relevant and worthwhile for inclusion.

Vision and Long-Term Outcomes

A simple vision statement for ESAs is as follows:

> Intact, healthy and functioning ESAs producing economic, social and cultural benefits for current and future generations of Mauritian society, as well as foreign visitors

In developing the desired long-term outcomes for ESAs it is useful to consider that the research undertaken for the ESA project has identified three categories of ESAs:

- Category 1 ESAs possess the highest ecological or economic values
- Category 2 ESAs possess important ecological or economic value, but which may, due to a variety of factors, permit some degradation

- Category 3 ESAs possess ecological or economic value, but which may, due to a variety of factors, permit degradation beyond that which is permissible for Category 2 ESAs

The long-term outcomes desired for ESAs are therefore as follows:

- Category 1 ESAs are protected intact and, where needed, restored to health and resiliency

- Category 2 ESAs are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on ESAs provided on-site

- Category 3 ESAs are protected, with an emphasis on conserving a viable number of features (instances of an ESA type) within an individual ESA type, and any loss is compensated.

Policy on Generic Regulation of Development

The overarching policy prescription proposed (in conjunction with the companion legal paper) applies to land use development and ESAs. The policies elaborated below are designed to restrict development in the following manner so as to meet the outcomes specified above:

- For Category 1 ESAs:

    - All development *in or on* an ESA is prohibited.

    - Development *outside* an ESA that will adversely affect the ESA is prohibited; development outside the ESA may proceed provided that mitigation measures will prevent adverse affects on the ESA.

- For Category 2 ESAs—Any development that may adversely affect an ESA must be offset by projects on *the same property* that provides environmental benefits.

- For Category 3 ESAs—Any development that causes *significant* adverse impacts is prohibited. Development is permitted and may degrade the ESA provided that mitigation measures prevent significant impacts and any net impacts are compensated.

In terms of the determination of compensation for impacts that cannot be mitigated it is recommended that economic valuation of these residual impacts be undertaken according to standard valuation methods presented in the table below. The key question is whether certain levels of compensation can be prescribed before the fact. This would be desirable to avoid case-by-case negotiation on these matters. On the other hand the range of different impacts that would need to be foreseen and valued is rather larger, making such an exercise unwieldy. It might be best to instead to develop a committee to oversee individual cases and ensure that the appropriate methods are employed. Perhaps then

after some time the more frequent types of impacts could yield themselves to a standardized compensation schedule.

Table ES-1. Economic Valuation Methods

	Observed Behaviour:	Hypothetical Behaviour:
Direct:	**Market Prices (Direct Observed)**	**Stated Preferences (Direct Hypothetical)**
	Competitive market prices Shadow-pricing	Contingent Valuation (dichotomous choice, willingness-to-pay, bidding games)
	Revealed Preferences (Indirect Observed)	**Choice Modelling (Indirect Hypothetical)**
Indirect:	Productivity methods	Contingent referendum
	Avertive (defensive) expenditure	Contingent ranking
	Travel cost	Contingent behaviour
	Hedonic pricing	Contingent rating
	Substitute goods	Pairwise comparisons

Source: WCD (2000)

The intent is that compensation be paid only when it is not possible to fully offset impacts on ESAs or when the ESA in question is not of critical importance. Monetizing the loss of ESA services in this fashion is effective only if these funds are then held in an ESA fund for reinvestment in ESA that are close substitutes (i.e. ESAs of the same type but in another location) or if not possible in other ESAs. It is imperative that the compensation developed be reinvested in ESAs and not spent on other budgetary items in order to follow the policy principles arrived at early in this paper.

Short- and Medium-Term Outcomes and Behavioral Change

Analysis of the threats and drivers to ESAs yield the behavioral changes required to achieve the desired long-term outcomes. These changes help to define the short- and medium-term outcomes to which policy instruments should be directed. These outcomes are:

- access, development and use of ESAs is controlled in the commons (uncommitted state lands-forests, caves, etc, streams and rivers, public waters)
- protection and creation of protected areas (national parks, reserves and boreholes)
- restoration of existing protected areas (national parks, reserves and boreholes)
- protection and management of ESAs on private and leased state land (forests, wetlands and other ESA types)
- subsidies for productive agricultural activities eliminated (rivers and streams; marine areas)
- marginal cost pricing of public services and resources (water, wastewater, etc)

Policy Instruments

For each of the outcomes above there may be one or more policy instruments that applies. The table below maps out the potential policy instruments identified in the full policy

paper and relates them to the six short- and medium-term outcomes. The cells highlighted in grey indicate those instruments that apply to the achievement of the outcomes. The application of these instruments to specific ESAs is then explored ESA-by-ESA in the subsequent sections of this paper.

Table ES-2. Policy Instruments for Achieving Short- and Medium-Term Outcomes

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private and leased lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*						
Micro-credit*						
Command and Control						
Decentralized and Polycentric Partnerships						
Co-Management						
Common Property Management *						
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						
Subsidies and Payments						
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation						
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Perhaps the most innovative of the policy instruments recommended here is the use of positive incentive programs to induce better management of ESAs that are located on private (and state lands). A range of instruments are presented, however, the use of direct payments to landowners to protect and manage ESAs probably holds the most attraction in terms of simplicity and tractability in the Mauritian context. Akin to payments for ecosystem services, such arrangements would be voluntary contractual arrangements that clearly specify the roles and responsibilities of the government and the landowner, and clearly proscribe compliance monitoring activities and the payments and any other consequences/inducements associated with performance under the contracts. In the Mauritian context adaptation of these arrangements to local groups and communities may be advisable in order to better sensitize communities to the importance of ESA protection and to enable wider benefit sharing with regard to actions taken and costs incurred.

The full draft policy paper then reviews each ESA type in detail to present the specifics of how the generic policy on regulation of development would apply and which policy instruments might best be used with the ESA. In this Executive Summary the example of marshlands (wetlands) is provided below as indicative of the types of detailed policies put forward in the paper.

Freshwater Marshlands (Coastal and Upland Wetlands)

There are a few freshwater marshlands, or wetlands, located in the uplands; with the majority in the coastal areas. As the outcomes and instruments do not vary much between types they are considered together here. Marshlands are likely to occur both on private and state land. As there are no protected areas in the inland coastal areas it is assumed that these marshlands are unlikely to be situated in existing protected areas. Nevertheless, the National Ramsar Committee is actively engaged in promulgating legal and other protections for these areas. Principal threats include:

- backfilling by property owners in advance of development
- rubbish dumping due to government failure to enforce state land status
- upstream management of rivers and streams that lead to higher pollutant concentrations and sediment delivery to lagoons
- damming and conversion for water storage to augment Central Water Authority water supply (uplands)
- invasion by alien species due to government or private property owner failure to manage marshlands

Degraded marshlands can be actively restored through habitat restoration. It is also possible to create new wetlands, although there is a high rate of failure due to the need to ensure the correct hydrological regime and inflow. The primary long-term outcomes needed are protection and restoration as follows:

- Category 1 Marshlands are protected intact and, where needed, restored to health and resiliency

- Category 2 Marshlands are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on marshlands provided on-site

- Category 3 Marshlands are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

Suggested policy instruments are shown in the table below. Marshlands provide a particular challenge in terms of protection and management due to their location in and around coastal settlements and their perceived negative attributes (odor and insect breeding grounds). For marshlands that are on state land the principal solution may be to have local communities adopt the marshland and monitor and manage it (including for its scientific and educational value) in return for a direct payment. An alternative would be to create a Wetland Reserve or other protected area designation. If this helps provide financial resources for ESA protection that may be a useful approach. However, the size of most marshlands in Mauritius is quite small and they are spread across the landscape. The practical problem is how to ensure their protection, not providing them a paper designation.

Effective command and control regulations against backfilling and development are critical (as described more in the companion Legislative Report). It is proposed here to marry the regulatory and incentive approach in the case of private lands. A landowner seeking to develop a wetland area of Category 1 status should be refused. Failure to comply needs to result in significant penalties – enough to serve not only as a disincentive but a deterrent in the first place. In addition, upon identification of a site as a marshland, the local authorities and the Ministry of Environment need to act in a proactive fashion to enroll the landowner in the direct payments program.

Table ES-3. Marshlands: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment			xxx			
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx		xxx		
Micro-credit*				xxx		
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx	xxx			
Common Property Management *						
Public-Private Partnerships		xxx	xxx			
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges			xxx			
Subsidies and Payments	xxx			xxx		
Regulated Markets						
Privatization		xxx				
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments				xxx		
Private and Voluntary Sector Investment			xxx			

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- a buffer zone between any development and the nearest marshland
- clear guidelines on on-site restoration or replacement that may serve as mitigation for adverse impacts to a portion of a marshland
- full monetary compensation for any net adverse impacts to Category 3 marshlands

1. INTRODUCTION

This policy paper forms part of a Study of Environmentally Sensitive Areas in Mauritius and Rodrigues carried out by NWFS Consultancy for the Ministry of the Environment and NDU. The Study provides a broad typology, survey and delineation of environmentally sensitive areas (ESAs) on Mauritius and Rodrigues, including the wetland areas of Grand Baie. The third and final portion of the Study is an examination of the policies and legislation necessary to protect and manage the areas identified as ESAs. An initial interim draft report on policies for Environmentally Sensitive Areas in Mauritius was prepared in December 2008. The interim report served as a discussion draft for the national stakeholder workshop held in January 2009. This draft policy paper incorporates comments and feedback from the workshop, provides additional guidance and examples on policy instruments, and responds to subsequent comments from the Ministry of the Environment. As noted in the paper itself, the draft legislative report and draft ESA legislation are complementary documents that should be consulted along with the current paper in order to understand the full set of policies and legislation that the NWFS team has identified for the protection and management of these ESAs.

1.1 Objectives

The objective of this report is to provide the necessary background, information and analysis to underpin a series of policies for governing ESAs. Particular attention was given to ensure that the report covers the following critical elements for policy development:

- review of existing land planning policies to ensure an ESA policy is fully integrated into the land development permitting process
- review of the EIA process to ensure compatibility with ESA policy
- review of all other policies impinging on effective implementation of an ESA policy, such as the NDS and Outline Schemes
- review of actual and potential policy instruments that form the basis for a policy framework for ESA protection and management
- compiling a catalogue containing a description and classification of each ESA type with the level of afforded protection using results generated from previous activities.

1.2 Methodology and Structure

The work methodology combines significant stakeholder consultation and document review in order to underpin the analysis and policies provided. The analysis (and the report) is broken down into diagnosis, review and ESA policies.

The diagnosis approach taken is sequential and involves the following steps:

- define the ESA types (based on prior NWFS reports)
- identify the direct and indirect drivers that threaten the integrity of these ESAs (based on NWFS and other reports)
- identify and compile the behavioral change that a successful ESA policy must induce in order to protect and manage ESAs

The review process includes the following:

- review of policy principles, objectives and instruments that have been employed in Mauritius that either directly or indirectly target ESAs
- review and compilation of policy instruments that may be deployed to protect and manage ESAs based on international best practice in environmental and ecosystem management

The ESA polices include the following:

- policy principles and objectives that emerge from both the existing policies and strategies, and the consultations conducted with public, private and NGO sectors
- policy instruments that emerge based on the adaptation of international best practice to the Mauritian context
- derivation of a generic ESA logic model that ties successful achievement of ESA conservation targets to outcomes, target audiences, activities and resources/partnerships.
- the application of this logic model, and the full set of principles, objectives and instruments, to each and every ESA type, in order to define the precise policies and conditions required in each case

The diagnosis is provided in Section 2, the review in Sections 3 and 4, and the ESA policies in Section 5.

1.3 Sources

Data and information sources for this report consist of documentation and interviews. Interviews were held with government officials, private sector representatives and non-governmental organizations. A brief list of parties consulted is provided in Appendix A. With regards to documentation, the report draws on existing work by NWFS under the project to identify and categorize ESAs, primarily including:

- Survey Report of Grand Baie Wetlands - May 2008 (Ministry of Environment & NDU 2008)
- Technical Report on Freshwater Wetlands (Ministry of Environment & NDU 2009)
- ESA Site and Location Maps (draft and final) - November 2008 & April 2009 (Ministry of Environment & NDU 2009b)

The remainder of the Mauritian documentation consists largely of government documents provided by NWFS, the Ministry of the Environment, parties interviewed, as well as the Government of Mauritius website.

In the last two decade the government has engaged in a number of policy, strategy and planning exercises that either directly contemplate ESAs or through their coverage indirectly bear on ESAs. These documents form the primary basis for collating and compiling existing policy and/or policy intentions with respect to ESAs and include:

- the National Environmental Strategy of 1999 – NES (1999)
- the National Biodiversity Strategy Action Plan of 2005 – NBSAP (2005)
- the National Development Strategy of 2005 – NDS (2005)
- the National Forestry Policy of 2006 – NFP (2006)
- the National Environmental Policy of 2007 – NEP (2007)
- the updating of the National Environmental Strategy – NES (2008)

Citations that will be used throughout the paper to refer to these government documents are so indicated. Each report is referred to in this report by its designation as indicated in parenthesis above.

A number of additional sources were employed, particularly in developing the review of policy instruments. These are cited in the paper and full references are included in the reference list at the back of the report.

2. ENVIRONMENTALLY SENSITIVE AREAS

In this section a review of ESAs and their coverage is provided, followed by a characterization of the direct and indirect drivers that threaten their function and existence. The behavioral change necessary to successfully protect and manage ESA is then summarized.

2.1 ESAs

The ESA Project has defined and mapped the following fourteen different ESA types:

1. seagrass beds
2. coral reefs
3. mangroves
4. mudflats
5. offshore islets
6. coastal freshwater marshlands
7. upland marshes
8. forests with native content
9. steep slopes
10. freshwater wells (boreholes)
11. rivers and creeks
12. lakes and reservoirs
13. sand beach and dunes
14. caves and other geological features

A fifteenth ESA Type, Native Fauna Habitat, has been defined but not mapped. Information needed to accurately map this type of ESA, consisting of the range of habitats affording refuge to endemic birds, bats, lizards and snails is currently unavailable.

The full extent of these areas on Mauritius is equal to 78,213 hectares and in Rodrigues 34,259. This is 38% of land and 38% of lagoonal area on Mauritius. In the case of Rodrigues 80% of the land and almost the entire lagoonal area is classed as ESA.

For each instance of an ESA type individual characteristics have been recorded, allowing for the ability in some cases to grade the relative importance of different ESAs into different classes, particularly with regard to their general environmental service value.

2.2 Direct Drivers Threatening ESAs

Direct drivers represent the proximate cause that can lead to the degradation or elimination of the function of the ESA. Based on the *ESA Classification Report* and and *Technical Report on Freshwater Wetlands*, the following direct drivers can be identified:

Seagrass Beds
- water pollution, including eutrophication
- mechanical destruction due to tourism or aquaculture development
- overfishing

Coral Reefs
- temperature changes due to water pollution and changing water levels
- water pollution, including eutrophication
- overuse by tourists and divers – trampling
- overfishing
- siltation by sediment

Mangroves
- cutting and removal due to touristic and other development

Mudflats
- water pollution
- change in water levels

Offshore Islets
- invasion
- development leading to habitat and biodiversity loss
- rubbish dumping
- deforestation
- farming

Coastal Freshwater Marshlands
- backfilling
- rubbish dumping
- water pollution

Upland Marshlands
- damming and conversion for water storage
- invasion by alien species

Forests With Native Content
- invasive species
- deforestation
- agricultural, tourism and industrial development

Steep Slopes
- housing construction
- hotel development
- accompanying infrastructure – roads, cell phone towers, etc.

Freshwater Wells
- over-extraction
- heavy construction

- chemical leaching and spills

Rivers And Creeks

- over-extraction and use of water
- dams
- water pollution
- vegetation removal
- rubbish dumping
- siltation

Lakes And Reservoirs

- change in amount and timing of rainfall
- over-allocation and extraction
- water pollution

Sand Beach And Dunes

- construction of leisure homes
- construction of hotels
- construction of golf courses

Caves

- rubbish dumping
- closure
- water pollution (raw sewage)
- siltation
- vandalism

2.3 Indirect Drivers and ESAs

Beyond the immediacy of direct drivers typically lie indirect drivers that stimulate the specific behaviors represented by direct drivers. These indirect drivers can be grouped at different levels. Two levels are specified here. The first and macro level reflects the fundamental indirect drivers of the Mauritian economy. These indirect drivers influence the demand for resources and hence impact ESAs. These drivers may be separated into national and international drivers. The second level of indirect drivers reflects specific market, policy and institutional failures that drive microeconomic behaviors. Correctly formulated and applied, government or collective intervention at the level of these microeconomic drivers could well condition and direct macroeconomic drivers that would otherwise lead to loss and degradation of ESAs.

National Macro-Drivers

The macro level indirect drivers and their first order impacts on ESAs that originate within Mauritius (i.e. national drivers) include:

- population and economic growth driving land use change and conversion of ESAs for:
    - residential development

  - commercial and industrial development
  - tourism development

- population and economic growth driving consumption of goods and services from ESAs or that drive the use of ESAs as pollution sinks:
  - demand for water resources
  - demand for food
  - demand for wood products
  - increase in solid wastes
  - increase in wastewater

To population and economic growth could be added other macroeconomic drivers that make up monetary and fiscal policy, including credit availability, interest rates, tax policy, etc. However, while such macroeconomic instruments may affect ESAs, at the margin changes in these instruments would likely be overwhelmed by the broader and long run impacts of growth in a rapidly developing economy such as Mauritius.

The relationships listed above are fairly general. It is worth emphasizing specific trends that lead towards or away from pressures on ESAs, both in terms of land use change and in terms of demand for ESA services. For example, growing population and rising levels of economic development leads to a demand for land to supply human needs for habitation and commerce in and around the conurbation. In the Mauritian context, the elimination of preferential access to European Union markets for sugar works to ameliorate this impact. The liberation of 15,000 hectares of land from sugar production in recent years provides significant opportunities for government to reallocate land to towns and cities without such growth extending into sensitive coastal or upland areas. This is not to say that there are not ESAs on former lands devoted to cane, only to say that the pressure on ESAs could be much worse if the need to accommodate populations and economic growth did not have former cane lands as an outlet. Residential and commercial development, therefore, need to be carefully planned with regard to ESAs but are probably not a primary threat.

Tourism development, on the other hand, must be regarded as a principal threat to ESAs with regard to land use change. Current tourist visitation is below 1 million per annum, however, it is government policy to grow this number to 2 million visitors by 2015. Foreign visitors come to Mauritius primarily to enjoy the abundant natural services and hospitality offered in coastal areas. Ecotourism, particularly that related to upland areas, and cultural tourism is very limited. Tourists, largely European in origin, come to Mauritius to relax and enjoy the beaches and the sun, and take part in recreational activities on the extensive lagoons surrounding the coast. The Tourism Development Plan suggests that a total of 20,000 rooms will need to be built by 2020, up from the current total of 9,000 rooms. To facilitate this development the government developed

the concept of Integrated Resort Schemes (IRS). Situating and building hotels and Integrated Resort Schemes in the coastal areas has significant potential to lead to the loss of ESAs. Tourism development, therefore, must be regarded as a primary threat to ESAs.

Loss of ESAs due to land use change is obviously a primary concern. However, population and economic growth not only increases demand for land development but also through increasing consumption patterns can lead to increasing pressure on natural resources and pollution sinks. This can result in degradation over time. In some cases this might lead to the loss of the ESA. In others the ESA may remain as a feature on the landscape but without providing the environmental services it previously performed. A few examples suffice to illustrate how population and economic growth can threaten ESAs through their impact on consumption.

Increasing populations and economic activity can drive an increase in need for water. Mauritius is thought to receive an annual input of water through rainfall of 3,900 Mm^3. This water can be divided into that going to evapotranspiration, or green water, and that going to surface and ground waters, or blue water. Given stable if not decreasing agricultural production the demand on green water is probably unlikely to change in any significant fashion. Evapotranspiration from land and soil moisture (apart from irrigation) is estimated at 1,170 Mm^3, leaving 2,730 Mm^3 for potential use from blue water. In Mauritius current blue water usage is estimate to be 1,014 Mm^3/yr. However, this includes hydropower use, which does not represent a consumptive (evapotranspirative) use of water. Taking this figure out leaves a consumptive use of 725 Mm^3/yr, leaving 2,005 Mm^3/yr of blue water unallocated. However, of the consumptive total only 235 Mm^3/yr (or 32%) is non-agricultural in nature. In other words, the domestic, industrial, commercial needs for water are all met from this 235 Mm^3/yr figure. A doubling of all such uses, including the demand from tourism, would lead to an increase demand of 235 Mm^3/yr or about 10% of the unallocated blue water.

It is certainly true that all of the unallocated blue water is not economically available (i.e. through extraction or storage). But, at the same time it is quite likely that there are affordable water conservation measures that Mauritius could (and will) implement to reduce the water intensity required by development (i.e. less water would be required by additional economic growth). Thus, on balance it appears that there is in physical terms no crisis in water supply in the country's future. However, unless conservation can meet the growth in demand, it is also true that to meet its growth needs Mauritius will need to invest in additional water supply facilities. This means extracting more groundwater, diverting more surface water, and, perhaps, building additional dams to increase water storage.

Each of these activities can be a direct driver that affects ESAs. Dams can lead to the submergence of ESAs and riparian habitat, as well as the loss of productive agricultural land. Storage also interrupts natural cycles that may include flushing flows during storm events, thereby altering downstream geomorphology with knock-on impacts on intact ecosystems in the lagoon. Additional diversions of water from rivers and streams can reduce in-channel habitat for fish and wildlife. Such diversions also reduce the quantity of water that flows downstream to the mouth. This can impact freshwater resources near

the outlets of rivers and streams, but it also concentrates the pollutants that are carried into tidal mudflats, mangroves and reefs. Increasing groundwater extraction, particularly in coastal areas may lead to saltwater intrusion, with negative impacts on wells and boreholes but also on freshwater ecosystems. In this manner, growth and development affects water resources and, ultimately, coastal ESAs. Where coastal developments for tourism put additional pressure on ground and surface waters near the coast the potential for negative feedback on resource availability and ESAs needs to be anticipated. Otherwise, tourism development on the coast will consume the very resource on which it is founded.

Similar arguments and trends can also be found with regards to the increase in the discharge of pollutants into streams and rivers, groundwater and the lagoons as consumption and resource use increases alongside population and economic growth. Proper treatment and disposal technologies that would limit any impact on ESAs and coastal resources are available – ensuring that they are employed is the challenge. Likewise solid wastes provide a number of threats to ESAs – both in terms of the use of ESAs as dumping sites, thereby eliminating their site value (e.g. caves and coastal marshlands) and the services they provide to other ESAs (e.g. rivers and stream and downstream water quality), as well as in terms of downstream impacts from improper solid waste disposal generally (e.g. leaching of toxic substance and impacts on water from boreholes and ecosystem degradation).

International Macro-Drivers

The influences described above are purely national in focus. In some cases they will be related to international economic drivers. For example, the Mauritian drive to build its tourism capacity would not be possible were it not that international conditions favored such development. Similarly, international trade reform is driving the contraction of the local sugar estate. The Mauritian economy is an open economy and, thus internal economic drivers depend to some extent on the global economy. Thus, the current credit crisis and economic downturn might have limited impacts on prospects in the sugar markets and on the marketing of Mauritius as a financial and technological entrepôt for Africa, but its effects on international tourism demand and credit for tourism investment projects may be more severe. Trends in these international drivers will affect national drivers and hence have implications for ESAs. Thus, the global economic slowdown suggests that rapid development of tourism assets and visitation growth will be difficult to achieve over the next few years. This may provide exactly the opportunity Mauritius needs to establish the policy, legislative and technical framework necessary to develop tourism while simultaneously protecting and managing its ESAs.

Aside from economic drivers, global environmental drivers may also play a role. Climate change is driven by the rate and accumulation of carbon emissions and sequestration across the globe. There is little Mauritius can do to affect climate change outcomes besides contribute positively to international accords on the matter and do its best to improve its own carbon footprint. Climate change may mean altered rainfall and weather patterns for Mauritius. This will compound efforts to manage water supplies and continue productive agricultural activities. Climate change and consequent sea level rise

are also cited as a risk for small island states and for coral reef systems (due to coral bleaching). However, Mauritius may differ from many tropical, reef-endowed island states in a number of ways that may limit risks and damage from climate change.

As a large volcanic island Mauritius is not at risk of losing its territorial integrity (as is, for example, the Maldives). Whether Mauritian reefs are at risk is not known but in relative terms there may be reasons for optimism. The extensive lagoonal and reef area inside the outer reef may buffer some impacts (as opposed to for example Central American reefs). Further, the extent of sea level rise and water temperature changes may be ameliorated by Mauritius' position near the Tropic of Capricorn and lack of proximity to the mainland (as opposed to the Caribbean Islands located close to North America and the Gulf of Mexico). Thus, while climate change can be assumed to be a threat to ESAs, it will create winners and losers. If enough other tropical tourist destinations suffer, Mauritius may increase its competitive advantage. Other things equal, this would in turn merely put additional pressures on ESAs. Thus, climate change remains an important international indirect driver threatening ESAs.

Microeconomic Drivers

Microeconomic drivers are those driving behavior at the level of firms and individuals. These are described here in terms of the negatives, the failures that may harm ESAs, but generally speaking these drivers can typically be managed in such a way as to promote sustainability in resource use and environmental quality. This involves, in a sense, getting the incentives "right." Here the failures (or potential failures) are emphasized, whereas in the ESA policies section the direction Mauritius could take to improve microeconomic incentives so as to strike the needed balance between growth and conservation are considered. In a sense then the indirect drivers reviewed above ultimately lead to adverse impacts on ESAs only in the failure of policy to appropriately limit the development and use of ESAs.

These microeconomic drivers include:

- under-pricing of resource use and pollution sinks, including the under-pricing of water leading to overuse of ground and surface waters

- subsidizing of productive and development activities, including subsidies for pesticides and fertilizer leading to overuse, leaching and water pollution

- public goods/market failure problems, i.e. lack of incentives for protection and management of ESAs on private lands, including:

    - failure to invest in species control and ecosystem restoration perpetuates invasion by alien species

    - failure to provide positive incentives to maintain ESAs on private property may lead to backfilling of wetlands, closing of caves to facilitate development

  - failure to recognize, legislate, monitor and enforce limitations on land use and development leading indirect drivers of growth and consumption to encroach upon and degrade ESAs and their functions (as per the indirect driver section)

- public goods/policy and institutional failure, i.e. lack of effective regulation and investment in ESAs already designated as protected areas, including:

  - failure to invest in controlling invasive species and restoring native species in the National Park and Nature Reserves

  - failure to invest in source protection measures at borehole sites

- common pool resource problems, i.e. failure to regulate access and use of ESAs on uncommitted state lands, streams and rivers, or in marine areas, leading to:

  - failure to adequately protect forested lands leading to invasion by squatters

  - failure to protect and police cave sites leading to vandalism

  - failure to control catch limits leading to overharvesting by fishermen

  - failure to monitor and enforce simple reef regulations leading to trampling and degradation of reefs by snorkelers, bathers and boat anchors

  - beach erosion due to inappropriately deployed groynes and other coastal defense devices in the Pas Geometrique

  - untreated wastewater and industrial effluent discharge into rivers and lagoons

Despite the long list of problematic areas it is important to signal that progress has been made in managing and protecting certain ESAs. While these are not covered until Section 3 these successes (see Section 3.4) serve to indicate that these failures can be overcome by actions taken by government, the private sector, producer cooperatives and NGOs (or public-private partnerships between these groups)

2.4 Interventions and Behavioral Changes

The assessment of direct and indirect drivers identifies the actual behavior that directly affects ESAs (the direct drivers) and the root causes that lead to this behavior (the indirect drivers). Based on this assessment it is then possible to identify the behavior (direct and indirect) that will need attention and change if ESAs are to be successfully protected and managed. These are equivalent to the interventions under a proactive ESA Policy. If interventions are identified then the proponents that must enact changes in policies are also clear. Finally, the new behaviors (or desired outcomes) and the on-the-ground target audience for such efforts also become clear. Table 1 therefore seeks to

illustrate how the material from the preceding section can be summarized in terms of desired interventions and outcomes to protect and manage ESAs, using a few of the examples cited above.

Table 1. Interventions to Protect and Manage ESAs

Intervention (Indirect Driver) and ESA System/Type	Proponents	Outcomes (Direct Driver)	Target Audience
1. Regulate access, development and use of ESAs on:			
a. Uncommitted State Lands			
i. forests	Forest Service	avoidance of invasion	Lessees, visitors
ii. caves	Ministry of Environment	avoidance of solid waste disposal	communities and business; waste haulers
b. streams and rivers	Ministry of Renewable Energy and Public Utilities / Water Resources Unit	reduction in pollutant discharge	industry
c. marine areas	Fisheries Division	sustainable catch	fishermen
2. Promote regulation, creation and restoration of protected areas			
a. parks and nature reserves	Ministry of AgroIndustry / Finance	absence of investment	NPCS and Forest Department
b. boreholes	Ministry of Renewable Energy and Public Utilities / Water Resources Unit	source protection	Central Water Authority / Private Users
3. Positive incentives for protection and management of ESAs on private land, leased State Land and in public waters			
a. private forests	Ministry of Environment	incentives for control of invasives	private landowners
b. wetlands	Ministry of Environment	incentives for wetland protection	private landowners
c. all ESA types	Ministry of Environment	Land use and development restrictions in and near ESAs	Private landowners and leaseholders
4. Elimination of subsidies for productive agricultural activities			
a. rivers and stream; marine areas	Ministry of Agro-Industry	reduced fertilizer use	farmers
5. Marginal cost pricing of public services and resources			
a. rivers and stream; marine areas	Ministry of Renewable Energy and Public Utilities / Water Resources Unit	reduced water use	farmers, industry and households

3. CURRENT PROTECTIONS FOR ESAs

A number of policies and legislation bear directly and indirectly on ESAs. These are summarized below bearing in mind that the companion Legislative Report examines the legal protections afforded to the proposed ESA types in great detail. Generally speaking, ESAs as a whole are covered directly only in policies and strategies given that ESAs have yet to be formally identified and designated. However, individual ESA types are explicitly provided for in past legislation, in some cases establishing specific designations, e.g. nature reserves. Precedent with regard to both areas is provided below. In addition, this section covers public investment under various National Environmental Action Plans as it affects ESAs. A number of early success stories in managing ESAs are summarized in the concluding portion of the section to demonstrate implementation achievements.

3.1 Policies

Policies and strategies reviewed for this paper (see Section 1.3) include a number of efforts to define policy principles, develop national policy with respect to the environment and development and propose environmental investment programs. These are reviewed below with an emphasis on understanding their implications for the protection and management of ESAs.

Policy Principles

A number of national policies and strategies provide guidance on principles that might be relevant to a Policy on ESAs:

- the National Biodiversity Strategy Action Plan (2006) lists a series of working principles including the interdependence of humans and biodiversity, intrinsic value, the precautionary principle, the priority of in-situ conservation and the ecosystem approach

- The National Environmental Policy (2007) lists a series of "guiding principles" that emphasize sustainable development – including the "mainstreaming" of environmental concerns – as well as the precautionary principle, the polluter pays principle, the maintenance of ecological integrity and that "human beings are at the centre of environmental sustainability."

- the National Forestry Policy (2006) lists 35 "principles or premises" including definition of sustainability as "meeting the social, economic, ecological, cultural and spiritual needs of the resent and future generations" but also references to balancing development with environmental conservation, maintenance of

ecological balance, best return on investment, rational use, efficient use, participation of stakeholders, and gender equity

- The National Development Strategy (2005) is based on a vision in which economic growth is encouraged while environmental quality is maintained and enhanced, and lists 14 "development principles" which are essentially a series of detailed planning guidelines suggesting that future developments reduce pressures on ESAs, a presumption against new development in the open countryside (and taking account of ESAs), economic diversification in the countryside that enables sustainable agriculture, forestry and tourism; and protection of ESAs in the countryside and on the coast.

Discussion. The range of policy principles is quite wide. On the one hand the recognition of intrinsic value of all forms of life (NBSAP) and presumption in favor of protection in the absence of information to the country (NEP and NBSAP) and on the other a clear directive to balance growth and conservation (NDS and NFP). Recognition of human needs and anthropocentric objectives does not preclude assigning a primacy to the protection of ESAs. However, at some juncture public policy must consider the ramifications of environmental protections offered against their costs. The core concept of sustainable use and sustainable development – which appears in all the strategies and policies cited above – clearly recognizes the need to provide for future generations.

In other words, current costs and income must be set off against their consequences for future costs and income. Where an investment in ESA protection today leads to a higher income stream in the future the decision may appear straightforward. But such an investment in ESAs may reduce funds available to spur economic development or invest in social programs today (or in the future). This illustrates that there is ultimately no escaping the need to make hard tradeoffs and balance economic, social and environmental objectives.

The precautionary principle is often cited to bolster arguments for environmental protection, as in the NEP (2007). This principle suggests that a lack of scientific certainty supporting the need to avoid a threat to biodiversity should not be used to avoid taking actions today to protect biodiversity. But this is not the same as saying that all such actions must be taken or that they must be taken at any cost. Public funds and budgets are not limitless and it is not practical (nor good policy) to suggest that they must always be dedicated first and foremost to environmental protection.

Therefore in specifying policy principles for ESAs it is useful to accept a more nuanced use of the types of principles noted in the NBSAP and to recognize that ultimately a balance must be struck between conservation and development. Still, the historical precedent in Mauritius is to favor development over conservation, with resulting degradation and diminishment of the country's natural heritage. The strategies and policies cited above have been critical, of course, in reversing this historic policy presumption. Therefore, in developing a policy for ESAs the relative scarcity of such areas and their importance to the economic future of Mauritius will bear consideration in actually assessing how to strike a balance between conservation and development.

Development Policy - 2005

National Development Strategy. One of the explicit objectives of the NDS (2005: 8) is to "promote sustainable development which allows for the protection of the best agricultural land and of environmentally sensitive areas." The need to revise the existing strategy to protect ESAs is referred to as a "fundamental guiding principle" of the Strategy (NDS 2005: 8). In recommendation ENV1 the NDS (2005) considers ESAs to be

- state protected areas including National Parks, Nature Reserves, State Forest Lands, Pas Geometriques and privately-owned Mountain Reserves
- habitat for endemic flora and fauna, much of which is designated for protection already
- mountain slopes and range peaks including moderately to very steep hillsides and mountain slopes
- coastal features and wetlands
- water resources, including major aquifers, catchments, reservoirs, boreholes, weirs and designated River Reserves
- geological features including lave tubes associated with cave networks

The NDS accepts that many parts of the coastline belong to ESAs and that the coast is arguably the most sensitive area given both its ecological vulnerability and its importance to the national economy (NDS 2005:145). The NDS acknowledges that this poses risks as the development of the coast for tourism and the dispersion of Mauritian residential development provide the potential for environmental deterioration (NDS 2005: 36). This problem is summarized by the strategy as follows:

> Inappropriate development within the coastal zone could disrupt the biological and hydrological function of the coastal ecosystem, which protects the lagoon and reefs from siltation, sedimentation and water pollution (NDS 2005: 145)

The NDS alludes to the difficulty of enforcing protection of ESAs, as opposed merely to management. It also states that the government has struggled in this role and that there is a need to promote environmental stewardships amongst communities in Mauritius and that national policy should be in support of enhancing stewardship. In restricting development options for ESAs the NDS adopts a precautionary approach to development.

More specifically the Strategy provides a draft map of ESAS and a number of polices that refer explicitly to ESAs:

- SP5 on Town Centres and Retailing includes the absence of ESA as a precondition for major new out-of-centre retail development

- SP15 on Development in the Open Countryside includes a general presumption against major new developments (except where such a developments are in the national interest) if the Ministry of Environment identifies the land as having environmental sensitivity

- SP16 on Coastal Development and Tourism includes a general presumption in favor of development within Tourism Zones identified in the Tourism Development Plan; SP 18 specifies that development proposals should comply with the recommendations contained within the revised PPG, which provides for 30 meter setback from the wetlands and also adequate measures for development proposals near wetlands and other water bodies

- H1 on Residential Land Allocation includes a general presumption against new residential development outside limits of permitted development in revised Local Plans where such sites would be in ESAs.

- I10 on Storage of Hazardous Substances calls for the safe storage of dangerous substances in appropriate locations away from sensitive areas, including ESAs.

- TM5 on Campement Sites allows for redevelopment of campement sites even where proposed tourism development lies within or adjoins an ESA provided there is an environmental management plan for the ESA and the EIA is successfully concluded. For similar projects with residential development as the objective ESAs are to be consolidated "in situ" so that "future redevelopment can incorporate the management of the ESA (NDS 2005: 126)

- TM 6 on Pas Geometrique allows intensification of existing settlements on committed Pas Geometrique land that is within the six Tourism Zones; where such would involve permitting in or near ESAs and EIA license must first be obtained. For uncommitted Pas Geometrique land and land outside of Tourism Zones no new developments will be permitted; whereas small-scale developments will be permitted provide they meet "environmental criteria" (NDS 2005: 127)

- AG5 on Marginal Sugar Cane Land states that marginal land released from cane production may be used for development except that it is forming part of or adjoining an ESA

- ENV1 on Environmental Management states that the natural functions, biodiversity, habitat and amenity of ESAs will be protected from adverse effects of development; that there will be a general presumption against major development of draft areas designated in the NDS except to sustain existing local economies or where development is in the national interest; and that in areas adjacent to these draft areas any development will require an Environmental Impact Assessment license (Policy Env1). Similar language with respect to development restrictions is used with respect to wetlands and the coastal zone in ENV2 and ENF3.

- in ENV2 there is a general presumption against development in wetlands except in the case of small-scale developments sited on small parcels of lands or infill sites in built up areas, where these can be shown to have minimal adverse environmental impact and are needed to sustain local economies.

Environmental Policy

A national environmental policy for Mauritius was first developed in a white paper in 1991. The policy was directed towards attaining sustainable development. Accompanying the policy was the first National Environmental Action Plan (1991). According to the National Environmental Strategy (1999) this first set of policies and action emphasized the roles of individuals in changing their behavior and avoiding environmental damage. For this reason, the policy and action plan emphasized the need for "sensitization", in other words education and awareness raising. Nonetheless, major accomplishments during the first decade of implementation consisted of the establishment of an institutional and legislative framework for environmental management, as well as investment in environmental infrastructure projects.

The second action plan, as presented in NES (1999: 137), did not change the policy objective, which was stated as:

> To follow the principles of sustainable development by providing environmental services, encouraging responsible environmental practices and enforcing appropriate environmental standards in order to safeguard the health and welfare, conserve the heritage, and enhance the quality of life of all the people of Mauritius.

However, the second NES of 1999 shifted the focus of action to integrating environmental concerns more fully into economic development planning. A number of economic instruments were highlighted including:

- phasing out subsidies to agriculture and industry
- cost-recovery charging for environmental services, energy and water
- reviewing the pricing of leases of land in the Pas Geometrique
- using taxes and tax allowances to support environmental goals

At the same time the need for continued strengthening of the Ministry of the Environment and enhanced inter-ministerial cooperation was emphasized. The NES also introduced the idea of a regulatory regime combining the "carrot and stick" approach. In this regard, new policy instruments of voluntary agreements and incentives were introduced, alongside the existing concepts of fines and penalties. Additional recommendations and actions surrounded the continued need for improved information management. With regard to ESAs the NES (1999) called for the ESAs to be demarcated as part of building a MoE environmental information system. Specifically the NES (1999) suggested a need to carry out an ecological survey of privately owned land and the riverine environment as

part of this work. Subsequent sensitization of other ministries, departments, the private sector and the public was then suggested. This was to include translating the ESA maps into outline and detailed schemes.

The NES (1999) made a number of other recommendations worth noting here:

- a need to strengthen the EIA process by clarifying what projects needed an EIA, clarifying technical EIA requirements, improving stakeholder involvement and reducing the number of projects going through the EIA process
- the Water Resources Unit should work with DoE and sectoral agencies to develop policy tools that encourage reduction of pollution at source (e.g. industrial effluent discharge charges, transfer of agricultural incentives from fertilizers)
- the WRU needs to take greater responsibility for regulating all aspects of the resource and its use
- on-going projects to improve the measurement and monitoring of water resource quality should be strengthened
- river quality monitoring should be supported by biological monitoring and an indexing system developed that clearly indicates river quality and its appropriateness for various uses
- bringing all protected areas under the National Parks and Conservation Service
- maximizing the role of NGOs to undertake specific projects
- increasing the involvement of the private sector and the public in conservation activities
- prepare and implement clear and unambiguous standards and guidelines for water resources and coastal zone management
- intensify monitoring and analysis in the coastal zone, particularly of lagoonal water quality, state of the coral reef, etc.
- consider the application of economic instruments to encourage conservation and preservation of lands with biodiversity resources
- increasing fines for littering and dumping of solid wastes
- phasing out subsidies on irrigation water and energy for pumping

An update of the 1999 NES was prepared in 2007 and 2008. This document reviewed progress since the NES in 1999 and revisited the policy framework. At the same time, government was preparing a new National Environment Policy. The latter most accurately reflects the recent direction of environmental policy in Mauritius. However,

before turning to this policy it is worth reviewing the main findings and recommendations of the NES (2008).

The NES (2008) concludes that ambient air quality, the coastal zone, land and water resources and waste management are still under threat. While not named explicitly it may be assumed that biodiversity and ESAs are included in this categorization. The NES (2008) calls for a series of legal and institutional changes aimed at moving from what it calls a "sectoral" approach to "centralized management." This would be achieved by forming a centralized environmental agency that would be an autonomous body under the Ministry of Environment/NDU and responsible for the diffusion of environmental technologies and enforcement across environmental media. The DoE would then be merged within the Ministry. At the same time as authority is centralized the report suggests that environmental units be created in the sectoral agencies and in local authorities. The proposal may be better characterized as improving both centralized and sectoral capabilities than purely a centralizing of authority.

The NES (2008) notes that the ESA project was on the cusp of being underway as the report was being finished. It also notes that delays in getting the ESA project off the ground must have had negative effects given the pressure on environmental resources. Later in the report it states that once identified, ESAs must be protected and environmental safeguards should be incorporated when development impacts the ESAs. This is to be accomplished through community participation and empowerment. Cooperation with local communities in monitoring ESAs is suggested.

The National Environmental Policy issues in 2007 states that it presents a comprehensive policy statement that consolidates other policies, including the Forestry Policy discussed above. Substantively, the policy departs from the assertion that the long-term socio-economic success of the country is not possible without environmental sustainability. In particular, the importance of environmental quality to the tourism industry and Integrated Resort Schemes (IRS) is heavily emphasized. The rationale for the policy then rests on pragmatic grounds and the concept of sustainable development. The mission of the NEP reflects this pragmatism and is framed as the provision of the highest level of environmental quality in order to improve quality of life, preserve the natural environment and advance the country's competitiveness.

The policy states nine objectives and fourteen guiding principles. These are a mixed bag of restatements of the mission, principles, objectives and outcomes, and approaches. Subtracting out the mission statements, approaches and principles leaves a series of desired outcomes

- critical ecological systems and resources are protected and conserved, and the diversity health and productivity of ecosystems is maintained and managed effectively

- sustainable production and consumption patterns, including recycling, are achieved

- the built up environment is characterized by good landscaping and architectural designs
- environmental awareness and ethic amongst citizens, especially children and youth, is created
- commitments under international and regional treaties and agreements are fulfilled
- transparency, accountability and other good governance practices are the cornerstones of environmental policies

These objectives all have relevance for ESAs.

More concretely, the policy specifies a series of policy instruments and a series of strategies in priority thematic areas. The NEP restates that there is need to diversify tools and approaches and adopt new environmental policy instruments. Command and control approaches are cited as being less flexible, failing to stimulate innovation and having high costs of enforcement. That said the policy recognizes the need to use a combination of instruments. The policy goes on to identify a series of environmental policy instruments, including:

- legal and institutional instruments
- enforcement and monitoring systems
- financial support programs
- capacity building and research
- environmental education
- information and awareness raising
- voluntary agreements, codes of conduct and practices
- market –based or economic instruments

All of these are probably necessary for the long-term protection and management of ESAs so that spreading a wide net makes for sensible policy. By implication there will be a need to develop expertise in the new instruments listed, including voluntary agreements and economic instruments.

The policy then goes on to emphasize a series of seventeen strategies for Mauritius in a sector-by-sector approach. The specifics are too long too review here, but a few elements pertinent to ESAs are worth repeating. In particular under the heading of conservation and sustainable use of biodiversity the NEP (2007) clearly states that:

> major disturbances such as infrastructure development shall be avoided in threatened habitat and ecosystems, e.g. in ESAs, and in vulnerable ecosystems important ecological functions shall be maintained

This follows along the line of the National Forest Policy (2006: 6) that calls for "ensuring the development, sustainable management and protection of environmentally sensitive areas, including watersheds" except the term "development" is not included. The source of the term "development" in the NFP is not clear, since the NFP has a very clear emphasis on reforestation with native species, biodiversity conservation and eradication of alien invasives. The NFP does not seem to be recommending the "development" of forest areas, and certainly does not pretend to speak for all ESAs generally. Given that the NEP supercedes the NFP it can be assumed that the objective with regard to ESAs, particularly forest ESAs, remains one of protection and management.

The NEP goes beyond mere protection and management to advocate the continuation of efforts to rehabilitate and enhance native species. The policy also calls for the establishment of a Protected Area Network to manage ecosystems.

On the topic of freshwater ecosystems the NEP states the intention to develop a water quality "indexing" for freshwaters and to preserve the ecological integrity of aquatic ecosystems. This would be accomplished by developing a water quality "indexing" system and establishing protection perimeters and levels for rivers, lakes, reservoirs and boreholes. Despite these protections the policy also call for ensuring reliable water supply for domestic, agriculture and industrial uses. That compromise may need to be struck between the aforementioned three human uses of water and the use of water by the ecosystem is not recognized in the policy. The policy does however call for the use of economic instruments to manage water demand and water quality, continuing with the theme of appropriate pricing brought forward by the NES (1999).

For management of the marine and coastal zone, the NEP (2007) recommends preserving the ecological integrity of these systems, including mangroves and wetlands. A number of measures are suggested creating more marine protected areas, zoning lagoons, and creating public-private-community partnerships, as well as improving the EIA process with respect to tourism developments.

Rodrigues. The NEP (2007) is clear that the general provisions of the policy apply to Mauritius and Rodrigues alike. Still, the policy does provide additional strategies specific to Rodrigues. In so doing the NEP highlights that Rodrigues faces particular challenges with regard to deforestation, soil erosion, water availability and storage, siltation in lagoons, lagoon sand extraction and squatting. However, in the strategies presented in the NEP for Rodrigues there are no explicit mentions of ESAs, and most of the strategies are similar to those already covered above.

3.2 Legislation

In theory government policy leads subsequently for the need to reform existing legislation or create new legislation. With ESAs as a previously undefined class of

environmental assets it is not surprising that a review of legislation must focus on the underlying types of ESAs. While a more thorough analysis in this regard is provided in the companion legislative report, it is useful to take a brief look at the status of legislations as it pertains to ESAs in Mauritius.

Existing legislation provides in one way or another for the ownership and usage of ESAs and their services, but does not always provide for their protection or management. For example terrestrial ESAs may typically be classified as on state or private land. The Ministry of Housing and Lands exercises authority over state lands and the Ministry of Agro-Industry exercises authority over public waters in marine areas (non-freshwater), but does not necessary manage ESAs in order to protect their environmentally sensitive nature. In some cases specific protected area designations for terrestrial or marine areas have been provided under law, including Marine Reserves, Nature Reserves, Mountain Reserves, River Reserves and National Parks. These provide for the active management of reserved areas by specific ministries and departments. In other cases, the ESA sites are on state land or in public waters and are not under a protected area as such; however legislation does provide for the delegation of authorities to different ministries and departments for the management of specific environmentally-sensitive goods and services such as ground and surface waters, beach sand, fisheries, etc. Similarly, some of these management authorities extend to the use of ESA goods and services that are derived from ESAs on private land. An attempt to gather this information and categorize it by ESA type is provided in Table 2.

In terms of a gap analysis of the coverage of ESAs and their products and services, Mauritian law does cover a large proportion of the proposed ESAs. A number of gaps do appear from a review of the table. First, there are a number of ESAs that do not have a protected area designation that might empower specific government authorities to manage them directly for their environmental values. These include:

- wetland areas making up the sum of upland marshlands, coastal marshlands, tidal mudflats and mangroves
- rivers and streams
- boreholes
- caves

Wetland, river and stream ecosystems can be of high environmental and economic value and may deserve a legal protected area designation of their own. In the case of rivers and streams the River Reserve merely dictates land use in the buffer strip adjacent to the river but there remains no protected status for the river itself. With respect to boreholes, in many cases these are simple well sites and not extensive areas. Typically they would be well looked after by the entity abstracting water from the site. Public health would be served by regulating the use and management of land immediately surrounding the site . For caves, these represent sites of scientific and recreational interest and would benefit from a protected area designation.

With regard to environmental goods and services associated with ESAs a number of regulatory functions are assigned by law to different ministries and, hence, to authorities. Goods include surface, ground water, wildlife, timber, sand, coral, fish, etc. The harvesting and extraction of these goods are generally provided for in law. In addition, there are regulations that govern the use of the environment as a pollution sink. With regard to ESAs this principally concerns liquid and solid waste disposal into ESAs. Although provided for in Acts, these activities are often not effectively regulated and, as noted above, form an important risk to the future health of ESAs. Policies and policy instruments that may help improve the control of these polluting activities are explored later in this document.

With regard to specific legislative proposals to improve the gaps and shortcomings in the protection and management of ESAs the reader is referred to the legislative analysis that accompanies this policy report as part of the ESA Project.

Table 2. Established Legal Authority and Designations Covering ESA Types

ESA types covered	Existing Ownership or Protected Area Designations (Usage)	Authorities Managing the ESA (or Regulating Usage)	Act
A. Marine Areas			
1. Seagrass beds 2. Coral reefs 3. Mangroves 4. Mudflats	Marine Reserves (2) Undesignated Public Waters	M. of AgroIndustry: Dept. of Fisheries	Fisheries & Marine Resources Act
5. Offshore islets	State Land (including leasehold)	M. of Housing and Lands	State Lands Act
	National Parks	National Parks and Conservation Service	
B. Terrestrial Areas			
6. Sand beach and dunes	Public Beaches	Beach Authority	Beach Authority Act
	Pas Geometrique, including leaseholds (Campements)	M. of Housing and Lands	State Lands Act
	(Sand Removal)		Sand Removal Act
7. Coastal freshwater marshlands	State Land Private Land	M. of Housing & Lands	State Lands Act
8.Upland marshlands	State Land Private Land	M. of Housing & Lands	State Lands Act
9, Steep slopes	State Land	M. of Housing & Lands	State Lands Act
	National Park	National Parks & Conservation Service	Wildlife & National Parks Act
	Private land, including Mountain Reserves		
10. Boreholes/wells	State Land Private Land	M. of Housing & Lands	State Lands Act
	(groundwater extraction)	M. of Renewable Energy and Public Utilities (MREPU): Water Resources Unit	Groundwater Act

11. Rivers and Streams	River Reserves (land portion)	Forestry Service	Forests and Reserves Act
	State Land (water portion)	M. of Housing & Lands	State Lands Act
	(surface water usage and storage)	MREPU: Water Resources Unit (licenses) Irrigation Authority (irrigation delivery) Central Water Authority (main water system)	Rivers and Canals Act Central Water Authority Act
	(pollutant discharge to surface waters)	MREPU: Water Resources Unit	Water Authority Act
	(sanitation)	MREPU: Wastewater Management Authority	Wastewater Management Authority Act
12. Forests with native content	National Parks	National Parks and Conservation Service	Wildlife & National Parks Act
	Nature Reserves	Forestry Service	Forests and Reserves Act
	Mountain Reserves	Forestry Service	Forests and Reserves Act
	Private Lands		Forests and Reserves Act
	(wildlife usage)	National Parks and Conservation Service	Wildlife & National Parks Act
	(timber extraction)	Forestry Service	Forests and Reserves Acts
13. Lakes and reservoirs	State Land	MREPU: Central Water Authority	Central Water Authority Act
	Private Land		
14. Caves	State Land Private Land	M. of Housing & Lands	State Lands Act

3.3 National Environmental Action Plans and Public Investment

The development of an environmental policy and creation of the Environment Ministry in the late 1980s and early 1990s was accompanied by an environmental investment program (called EIP1). These public investments went to environmental infrastructure including sewerage and wastewater treatment. In addition the development of capacity in the DoE was funded under this program. The NES (1999) put forward a National Environmental Action Plan that included 72 projects with total costs over five years of $24 million. This program of public investment was called EIP2.

NES (2008) reports that 34 of 72 projects envisioned under EIP2 have been undertaken, in at least a reduced form. An additional 24 projects are underway. Although only 36% of projects have been completed as originally envisioned and thus implementation has been slow it is a positive sign that the majority of the projects recommend are at least underway.

The NES (2008) also – as part of its terms of reference – proposed a third EIP, consisting of 30 new projects of which 6 are selected for immediate implementation, including:

- Integrated air quality management project (Air Quality)

- Mauritius industrial pollution prevention project (Industrial Pollution)
- Quality and ecological assessment of fresh water bodies (Freshwater Assessment)
- Facilitation of sustainable environmental practices (Sustainable Practices)
- Reforming of the environmental management framework in Mauritius and capacity building of environmental agencies (Reform and Capacity Building)
- Environmental education awareness and community empowerment (Awareness and Empowerment)

The NES (2008) volume containing the write up of the 30 projects contains only a single reference to ESAs. It is therefore not abundantly obvious how the current ESA Project would be implemented in terms of effecting the protection and management of these areas. The terms "protected area" does not appear in the document and only a brief description of national parks is presented in the document. There is one project (though not a priority) for the assessment and improvement of biodiversity on forestlands. This project appears to be the same as the PAN (Protected Areas Network) project being lead by the National Parks and Conservation Service. This project and the Freshwater Assessment are the two projects that have a focus on biodiversity.

Unfortunately, only the six high priority projects in the NES (2008) were fully elaborated with logframes and budgets. Despite the small sample, these projects are reviewed below in order to examine their connection to the implementation of protection and management of ESAs and the use of innovative policy instruments. The results are as follows:

Air Quality. Air quality has little bearing on ESAs and thus this project has little benefit for ESAs. The project logframe has 12 outputs, only one of which relates to implementation. This output (O4 under A2) simply states that agencies implement measures to achieve air quality improvement targets. No policy instruments are proposed, nor is it clear how implementation would be achieved. While air quality in the streets of the conurbation can obviously be improved, a better, more worked out project proposal would be expected before $6.8 million would be allocated to this purpose, particularly as no budget (except for consultants) is provided for actual implementation of air quality improvements.

Industrial Pollution. The discharge of pollutants into waterways and the possibility of the disposal of industrial solid waste at ESA sites (such as caves, wetlands, etc) is an important concern for the protection of ESAs. The application of economic instruments is posited to be an important way to stimulate industry to adopt cleaner technologies and disposal practices. Which economic instruments might be used is not stated clearly, however, the importance of having DoE enforce pollution provisions under the Environment Protection Act is mentioned in the logframe. For some reason in this project as in the Air Quality Project there seems to be an assumption that carbon finance should be sought as part of the project. This suggests some overlap as air quality is one of the pollutants targeted under this project, yet industrial air pollution is also the target in

the Air Quality project. Again, in the $5.1 million project budget, apart from consultancy time there is no budget for the direct costs of implementation per se.

Freshwater Assessment. This project explicitly targets an ESA type: rivers and streams. The project would examine both the current condition of streams and rivers as well as examining the threats, principally from water pollution. This project could be important to ESAs given that interviews for the ESA project showed that outside of the Wastewater Management Authorities activities in treating and monitoring wastewater from the piped Central Water Authority water delivery system, there is no active regulation of water pollution in Mauritius. The project calls for considerable water quality monitoring and study of freshwater systems. The $4.4 million for what essentially constitute a series of studies probably over-estimates what would be necessary to rapidly inventory water quality, stream health and freshwater biodiversity in order to propose a plan of action for water pollution regulation. Note also that in this regard there would be overlap with the Industrial Pollution project above.

Sustainable Practices. The project proposes a consultative and consensual approach to policy development and decision making for environmental sustainability. The project is placed under the program on pollution prevention and control but as the term "environmentally sustainable practices" is not defined the actual outcomes of the project are not clearly specified in the project description or log frame. Given the Air Quality and Industrial Pollution projects above, the exact purpose of this project is not clear. The project budget is $1.55 million for a series of workshops, consultations, studies, plans and institutional strengthening. It is unclear if this project is related to ESAs. As the project includes no implementation activities it would have no impact on ESAs, at least in the short run. No policy instruments are mentioned given that the project is effectively a large sensitization and planning project.

Reform and Capacity Building. This project is intended to carry out the institutional reforms recommended in the NES (2008) and to provide the capacity building to ensure that the new framework can work effectively. Again, this project has no implementation content and thus no suggestions for policy instruments. In the first two years the reform is to be undertaken at a cost of $1.16 million. Capacity building in the following three years is expected to be $3 million. If this project led to better implementation of ESA protection and management activities it could be considered of value to ESAs. However, by forcing a reorganization of environmental management responsibilities on government it effectively may serve to delay implementation of measures proposed under the ESA project and thus, ultimately, would have deleterious effects on ESAs – given as the NES (2008) report itself states that the delay in undertaking the ESA project has had negative impacts on ESAs. Ironically the same report seems to be advocating a further delay.

Awareness and Empowerment. This project has the admirable objective of educating and empowering local communities on the environment. In the preamble it is mentioned that this might lead to engaging the public in activities like post-EIA monitoring, again a laudable goal. The project fails, however, to be explicit about what the desired outcome is – outcomes listed include centralizing environmental education in the country, developing training programs, training trainers, and writing action plans. Again this

project has no implementation content. Sensitization may be considered a policy instrument but it is a very indirect one. What this project proposal misses is the objective of all the sensitization. For example, such a project might have as its objective to create local community groups that sign up to monitor the ESAs in their area. This would make the project of value to ESAs and give the project a tangible objective. As proposed, however, the project is another $2.3 million with no clear output.

Summary. In sum the NES (2008) proposes 6 key projects with a total cost of $23.3 million. Note this is the same amount as the NES (1999) report suggested for 72 projects. Of the $23.3 million some $3 million is for air quality monitoring equipment and the remainder is for consultants. As reviewed above it is questionable whether any of these projects will result in a marked improvement in the actual on-the-ground protection and management of ESAs. Further, it is unclear whether the expenditure of an additional $20 million on consultants will improve the environment in Mauritius in any measure commensurate with the costs.

As related above Mauritius began setting up its legal, policy and institutional framework for the environment over 20 years ago. The ESA Project will fully delineate the ESAs and provide useful information on these areas that will guide their management. As detailed in this report on ESA Policies and the companion report on ESA Legislation, the threats to the environment and ESAs are well known and the drawbacks of current policies and legislation can be clearly identified. While the Freshwater Assessment would be of value in providing additional information about an important ESA type, it is arguably past time to begin a systematic push in Mauritius to implement on-the-ground environmental protections. Doing so with regard to ESAs may be a good place to start as detailed later in this report and in the companion Legislation report.

3.4 Mauritian Success Stories in ESA Management

It is important to emphasize that Mauritius does have its success stories in environmental management. These stories can be used to illustrate on-the-ground implementation of ESA protection and management in Mauritius and the policy instruments used thus far.

Sand Mining. For a very long time, sand was frequently dug up and removed to other parts of the island, with very little in the way of limitations. In 1982 the Removal of Sand Act was passed into law. The Act required a license for a "dealer" of sand and provides for the lease of state land to such dealers for the purpose of a sand quarry. No sand was to be removed from any other site, except with purchase of a permit. However, the key provisions of the Act were those restricting the movement of sand as, after all, trying to police the entire coastline and prevent unauthorized removal of sand poses a significant enforcement hurdle. Sand is of no value unless it can be transported to the site at which it is to be used.

The Act prohibits any movement of sand between sunset and sunrise and requires anyone transporting sand to be in possession of a document that authorizes the transportation. If a driver is found transporting sand in the absence of the proper authorization, policy

officers may arrest the driver. If operating outside of daylight hours the Act states that the police officer shall make the arrest. Penalties of from Rs 10,000 to 50,000 and the court may order the forfeiture of the sand, the vehicle or both. As a matter of policy, Cabinet banned sand removal from lagoons in a decision in 2001. The transportation provisions of the Act put the burden of enforcement on the police but spotting trucks hauling sand is relatively straightforward. A simple traffic stop of any suspicious vehicle is all that was required to initiate the enforcement action. Thus the nature of the prohibited action and the ensuing provision of enforcement authority to the police made implementation of the ban feasible and at a relatively low cost.

Ferney Valley Forest Restoration. Starting in 2004 government proposed a new tunnel and road on the east coast. This South-Eastern road project would connect through the Ferney Valley area to the coast road, providing a more efficient route to the northeast. As part of the evaluation of the project, government contracted for a survey and analysis of the impacts on the forest that lay in the path of the road. The potential mitigation costs from the project were of substantial magnitude due to the relatively high quality of the forest area that would be affected. In the end, government scrapped the project.

The private landowner of the forest area, the Ciel Group, was interested to see what other arrangements could be made for management of the forest and has now entered into a partnership with the Mauritius Wildlife Foundation (MWF) and the government to manage the forest for restoration and to permit limited ecotourism on the site. At present the ecotourism is not a large financial success, but the CIEL Group – recognizing the importance of the site to biodiversity management in the country – has committed to funding of up to Rs 1.5 million per year to continue efforts to restore and maintain the site. Forest restoration of this type in Mauritius is very expensive given the high cost of removing alien invasive species and planting natives. The MWF provides technical input of setting up the reserve in terms of biological surveys, tracks, and training of guides. The latter are employed by the CIEL Group.

This project demonstrates how environmental review and estimation of the harm from a development can lead to the halting of the development project and the onset of an environmental restoration project. EIA is not a tool for stopping development but rather one for improving development. Still, given stakeholders general reluctance to conclude that EIA as practiced in Mauritius has helped forestall further environmental degradation this example is a valuable one. The project also illustrates how private sector, NGOs and government can partner to achieve on the ground ESA protection and management. At present the private sector and the NGO are providing the bulk of the funding and labor to the project, but hope that the government can eventually come on as a funding partner.

Blue Bay Reef Visitation Management. Blue Bay was originally designated as a Fishing Reserve, prior to 1997. In 1997 it was declared a National Park and in 2000 it was declared as a Marine Park. Finally, in 2008 it was also declared a Ramsar site. As part of the Marine Park designation permits were required for the boats that would have access to the portion of the bay allocated to passive viewing of the extensive and varied corals and associated fish species in the Bay. Hotels in the area needed to obtain permits for their boats as did the private operators that moored their boats and ran their tours from the

Public Beach area. Initially, the operators competed one with another. Marketing on the beach was competitive as different operators approached and marketed their services to those visiting the beach. Similarly, there was plenty of opportunity for competitive behavior on the water and at the buoys (for snorkeling) in order to gain competitive advantage. Eventually, this race to the bottom became evident to the private operators.

They subsequently banded together and now operate on a cooperative basis. The13 boats owned by 6 different proprietors do not engage in competitive sales and marketing on the beach. Instead each day one of the operators is in charge of collecting fares from all tourists taken out on one of the boats. At the end of the day all revenues are shared out equally among the operators. The next day another operator takes a turn as the fare collector. In this manner the operators have developed a common property-like regime. The regime is sustained by the permit regulations and the presence of an active Environment police office near the Public Beach. Should another operator decide to locate at the Bay they would need to show a permit to the police. Should they attempt to acquire a permit they might well find that no further permits are being allocated, particularly if they are not willing to join the operators' collective. By engaging in cooperation the operators have likely increased their revenues by avoiding the nuisance of unmitigated hawking by competing interests. At the same time they have eliminated any incentive for competitive behavior in the water – which over time might have led to actions by the operators and their passengers detrimental to coral and fish health.

4. POLICY INSTRUMENTS FOR ESA PROTECTION

Traditionally, policy instruments were the exclusive province of government and quite distinct from tools and activities employed in the private sector. The addition of a voluntary or non-governmental, not-for-profit sector complicated matters as often NGOs engaged in activities that were allied with government objectives – in terms of overcoming the failures of the free market – but relied less on top-down command and control measures and more on bottom-up, collaborative approaches. Often-times these resemble private sector initiatives more than they do government policy instruments.

In discussing policy instruments for ESA protection it is therefore valuable to acknowledge that there is a wide suite of instruments available to effectuate ESA conservation. Not all of these are necessarily instruments of government policy, per se, but they remain important ways to achieve the objectives of government policy with respect to ESAs. It is also the case, that even with initiatives that rest fully within the voluntary or private sector domain, government policy can promote or hinder these initiatives. For this reason government policy needs to be aware of the full range of instruments for ESA protection, so that it can best support and promote allied initiatives of the other sectors.

With this in mind we somewhat arbitrarily divide the full range of instruments into those that involve the exercise of government authority – regulatory instruments – and those that really are initiated by the private and voluntary sectors. The latter are referred to here as non-regulatory for the sake of convenience. Oftentimes these are referred to as voluntary approaches, but the term "voluntary" can be confusing as there are many opportunities for the public and business to voluntarily participate in government programs and the term "voluntary" may confuse the issue that the subject here is really the set of initiatives arising out of the private sector, i.e. businesses, and the voluntary sector, i.e. NGOs.

The approach taken here is to survey existing knowledge on these instruments to elicit a broad representation of these instruments and to provide a fairly systematic categorization of approaches. Ultimately, the objective is to arrive at the subset of approaches that may be applied to the protection of ESAs generally or of specific ESAs. Thus, there may be some instruments that have been overlooked or are not represented due to the particular context of the problem presented by protecting ESAs in Mauritius.

The full suite of instruments is summarized by category in Table 3. Beginning with regulatory and proceeding to non-regulatory, the sections below describe each instrument, give an overview of how and where the instrument has been used, explain the strengths and weaknesses of the approach and provide an example of the instrument. The examples are chosen either to illustrate either an application of the instrument to an ESA-like case or to demonstrate how the instrument can work in a context that is not that dissimilar from Mauritius. Thus, a developed country example may be used to illustrate

and approaches that might be recommended in Mauritius. Or an example from the region may be used to show that the approach can work in a tropical environment or a middle-income country. At the end of each section a brief effort is made to suggest how the instrument might be applied to the protection of Mauritian ESAs. A more exhaustive analysis of the match between instruments and ESA types is conducted in the final section of the paper.

Table 3. Instruments for ESA Protection

A. Regulatory Instruments
Centralized Management
Public Ownership
Public Investment
Enhancing Public Assets
Integrated Conservation and Development Projects (ICDPs)
Sensitization*
Micro-credit*
Command and Control
Decentralized and Polycentric Management
Co-Management
Common Property Management*
Public-Private Partnerships
Market-Based Instruments
Fiscal Instruments
Taxes on Pollution
User Fees and Charges
Subsidies and Payments
Regulated Markets
Privatization
Cap & Trade
Product Certification*
B. Non-Regulatory Instruments
Self Regulation
Market-Based Approaches
Voluntary Contractual Arrangements
Private and Voluntary Sector Investment

Notes: *Can also occur as a non-regulatory instrument

4.1 Regulatory Instruments

Regulatory approaches to sustainable financing hold the significant appeal of directness. In a strong state with adequate authority, funding, and institutional capacity a regulatory approach to environmental regulation may achieve full compliance. It then follows that whatever environmental standard it seeks to produce – in this case protection of ESAs – is likely to be achieved. However, the capabilities of most states in this regard are often constrained and, therefore, the utility of pursuing solely a top-down, regulatory approach is also limited.

A simplistic approach to economics suggests that public goods should be provided by central government and private goods provided by the market. As described above, ESAs come in a variety of types and, therefore, it is beneficial to consider the full range of arrangements available for their management. An "institution" is a set of norms or effective rules used by a group of people in order to organize a certain sphere of their collective activities (Ostrom et al. 1993). A number of possible institutional arrangements are typically cited as available for resource and environmental management including market, centralized, decentralized or polycentric arrangements. Each of these arrangements is briefly described below.

- centralized arrangements – central collective management by public functionaries, some elected others not, that take decisions at the national scale

- decentralized or devolved arrangements – power and authority to manage the resource are delegated from the centre to a region (or other subunit of management)

- markets – resource allocation is conducted through buyers and sellers acting in a market environment that can be characterized as (a) a simple market where there are just buyers and sellers, (b) a differentiated markets where there are provider organizations and intermediaries that lower transaction costs and (c) user groups that function as provider organizations in a differentiated market orchestrating production and other market functions.

- polycentric arrangements – power and authority is distributed across different groups all of which have their own set of roles and responsibilities in the production and management of the resource, this includes common property regimes or user groups where resource users treat the resource as common property and agree on rules for exclusion, i.e. for access and management

Government authority may therefore be exercised in three forms: centralized, decentralized ,or shared with other actors through polycentric arrangements. Even further, it is important to acknowledge the role of government in creating and underpinning markets. In the modern state, formal markets are regulated markets. Thus, the regulatory instruments can usefully be grouped according to this typology of institutional arrangements. The distinction between decentralized and polycentric arrangements is not crucial to the exposition of approaches below, so these are loosely grouped together for instruments where central government is sharing its authority with other entities – whether local government, the private sector or the voluntary sector. For market instruments those government initiatives that involve either changes in market incentives (through fiscal policy) or the creation of new, regulated markets are grouped together.

While the potential effectiveness of regulatory instruments is significant the potential limitations and barriers to the exercise of government authority are important to list at the outset. These limitations come into forms. First, the direct exercise of government authority is often subject to criticism on efficiency grounds; the argument is that whether

through ignorance of opportunities or disinterest in efficiency, the regulations fail to meet objectives in the most cost-effective manner possible. This problem can be particularly acute with the more centralized approaches. In fact, it is this problem that has spurred innovation and experimentation with decentralized, polycentric and market-based approaches. The second problem, returns to the presence of the critical enabling functions of authority, funding, and capacity. In particular, the ability of the state to monitor and enforce its own regulations and penalties is of concern. Again, these issues come out in the case of purely centralized approaches, in particular the use of command and control instruments. And again part of the reason for expanding the toolbox of instruments is to distribute some of the responsibility for these critical enabling conditions to the business community and civil society, instead of having them be the unique province of central government.

Each of the regulatory instruments listed in Table 3 is reviewed below.

Public Ownership

The most direct way for government to provide public goods, like ESAs, is to establish public ownership over the asset, fund operations and management activities and enforce rules of access and use to the resources involved. National parks and forests are a prime example of this approach. As a long-established tradition in most jurisdictions this centralized approach does not offer a new approach and is not discussed at length here. It is relevant to a discussion ESAs only insofar as there may be opportunities to:

- nationalize assets or resources that are currently owned by the private sector
- raise public investment in assets already under public ownership
- privatize resources that are currently owned by the public sector
- develop other innovative partnerships for managing national assets or resources that will remain in public ownership but that may be operated and managed by other entities

In the current context of ESAs and their management and protection in Mauritius the problems of monitoring and enforcement by the state are considered significant. For this reason there is little mandate for pursuing the first option above and nationalizing additional ESA properties or resources. Changing how specific properties or resources are managed that are already owned by the government is, however, an important issue, given the inability at times of the state to manage these ESAs successfully. Specific policy instruments associated with these opportunities arise below with public investment and under decentralized/polycentric instruments and regulated markets

Public Investment – Uses of Funds

Apart from public ownership the next most direct way for government to provide public goods is to directly finance their provision. The two principle alternatives here are to

provide additional funds to manage publicly owned assets or to finance provision by the private or voluntary sector. There are numerous ways that public investment can be structured to promote sound resource and environmental management. Just a few of these that may be particularly relevant to ESA are described below.

Enhancing Investment in Public Assets

Although the difficulties of centralized management of public assets are clear, it is not necessarily the case that the solution is always to explore other ways of managing the assets. In developed countries, for example, state agencies still manage many public assets and do a reasonable job at this task. In some cases the most direct solution is therefore to recognize that provision of public goods – like ESAs – is not a costless exercise and that additional staff, vehicles, equipment and materials is necessary to adequately protect, manage and restore the assets.

Integrated Conservation and Development Projects (ICDPs)

ICDPs are an indirect approach to public goods provision. Instead of directly financing biodiversity conservation or resource protection, ICDPs invest public (and private) resources in enhancing economic opportunities to local residents in order to alleviate pressures on the resource and the environment. The intent is to ensure that conservation goals are not undermined by subsistence resource use stemming from poverty. Developing such alternative livelihoods approach is particularly important in areas where settlement and land use patterns preclude conservation by exclusion. In addition, some management programs can integrate alternative livelihood efforts in the achievement of their conservation gains, for example by using local populations to enforce regulations or conduct ecosystem restoration.

The need to incorporate alternative livelihood provisions into conservation projects depends on the opportunity cost of conservation and on the options available to the local community. By including a strong focus on local development opportunities, ICDPs enhance the chances that overall projects will be successful and that conservation will gain community buy-in. One such example can be found in the work done by Wetlands International with a peatland restoration project in Kalimantan (see Box 1). In this case, the community was employed in the restoration planting effort and follow-on capacity building assistance was provided to ensure the continuation of the project by helping to develop an export product. Similarly, certain aquaculture practices can achieve dual conservation and economic development goals.

Box 1. An ICDP in Indonesia

The international NGO Wetlands International has been working on a peatland restoration project in Kalimantan. Because this is a far more remote area compared to its work in Pumalang, the options for local community sustainable livelihoods are severely limited. Prior to the palm oil boom, the land in the region was once rich peatland that had been cut down for palm oil plantations. Wetlands International employs local community members to rehabilitate the land by planting trees and blocking canals that were dug to support the palm oil plantations. Once the peatland is restored and the blocked canals return to being small ponds, subsistence activities will be restored; these include gathering fruit, food, hunting, and fishing in the newly created ponds. Because the area is so remote – more than 3 days from the market – Wetlands International is also assisting the community to create a marketable fish powder product from its fish.

Source: Dibja Sartono, Wetlands International

Sensitization

Sensitization efforts directed at environmental assets are another indirect means to protection and management. The immediate objective is to build understanding and awareness, whether or not this affects the environmental asset depends on what the recipient does with this knowledge. Public financing is often employed in these campaigns, although they are just as likely to be financed by the voluntary sector. Therefore, there is an implicit tradeoff between, for example, financing sensitization and direct resource protection (as above). Arguably, to finance only one or the other is not the best solution. Finding the right amount of investment in sensitization is therefore difficult.

It can be argued that in the initial stages of environmental policy implementation that expenditure on sensitization is critical. Otherwise communities may not understand the purpose of public management and investment in ecosystems and the environment. In which case they may short-circuit such efforts or engage in destructive behavior that renders the government investment worthless. On the other hand, as sensitization takes hold it can be argued that diminishing returns set in – and at that point it is more useful to direct government funding to activities that directly increase environmental management. This, as at some point communities will want to see the promised social and economic benefits of well-managed ecosystems and biodiversity.

Micro-Credit and Revolving Loan Programs

Under micro-credit and revolving loan programs, dedicated pools of financing are made available to small scale, environmentally responsible enterprises on a loan basis. In a best

case, this provision of credit can alleviate the capital constraints facing poor populations, allowing them to establish viable enterprises that reduce poverty. This poverty reduction can in turn support environmental stewardship, by reducing the subsistence use pressure placed on resources by the extreme poor. Micro-credit is a particularly promising measure as a complement to establishment of environmentally protected areas that can help reduce poverty that may threaten conservation efforts. Micro-credit is not an instrument specific to government. In developing countries it is often a way of providing development aid from the voluntary sector or development donor organizations.

The use of micro-credit has seen mixed results (see Box 2). Microcredit is particularly suited for addressing the sustainable livelihood and pro-poverty aspects of conservation projects, but it is critical that capacity-building efforts and money management training precede the establishment of a fund. In addition, timing is important. There seem to be two models of micro-credit. One involves an initial infusion of funds, which are then managed by a local representative. The second, and more informal but seemingly prevalent case, appears to be via the use of occupational groups like shrimp or crab banks.

Box 2. Lessons learned: Experiences with Micro-credit

In Sri Lanka, an Asian Development Bank micro-credit scheme was used to encourage the fishing community to adopt alternative livelihoods and thus reduce pressure on fishery resources. This effort was one component of a water effort to reform fisheries in Sri Lanka, where poor enforcement and incomplete knowledge of local coral reef resources hampered effective management. The program was implemented through local credit institutions. Unfortunately, efforts to increase disbursement of available program funds led to pressures from the Asian Development Bank on the local lenders to lend more money. As a result, large loans were made to the best customers, many of whom defaulted on the loans. Despite this setback, the effort heightened recognition of the need for alternative livelihoods that are financially feasible for individuals (Perera et al. 2005).

In Thailand, the national NGO Raks Thai Foundation began a revolving loan fund for 40 communities on the Andaman Coast that had suffered damage from the Tsunami. Though traditionally a relief organization, Raks Thai was transitioning into a restoration role. Their revolving loan program covered 9,000 hectares, 134 villages and targeted 40 occupational groups. An initial $5 million was provided by CARE to start the fund. Despite Raks Thai offering below market interest rates on the loans, because the fund followed behind of so much grant aid from around the world, the fund saw only 40% to 50% repayment rates and did not reach the 5-6 repayment cycles it had targeted. Both the timing of the revolving loan opportunity and the preceding investments from grant aid made it difficult to develop the capacity building and management skills needed to enforce the loans terms.

In contrast, in 1998 Wetlands International assisted the Pumalong community in Indonesia with a mangrove restoration that created a long-term revolving loan fund. Wetlands International left the community eight years ago, and the loan structure and mangrove still remain in place and are functional. The project was funded in part by the Netherlands and Canada, with the purpose of restoring shrimp farms *on private lands* to mangroves and allowing for the joint use of these lands (for both shrimp and ecosystem services provided by mangroves). The project addressed the conservation and livelihood needs of the community, and the revolving loan fund assisted the community to develop an exportable market product of dry, salted fish. After the departure of the NGO, the government did come in to assist the community in sustaining the dual use of the area by stocking the remaining ponds with fish. Critical to the success of this effort was the fact that it

was done on an area with clear property rights belonging to private parties and in a place where there were multiple livelihood opportunities.

Sources: Perera et al. (2005); Bruce Ravesloot, Raks Thai Foundation; Dibjo Sartono, Wetlands International

These occupational groups have long been self-regulating and have collected funds to support such things as purchasing new equipment or funding weddings. Consequently, micro-credit programs that can leverage these existing relationships will be more successful.

Public Investment – Sources of Funds

The ability to deploy public investment rests on the ability to collect funds for this purpose in the first place. Governments have a variety of sources for the funds that can be deployed as public investment. Tax revenue through government appropriation is an indirect, but effective source of funds for environmental protection. Again, recognizing the public nature of assets like ESAs there is a logic in using government to assess the general public as a way to raise funds for this purpose. Direct taxation – that is taxing actions that directly affect or interact with the environmental assets – is another method. Such direct taxation affects the incentives to use or pollute the asset and therefore is further described below under fiscal instruments. Additional source of finance that government often controls are foreign aid and other innovative instruments like debt for nature swaps. The latter are not included in the discussion due to their limited utility in the case of Mauritius

Government Appropriations and General Taxation

Government taxation is the traditional method for raising funds to dedicate toward public goods like ESAs. Given continued government support for ESAs it may be that this could be a strong source of sustainable financing for ESAs in Mauritius. However, the current economic downturn suggests that optimism in this regard should be limited.

To some extent the use of government appropriations and the use of general taxation for this purpose would be made more palatable where the economic values of ESAs and their resultant services more clearly demonstrated, including in economic terms. Little to no economic valuation of the ecosystem services and biodiversity provided by ESAs in Mauritius has been undertaken. Internationally, much research on this topic has been done and more is underway. It may be that as part of sensitization activities it would be instrumental to have at least a few case studies of the economic value of ESAs. The major approaches used in conducting this type of valuation exercise are summarized in Table 4

Table 4. Economic Valuation Methods

	Observed Behaviour:	**Hypothetical Behaviour:**
Direct:	**Market Prices (Direct Observed)**	**Stated Preferences (Direct Hypothetical)**
	Competitive market prices Shadow-pricing	Contingent Valuation (dichotomous choice, willingness-to-pay, bidding games)
	Revealed Preferences (Indirect Observed)	**Choice Modelling (Indirect Hypothetical)**
Indirect:	Productivity methods	Contingent referendum
	Avertive (defensive) expenditure	Contingent ranking
	Travel cost	Contingent behaviour
	Hedonic pricing	Contingent rating
	Substitute goods	Pairwise comparisons

Source: WCD (2000)

International Aid

International aid still comprises a significant portion of the financing given to environmental protection in developing countries. The more traditional sources of international aid include UNDP, UNEP, GEF, World Bank, and Asian Development Bank and a number of bilateral donors (e.g. Canada, Denmark, France, USA). In addition, many of the projects executed by the voluntary sector receive their funding through these agencies. In the case of Mauritius, a middle-income country, the opportunities for government to receive funds for ESA protection from the international aid sector are probably limited.

Command and Control

The concept of command and control mechanisms is one in which the government compels actions it desires by virtue of its state authority. Specifically, the government might simply order the halt of certain development activities that threaten coastal ecosystems. In other words command and control mechanisms are a tool government uses to directly influence behavior in the non-government sector – including businesses, communities and individuals. Like most centralized regulatory approaches, pure command and control efforts require a strong ability to enforce government rules – this enforcement enables the state to effectively command and control. In the context of ESA protection and management, the question is first whether the state has the ability to effectively promulgate regulations, fund monitoring and execute enforcement actions. As noted above, another relevant question is whether more efficient alternatives are available, and what are the tradeoffs between efficacy and efficiency in implementation.

Command and control approaches consist of regulations placed on resource users that set either the level of resource use or pollution, or direct the user to what technology they must use in association with their interaction with the resource. For example the state may set the level of water pollution that a point source may discharge. Alternatively a particular pollution control technology may be mandated by the state. Use of the command and control approach implicitly recognizes that use or pollution is a problem,

and that regulations are needed to protect the resource. Technology-based standards specify the methods and equipment that must be used to comply with environmental regulations. Such an approach eliminates the incentive for the user to find a low-cost solution to the problem and may lead to rent-seeking behavior by government officials that promote a certain type of technology as a means of currying favor or funds from industry. Performance-based standards set uniform control targets for all regulated users, but unlike technology-based standards the users are given some choice over how the target is actually met. This tends to minimize the costs of compliance as opposed to a technology-based standard.

The advantage of command and control approaches is that they are a direct approach to resolving excessive levels of resource use or pollution. In a performance-based standard the sum of individual use or pollution permits represents the overall total resource use or pollutant load. This aggregate level is often called a "cap. " In natural resource management having the ability to set limits on use and pollution can be an important management tool.

The design of command and control programs reflects a criminal law model of deterrence in which compliance with regulation must be compelled by threats of sanctions or other enforcement actions. In order for this model to work the probability of being caught must be high enough and the punishment (often a fine or time in jail) must be significant enough to warrant compliance on the part of the user or polluter. The obvious difficulty here is that enforcement requires authority, funding and capability. Where these attributes of government are weak or absent, command and control programs tend to be mere de jure statements of intent that do not inspire on-the-ground compliance.

A disadvantage of command and control approaches is their failure to take advantage of variation in the opportunity costs of resource use and pollution abatement costs across users. Requiring all users to adopt a specific pollution technology or use only so much water does not lead to efficient outcomes in terms of resource allocation. As discussed later in this section the addition of trading to a cap system can overcome this problem. There are numerous examples of how command and control has been employed to manage natural resources and environmental assets. This approach was the predominant approach in the latter half of the 20th century and only started to cede ground in the last couple of decades to more nuanced approaches such as those discussed in the rest of this section.

It is also important to note that command and control measures may be combined with other approaches. Box 3 provides an example of how an ICDP approach was merged with an attempted effort at command and control. The example highlights that the success of the overall effort is then only as good as the implementation of both parts.

Box 3. Integrated Coastal Management in Sri Lanka

In Sri Lanka, management of the coastal zone has endeavored to include community participation, particularly through the use of Special Area Management (SAM) designations to manage small-scale developments and address ecological issues including coral mining, destruction of mangroves, and mining of sand. Under these designations, local communities engage in a collaborative process to identify key community issues pertaining to coastal zone management, leveraging local expertise in a voluntary effort to achieve conservation ends.

At Rekawa, one of the first SAM sites, the community discussion resulted in a plan to halt destructive activities, including coral mining and mangrove cutting (Clemett 2003). Given this goal, the plan the used a hybrid regulatory and voluntary approach to address the problem. In particular, a prohibition on coral mining was included along with promotion of alternative employment that would provide the economic stability to enable local populations to comply with the prohibition.

Despite the integrated program design and good enforcement of the prohibition, failure of the alternative employment opportunities led to a disintegration of the initial community consensus. Some villages then withdrew from the SAM process and resumed their destructive activities. Efforts to conserve mangroves were more successful, with local populations generally recognizing the benefits to fisheries from habitat conservation.

Source: Clemett (2003)

Decentralized and Polycentric Management - Partnerships

In a context where government lacks the necessary authority, resources or ability to directly fund and manage publicly held assets or regulate the use of privately held assets, partnerships with other sectors become a useful tool, if not an imperative. Whether authority is decentralized to local government or shared with communities, businesses or civil society is not so relevant as the manner in which the shortcomings of an exclusively centralized approach are targeted and overcome. Co-management, common property management and public-private partnerships offer particular promise as ways of sharing both the costs and benefits of resource and environmental protection with the non-government sector. As shown in Box 4 of crucial importance is the need to ensure that benefits are shared, as well as simply decentralizing authority.

Unfortunately, the process of developing such partnerships can be time-consuming and difficult for central government as these partnerships are able to proceed provided they are allowed to work fairly autonomously, employ adaptive management, and operate with minimal government influence. Successful partnerships have also succeeded at different scales by pairing large NGOs with more locally engaged NGOs, and allowing a fair amount of autonomy at the project level to relay information between the field and the overarching organization. However, partnerships can be intensely time consuming and have the potential danger of become too process oriented and too unwieldy in terms of redundant management and operational structures. Simplicity is often then of great value in designing such partnerships, rather than simply recreating bureaucratic-like procedures and structures in the voluntary or private sectors.

Box 4. Property Rights and Decentralized Forest Management in India and Nepal

A comparison of efforts to decentralize forest management in four separate cases in India and Nepal illustrates the relationship between the property rights created and program outcomes (Agrawal and Ostrom 2001). Contrasting decentralization of forests in Kumaon, India, joint forest management in India, community forestry in Nepal, and the parks and people program in Nepal's Terai yields several insights.

First, decentralization is more likely to succeed where there is local interest in the process and users obtain proprietorship over the resource. In addition, the ability of users to exercise any right they obtain is in part a function of the institutional support the government puts behind decentralization efforts. Governments can easily promise decentralization and award locals nominal control over natural resources, but if governments fail to give the administrative and enforcement support to these rights, locals may in practice find it difficult to effect decentralized management. As an example, *de jure* rights to protect forests are meaningless if the right holders have no resources to enforce any management decisions. On the other hand, forest councils in Kumaon, India are more able to exercise management because they have the ability raise local revenues and have access to a local government official charged in a supervisory capacity.

In particular, the Nepali Parks and People program was of little local interest and devolved few property rights – as a result, it was largely a failure and resource conditions did not improve. It suggests the utility of not just decentralizing authority, but of granting at least some proprietor-level rights in order to generate local interest and provide incentives for improvements in the resource conditions.

Source: Agrawal and Ostrom (2001)

Co-Management

Co-management typically consists of agreements between government and local communities to share in the management of local resources or protected areas. Typically each party takes on the tasks to which they are most suited in order to achieve operational efficiency and match the scale of efforts made and benefits received.

Co-management of conservation efforts can increase the financial sustainability of protected area management by both generating local investment in conservation efforts and reducing management costs. Partnerships and co-management agreements can increase management efficiency and reduce costs because beneficiaries of protected area management are often willing to contribute time and services or able to carry out management functions at a lower cost than the designated management agency. In some cases, co-management of conservation efforts can also be a source of sustainable livelihoods for local residents, mitigating the risks that prevalent poverty can pose to specific projects.

Box 5. Co-management of Mangroves in Tanzania

In coastal villages around Tanga, Tanzania, failing mangrove management led to adoption of a cooperative approach (Nurse and Kabamba 1999). In particular, inadequate numbers of forest field staff were unable to effectively monitor and enforce resource use regulations, while at the same time a lack of restoration and rehabilitation funding left degraded forest unaddressed. In addition, external commercial pressures on the forest posed a further threat. Prior to program implementation, an open access culture existed in which locals were free to harvest mangroves without controls. Originally, resource pressures were light enough for this to be sustainable, but as populations grew, the resource was overused.

In response, two collaborative management processes were launched, the Tanga Coastal Zone Conservation and Development Programme and the Mangrove Management Project. Under the approaches, committees were established to manage mangroves. These committees included representation from the two local villages and resource users. It was decided that revenues from resource harvest would be equally divided between the villages. A mangrove resource management plan was also designed to determine how to best use the forests.

In the Tanga case, consensus among local resource users about the desire for a common pool resource and the importance of preserving the local environment for subsequent generations contributed to successful management collaboration. At the same time, the large group of users has some trouble making management decisions, and some felt that the committee structure of the partnership concentrated power. Other threats to the partnership include its lack of legal basis for its actions, and the absence of external institutional support to the user groups, who lack a source of impartial advice. In sum, co-management was able to effectively address the failings of centralized management by establishing local governance partnerships. While largely successful, the program was unable to achieve universal approval, illustrating the practical difficult of meeting self-governance ideals in on-the-ground implementation.

Source: Nurse and Kabamba (1999)

Common Property Management

In the extreme co-management can lead to the full-scale management of a particular resource by local resource users or of a protected area by the community. Traditional forms of common property management typically operate without (or outside of) government authority (and hence can appear also as non-regulatory instruments). However, as the benefits of the approach are recognized, there is increasing interest in promoting the approach. In such circumstances, common property management may still originate from the bottom-up, but it may also emerge as a top-down imitative. Regardless of the origins the point is that new common property management regimes will often require explicit approval from government, particularly where the authority to manage the resource and make decisions on resource use and pollution have been formally assigned to the state.

In such cases, the state will often need to formally devolve this authority to local institutions (not necessarily government). Common property management relies on the will of the group or the community to mange the resource. From government's standpoint this approach is attractive in situations of limited government capacity. In areas where strong local institutional norms of resource use and stewardship exist, they can be leveraged to engage the entire community in conservation. Cultural norms of behavior and social cooperation constitute an important method for safeguarding

resources that are vital to the collective security of a region. Typically, for such arrangements to function there needs to be a sustainable livelihoods use associated with the resource or an important local cultural value.

The difficulty of establishing a new common property management regime can be substantial (see Box 6) given the multiple layers of local and government authorities that typically interact in a given context. It is no surprise that traditional common property management systems typically evolved over long periods of time and in the absence of a strong state legal regime.

Box 6. Local Participation in a Mangrove Rehabilitation Partnership in the Philippines

In Cogtong Bay, Philippines, a mangrove rehabilitation and coastal management program featured a partnership with local residents to increase compliance and sustainable management of coastal ecosystems. In the area around the bay, local villages are demographically similar and all depend on coastal resources for survival and livelihood. Seafood is harvested for both use and sale, and mangrove forests are sources of fuelwood. Historically, the bay itself has been open access, though informal tenure to the mangrove forests has developed over time. At present, 25 families have management rights over the mangroves.

Faced with recent resource degradation from overfishing, fishpond use, and mangrove harvest, a public-private partnership funded by USAID in cooperation with the Philippine Department of Environment and Natural Resources set out to rehabilitate coastal ecosystems (Katon et al. 1998). Specifically, the project sought to involve local resource users in resource management. Community organizers were hired to raise awareness and strengthen capacity among local populations. Property rights were used to provide incentives for sustainable management, establishing rights for locals to harvest mangrove trees in specific areas if they replant the trees and prosecute an agreed-upon sustainable management plan.

Local populations were also involved in enforcement, with fishermen's' associations and project staff joining forces with municipal governments and local police to patrol and guard mangroves and coastal areas. This enforcement was able to prevent illegal mangrove harvest, illegal fishpond building, and blast fishing.

Despite these successes, the partnership-based approaches also encountered some classic difficulties. In particular, conflicting government policies between the national fisheries department (which encouraged establishment of fishponds) and the Department of Environment and Natural Resources led to initial confusion, illustrating the importance of coordination between all potential stakeholders in resource management. Displacement of local residents who relied on the mangroves for fuelwood was also a challenge, though it was eventually addressed by creating a subsistence fuelwood harvest area, complemented by a law prohibiting the external sale of this firewood. In sum, the experience illustrates the potential of leveraging local resources towards environmental stewardship, and the importance of addressing all stakeholder concerns in order to give programs every chance to succeed.

Source: Katon et al. (1998)

Public-Private Partnerships

Public-private partnerships involve a sharing of the responsibility and the benefits for resource management between the government and the private sector. The outsourcing of park management is a form of co-management that has been successfully implemented in the Indian Ocean region, as the example from Tanzania in Box 7. Despite this

successful use of partnerships, such approaches require caution. Public-private partnerships hold political appeal and are currently in vogue so that attention needs to be given to whether they are an appropriate remedy for the problem at hand. Given the somewhat vague definition of a public-private partnership, it can be easy to arrive at consensus on the importance of partnerships in the abstract without sharing actual goals for the exact actions sought. The question therefore is what role such partnerships *should* serve, given the risks and cost associated with their employ. In particular, given the involvement of the private sector – presumably on the premise of profits – the provisions of any contractual arrangements need careful scrutiny for their financial consequences for both parties. More to the point, the likelihood of profits to be made should be clear to both parties.

A further issue is that public-private partnerships are often entered into on the basis that private involvement brings with it the financial resources to invest in making the asset productive. This premise is increasingly questioned as large-scale privatizations of government assets have shown. This perhaps reflects an undue emphasis on financial resources. Oftentimes the critical need is for the real resources represented by business know-how and technologies. In other words, the private sector must provide complementary skills to that held by government; otherwise the partnership is unlikely to improve the situation. It is precisely the ability of the private sector to run a resource or environmental asset as a business, with the efficiencies and marketing that that entails that can actually make an underperforming public asset yield a new level of net benefits – that can then be shared by the parties to the partnership.

Box 7. Outsourcing of Park Management in Tanzania

In Tanzania, a private company was used to manage a coral park in lieu of government administration. Ecotourism fees coupled with low management costs enable the park to operate without government support. Co-management with local communities was used, with local fishermen trained as park rangers. Other local fishermen cooperated with no-take areas based on the spillover benefits of the marine reserve in increasing fish stocks for their harvest. The small scale of the park, secure resource tenure, and strong contracts were seen as critical enablers of program success. At the same time, private park operation increases political risk. Further, competition between private parks could eventually result in ineffective conservation, raising questions about the scalability of this approach. Still, despite these concerns, volatility of international tourism, the primary source of park income, is the main threat to park viability

Source: (Riedmiller no date)

Another form of public-private partnerships are so called 'knowledge partnerships', in which local resource users collaborate with managers or academic experts in efforts to enhance understanding of local natural resources in order to inform management decisions, are an example of the multiple and overlapping benefits of partnerships. Under this approach, "(b)y partnering local knowledge with expert opinion, new knowledge is created that exceeds the limits of either type of knowledge alone. This partnership melds the relevant sociological, cultural, ecological, political, and historical facets about a particular natural resource and community concern into a comprehensive knowledge base for environmental decision making and action" (Zanetell and Knuth 2002). This approach holds particular potential in the area of fisheries management, where highly localized behavior of fish stocks is often familiar to local resource users but inaccessible to academic experts and biologists, who nonetheless may have greater knowledge about other aspects of fishery function. Only through partnership can both local and academic knowledge be used to inform management strategy.

These knowledge partnerships bring benefits that cut across multiple categories discussed in this section. Knowledge sharing brings external resources, in the form of information, to the management process. At the same time, the participatory framework leverages local support and helps to build consensus among resource users. The participation of local resource users and outside experts lends two sources of political legitimacy to the management process. Most importantly, the contributions of these groups are genuine and valuable, and this creates a better-informed decision-making process that should yield a better policy. An interesting application of this concept to coral reefs is presented in Box 8.

Box 8. Leveraging Partnerships to Gather Monitoring Data for Coral Reefs

The Reef Environmental Education Foundation (REEF) has partnered with coral reef managers around the world to provide monitoring data about ecosystem health. REEF has a program to collect data from divers who report what species and conditions they observed at various sites and disseminate it to resource managers at those sites. As a result of this program, reef managers in Jamaica and Mexico have a way to integrate those observations into their management decisions.

The REEF program illustrates the potential for partnerships to facilitate vertical and horizontal integration of stakeholders and resource users. Specifically, the program allows horizontal integration of information from thousands of diving enthusiasts who are interested in making a contribution to monitoring but lack the direct relationships with resource managers to do so effectively. The REEF program achieves economies of scale in assembling and parsing the data, and then can be effective in vertical distribution of the information to on-the-ground resource managers who can use it in their operational decisions. Thus, local managers access additional resource, in the form of actionable information, through a partnership, and international divers can help to protect a resource they value.

Source: (Pattengill-Semmens and Semmens 2003)

Fiscal Instruments – Pollution Taxes

Fiscal instruments involve the use of government powers of taxation and appropriation to shape conservation finance. The goals of a particular fiscal instrument can range from the establishment of a secure stream of tax revenue to the correction of market failure through reform of incentives. The classic case of market-based incentives regulation is that of the polluter-pays-principle. If the tax is formulated to reflect the marginal external costs of the pollution than society will in effect internalize these external costs and supply and demand will adjust from market levels to levels that produce an efficient allocation of societal resources. Taxes not only help shape behavior but also generates funding. Design of tax programs therefore involves selecting which of these benefits is desired.

For example, a heavy tax on industrial aquaculture may be sufficient to induce resource conservation without any accompanying investment in protected areas. Alternatively, the tax might not spur a behavior change, but could be valuable as a source of conservation funding. Careful valuation work and economic modeling is advisable prior to calibrating a pollution tax – taxes that are too low may be inefficient revenue generators while at the same time not curbing harmful behavior. Excessive taxes may encourage non-compliance. As with all regulatory mechanisms, pollution taxes require effective administration and enforcement to succeed, and as such are not appropriate in all circumstances. Box 9 provides an example of the imposition of how a tax can be used to differentiate between local and foreign resource uses.

The advantage of using these fiscal instruments is that they make the opportunity cost of pollution clear to the polluter. In theory then the polluter will work to reduce his or her pollution to the point where the cost of another unit of pollution reduction is equal to the tax on the pollutant. The polluter thus will likely explore all the different means at his or her disposal to limit their effluent or emission. Another advantage of a tax or payment system is that it can be relatively simple to set up as the central authority sets the tax – and therefore there is no uncertainty (at least within the current tax period) as to the price of pollution.

An important difficulty with fiscal instruments is that it is an indirect approach to pollution targets. Considerable technical information would be required to set the amount of the tax or payment so as to achieve an efficient level of pollution. This may also require adaptive management of the tax level over time so as to move towards the

pollution target. This may be difficult to do where central authority sets prices administratively. Further, the availability of tax revenue or the need to find tax financing (for payments) can lead to political incentives to overtax polluters or under-tax the general public. And finally, there remains no incentive for those polluters for whom the cost of pollution control exceeds the tax to invest in pollution control. Instead they simply pay the tax and continue on polluting.

Box 9. Environmental Fiscal Reform for Fisheries

The fisheries sector provides an opportunity to use environmental fiscal reforms to achieve conservation and poverty reduction objectives (OECD 2005). In cases where long-distance foreign fleets contribute to excessive fishing pressure, a levy on fish harvest can be used to internalize the costs of over-fishing. Imposition of a tax on these vessels can bring in foreign income to a government while simultaneously reducing fishing pressure and raising long-term sustainable yields from the fishery. In addition to these positive environmental and fiscal results, poor local fishermen who rely on the fishery for food will benefit from the increased productivity, and can be sheltered from the fees imposed on the foreign fleets. When used in conjunction with other management and effective monitoring and enforcement, environmental fiscal reforms hold particular promise for fishery management.

Source: OECD (2005)

Fiscal Instruments - User Fees and Charges

User fees are another type of fiscal instrument that are structurally similar to taxes in their potential to both shape behavior and generate revenue. User fees can be remarkably sustainable and valuable sources of financing, if applied in the right context and administered in such a way as to match the level of resource use (see Box 10). Specifically, the setting of a user fee must be informed by an assessment of the economic capacity of the user who will pay the fee. For example, the Maldives and Seychelles are quite expensive places to visit, and, consequently, the average tourist there is relatively well off. A user fee is less likely to deter a potential tourist visitor to Maldives or Seychelles than an equivalent fee in Thailand, where perhaps the average visitor has much more choice and is relatively more price conscious. This is an issue that integrates valuation and financing issues. In the extreme, user fees will have limited potential in areas of pervasive poverty – there may simply be no one to pay the fee.

Administration of a user fee as financing mechanism requires careful attention. While user fees have been successful in national parks across many countries, implementers must consider a) how the fee will be collected, b) what government or bureaucratic process will be required for remitting funds, and c) whether the monies make their way back to the protected areas where they were collected. For example, in Thailand, though many of the national parks do charge entrance fees, the percentage of receipts that actually is returned to the park to support operations is estimated to be only 2-10%. In that context, the fees must frankly be acknowledged as an inefficient financing mechanism. If fees can be earmarked for local conservation finance, they will be more efficient, all else equal.

In the Seychelles, a plan to generate large fees through sale of a lifetime parks pass for $100 (which would have been an effective way to favor local visitors, who would diffuse costs through many visits) was abandoned for fear that it would discourage tourists from visiting (Sherman 2003). Estimation of the value tourists place on a given experience is essential in setting appropriate fees, though this valuation work can be difficult. Further experiences with fees and marine protected areas are provided in Box 10.

Box 10. User Fees for Marine Protected Areas

In Indonesia, user fees have been implemented at Bunaken National Marine Park. All visitors to the Bunaken National Park (divers and non-divers) are required to pay an entrance fee, in accordance with North Sulawesi Provincial Government Provincial Law Number 9/2002. The entrance fee for foreign visitors is Rp 50,000 per daily ticket (approximately $6), or Rp 150,000 (approximately $17) for a waterproof plastic entrance tag valid for the full calendar year. The entrance fee system has been adapted from the Bonaire Marine Park system, and the Bunaken National Park Management Advisory Board (BNPMAB), a multi-stakeholder board that NSWA is a member of, manages the proceeds from the sales of the entrance tags. The system has been very successful in raising over $250,000 for conservation programs in the Bunaken Marine Park since its inception in 2001.

Source: www.divenorthsulawesi.com

Fiscal Instruments – Subsidies and Payments

In the case of taxes on pollution the state holds the authority to regulate pollution and assess the tax. An alternative to punishing those who produce public bads, is to provide positive incentives for the provision of public goods. Subsidies are therefore structurally analogous to taxes, and can function in the same two roles: providing financial support and shaping behavior. Subsidies require less enforcement capacity than taxes in general, because those who are affected are not likely to evade the programs. Rather, there is a need to verify that applicants to receive a certain subsidy are actually entitled to its benefit. Just as with taxes, subsidies require monitoring and enforcement. Enforcement tends not to be thought of as such a considerable a task as with taxes and pollution, in part due to the ease of verifying that the recipient has not engaged in productive activity or has adopted new management practices.

Direct subsidies are typically thought of in the context of terrestrial programs and payments for environmental services (or PES). These often consist of the channeling of tax revenue to landowners or land managers to conserve forest or adopt soil and water conservation practices. In the marine environment subsidies have been employed as incentives for fishers not to fish and in the freshwater environment payments have been made to irrigators to reduce the diversion of water from streams and rivers.

It is important to note that these payment (or subsidy programs) are distinct from voluntary contractual arrangements such as those discussed earlier, where a downstream water user directly pays upstream land managers to undertake improved practices (or refrain from practices that will negatively affected downstream services). That the funding for the national program does not really come from the beneficiary means that

these programs inevitably involve legislation and regulation in order to acquire funding and create intermediary institutions (Aylward 2007).

Box 11. Subsidies and Payments for Environmental Services

The Working for Water Program in South Africa is an example of a nationwide program that subsidizes efforts to improve land management with a view towards improving downstream hydrological services. In South Africa, the concern is enhancing water supplies, particularly during dry periods. By comparison, the United States' Conservation Reserve Program (CRP) originated largely as a means of tackling non-point source water pollution in agriculture. The CRP is part of the US Farm Bill and provides a range of subsidies – including cost-share on best management practices, incentive and rental payments – to farmers that idle land and undertake conservation measures. CRP represents one of, if not the, largest global efforts to subsidize watershed services. In 2006, the federal government spent $1.9 billion on the program and from 1986 to 1996 some 14.5 million hectares had been enrolled in the program with total outlays of $32 billion (Farm Service Agency 2007).

Costa Rica and Mexico also have national payment programs that aimed at improving environmental services. In Cost Rica, landowners are paid an annual fee under a multi-year contract for a variety of forest conservation activities that generate carbon sequestration, hydrological services, scenic beauty and biodiversity benefits. In Mexico, the program targets the hydrological benefits of maintaining existing high altitude cloud forest areas. Following protracted negotiations in 2003 the government approved the program at a level of approximately $20 million per year (Muñoz-Piña et al. In Press). The funds come from the fees paid annually to the National Water Commission by large, non-agricultural water users. With payments of around $40/ha/yr, the program protects over 300,000 hectares under five-year contractual arrangements.

Regulated Markets - Property Rights and Privatization

Hardin's tragedy of the commons predicts that absent property rights, resources held in common are bound to be destroyed as self-interested individuals seek to realize the maximum benefit from the resource before it is destroyed (Hardin 1968). Free market economists often suggest that resources and environmental assets will only be effectively managed for the long term when property rights in these are created. The idea is that the long-term ownership interest will inspire sustainable use as a route to profit maximization. A central agreement of these rights will be the ability to exclude others from accessing and using the resource, in a sense privatizing the commons.

This has been a controversial idea but merits consideration in the case of ESAs. Notably, this approach can both influence behavior in itself by providing public goods but also provide the necessary structures to enable other regulatory instruments like cap and trade or various tax schemes. With reference to ESAs property rights have the following potential applications:

- the government may grant rights to a resource (or lands) that was previously held under government ownership

- the government can privatize a previously commonly held resource (or lands) – or a resource used in common under customary practice or law – by granting specific property rights to one or more entities

- the government may seek to establish property rights over ecosystem services

Privatization

Privatizing existing state assets is likely to be the easier task, at least to the extent that such assets were actively managed by the state. In other words if the state regulated access and withdrawal from such lands then the new owner might well continue along similar lines. However, when government ownership has been, in effect, a state of no-management or open access then the task is much greater. Logically, these will be precisely the ESAs that government may want to privatize.

The potential then emerges that absent active management there are in fact a number of customary users of the resource (or lands). Should the government then grant full, alienable property rights this may have an ambiguous effect on resource health and human welfare. On the one hand, alienation allows a resource to be transferred to a more productive, 'highest and best' use, and is therefore requisite for economic efficiency. At the same time, this very transfer to a non-traditional owner or use can disrupt the social institutions that are conducive to long-term sustainability. A corollary is that actions taken by one right holder to maximize the value of his asset may undermine the mechanisms by which others derive benefit streams from their rights. The gain from privatization for one is a loss for others, and thus the change may not actually be an improvement over the prior condition. An example of this would be that privatization has been shown to cause inequality and undermine common property management of mangroves in Vietnam (see Box 12). On the other hand, restricting property rights in resources to traditional subsistence uses is paternalistic and potentially environmentally harmful. In other cases, co-management has presented an opportunity to move away from the resource pressures of traditional regulatory management. (see Box 5). Integrated coastal management can be another community oriented, participatory approach to voluntary sustainable financing and resource management. At the same time, the example below illustrates the peril of ignoring sustainable livelihood needs when working in areas with significant poverty problems (see Box 3). The examples in the boxes below illustrate some of the experience with using, and transitioning away from, common property resource management arrangements in coastal areas.

Box 12. Traditional Management of Mangroves in Vietnam

A case study of 1,200 hectares of mangrove being converted to agriculture and aquaculture in Quang Ninh Province in northern Vietnam illustrates how privatization and the creation of property rights can actually undermine longstanding common property resource management, negatively impacting sustainability. In particular, conversion of mangroves has significant equity implications, as benefits accrue to those with the property rights while the burden of degraded natural systems fall mostly on the poor, who are disproportionately reliant on subsistence fishing and other practices.

There is a long history of collective ownership and management of land and other resources in Vietnam. This tradition of community ownership has been attributed to everything from Confucianism to technological necessity. More recently, state control of resources has deferred to traditional communal management on certain issues. At the same time, some state programs have resulted in *de facto* privatization of previously communal resources.

In the Hoanh Bo District, a scheme to convert mangroves and develop the Bac Cua Luc wetland as part of a broad effort to resettle agricultural households from the Red River Delta to reclaimed lands. The government is subsidizing the land reclamation, and construction companies are allowed to retain one third of the reclaimed area as their private property. This reclamation work and establishment of property rights is eroding the traditional communal management of the mangrove ecosystem.

Though the efficiency case for the reclamation project is weak, negative effects of the privatization on common property management efforts further diminish its appeal. In particular, it appears that privatization of one resource can threaten the institutional capacity of the local community to continue communal management of other resources (Adger et al. 1997). These conditions include growing income inequality, as evidenced by positive correlations between extent of land under private management and diversification of income. This in turn increases the likelihood of disagreement on resource management decisions on remaining common parcels.

In sum, private property can increase narrowly construed benefits from some lands, but resulting income inequality can harm consensus and render common property management of remaining lands dysfunctional.

Source: Adger et al. 1997

Creating new Property Rights

The creation of new property rights and, potentially, markets for new ecosystem goods and services is an entirely more complicated endeavor. First, depending on the context, it may be difficult to create and enforce property rights to ecosystem services that are already in scarce supply – particularly were users are already competing over the resulting goods or resource fetching a premium price in the market. For less tangible items like ecosystem services, creation of new property right can prove so costly as to be impossible (Vira 1999). For example, though ideas of the creation of carbon emission allowances have been discussed for over a decade as a means of addressing global climate change, an internationally operational system of these property rights remains a distant prospect. Second, in some cases financial incentives can encourage unsustainable resource use even in the presence of property rights. That is, property rights do not always result in stewardship, especially if discount rates are high (Schlager and Ostrom 1992). And finally, there is always the likelihood that the supposedly "new" ecosystem good or service is in fact already in customary use or protection by local communities. In

this case the creation of "new" rights simply creates the aforementioned problem of privatizing existing customary uses.

Free market environmentalists (and economists) would presuppose that a critical precondition to efficient allocation and production of natural resources would be the right to dispose of the right to resource use, a concept known as alienation. From this perspective, ownership implies full property rights. From a theoretical perspective, only when the right holder must weigh their use of the resource against that which could be made by others is efficiency likely to occur. In other words if rights are tradable then the owner must constantly contrast the net benefits gained through his own use of the resource with that available from leasing or selling the resource on the open market. The rational owner is presumed to be likely to sell his rights to others if they can earn more from the use of those rights. In this manner property rights – which is to say the authority to use resources – should be allocated to their highest and best use.

However, as with so many regulatory approaches to sustainable financing, the ability to sell or lease a right requires the institutional capacity to enforce this right. In many jurisdictions, including in Mauritius, this capacity will not exist for some or all rights and therefore it may be more appropriate to discuss the establishment of claimants, rather than proprietors per se, i.e. those who use and manage resource but do not own them. For example, in capture fisheries in India right holders typically fall into the claimant category (see Box 13). Creating such property rights will thus be different than the creation of explicit cap and trade systems as discussed next.

Box 13. Resource Claimants in India

Claimants to a resource enjoy the right to access, withdrawal, and management (Schlager and Ostrom 1992). The net fishers of Jambudwip, India, have the fishing rights of claimants. Their access rights allow them to enter the fishery and their withdrawal rights – probably the most familiar (and important) property rights to fishermen – allow them to remove fish from the fishery. Finally, their management rights allow the fishermen to collectively determine the operational rules of fish harvest. In the case of Jambudwip, which is a seasonally occupied island in the Bay of Bengal, fishermen have established withdrawal rules that coordinate use of the fishing grounds. These rules involve laying claim to certain areas by setting up nets. Once the nets are established, other fishermen by convention do not set nets in certain adjacent areas. Also, once claimed, an area is appurtenant to a specific fishing crew for the rest of the season. These claimant rights allow for certain tenure to the fishery resource, but are less complete than proprietorship, because the fishermen cannot exclude others from participating in the fishery or sell their use rights.

Source: Schlager and Ostrom (1992)

Market-Based Approaches - Cap & Trade

Beyond the use of simple market instruments like taxes and subsidies are more sophisticated efforts to harness the power of economic incentives for environmental protection. This can be accomplished through the creation of regulated markets for ecosystem services. Establishing cap and trade systems can be a useful and efficient method for limiting resource extraction or pollution. As opposed to subsidy or payment systems this approach has the added benefit of often placing the burden back on the

polluter or the resource user. Cap and trade systems are developing across the spectrum of environmental management, particularly but not exclusively in developed economies.

A cap and trade system sets an aggregate rather than individual cap on pollution (or resource use), and tradable allowances take the form of individual quota shares of the aggregate pollution cap. For example, a system of marketable pollution permits involves setting the scale, distribution and allocation of permits in three steps:

- Determine an overall maximum level of pollution (the "cap")
- Assign available pollution permits to polluters
- Allow polluters to buy and sell pollution permits such that their pollution is equal to or less than the permits held.

So-called 'mitigation' or 'offset' programs represent a slight expansion of the traditional marketable permit systems in that they provide for third parties to enter the pollution credit market with activities that offset the pollution and generate credits. These credits are then sold to polluters. Credits generated by offsets may represent the same authorized amount of pollution as a permit, but it is useful to consider them as conceptually distinct categories. Regardless, all three steps above apply; it is just that in mitigation programs the emphasis is typically on 'no net loss' – i.e. the overall cap is zero. In other words, no increase in pollution is allowed – in effect all existing polluters are allocated permits to pollute equal to their current pollution and any new pollution needs to find credits to offset this new pollution, to achieve no net loss.

Such cap and trade systems – including offset programs – function in an analogous manner when it is water use that is being capped and water rights that are traded.

While cap and trade systems have as their primary objective holding pollution (or resource use) to a targeted level, once established they also might be used to lower the overall pollutant load. If third parties are allowed to purchase permits (or credits), then the price of permits will rise and the supply will be less plentiful leading to lower pollution levels. By monetizing pollution, these systems allow for a market to emerge in not just pollution control but also ecosystem restoration. This is always possible through direct funding of restoration project, though the existence of a market for permits and offsets provides a higher likelihood that the cost of permits/credits will be minimized as polluters and third party providers all search for low cost solutions.

The principle advantages of cap and trade systems are that they allow explicit setting of pollution targets and they minimize the cost of abatement. The related advantage they have is that they leave price setting to the market—to buyers and sellers—and not to government officials (as with tax and subsidy instruments). The disadvantage of such systems is that they do leave buyers and sellers with price uncertainty, at least at program initiation. This can increase political resistance to such schemes by large institutional players and industry. The programs can also be complex to administer as monitoring, tracking and reporting programs are required to ensure that the program meets its targets

and that the participants are following the rules. Still, these are largely up-front issues and on the current evidence a well-designed cap and trade system appears to offer a cost-effective approaches to pollution management (Freeman and Kolstad 2007).

Though cap and trade approaches have been applied to natural resource management in areas from pollutants to fishery management, the global market for carbon offset credits receives the most attention as a way to provide finance to the global south. That said, despite that fact that mangrove soils are the second largest global carbon sink, carbon finance faces multiple obstacles as a potential source of financing for mangrove conservation. In Thailand, the NGO Mangrove Action Project (MAP) has explored the possibility of leveraging carbon finance, but found that mangroves are typically too small and too dispersed to allow monitoring and verification to be done at a cost-effective level and consequently attract international interest. In addition, biodiversity concerns (i.e. planting various types of mangroves rather than simply the most carbon-sequestering species) and potential restrictions on livelihood activities make it extremely difficult to find viable projects. In Sri Lanka, there are five completed carbon credit projects in Sri Lanka of which three are forestry projects, but none involve mangroves. Commercially viable carbon credit projects tend to require at least 5,000 hectares and it is very difficult to find 5,000 contiguous hectares of mangroves.

This limited physical viability for cap and trade financing may also be complicated by governance limitations. Specifically, use of cap and trade approaches generally requires the ability to promulgate and enforce regulations, and also denote and manage property rights to resources that are difficult to measure due to debatable fungibility. In addition, the political and equity implications of the creation of a new set of property right, often to pollute or engage in some other resource harm, should not be underestimated by the implementer of a cap and trade approach.

Market-Based Approaches – Product Certification

Product certification refers to the certification of a product as a means to capture and internalize the environmental value of responsible production. Green products may command a higher price in the market or add to market share. In this manner certification generates funds to compensate producers for any added cost of environmentally responsible production. Product certifications are essentially a means to differentiate between goods based on information about how they are produced. Absent certification – or an "ecolabel" – a sustainably produced product is often indistinguishable from a conventional one; yet once established such programs provide conservation incentives to producers to invest in sustainable practices.

Product certification schemes are numerous. Perhaps the best known is the Forestry Stewardship Council, which certifies forest stands and the resulting timber as sustainably managed. FSC is a non-governmental initiative and therefore a non-regulatory initiative. However, government can also initiate and operate certification schemes. In the United States the US government operates its own organic label. Similarly, product certifications have been developed by government in Thailand to encourage more responsible shrimp farming techniques (see Box 14)

Box 14. Product Certification of Shrimp Farms in Thailand

In Thailand, a voluntary Code of Conduct (CoC) has been used in efforts to promote environmental responsibility and sustainable development of the Thai shrimp industry (Pongthanapanich and Roth 2006). Against a background of some command and control regulations, including a prohibition against mangrove clearing, the government has promoted the CoC scheme to try to encourage voluntary environmental stewardship. Program participants can market their product with the "Thai Quality Shrimp" seal, which assures a "standard production method, high quality and safe product and environmentally friendly production."

To participate in the program and be awarded the seal, aquaculturists must follow guidelines based on 11 standards:

1) Site selection on legal land outside of mangrove areas

2) General pond management such as farm layout, pond preparation, water and pond soil quality check, water management, and other daily farm operations

3) Stocking procedures such as proper density, qualified seed size, and quality seed

4) Feed management such as reduced feed and proper feeding, feed storage, efficient food conversion ratio

5) Shrimp health management such as daily health check, disease control and prevention

6) Therapeutic agents and chemicals, in which some substances are used only when absolutely necessary

7) Effluent management such as water effluent and sludge treatment including farm sanitation methods

8) Harvesting and distribution such as harvesting plan and methods, quality and antibiotic residue checking

9) Social responsibility concern over labor welfare and participation with local community

10) Farmers association and training

11) Farm record keeping to facilitate evaluation

In terms of actual procedures of CoC farms versus conventional management, participating farms differed primarily in location and management of effluent.

Program participation was moderate, despite the increased profit (derived primarily from harvests of larger shrimp) under the program. Evaluations found that though farmers often perceived program benefits including lower input costs, a higher shrimp survival rate, and larger shrimp, many were unable to participate due to lack of land (the sustainable management of effluent required additional land). Farms participating in the CoC program had higher cost per kg of $0.15 (owing to higher fixed cost of land). However, they were able to earn $0.63 more per kg of harvest because their shrimp were larger. The sale premium was entirely associated with the size of the shrimp as opposed to environmental performance.

While the CoC program had modest participation, a separate product-safety standard (call GAP) was widely followed. This suggests that the benefits of environmental stewardship are externalized, while some of the product safety benefits are reflected in market prices. Ironically, this suggests that while program participation should grow, this growth will be driven by the economic potential of growing larger shrimp as opposed to any successful marketing of environmental benefits. Though it is a happy coincidence that sustainable management creates a more valuable product, this does not bode well for other contexts where this may not be the case.

Other obstacles to program adoption include capital costs associated with acquiring new land and risk-aversion, particularly as pertains to the disease management aspects of the protocol. Financial tools including micro-credit and insurance against diseases are potential solutions to these reservations. In addition, with widespread adoption, peer-enforcement could lower the costs of program management.

Source: Pongthanapanich and Roth (2006)

4.2 Non-Regulatory Approaches

Pure non-regulatory approaches are not policy instruments strictly speaking. These initiatives require no government rulemaking or enforcement. However, government is well advised to be aware of the opportunities for the voluntary or private sector to share in the task of protecting and managing ESAs. In addition, these approaches may be well suited to resources or lands where government faces constraints or has limited ability to effect government regulations. While, theoretically, there are a large number of forms such initiatives may take emphasis is placed here on three categories into which such efforts fall:

1. Self-regulation, i.e. efforts by consumers and firms to self-regulate their environmental behavior

2. Market-based approaches, e.g. voluntary contractual arrangements and product certification (as covered above)

3. Private and voluntary sector investment, i.e. similar to public investment but generated at the will of the investor

Self Regulation – Recycling, Reduced Consumption and Environmental Stewardship

Under self-regulation, private actors take actions to reform their environmental behavior without being forced by regulators. Such actions can include recycling of wastes, reduction in resources consumed (including greater energy and water conservation), and general environmental stewardship in the community. The advantage of self-regulation is that government regulation is not required, which is an advantage in the case of limited capacity or enforcement. At the same time, behavior changes or voluntary contributions to project funding (whether in-kind or financial) do have costs, and it may be difficult to get private actors to change their behavior unless they perceive a benefit in some way. For business, benefits that can prompt self-regulation can include marketing or public relations advantages that come from environmental responsible behavior. Similarly, concern with avoiding the creation of new regulations can prompt self-regulation, though this outcome requires careful coordination between competing firms, local environmental interests, and in some cases regulators. For individuals, ethical and religious considerations and reputational incentives can spur such behavior. Box 15 below further illustrates some of the actual mechanics of self-regulation in the case of business.

It is important to note that there is a continuum between self-regulation on ethical or moral grounds through to product certification. At the far end, business or landowners adopt the requirements called for by a certification approach, purely on the promise of financial benefit. This can be said to be different, than a business that already meets or exceeds such environmental standards and, then, decides to join the appropriate certification program. It is worth noting that corporate social responsibility programs tend to be based on the concept that green production is a good thing in and of itself. In practice of course it can be difficult to assess the motivations. Thus self-regulation schemes may appeal to some businesses, while product certification programs appeal to others. To some extent CSR programs have the effect of branding the company and all its products as meeting a certain level of standard, potentially conferring the benefits of product certification through the value of the companies brand.

In many countries, including the Maldives, Sri Lanka and Mauritius, leading hoteliers are already pursuing corporate social responsibility (CSR) standards and have implemented projects to support marine and coastal protection on their own, or through their trade associations. It is worth emphasizing the self-regulation may extend beyond purchasing decisions and also include the decision to reinvest in the environment (as covered further below).

Box 15. Cooperation as the Prisoner's Dilemma

In the context of environmental management, voluntary approaches in which firms cooperate because of their own volition are desirable for reasons beyond avoidance of conflict – they are less expensive. If regulators can be confident that firms will adhere to certain technology, processing, or performance standards, then costly monitoring can be avoided or eliminated. Similarly, for firms, the ability to negotiate cost-effective means of meeting environmental goals and forgiveness for minor transgressions has financial appeal. Some researchers have highlighted that despite this potential for a win-win outcome in environmental governance, powerful incentives for both parties to cheat turn the policy process into a prisoner's dilemma (Potoski and Prakash 2004). Firms are tempted to flaunt environmental controls under lax 'voluntary' monitoring, while governments may prosecute minor transgressions that firms disclose under a voluntary scheme. This understanding of the political economy of cooperative regulation further highlights the importance of trust and adaptive management. Notably, repeated interactions and voluntary compliance with third-party certified codes of conduct can help establish credibility and trust that is necessary to reach the pareto optimal cooperative agreement, avoiding the inefficient equilibrium that results from a lack of cooperation. In some cases, dynamics of the interaction are such that a voluntary agreement will actually be the equilibrium outcome (Segerson and Miceli 1998).

Source: Potoski and Prakash (2004); Segerson and Miceli (1998)

For the voluntary sector and civil society, self-regulation can also be a powerful force for change. Indeed, sensitization to the impacts of consumption on the environment can have an important impact if they take hold at the household level and lead to recycling, reduces resource consumption and efforts to steward the broader environment. The example Box 16 is an illustration of how community pressure can provide the motivation that so frequently underlies a voluntary behavior change in self-regulation. In particular, is illustrates how some government action, though not regulatory per se, can achieve regulatory goals.

Box 16. Community Pressure as a Voluntary Mechanism in Indonesia

Voluntary approaches to achieving conservation goals have been used to some extent in India and Indonesia in regulating pollution. In particular, disclosure rules are used to bring social pressure on companies to reduce pollution levels where there is a weak regulatory infrastructure (Khanna 2001). In Indonesia, the Program for Pollution Control, Evaluation and Rating (PROPER) rates and publicly discloses the environmental performance of water polluters. This program uses information to create a cost, in terms of reputation, for firms that pollute more. Notably, this effort increases the costs of pollution for firms in a way that imposes relatively few costs on enforcement agencies (relative to traditional monitoring). In the program, the Indonesian environmental agency created a series of color-based ratings of firm compliance on water pollution. Firms were rated black, red, blue, green, or gold, with black indicating non-compliance and gold signifying over-compliance. Subsequent analysis found that this simple scheme was effective in motivating firms to reduce pollution. Under the program, the number of plants rated black fell by 50% in six months and 83% in one year. There was also a 54% increase in plants with a blue designation, suggesting that the worst polluters moved towards compliance. The lesson is that when regulators lack the capacity for formal enforcement, voluntary mechanisms leveraging community pressure can be an effective complementary measure in promoting behavior change.

Source: Khanna (2001)

Market-Based Approaches - Voluntary Contractual Arrangements (Private Payments for Environmental Services)

The classification of PES above as a subsidy or payment system may seem unfair to those that understand PES and the term 'payments' in PES to be distinct from a subsidy because the funds are going to purchase something specific – typically an environmental service of some kind. However, this ignores the point that a subsidy is also offered in the hopes of acquiring some benefit. The benefit may be somewhat diffuse, as in energy or food security, but can also be very specific, such as health care subsidies. Political economy dictates that subsidies are not provided by the public purse for no gain whatsoever. While it is true that some subsidies do not produce positive benefits for society, but simply are a means for acquiring votes (as in the concept of 'pork-barrel spending') the general concept of a subsidy as a market-based instrument is to provide a positive externality. So it would seem that a more useful definition of a payment system is one where a buyer provides the funding to a seller in exchange for the rendering of a service. In other words the key distinction between a payment and a subsidy is not the existence of the benefit but the degree to which the entity providing the funding is the entity receiving the benefit. For this reason there is a distinction between the regulatory payments discussed above and the concept of voluntary contractual arrangements for the exchange of ecosystem services – or as labelled above "private" payments for environmental services (PPES).

The idea of the buyer as beneficiary of the rendered service is not a new concept or a new tool in economics; however, it does fly in the face of the standard assumption that public goods are not amenable to provision by the market, instead requiring collective action, in other words government regulation of some kind. However, economists have long acknowledged that in certain situations the recipient of pollution and the polluter will be able to negotiate an arrangement that leads to a reduction in the level of pollution (Coase

1960). Coase's Theorem suggests that regardless of the original allocation of property rights between the two parties such an arrangement will emerge, subject only to transaction costs. In other words, if the costs of arriving at a transaction exceed the net benefits of such an arrangement then the parties will be better of living with existing levels of pollution and doing nothing. If the transaction costs are low, the parties can negotiate and enter into an agreement and still generate net benefits. Such a voluntary arrangement is called a "Coasian Bargain" although it is referred to here as a PPES.

Some economists have taken Coase's Theorem as suggesting that pollution (and other natural resource and environmental problems) can be solved by simply assigning and enforcing property rights (Anderson and Leal 2001). Externalities therefore are eliminated as agreements are reached for 'efficient' levels of pollution. However, the problem of exclusion and rivalry remain, as fundamental defining features of public goods and, thus, market failure and collective action remain a necessity (Randall 1983). Further, whereas such negotiations may not succeed due to transaction costs in the marketplace, collective action may cut right through to resolve the situation. Thus, the existence of Coasian bargains does not mean that the creation of property rights (as discussed above) will resolve all market failures. Government regulation will still be required.

It is also worth noting that these voluntary arrangements do not exclude public entities. For example, a public drinking water agency may in fact enter into private arrangement with upstream landowners. It is therefore not a matter of whether the entity is private or public but rather that the private PES is entered into on a voluntary basis, without requiring collective action or government regulation. In other words PPES are examples of unregulated markets and a result of the unique circumstances where markets can resolve environmental problems without regulation.

It is also worth recognizing that in the case of upstream/downstream hydrological services there are at least two forms that a PPES may take. The downstream buyer has a choice between paying an upstream land manager to provide the services or acquiring the upstream property so as to undertake provision directly. By in essence undertaking vertical integration of the upstream and downstream portions of the provision of hydrological services the downstream buyer may also solve the externality problem. From an efficiency point of view this may not be the best alternative and in some cases may not be feasible for a variety of reasons. The difficulty is that the buyer really desires to acquire only the hydrological services associated with the land and not the full suite of goods and services the land provides. Therefore, it may be more efficient to 'rent' just these services through a payment system.

Where the potential for this tool is great, its application has been limited. Many of the PES initiatives reported in the literature are tax and pay schemes rather than programs where direct beneficiaries compensate providers. A fair number of the well-documented examples come from Latin America, where the approach is prevalent due to the importance of forest in securing downstream hydrological services of direct benefits to water supply and hydropower (see Box 17)

Box 17. Private Payments for Environmental Services in Quito, Ecuador

In Quito, the capital of Ecuador, a non-profit initiative convinced the city to enter into a scheme where a surcharge on monthly municipality water bills is funneled into a conservation trust fund (FONAG) (Echavarria 2002). The intent was to create a non-declining endowment fund that can receive funds from different sources and use the investment returns to fund watershed protection activities. However, a recent decision by the Quito municipality to guarantee the payments by water users into the future are leading FONAG - the non-profit in charge of the program – to change its strategy and to begin funding projects right away (Arcila 2007). The program has only recently begun funding projects so to date it has very little experience with contracts and payments for watershed services. The program shows the time lag between the institution of an endowment payment scheme and the onset of implementation, in this case five years passed between the first payments in 2000 and the first set of projects around five years later.

Source: Echavarria (2002); Arcila (2007)

Private and Voluntary Sector Investment

Just as government can contribute funds to invest in ESA protection, so may the private and voluntary sectors. NGO funding is probably the more visible of the two sources, with funds collected by local, regional or international NGOs finding their way back to grassroots initiatives. In Mauritius, there appears to be little connection to international NGOs and thus these voluntary funds are likely to be of the home grown variety. But private investment can also be sought and leveraged with other monies to reach conservation goals. Generally, the prospects for this outcome will depend on the underlying economics of various investment opportunities – generally, the richer the opportunities to earn a return, the larger the attraction to private investors, and the more money will be available for conservation finance. Private investment is perhaps most applicable through the tourism industry, in particular because tourism in depends on the attractions of the natural environment for a significant part of their tourist revenues. Enabling conditions for private investment include a decentralized system of government, clear property rights and, of course, a business proposition. As discussed in Box 18 below, perhaps one of the most successful private investment cases has been the Banyan Tree resort in the Maldives, which has made substantial investments in research and conservation of its local marine environment.

Box 18. Private Investment in the Maldives

In the Maldives, the Banyan Tree Resort has developed its own, very successful model for coastal protection. With so much revenue coming from premium tourism, it is not difficult to understand why resorts like the Banyan Tree undertake major conservation projects. In developing its four resorts, the Banyan tree worked with UNDP to ensure sustainable development. Since 2001, the Banyan Tree Vabbinfaru has had a marine laboratory with 5 staff that does research on coral reefs, inhabitants, beach erosions, etc. and brings in outside researchers for education events. The resort also hosts reef cleanings, adopt-a-turtle events, and poster sessions where Maldivian school children come to present their research. The resort also hosts internship programs for Maldivians and foreigners. The Banyan Tree has done their own research into asking why people choose their resort, and note that 5-10% of visitors say it is due to the resort's environmental efforts. Interestingly, no other resort has come to the Banyan Tree requesting to learn from their environmental efforts and there is no coordinated resort organization in the Maldives. The Banyan Tree prefers its self-directed approach and has no

interest in funding MPAs. Visitors can donate USD2/day for their stay for these programs. Each year USD100, 000 is raised and the resort provides a 1:1 match for a total budget of USD200, 000 per year.

Source: Abdul Azeez Abdul Hakeem, Banyan Tree

5. POLICIES FOR ESA PROTECTION

Below a series of proposals for a policy on ESAs in Mauritius and Rodrigues is provided. It begins with a generic set of policy principles, objectives and instruments that can be applied to all ESAs. A generic logic model is provided as well. Then, each ESA type is parsed one-by-one to identify specific outcomes and policy instruments and objectives. The conditions that must be met in order for any development or sustainable use of each one of these categories is therefore also specified.

5.1 Policy Principles

Based on the review of previous policy principles applied it is clear that there are many policy principles to choose from with respect to ESAs. Sustainable development – meeting the needs of the current generation without sacrificing the needs of future generations – is a powerful concept that reflects the principle of intergenerational equity. However, it leaves unanswered the question of what exactly is to be the role of the environment in sustainability.

Sustainability can be defined in two different ways (Pearce et al. 1990). Strong sustainability is taken to mean that the stock of environmental capital must meet the intergenerational criteria. In other words in this context, the income (monetary and non-monetary benefits) – in this case derived from ESAs – cannot be decreasing over time, and preferably will be increasing. Typically, this will mean that the physical stock of ESAs is also increasing over time – though this is not necessarily the case as the same physical stock of ESAs may generate increasing benefits if the number of people enjoying ESAs can rise without an accompanying decrease in the enjoyment value, for example. Weak sustainability, on the other hand, refers to the idea that what is important to grow (or at least not have decrease) over time is income in all its forms. In the case of weak sustainability then the only constraint is that the overall stock of capital stay the same or increase – not that any one type of capital, such as ESAs, be maintained. As development proceeds on the basis of environmental, physical, financial, human and technological capital achieving weak sustainability may mean that ESAs are exchanged for other forms of capital in order to spur overall development. Under this vision of sustainability one form of capital is assumed to be substitutable for another.

These ideas of strong and weak sustainability are quite powerful and could be applied in various ways. In simple terms, strong sustainability could be equated with environmental sustainability and weak sustainability with sustainable development. Arguably, Mauritius has been practicing weak sustainability at best. Under this approach ESAs are sacrificed in effect to development in the expectation that the sacrifice is "worth it." Whether this implicit valuation has adequately taken into account future generation can certainly be questioned. It is no secret that as societies develop their level of appreciation for the environment and, indeed, their use of it for recreation, tourism and simply for

satisfaction is well established. So, by degrading and developing its ESAs it would appear that Mauritius has closed off future options (or made these options much more costly) for generations to come in terms of their potential to interact with and derive satisfaction from these ESAs. In other words Mauritius has likely well overshot not only the optimal point for environmental sustainability but also sustainable development.

Under such an interpretation of the situation the primary policy principle needed to underpin an ESA policy is that of strong or environmental sustainability. This means that ESAs are generally regarded as not substitutable with other forms of capital. In practical terms this means that the any development, use or alteration of an ESA must be considered as an exception from the rule. The starting point for policy is no loss or adverse impacts on ESAs not whether the action is merely consistent with sustainable development, in the weak sense. Again, as we shall see this is not a hard and fast rule, regardless of the case at hand. Unfortunately, there are areas designated as ESAs, whose environmental value must be regarded as limited due to past degradation and use. So the policy criteria of *no loss* or *no adverse impacts* is not independent of the quality of the ESA. However, the burden of proof for actions with regard to ESAs will rest with the proponent– to substantiate that no adverse impacts are occurring or that limited impacts are warranted. However, even in the case of lesser quality ESAs the strong sustainability argument carries weight in that any adverse impact to one ESA must be compensated with a corresponding investment in another ESA or an ESA elsewhere in the country.

Aside from the issue of intergenerational issue is that of intragenerational equity. If an ESA policy is based on concerns about future populations it should also be based on a principal of equity amongst the current generation. It may be argued that this comes secondarily to intergenerational equity. ESAs are distributed between private and state lands. It is not clear that there is a need or an interest in redistributing ESAs so that lower income groups can have a greater share in the benefits of these ESAs. However, there are at least two ways in which this concept of equity and distribution of ESAs and or their benefits arises in the Mauritian context.

First, is the case of the coastal ESA assets, particularly the beaches. As an artifact of history, the Pas Geometrique was leased out largely to wealthy patrons able to afford to construct campements. Over time this led to efforts by these patrons to “privatize” the beach resource by building cement or rock outcroppings into the sea on their boundary line. This, of course, limited access to the beach for the bulk of the Mauritian population. This is an example of how a policy of the privatizations of a common resource can create regressive impacts. Under a policy of no adverse impacts and an equitable distribution of resources this construction would not have been allowed. Ultimately, the government has stepped in and forced the removal of these breakwaters. As can be seen in this case a clear policy of equitable distribution and access to ESAs is warranted, even if only to preserve based access to common resources.

Viewed in this light a policy of equitable distribution remains a significant issue with regard to ESAs in Mauritius. IRS and other schemes were developers are currently being granted leaseholds over state lands for their developments. Similarly, law now sanctions the use of lagoon areas for aquaculture. Both of these policies of in effect privatizing the

commons have generated controversy in Mauritian society, as they probably well should have given the potential for inequities arising from these actions. Still, adherence to equity as a policy principle does not necessarily lead to prohibitions on this leasing of state lands and environmental assets. Rather it leads to the imposition of an additional criterion. In addition to developers demonstrating that their actions in ESAs are environmentally sustainable, the government must demonstrate to Mauritians that these developments will not be given away and that Mauritian rights of access to ESAs will not be abridged.

The first criterion simply reflects the need to ensure that the state is collecting appropriate revenue from the leases and concessions. It is inequitable that a few Mauritians should profit unduly from the use of common resources. While it is hard to define what are fair lease rates in the abstract civil society needs to at least be convinced that government is doing its due diligence and not just "giving" the resource away.

The second criterion has both inter- and intragenerational content. As hotels have sprouted along the coast, the government has developed a system of public beaches. In theory, all Mauritians have access to walk the beach but with leases extending to the high water mark it is not clear that as the coast is developed more and more that there will not be a corresponding loss of beach that is "public." It would seem advisable to plan not just for tourism development, but also a strong, plentiful and resilient supply of public beaches to meet future needs of Mauritians. At present, it appears that these public beaches are quite limited in areas of tourism development, such as Grand Baie. While state land along the coast is unallocated there may be plenty of public beach (without services), but as these lands are allocated this resource will be limited.

Environmental sustainability – for future and current generations – as a condition of sustainable development is thus the only policy principle necessary to underpin the substance of an ESA Policy. Other principles that have to do with how environmental sustainability is achieved may also be proposed. Typically such principles would acknowledge the importance of participation, empowerment, transparency and accountability in implementing an ESA policy. Participation comes in many forms and here it is used in the sense of purposeful participation not merely participation in the sense of consultation for consultation's sake. Participation then goes hand in hand with empowerment – as outlined in the NEP (2007) – in that community-based or co-management of ESAs is acknowledged as an important policy instrument. With respect to government actions transparency and accountability are equally important in building trust between the public sector and communities and the private sector. Such trust is essential to form working partnerships needed to effect community based management and public-private partnerships.

5.2 Policy Components

As noted above a number of the policies and strategies reviewed here have difficulty distinguishing between mission statements, objectives, strategies, and activities. Noting the use of a logframe approach in a number of the plans and strategies the policy

proposed here suggests a similar path in constructing an overarching logic model for ESAs. The components of such a logic model would include:

- the overarching target for ESAs, equivalent to a mission or vision statement
- the long-term outcomes desired for ESAs
- the short- and medium-term outcomes desired, representing the desired behavioral changes
- the target audience – that is the groups that will need to change their behavior with respect to ESAs
- the activities – that is the sets of tasks that the partners in this effort must undertake
- the resources and partners necessary to engage in these activities.

Below the vision and outcome portions of such a logic model are presented. Subsequent operational planning exercises may be used to flesh out the remainder of the model.

5.3 Vision and Outcomes

A simple vision statement for ESAs is as follows:

> Intact, healthy and functioning ESAs producing economic, social and cultural benefits for current and future generations of Mauritian society, as well as foreign visitors

In developing the desired long-term outcomes for ESAs it is useful to consider that the research undertaken for the ESA project has identified three categories of ESAs:

- Category 1 ESAs possess the highest ecological or economic values
- Category 2 ESAs possess important ecological or economic value, but which may, due to a variety of factors, permit some degradation
- Category 3 ESAs possess ecological or economic value, but which may, due to a variety of factors, permit degradation beyond that which is permissible for Category 2 ESAs

The long-term outcomes desired for ESAs are therefore as follows:

- Category 1 ESAs are protected intact and, where needed, restored to health and resiliency

- Category 2 ESAs are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on ESAs provided on-site

- Category 3 ESAs are protected, with an emphasis on conserving a viable number of features (instances of an ESA type) within an individual ESA type, and any loss is compensated.

In general terms these outcomes imply that if there are 60 wetland sites of ESA Category 1 and 2, and 10 wetlands sites of Category 3 then the desired outcome is to protect all 60 wetland sites in Category 1 and 2. Category 1 sites are not to be degraded in any way, and in fact in cases of some ESAs will need an investment in restoration, as well as protecting from on- and off-site threats. Category 2 sites may see some alteration of the original sites but must all be maintained in a healthy state. A few of the Category 3 sites may be lost to on-site development or off-site threats. However, this loss must be compensated be reinvesting in wetlands generally. If on the other hand there were 5 wetland sites of ESA Category 1 and 2, and 60 sites of Category 3 then further consideration of the extent to which Category 3 sites might be developed or adversely impacted. There would be a tradeoff then in terms of developing Category 3 sites and, perhaps, the viability of creating additional Category 1 and 2 sites. These decisions of course will depend on the nature of the ESA types and its types of values: i.e. biological, ecological, social, economic or cultural.

Short- and medium-term outcomes are the behavioral changes required. These emerge from the threats and drivers in Section 2:

- access, development and use of ESAs is controlled in the commons (uncommitted state lands-forests, caves, etc, streams and rivers, public waters)
- protection and creation of protected areas (national parks, reserves and boreholes)
- restoration of existing protected areas (national parks, reserves and boreholes)
- protection and management of ESAs on private and leased state land (forests, wetlands and other ESA types)
- subsidies for productive agricultural activities eliminated (rivers and streams; marine areas)
- marginal cost pricing of public services and resources (water, wastewater, etc)

5.4 Policy Instruments

For each of the outcomes above there may be one or more policy instruments that applies. Table 5 makes a first effort to map out how the potential policy instruments described in Section 4 on to the six short- and medium-term outcomes. The cells highlighted in grey indicate those instruments that apply – at least in theory – to the achievement of the outcomes. The application of these instruments to specific ESAs is then explored ESA-by-ESA in the subsequent sections, marking those instruments that apply with "xxx" on top of the grey shading.

Table 5. Policy Instruments for Achieving Short- and Medium-Term Outcomes

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private and leased lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*						
Micro-credit*						
Command and Control						
Decentralized and Polycentric Partnerships						
Co-Management						
Common Property Management *						
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						
Subsidies and Payments						
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation						
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

5.5 Policy on Generic Regulation of Development

It is also worth stating generally, the policy that is proposed (in conjunction with the companion legal paper) with respect to land use development and ESAs. The proposed policy is to restrict development in the following manner so as to meet the outcomes specified above:

- For Category 1 ESAs:
    - All development *in or on* an ESA is prohibited.
    - Development *outside* an ESA that will adversely affect the ESA is prohibited; development outside the ESA may proceed provided that mitigation measures will prevent adverse affects on the ESA.
- For Category 2 ESAs—Any development that may adversely affect an ESA must be offset by projects on *the same property* that provides environmental benefits.
- For Category 3 ESAs—Any development that causes *significant* adverse impacts is prohibited. Development is permitted and may degrade the ESA provided that mitigation measures prevent significant impacts and any net impacts are compensated.

These restrictions on development require application in the case of each ESA Type. This raises the following practical questions:

1. How is the determination made and who determines which ESAs are allocated to which Category?

2. What are the allowable developments under Category 2 and what types of buffer zones might be required with respect to each ESA Type

3. What activities are eligible to serve as offsets on the same property under Category 2?

4. How are significant adverse impacts determined and who makes those determinations?

5. What mitigation measures qualify to prevent significant impacts?

6. How is compensation determined for any impacts net of mitigation?

The answer to these questions requires access to the relevant technical and legal expertise. The questions will in practice be answered at the appropriate level, being in legislation, by regulation or by administrative interpretation. It is ideal, therefore, that the ability of these offsets and mitigation activities to protect or enhance ESAs be well understood and predictable in terms of outputs. Where this is not the case a "trading ratio" needs to be applied so that the offset or mitigation provided is scaled up in direct relationship to the uncertainty over the probability of success in replicating or reproducing natural functions. From a policy perspective and employing the principles developed above it is important that the objective of offset and mitigation measures be the adequate protection of the functioning stock of ESAs – so that they may generate the same or increasing levels of ecosystem goods and services into the future.

It is important to emphasize that it is not required that all the instances of a given ESA Type be apportioned across these three categories. If all the instances provide important services and it is not possible to define, at present, effective offset or mitigation measures, then all instances of this ESA Type may be placed in Category 1 and made off-limits for development. Similarly, if off-site mitigation is not effective and compensation for net impacts would not be meaningful then it may be that no instances of the ESA Type should be allocated to Category 3.

In terms of the determination of compensation for impacts that cannot be mitigated it is recommended that economic valuation of these residual impacts be undertaken according to the methods prescribed above in Table 4. The key question is whether certain levels of compensation can be prescribed before the fact. This would be desirable to avoid case-by-case negotiation on these matters. On the other hand the range of different impacts that would need to be foreseen and valued is rather larger, making such an exercise unwieldy. It might be best to instead to develop a committee to oversee individual cases and ensure that the appropriate methods are employed. Perhaps then after some time the more frequent types of impacts could yield themselves to a standardized compensation schedule.

The intent is that compensation be paid only when it is not possible to fully offset impacts on ESAs or when the ESA in question is not of critical importance. Monetizing the loss of ESA services in this fashion is effective only if these funds are then held in an ESA fund for reinvestment in ESAs that are close substitutes (i.e. ESAs of the same type but in another location) or if not possible in other ESAs. It is imperative that the compensation developed be reinvested in ESAs and not spent on other budgetary items in order to follow the policy principles arrived at early in this paper.

5.6 ESA-by-ESA Policy Proposals

In attempting to examine potential policy proposals and instruments for each ESA a number of caveats are in order. First, is that the extent to which these ESAs lie in existing protected areas, are in uncommitted state land or waters, or are on private land is not yet known. As more information on ESAs is collected it will become possible to produce map overlays and statistics for these lands and waters, which in turn will greatly clarify the major types of problems faced for each ESA type. Similarly, as ESAs are allocated to the different Categories, the actions for specific ESAs will become clear. In other words, a matrix distributing the number and area of each ESA type by type of ownership status and Category once overlaid with the policy proposals below will greatly focus the effort to understand which outcomes and which policy instruments are relevant to each ESA type. Another caveat is that further consultation with the ESA project and government is needed to identify relevant conditions that may be put into these policies with respect to any use, pollution or development of an ESA.

The intent of this draft of the policy proposal is therefore to provide the relevant format so as to focus contributions on the precise information needed for the policy. Due to time limitations just a few worked draft proposals are provided below so as to at least illustrate how such policies might look when fully fleshed out. In each matrix (table) the policy instruments that may apply are marked with "xxx".

Seagrass beds

Seagrass beds are located in lagoonal areas and therefore the majority are expected to be in what is called here uncommitted public waters, although some may be in marine reserves. As such the protection of seagrass beds in protected areas is likely to be only a minor concern. More important will be controlling access and use of seagrass beds that are in public waters. Principal threats include:

- tourism operators cutting and removing seagrass beds as being unsightly,
- the lease of waters for use in aquaculture would be the principal threats here.
- over harvesting of seagrass, fish or other species inhabiting the beds
- upstream management of rivers and streams that lead to higher pollutant concentrations

- discharge of untreated wastewater into the lagoons

For seagrass beds that are degraded it is not clear what active restoration would consist of and it is assumed here that restoration would proceed from reversing the direct drivers of degradation, which would be cutting, removal and water pollution. Seagrass beds do not require active management either (as long as threats are abated). Therefore the primary long-term outcome needed is protection as follows:

- Category 1 and 2 Seagrass Beds are protected intact and, where needed, are left to return to health and resiliency

- Category 3 Seagrass Beds are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated.

Note that Category 1 and 2 are merged, as the concept of providing on-site mitigation is not relevant in the case of seagrass beds.

Quite a number of policy instruments may be applied in achieving these outcomes as shown in Table 6. Given the prevalence of seagrass beds in public waters, probably the most significant short- and medium-term outcome will be the ability to control access, development and use of seagrass beds. This could be achieved purely through command and control regulations. However, given the lack of monitoring and enforcement capability on the part of government co-management with local communities, tour operators or fishermen groups spurred by a subsidy or direct payment program might be the more effective approach.

Table 6. Seagrass Beds: Short-term Outcomes and Policy Instruments

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership		xxx				
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx				
Micro-credit*						
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx				
Common Property Management *	xxx					
Public-Private Partnerships		xxx				
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						xxx
Subsidies and Payments	xxx				xxx	
Regulated Markets						
Privatization		xxx				
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation	xxx					
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- a buffer zone between any aquaculture use and the nearest seagrass bed
- full monetary compensation for any adverse impacts to Category 3 seagrass beds

Coral Reefs

Coral reefs are located in lagoonal areas and therefore the majority are expected to be in what is called here uncommitted public waters, although some of the best quality Category 1 reefs might be expected to be located in the two marine reserves. As such the protection of coral reefs in protected areas may be a major concern. Still, controlling access and use of coral reefs that are in public waters will be important. Principal threats include:

- snorkelers and divers trampling coral reefs
- tour operators damaging corals with their anchors
- the lease of waters for use in aquaculture could be a threat if improperly designed
- over harvesting of coral, fish or other species inhabiting the reefs

- upstream management of rivers and streams that lead to higher pollutant concentrations and sediment delivery to lagoons

- changing water levels and temperature due to climate change

As with seagrass beds, for coral reefs that are degraded it is not clear what active restoration would consist of and it is assumed here that restoration would proceed from reversing the direct drivers of degradation, which would be trampling, anchor damage, removal and water pollution/levels. Coral reefs do not require active management either (as long as threats are abated). Therefore the primary long-term outcome needed is protection as follows:

- Category 1 and 2 Coral reefs are protected intact and, where needed, are left to return to health and resiliency

- Category 3 Coral reefs are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated.

Note that Category 1 and 2 are merged, as the concept of providing on-site mitigation is not relevant in the case of coral reefs.

Given the similarity in threats, outcomes and physical context, the same policy instruments applied in the case of seagrass beds may be applied in the case of coral as shown in Table 7. To the extent that any harvesting of corals is allowed from Category 3 reefs these would need to be paid for and, therefore, user fees could be an additional instrument. Also, given the value of corals as a tourism attraction co-management with tour operators or the community is much more likely to be the best option. In this case the arrangement would effectively be a case of common property management on the part of the operators or community. Given that operators (and local communities) derive their livelihood from the corals they may not require a direct payment to participate in such an arrangement. This would not be the case if new marine reserves were created. In such a case efforts to retrain fishermen as tour operators and some form of direct compensation for the loss of fishing may be necessary.

Table 7. Coral Reefs: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Command and Control	xxx	xxx				
Sensitization	xxx	xxx				
Public Investment						
Government Taxation						
International Aid						
Debt for Nature Swaps						
ICDPs						
Fiscal Instruments						
Pollution Taxes						
User Fees/Charges	xxx					xxx
Subsidies (PES Type 2)	xxx				xxx	
Microcredit*						
Market Mechanisms						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self Regulation	xxx					
Coasian Bargain (PES Type I)						
Common Property Management	xxx					
Partnerships						
Co-management	xxx	xxx				
Public/Private Partnerships		xxx				
Privatization		xxx				
Private Investment						
NGO Grant Funding						
Biodiversity Enterprise Funds						

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- a buffer zone between any aquaculture use and the nearest coral reef
- full monetary compensation for any adverse impacts to Category 3 coral reefs, including user fees for any removal of coral

Mangroves

Mangroves are located in lagoons but on the terrestrial edge and therefore the majority are expected to be in what is called here uncommitted public waters. Mangroves may be in marine reserves but most will be outside of these areas. Principal threats include:

- cutting and removal of mangroves due to tourism development or demand for wood

Unlike the other lagoonal resources, degraded mangroves can be actively restored through replanting. Therefore the primary long-term outcomes needed are protection and restoration as follows:

- Category 1 Mangroves are protected intact and, where needed, restored to health and resiliency

- Category 2 Mangroves are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on mangroves provided on-site

- Category 3 Mangroves are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

The outcomes and policy instruments for mangroves are shown in Table 8. They are similar to those of coral reefs except that active restoration using government or donated funds becomes an additional outcome. To the extent that any harvesting of mangroves is allowed from Category 3 mangroves these would need to be paid for and, therefore, user fees could be an additional instrument. On the other hand, if wood extraction is considered a sustainable use than options for co-management and common property management with local communities arise (as in the case of coral reefs).

Table 8. Mangroves: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment			xxx			
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx				
Micro-credit*						
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx	xxx			
Common Property Management *	xxx					
Public-Private Partnerships		xxx	xxx			
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges	xxx					
Subsidies and Payments	xxx					
Regulated Markets						
Privatization		xxx				
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation						
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment			xxxx			

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- a buffer zone between any aquaculture use and the nearest mangrove

- full monetary compensation for any adverse impacts to Category 3 mangroves, including user fees for any removal of mangroves for poles, wood or firewood

Mudflats

Mudflats are located in lagoons where rivers and streams discharge into the lagoon. The vast majority are expected to be in what is called here uncommitted public waters. A small number of mudflats may be in marine reserves (such as Blue Bay) but most will be outside of these areas. Principal threats include:

- water pollution from upstream discharge of pollutants in rivers and streams
- water pollution due to wastewater discharged by coastal developments
- change in water levels due to stream and river inflows and/or climate change

Unlike mangroves, it is not clear how degraded mudflats can be actively restored. Therefore the primary long-term outcome needed is protection:

- Category 1 and 2 Mudflats are protected intact and, where needed, are left to return to health and resiliency

- Category 3 Mudflats are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated.

Note that Category 1 and 2 are merged, as the concept of providing on-site mitigation is not relevant in the case of mudflats.

As compared with prior ESAs covered, only a few policy instruments apply, as shown in Table 9. This is in part because mudflats are largely expected to be uncommitted public waters and due to the expectation that mudflats have limited if any direct uses. There are therefore few beneficiaries and local communities and government are the best suited to manage these areas. In the case of communities some positive incentive may be necessary to ensure participation and compliance with management responsibilities.

Table 9. Mudflats: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx				
Micro-credit*						
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx				
Common Property Management *						
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						xxx
Subsidies and Payments	xxx				xxx	
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation						
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- a buffer zone between any development and the nearest mudflat
- full monetary compensation for any adverse impacts to Category 3 mudflats

Offshore Islets

Offshore islets are located in lagoons or outside the reefs. As terrestrial territory these islets are expected to be state lands, although in some cases they may be leased out for agricultural or tourism uses. In a few cases the islets have been gazetted as national parks. Principal threats include:

- invasion by squatters due to government failure to enforce protected area or state land status
- development leading to habitat and biodiversity loss due to tourism development on state lands
- rubbish dumping due to lack of government monitoring and enforcement
- deforestation due to lack of government monitoring and enforcement
- farming on private or leased state lands

Unlike the other lagoonal resources, degraded offshore islets can be actively restored through habitat restoration (mangroves, grasslands, forests). Therefore the primary long-term outcomes needed are protection and restoration as follows:

- Category 1 Offshore islets are protected intact and, where needed, restored to health and resiliency

- Category 2 Offshore islets are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on offshore islets provided on-site

- Category 3 Offshore islets are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

Pending the coverage overlays of ownership types with islets it is suspected that there are few Category 3 islets. Still a number of islets have already been subjected to hotel or tourism development and, thus, are unlikely to be classed as Category 1 and 2 islets. Management of these islets will likely require voluntary participation or positive incentives for the tourism operators.

Suggested policy instruments are shown in Table 10. Islets provide a particular challenge in terms of protection and management due to their remote location or as state lands. For remote islets that are uncommitted state land or national park some form of co-management may be ideal, but difficult to achieve due to the distance – positive incentives will no doubt be necessary. For any future hoteliers or farmers that will lease islet lands no compensation would be needed for compliance with conditions placed on usage. For those already engaged in business activities that would be required to constrain or reduce their usage, and hence their revenues, some form of compensation or ongoing payment would be useful. Also, note that investment in restoration of islet protected areas should be entertained. This will likely require an allocation of government funds or voluntary NGO funds.

Table 10. Offshore islets: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on leased lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment			xxx			
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx				
Micro-credit*						
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx	xxx	xxx		
Common Property Management *						
Public-Private Partnerships		xxx	xxx			
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges	xxx		xxx			
Subsidies and Payments	xxx					
Regulated Markets						
Privatization		xxx				
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment			xxx			

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- limited densities on any tourism developments in Category 2 or 3 offshore islets
- full monetary compensation for any adverse impacts to Category 3 offshore islets

Freshwater Marshlands (Coastal and Upland)

There are a few freshwater marshlands, or wetlands, located in the uplands with the majority in the coastal areas. As the outcomes and instruments do not vary much between types they are considered together here. Marshlands are likely to occur both on private and state land. As there are no protected areas in the inland coastal areas it is assumed that these marshlands are unlikely to be situated in existing protected areas. Nevertheless, the National Ramsar Committee is actively engaged in promulgating legal and other protections for these areas. Principal threats include:

- backfilling by property owners in advance of development
- rubbish dumping due to government failure to enforce state land status
- upstream management of rivers and streams that lead to higher pollutant concentrations and sediment delivery to lagoons
- damming and conversion for water storage to augment CWA water supply (uplands)

- invasion by alien species due to government or private property owner failure to manage marshlands

Degraded marshlands can be actively restored through habitat restoration. It is also possible to create new wetlands, although there is a high rate of failure due to the need to ensure the correct hydrological regime and inflow. The primary long-term outcomes needed are protection and restoration as follows:

- Category 1 Marshlands are protected intact and, where needed, restored to health and resiliency

- Category 2 Marshlands are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on marshlands provided on-site

- Category 3 Marshlands are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

Suggested policy instruments are shown in Table 11. Marshlands provide a particular challenge in terms of protection and management due to their location in and around coastal settlements and their perceived negative attributes (odor and insect breeding grounds). For marshlands that are on state land the principal solution may be to have local communities adopt the marshland and monitor and manage it (including for its scientific and educational value) in return for a direct payment. An alternative would be to create a Wetland Reserve or other protected area designation. If this helps provide financial resources for ESA protection that may be useful. However, the size of most marshlands in Mauritius is quite small and they are spread across the landscape. The practical problem is how to ensure their protection, not providing them a paper designation.

Effective command and control regulations against backfilling and development are critical (as described more in the companion Legislative Report). It is proposed here to marry the regulatory and incentive approach in the case of private lands. A landowner seeking to develop a wetland area of Category 1 status should be refused. Failure to comply needs to result in significant penalties – enough to serve not only as a disincentive but a deterrent in the first place. In addition, upon identification of a site as a marshland, the local authorities and the MoE need to act in a proactive fashion to enroll the landowner in the direct payments program.

Table 11. Marshlands: Short-term Outcomes and Policy Instruments

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment			xxx			
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx		xxx		
Micro-credit*				xxx		
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx	xxx			
Common Property Management *						
Public-Private Partnerships		xxx	xxx			
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges			xxx			
Subsidies and Payments	xxx			xxx		
Regulated Markets						
Privatization		xxx				
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments				xxx		
Private and Voluntary Sector Investment			xxx			

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- a buffer zone between any development and the nearest marshland
- clear guidelines on on-site restoration or replacement that may serve as mitigation for adverse impacts to a portion of a marshland
- full monetary compensation for any net adverse impacts to Category 3 marshlands

Forests With Native Content

Forests with native content are largely located in the uplands, on private and state lands. In many cases these forests are already in protected areas, including Nature Reserves, River Reserves or National Parks. However, protected status does not imply native content, as River Reserves are largely made up of exotic species. Reportedly, some of the better forest areas – Category 3 Forests – are located on private lands. In addition, there is likely to be substantial overlap between steep slope ESAs and forest ESAs.

Principal threats include:

- invasive species due to lack of active management by Forest Service or private owners

- deforestation due to government lack of monitoring and enforcement on state lands or as a result of leasing of state land for deer ranching.
- change in land use due to agricultural, tourism and industrial development and lack of effective protections for forest lands in the development and EIA process

Forests can be actively restored through reforestation and intensive eradication of alien invasive species (as per the Ferney Valley example cited earlier). The primary long-term outcomes needed are protection and restoration as follows:

- Category 1 Forests are protected intact and, where needed, restored to health and resiliency

- Category 2 Forests are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts provided on-site

- Category 3 Forests are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

Suggested policy instruments are shown in Table 12. As indicated above if much of the higher quality forests are on private land it will be important to offer positive incentives – including direct payments or certification schemes to support restoration and protection efforts. Much of the forest area is likely to be on uncommitted state lands, but it may be of marginal biodiversity value. Given the expense of forest restoration, for these forests, the protection of forest cover may be sufficient to yield downslope watershed protection benefits. In such cases, there is the possibility of a Coasian bargain where downstream beneficiaries contribute directly to upstream management. This is particularly likely in watersheds where small community water systems or the CWA have off takes. Alternatively co-management or common property management regimes may be worth promoting depending on the exact nature of benefits derived by local communities.

Table 12. Forests: Short-term Outcomes and Policy Instruments

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment			xxx			
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx		xxx		
Micro-credit*				xxx		
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx	xxx			
Common Property Management *	xxx					
Public-Private Partnerships		xxx	xxx			
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges			xxx			
Subsidies and Payments	xxx			xxx		
Regulated Markets						
Privatization	xxx	xxx				
Cap & Trade						
Product Certification*				xxx		
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments				xxx		
Private and Voluntary Sector Investment			xxx			

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- clear guidelines for what constitutes acceptable management of Category 2 or 3 forests leased for deer ranching

- full monetary compensation for any net adverse impacts to Category 3 forests

Steep Slopes

Steep slopes may occur on private or state lands, though it is assumed here that much of the >20 slopes and hence the Category 1 steep slopes will be on state land. In many cases these steep slopes are already in protected areas, including Nature Reserves, River Reserves or National Parks. In addition, there is likely to be substantial overlap between steep slope ESAs and forest ESAs. For this reason restoration is not considered here as it would largely take place as part of forest restoration or reforestation activities.

Principal threats include:

- housing construction due to population growth and economic development
- hotel development for tourism development
- accompanying infrastructure – roads, cell phone towers, etc.

The primary long-term outcomes needed are protection as follows:

- Category 1 Steep slopes are protected intact

- Category 2 Steep slopes are protected in a viable and healthy state, with any mitigation for adverse impacts provided on-site

- Category 3 Steep slopes are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

Suggested policy instruments are shown in Table 13. For steep slopes on state land, command and control regulation must be regarded as the primary policy instrument. Category 1 steep slopes must simply remain untouched by use or development. Category 2 steep slopes may see limited development, but subject to strict design guidelines and most likely not on the >20 percent slopes. These guidelines would need to clearly ensure that any land degradation from development would be addressed on-site so that there would be no negative downslope or downstream consequences. In Category 3 slopes, development will certainly be allowed, perhaps subject to lesser guidelines. As there is no effective on-site mitigation for viewshed issues – besides design guidelines – it is suggested that any development in steep slope ESAs of Category 2 and 3 pay significant compensation. These funds could go towards a fund aimed at retrofitting and reducing the visual impact of existing infrastructure (roads, antennae and cell phone towers) on the tops of mountain areas. Similarly, any off-site or downstream consequences of land degradation from development in Category 3 sites that cannot be mitigated would need to be compensated.

For steep slopes on private lands positive incentives will be necessary if development rights are to be expropriated through denial of permission to build during the EIA process. Creative financing mechanisms such as certification, voluntary contractual arrangements, and self-regulation should be employed wherever feasible.

Table 13. Steep slopes: Short-term Outcomes and Policy Instruments

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx			xxx		
Micro-credit*						
Command and Control	xxx					
Decentralized and Polycentric Partnerships						
Co-Management	xxx					
Common Property Management *	xxx					
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						xxx
Subsidies and Payments	xxx				xxxx	
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- clear guidelines for what constitutes acceptable design standards for Category 2 or 3 steep slopes with the intent that structures fit into the natural landscape

- full monetary compensation for any unmitigated viewshed or land degradation consequences on Category 3 steep slopes

Freshwater Wells

Freshwater wells (or boreholes) may occur on private or state lands. CWA boreholes are assumed to be on state land, while other wells are likely to be on private lands. Principal threats include:

- over-extraction due to population growth, poor water use efficiency and subsidies for agricultural production
- heavy construction and development near well sites
- chemical leaching and spills due to poor government regulation of waste disposal

With wells some site restoration may be necessary to adequately protect the site. The primary long-term outcomes needed are protection as follows:

- Category 1 Well sites are protected intact and, where needed, protective vegetation or other measures are taken

- Category 2 Well sites are protected intact, with localized adverse impacts mitigated on-site

- Category 3 Well sites are protected as best as possible given existing or planned developments at the site

Suggested policy instruments are shown in Table 14. For wells on state land, command and control regulation must be regarded as the primary policy instrument. An alternative would be common property management where wells generate localized benefits (i.e. community water systems as opposed to CWA system or private systems). Alternatively co-management by the community in return for a direct payment may be the best option. For wells on private lands sensitization is the primary policy instrument as self-regulation would appear to be in the self-interest of the landowner (who is also the water user). In order to limit over-extraction the economic policy instruments of eliminating subsidies and correctly pricing water (on CWA or community systems) will be necessary.

Table 14. Wells: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx			xxx		
Micro-credit*						
Command and Control	xxx					
Decentralized and Polycentric Partnerships						
Co-Management	xxx					
Common Property Management *	xxx					
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						xxx
Subsidies and Payments	xxx				xxxx	
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- guidelines for site protection measures for all Categories need to be clearly specified

- no monetary compensation is suggested for actions affecting wells sited on private lands

Rivers and Streams

Rivers and streams were not extensively surveyed as part of the ESA project. As suggested above the priority project listed in the 2007 NES update is probably necessary before making any policy recommendations. At this point it is simply worth noting that the principle threats are from water extraction, water pollution and climate change. As such the economic policy instruments for eliminating subsidies and instituting marginal cost pricing are very relevant to rivers and streams. With regard to waste discharge into rivers the next policy step is for WRU to receive funds and capacity to establish an effluent discharge permit system, along with the necessary monitoring and enforcement capacity. However, without the capability to grade rivers and streams into appropriate Categories these recommendations can have little practical impact at the moment as the capacity of individual stream and loads to accommodate pollutant discharge is not known. It may be impractical to eliminate all discharge in Category 2 and 3 rivers and streams. However, in order to regulate discharge further research and study will be necessary.

Lakes And Reservoirs

Lakes and reservoirs can be divided into those that fall under the authority of the Ministry of Renewable Energy and Public Utilities as water supply sources and those that are simply public waters, unrelated to water supply. The former category is probably best managed in association by the relevant authority. Interviews with WRU revealed the concern that attempting to restrict use and development at what are in effect water infrastructure sites could create major complications. Further site-by-site evaluation would therefore be needed before making any recommendations.

For sites that are not actively managed for public water supply, the policy approach should be similar to that for rivers and streams, as the same issues present themselves. The issue that will arise that needs a higher level discussion is what the policy of the government is towards lakes (or rivers) that may be modified in the future by dams in order to create water supply reservoirs. Here the three-tiered categorization employed here can help to guide desired outcomes. Unfortunately, at present it is not clear that there are potential dam sites that would fall into Category 1 or 2 status, given the potential national importance of additional surface water storage as a response to climate variation under climate change. However, it would be important to stress that a condition for granting any EIA license for a new dam and reservoir would depend on a full examination of the real need for the facility. With poor water use efficiency and a seeming desire to connect all water users to the CWA system – instead of using locally appropriate sources, including groundwater – it is unclear that such dams are necessary or are the least cost alternatives. Many countries, including the Republic of South Africa, have invested considerable effort in adapting the recommendations of the World Commission on Dams to their needs. Undertaking a scoping and review of the WCD

report could greatly assist in developing a coherent EIA process for large dams (World Commission on Dams 2000)

Sand Beach And Dunes

Beaches and dunes will consist of state lands, including those leased out to private parties. In many cases these beaches are already in protected areas, such as Public Beaches or the Pas Geometrique.

Principal threats include construction of leisure homes, hotels, golf courses and IRS schemes. Some beaches may need restoration due to years of erosion and mismanagement duet to the use of grunions. The primary long-term outcomes needed are protection and restoration as follows:

- Category 1 Beaches are protected intact and, where needed, restored to health and resiliency

- Category 2 Beaches are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts provided on-site

- Category 3 Beaches are protected, with an emphasis on conserving a viable number of Category 3 sites, and any loss is compensated

Suggested policy instruments are shown in Table 15. For beaches, command and control regulation is necessary to enforce regulations in the Pas Geometrique, particularly on leased land. As suggested earlier it would also be advisable to designate additional Public Beaches, to provide for future demand and protect public uses in the face of tourism development pressure. An alternative would be co-management or common property management where beaches generate localized benefits (including community concessions at public beaches). It may also be the case that given the high sensitivity of beaches, the numerous threats to these important national assets, and the scarcity of beaches for recreational purposes that all beaches should be designated as Category 1 ESAs.

Table 15. Beaches: Short-term Outcomes and Policy Instruments

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment			xxx			
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx		xxx		
Micro-credit*						
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx	xxx			
Common Property Management *						
Public-Private Partnerships		xxx	xxx			
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges			xxx			
Subsidies and Payments						
Regulated Markets						
Privatization		xxx				
Cap & Trade						
Product Certification*				xxx		
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment			xxx			

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- clear guidelines for what constitutes acceptable management of Category 2 or 3 beaches is needed

- full monetary compensation for any net adverse impacts to Category 3 beaches

Caves

Caves and other significant geological features may occur on private or state lands.. Principal threats include rubbish dumping, closure, water pollution (raw sewage), siltation and vandalism all due to the problem of managing a common resource or managing private lands for public benefits

With caves some site restoration may be necessary to adequately protect the site, given the degree of rubbish and waste found at many sites. The primary long-term outcomes needed are protection as follows:

- Category 1 Caves are protected intact and, where needed, restorative measures are taken

- Category 2 Caves are protected intact, with localized adverse impacts reversed or mitigated on-site

- Category 3 Caves are protected as best as possible given existing or planned developments at the site

Suggested policy instruments are shown in Table 16. For caves on state land, command and control regulation may be necessary. One alternative would be to designate Category 1 caves as a protected area – particularly where they are of great geological significance or have visitation/ecotourism potential. An alternative would be common property management where caves generate localized benefits (i.e. for visitation or spelunking). Alternatively co-management by the community in return for a direct payment may be the best option. For caves on private lands direct payments in return for monitoring, protection and management will likely be needed – unless there are revenue opportunities.

Table 16. Caves: Short-term Outcomes and Policy Instruments

	Short- and Medium-term Outcomes					
Policy Instruments and Financing Mechansims	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*	xxx	xxx		xxx		
Micro-credit*						
Command and Control	xxx	xxx				
Decentralized and Polycentric Partnerships						
Co-Management	xxx	xxx		xxx		
Common Property Management *	xxx					
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges	xxx					
Subsidies and Payments	xxx			xxx		
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation				xxx		
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Conditions on access, development and use may include:

- guidelines for site protection measures for all Categories need to be clearly specified

- full monetary compensation for any developments on Category 2 or 3 caves

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