

HOUSEHOLDS' RESOURCE USE, CONSERVATION ATTITUDE AND PERCEIVED  
SOCIOECONOMIC IMPACT OF THE PROTECTED AREAS POLICY IN THE NARIVA  
SWAMP, TRINIDAD AND TOBAGO

By

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To my Mom for her unwavering support and encouragement

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The designation of the Nariva Swamp, Trinidad and Tobago as an Environmentally Sensitive Area (ESA) was analyzed on a socioeconomic level from the perspective of the two communities; the Kernahan/Cascadoux and Plum Mitan communities. The resource dependency and conservation attitudes of households in the community and the factors that affect them were assessed. In addition, potential impacts (both negative and positive) of the ESA designation, as perceived by the communities, were also examined at both the household and community level. The preferences for management of the Nariva Swamp by the communities were also assessed.

Conservation attitude and resource dependency were determined through a survey of 80 households in the communities and analyzed using regression in order to determine the significant factors. Perceived impacts of the ESA designation were analyzed using socioeconomic impact matrix analysis at the household level and the SWOT-AHP (Strengths, Weaknesses, Opportunities, Threats Analysis-Analytical Hierarchy Process) at the community level. Community members were also asked to vote on their preferred management scenarios for future management of the swamp.

The factors that significantly affect resource dependency in the Nariva Swamp were age, gender and length of residency and those that significantly affect attitude towards protected areas were age, gender and landholding size. The perceived socioeconomic impacts of ESA designation by the households were mostly negative and potential loss of access to the swamp was considered the greatest negative impact. The SWOT-AHP analysis showed that different groups within the community had varying perceptions about the effects of ESA designation of the Nariva Swamp. General community members and members of an environmental group considered the potential opportunities presented by the ESA designation to be most important whereas the ecotourism operator considered the potential threats represented by the designation to be most important. The preferred management choice of the communities was shared authority in management of the swamp with the government agencies. The results of these analyses were used to suggest community management strategies for the Nariva Swamp to encourage and promote maximum participation by the communities.

## CHAPTER 1 INTRODUCTION

### **Protected Areas**

The concept of protected areas (PAs) is an historic idea, which first became explicitly expressed in the Yellowstone National Park, USA and now encompasses over 30,000 areas worldwide known as national parks, nature reserves, conservation areas, and several other designations (Beresford and Phillips, 2000). The initial approach to conservation advocated the “fortress conservation,” “fines and fences” or “coercive” approach which was based on preservation of natural resources on the principle of separation from human influence by establishing strict nature reserves in which no human activity was allowed (Adams & Hulme, 2001). This type of approach was followed in the West Indies, India and Africa and was accompanied by the development of legislation and central government institutions to manage these reserves (Adams & Hulme, 2001).

This centrally organized strategy which excluded the human element from biodiversity conservation was not fulfilling its objectives in some countries (Hulme & Murphree, 2001). This occurred in part because these exclusionary strategies led to negative impacts on social and economic characteristics of the local communities which often led to a lack of compliance of the regulations governing the protected areas (Adams & Hulme, 2001). The overexploitation of resources often has socioeconomic reasons when human welfare is not addressed or are based on social actions such as logging or development so that resource management should focus on the people involved and not only on the actual resource (Pomeroy, 1995). The sustainability of protected areas was compromised by such conflict as well as a lack of sufficiently large areas protected within the reserves to conserve the natural resources (Kellert et al., 2000).

Protected areas in the Caribbean increased after the 1970's in both number and area but this trend has diminished possibly due to the lack of available land (Green & Paine, 1997). There is a new protected area community-based paradigm which has been developing over the last decade led mainly by the World Congress on National Parks and Protected Areas (Kellert et al., 2000; Gillingham, 2001) within which these areas now include places where people live and work and a collaborative approach to management is required which keeps social and economic objectives in mind (Beresford and Phillips, 2000).

The International Union for Conservation of Nature (IUCN) has developed a system of protected areas that continue to range from the traditional strict nature reserves to sustainable use protected areas (IUCN, 1994). There is a broad spectrum of initiatives possible under this paradigm of community conservation within which participation and economic use are the main criteria and this allows for situations ranging from low levels of participation by communities to areas in which the community has full proprietary rights to the area (Adams & Hulme, 2001).

“Fortress conservation” is biocentric in that nature is the focus of the conservation goals whereas community conservation can be seen as more anthropocentric (Jones & Murphree, 2001). They also focus at a coarse level rather than at the fine focus of the local context (Bawa et al., 2004). The new community conservation paradigm instead emphasizes benefits to communities, proprietary rights of locals and sustainable use (Child, 2004). This approach focuses on the conservation of ecosystems and their services instead of single species conservation (Child, 2004). Instead of negatively affecting biodiversity, there have been many instances of more effective biodiversity conservation on community managed land than in the “fortress” type of conservation area (Child, 2004).

It is preferable for protected areas to meet socioeconomic needs especially in poor areas while simultaneously protecting biodiversity and ecosystem services (Child, 2004) especially since local people would depend on the area for their livelihood. There can be benefits from sustainable use of protected areas while conserving them if monitoring of ecosystem integrity is included in management (Child, 2004). Institutions and incentives are prominent within this conservation paradigm so that people can maintain their livelihood through conservation (Child, 2004).

Within this paradigm, there can be more equitable access to the protected area, improved implementation of management strategies and improved resource management when stakeholders are allowed to participate fully in management actions (Kessler, 2004). There is a need for adaptive schemes, traditional knowledge and improvement of social capital within each specific local setting (Bawa et al., 2004). Participatory democracy, institution strengthening and empowerment of resource users are also important (Jentoft et al., 1998; Bawa et al., 2004). The partnership between local community and government works when they can provide legislation, enforcement and other assistance (Pomeroy & Berkes, 1997).

There is also a need to draw from local knowledge and natural science information so that the area is treated as a single economic and ecological unit in order to build resilience (Bawa et al., 2004; Pomeroy, 1995). The protected areas can conserve natural resources and ecosystem services while simultaneously providing benefits to the community through alternative activities such as nature-based tourism as well as by protecting the natural resources on which traditional livelihoods depend (Singleton et al., 2002; Picard, 2003). PAs are now designated with the expectation that they will provide economic, social, scientific (Picard, 2003) and ecological benefits.

The ecological and socioeconomic aspects of natural resources should not be considered separately in conservation management. Neither purely biocentric nor anthropocentric approaches will lead to effective conservation. Instead a dual consideration of nature and humans is necessary to ensure the sustainability of protected areas and other conservation initiatives. In many instances, the benefits (local and national) of protected areas are more likely achieved when stakeholders are involved in management (Child, 2004).

### **Protected Areas Policy in Trinidad and Tobago**

The development of protected areas policy in Trinidad and Tobago has evolved along the general pattern of protected areas elsewhere starting with the “fortress conservation” approach and ending with the community-based approach. The history and evolution of this policy can be described using a Punctuated Equilibrium framework.

#### **Punctuated Equilibrium Theory**

Punctuated equilibrium theory originated in the field of evolutionary biology whereby species evolution was seen to be stable or in equilibrium followed by apparently ‘sudden’ evolution of a new species (Repetto, 2006). This theory has been adapted to policy change where a similar trend has been observed in particular in environmental policy (Repetto, 2006). In the policy arena, there tends to be the maintenance of the status quo or equilibrium followed by a break in the logjam leading to a change in the dynamics of the policy and a subsequent speeding up of the policy process (Repetto, 2006). Underlying this trend is the fact that there are more marginal changes and fewer paradigmatic changes that occurred to lead to the “punctuation” (Repetto, 2006). These changes tend to be sudden and discontinuous and cannot be explained sufficiently by the idea of “political will” (Repetto, 2006).

In order to explain this pattern, there is a need to know the processes and drivers of environmental policy in their particular context, especially the political context (Repetto, 2006).

The causal variables as to why the old policy fails are important and they lead to the need for new “policy images” which means that the issue is thought of in a new way (Repetto, 2006). These determinants of policy change are characterized by negative and positive feedbacks to the system (Repetto, 2006). When change causes a disturbance, forces (negative feedback) may drive the system back to its original status (Repetto, 2006). On the other hand, the disturbance may be caused by forces (positive feedback) that reinforce the change and move it further away from the original state (Repetto, 2006). For example, positive feedback may take the form of new programs that have been initiated since the last shift in policy (Repetto, 2006).

Elections, social movements and institutional changes may all cause policy shifts (Repetto, 2006). In particular, environmental policy faces the challenges of economic growth, property rights issues as well as the support of positive factors such as saving species and reducing pollution (Repetto, 2006). The cost of reversal of policy is considered to be high and the influence of the change agents must be great (Repetto, 2006). The Catch 22 or “social trap” is that there is no positive experience to look at during the equilibrium so that there is a reluctance to depart from traditional practice but if new approaches are not adopted, there will be no favorable examples to look at (Repetto, 2006).

### **The Case of Protected Areas Policy in Trinidad and Tobago**

The various forms of protected areas policy in Trinidad and Tobago appear to fit into this pattern inherent in the Punctuated Equilibrium Theory. Interest in the protection of natural areas began at a very early stage in Trinidad and Tobago’s development. As far back as the 1880’s, the first attempt at some form of protective environmental policy was made by the administration of Trinidad and Tobago, which at that time was still a British colony, and took the form of commissioning a report on the forests of the islands. Protected areas, designated as national parks, were first identified by the independent government in 1972, but the formal acceptance of

national parks into the environmental policy of Trinidad and Tobago was not done until 1981 (Leach & Fairfield, 2001).

This policy remained a ‘paper policy’ with no associated legislation to enforce its provisions. National parks continued to be formed under related legislation such as Forestry and Wildlife legislation. Some of the parks that were designated, such as the Chaguaramas National Park in 1974, were done largely on the basis of recreational criteria rather than environmental issues. This first attempt at protected areas policy can be seen as one policy change followed by equilibrium since this status quo persisted for several years.

Multi-lateral international conventions such as the Convention for Biodiversity and the Ramsar Convention, to which Trinidad and Tobago is a signatory, played a role in promoting the further development of a policy on protected areas. These acted as some of the external drivers that cause changes in policy (Repetto, 2006). The need for changes in protected areas policy was also driven by the government agencies responsible for these areas, the scientific community represented by the conservation specialists at the University of the West Indies as well as a small environmentally conscious community within the country (Brown, 2000).

The apparent over-exploitation of resources, changing land use and lack of effective conservation in the natural areas of Trinidad and Tobago prompted these stakeholders to promote the concept of a comprehensive and enforceable piece of legislation to conserve protected areas (Brown, 2000). The Forestry Division, in particular, drafted several policies and pieces of legislation in order to encourage governmental approval of a national parks system. This advocacy is identified as one of the causes for policy change and punctuation of the policy equilibrium (Repetto, 2006). In combination, the pressure of international agreements and the

opinions of scientific experts, members of the general citizenry as well as government employees themselves, represented these marginal changes that led to punctuation in protected areas policy.

This “new” policy took the form of several variations and iterations as it developed, ranging from being a forestry policy to a combined national parks and wildlife policy to a stand-alone national parks policy. The National Parks and Wildlife Bill in particular, received severe criticism from reviewers over jurisdictional issues and in particular, land use, the rights of which would be curtailed for existing users (Leach & Fairhead, 2001) and was withdrawn to reemerge as two separate Bills for national parks and wildlife respectively.

Leach & Fairfield (2001) consider the main reason for the lack of enforcement of a comprehensive protected areas policy at this time to be a lack of political will in a government more committed to industrial development issues (Leach & Fairhead, 2001). However as identified in Repetto (2006) there must be additional reasons for the maintenance of this status quo. One reason may have been economic since large tracts of resource-rich land were required for conservation purposes to be set aside when the country was in the midst of a reinvigorated energy sector.

In addition, constant indecision and confusion over which governmental agency should control the protected areas was a contentious issue (Leach & Fairhead, 2001). In the midst of the debate over this policy, the Environmental Management Authority (EMA) was formed in 1995 through the promulgation of the Environmental Management Act. This served to introduce further conflict since the EMA was given the authority to designate Environmentally Sensitive Areas (ESAs) which are, in effect, protected areas. This was viewed as a duplication of effort and resources to the proposed National Parks and Protected Areas Bill. These factors acted in concert as negative feedbacks (Repetto, 2006) causing a “stall” in this particular protected areas

policy and a maintenance of the status quo which was exemplified by the fact that the National Parks and Protected Areas Bill was never passed in Parliament.

The punctuation of the protected areas policy in this instance was caused in part by this shift in responsibility from the Forestry Division to the EMA. However since many of the responsibilities for implementation of the ESA will still reside with the Forestry Division, the change in agency may be more of a political and legislative issue rather than a functional one. The resultant policy which now governs the sustainable use and conservation of protected areas in Trinidad and Tobago is the Environmentally Sensitive Areas Rules, 2001 (ESAR). Implementation of these rules is currently being undertaken and areas are being designated as prescribed by these rules. This process is being conducted in stages and one of the first sites to be legally designated is the Nariva Swamp.

### **Problem Statement and Research Questions**

Based on the ESAR as PA Policy, it is important for PAs such as the Nariva Swamp to promote social and economic aspects of sustainability in addition to biological and physical ones. In addition, the impact of the designation of a PA on the surrounding community will affect the success of the PA as determined by the achievement of short and long term conservation goals of the PA. Success can be measured by the socioeconomic status of the community and status of the resource (Singleton et al., 2002). This success is reliant on the perceptions, attitudes and behavior of the people involved in the use of the natural resource.

Effective natural resource management initiatives will be those that consider people's perceptions and use of their natural resources as well as their perception of costs and the processes that affect these resources (Marcus, 2001). It has been suggested that a combination of positive attitudes of the community and their perceived benefits should provide an increased probability of compliance with PA restrictions and plans as well as participation in these

management plans (McClanahan et al., 2005). PA management success also requires the continuous assessment of these perceptions which includes the determination of the factors that influence these perceptions (McClanahan et al., 2005).

The variability of socioeconomic and political contexts of different countries leads to differing conclusions about stakeholder attitudes and perceptions about PA policy (Weladji et al., 2003). In order to achieve the protection of natural resources through protected areas policy, one of the key actions is to identify stakeholders, ascertain their attitudes towards protected area management and the factors that affect these attitudes (McFarlane and Boxall, 2000). Surveys on these issues can help to guide management decisions and provide baseline information for assessing the effectiveness of new policies (Weladji et al., 2003). The study of community attitudes and behavior to the ESAR before they are implemented is important to ensuring that the local people participate in management. My study will seek to determine the factors that affect people's perceptions and attitudes with a view to promoting conservation success by ensuring that their concerns are addressed at an early stage of implementation of the ESAR in the Nariva Swamp.

In order to assess the effectiveness of protected areas management, one element to be evaluated is the planning of protected areas as characterized by the protected areas legislation, policy and management planning (Hockings, 2003). Designating an area as protected does not make sense if it is not possible for the sustainable traditional uses and services to continue for the communities (Hockings, 2003). This interaction of human communities with protected areas includes the provision of livelihoods and sustenance (Hockings, 2003). Planning for protected areas must now be done with and for local people rather than against them (Beresford and Phillips, 2000). This includes ensuring that they are not negatively impacted by these

designations but can obtain maximum benefits by improving the social and economic conditions for people living within these areas (Beresford and Phillips, 2000). It has been predicted that local communities within and around a protected area would prefer to obtain maximized positive social and economic impacts rather than only require mitigation of negative impacts (O’Faircheallaigh, 1999).

My study will ascertain the level of community support for the policy in order to enable its success and ensure that local communities are not negatively affected. If local people do not perceive that the policy will benefit them; they may choose not to participate and may ignore management plans and restrictions. Protection of these Environmentally Sensitive Areas will only be effective if stakeholders are meaningfully and transparently involved, traditional or customary rights are recognized and their loss compensated for, and there are direct linkages between conservation and development objectives (Elliot et al., 2001; Ngugi, 2002). My study will therefore establish attitudes about protected areas policy and the ESAR in general, the ESA designation of the NS, the purpose of its designation and the perceived impacts of designation. It will also assess the dependency of households on the resources of the Nariva Swamp.

The management of the swamp under the ESAR legislation can potentially affect the communities adjacent to the swamp. Management actions will include restoration of previously cleared areas of the swamp using native species in order to both regenerate natural habitat and increase carbon sequestration in the swamp. Existing forest cover will also be protected in order to maintain the carbon sequestration of the swamp forest. There is also a planned increase in nature-based tourism activities within the swamp. There is known to be an un-quantified level of nature-based tourism being conducted in the swamp which is expected to increase with the ESAR implementation.

In Trinidad and Tobago, since the legislation is still in the process of being implemented, the effects of the ESAR are as yet unknown, so it is important to ascertain the potential socioeconomic impacts of ESA designation as perceived by local communities to ascertain potential barriers to ESA implementation in the Nariva Swamp. Based on the findings of my study, recommendations can be made on the additional measures or modifications to proposed management plans for the Nariva Swamp that need to be implemented in order to maximize the benefits and minimize the negative impacts of ESA designation on local communities and to promote sustainable wetland co-management. Recommendations can also be made on the approaches and steps needed to enhance participation of stakeholders in ESA management and whether the community needs to be more fully involved in the projects.

A conceptual framework depicting this is shown in Figure 1-1; the conservation attitudes, resource dependency and perception of potential socioeconomic impacts of the two communities will be determined. These components are all influenced by socioeconomic variables such as age and income and depending on the influencing variables as well as the characteristics of these factors (attitudes, dependency and impacts) participation in management and appropriate management strategies can be predicted or developed.

**Research Questions.** The aims of my study will be fulfilled by addressing the following questions:

- 1) What are the existing use patterns of resources by communities surrounding the Nariva Swamp? What factors affect this dependency?
- 2) What are the attitudes of households towards the designation of the Nariva Swamp as an ESA? What are the variables that affect these attitudes?
- 3) What socioeconomic impacts are expected by households in response to the designation of the Nariva Swamp as an ESA? What are the variables that affect these perceptions?

- 4) What are the choices for management by community members? How do the community members view their role in co-management of the Nariva Swamp as an ESA? What is their preference towards imminent changes in management of the Swamp?

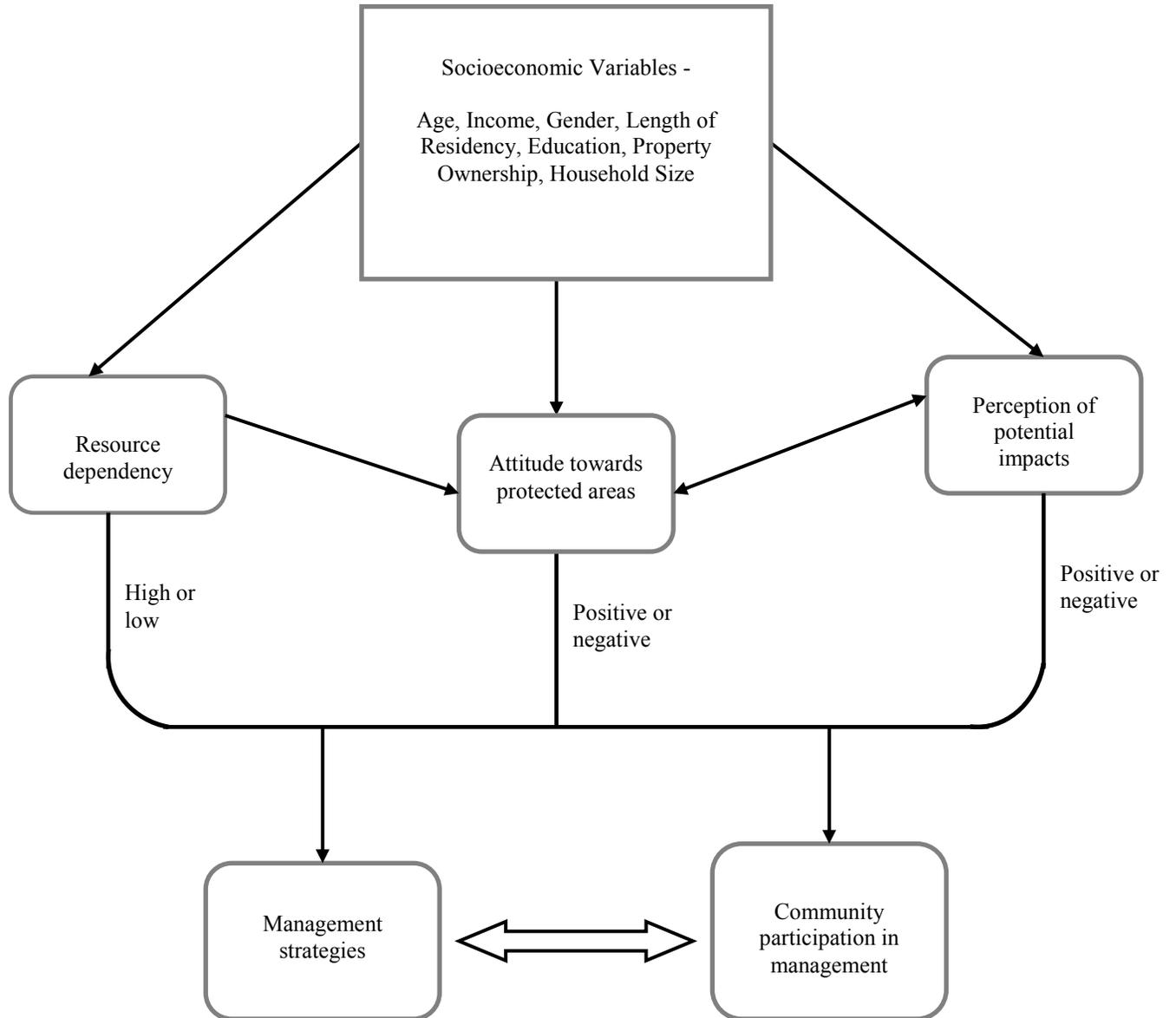


Figure 1-1. A conceptual framework to operationalize community participation in conservation and management of the Nariva Swamp.

### Project Significance

The Nariva Swamp in Trinidad and Tobago is a Ramsar Site and will be designated as a protected area known as an Environmentally Sensitive Area (ESA) under the legislation of

Trinidad and Tobago. The conservation of the natural resources of this swamp is of both regional and international significance but this conservation cannot be achieved without the participation of the surrounding communities in the sustainable use of these resources. The variability of socioeconomic and political contexts of different countries leads to differing conclusions about stakeholder attitudes and perceptions about PA policy (Weladji et al., 2003). Developing countries require the support of local people who live adjacent to PAs to ensure their integrity into the future (Anderson and Grove, 1987; West and Brechin, 1991; Brandon and Wells, 1992). It is crucial to determine whether local communities understand and are in support of conservation measures, their attitudes toward the PA, the benefits to locals and the extent of these benefits (Alexander, 2000; Hough 1991; West and Brechin, 1991).

It is expected that people will choose to participate in protected areas management if their expected benefits (positive impacts) will exceed their costs (negative impacts) (Marshall, 2005) which is also true of the ESA designation of the Nariva Swamp. Support for protected areas by local communities in these developing countries tends to be reduced or lacking if the designation and management of these protected areas has negative effects on these communities (Hough 1991; West and Brechin, 1991). There have been few evaluations of these social impacts in protected areas systems and these are a critical component in the discussion of international conservation policies which is currently deficient (Fortin and Gagnon, 1999). Surveys on these issues can help to guide management decisions and provide baseline information for assessing the effectiveness of new policies (Weladji et al., 2003). In developing countries, there is a need for this type of survey research to inform social impact assessment (Becker, 2001).

In Trinidad and Tobago, since the legislation is still in the process of being implemented, the effects of the ESAR are as yet unknown, but it can be predicted that the designation of ESAs

will lead to socioeconomic effects and complexities within the communities adjacent to these protected areas. The attitudes towards and potential socioeconomic impact of ESA designation of the Nariva Swamp as perceived by local stakeholders are issues that must be assessed *ex ante* in order to ensure public support for this PA policy. This empirical research will contribute to the literature and information on socioeconomic effects of protected areas in developing countries, which is considered deficient as identified by the authors above. It will also contribute to the literature on stakeholder attitudes of protected areas policy and management as well as the pattern of their resource use. The results of this project will provide this type of information by identifying the country specific, contextual factors that affect people's attitudes and impact perception as well as the types and levels of perceived positive (benefits) and negative (costs) impacts of this PA policy in the Nariva Swamp.

Although the Nariva Swamp has been earmarked for designation as an ESA and management plans are in place, there is still an opportunity for modifications to the management plan as well as the timing and mode of implementation of required management actions prescribed in this plan. This pre-assessment can proactively identify potential issues of concern to the communities on the ESA designation and ensure that they are included in management as appropriate. These results will be communicated to the EMA, the community and other stakeholders in order to promote conservation success by ensuring that these concerns are addressed prior to the implementation of the ESA Rules in the Nariva Swamp. In addition, this information can be used by government agencies to address the community's perceived impacts with respect to the Nariva Swamp before these management actions are undertaken and also avoid or mitigate these impacts through the amendment or alteration of similar proposed actions in other ESAs. It is important to determine the predicted socioeconomic impacts of the ESA

policy management actions at this stage before they are implemented so that management plans may be guided accordingly based on the results of my study.

My study will also contribute to the improvement of resource management of the swamp by providing a baseline study for the comparative assessment of the PA policy and management after a period of implementation has elapsed. My study can be used within a framework of adaptive management of continuous monitoring, assessment and amendment of management plans. The social fabric of communities is a product of the dynamic and changeable values, attitudes and behaviors held by these communities further emphasizing the need for an adaptive approach to resource management (CERM, 2002). This empirical research addresses these attitudes and so, can be used as a baseline study for a framework of adaptive management within the Nariva Swamp in which the predictive assessment can be followed by continuous monitoring and amendment of management plans.

It can also be used as a model for similar socioeconomic assessments within the other areas earmarked for designation as Environmentally Sensitive Areas (ESAs). The management of the Nariva Swamp should provide social benefits to outweigh potential costs and the attitudes of stakeholders should be incorporated into these management plans for the swamp. My study will provide this information to improve resource management of the swamp and support better decision-making by providing information that can be used in the implementation strategy of the policy to mitigate negative impacts as well as provide a comparative framework for the assessment of the policy after a period of implementation has elapsed. It also provides a framework for similar studies in other sensitive areas as the policy and management plans are implemented for each of these areas.

The research will also provide policy relevant information that will lead to the enhancement of natural resource protection by contributing to well-informed policymaking. The project will benefit the policy makers and other decision makers within the realm of protected areas policy and management in Trinidad and Tobago by improving the goals and implementation of this policy with specific recommendations. The relevant stakeholders who participate in and depend on protected areas policy will also benefit from the analysis. Within the larger perspective, the social and natural resources of the country will benefit through improved policy alternatives and decisions in the long term.

### **Plan of Dissertation**

The dissertation is divided into five chapters that build on each other by assessing household dependency, attitudes, potential impacts and community management preferences of ESA designation of the Nariva Swamp.

Chapter 2 addresses the resource use patterns of the local communities in and around the Nariva Swamp. Natural resource dependency is estimated and converted to a binary scale resulting in a division into high and low dependency households. The factors that affect this resource dependency are also analyzed using a logistic regression in order to assess the effect of these factors on high or low dependency by the households in the community. The results of these analyses are used to suggest the role of dependency in PA management.

Chapter 3 assesses household attitudes towards protection of the Nariva Swamp to determine whether these attitudes are positive or negative. It is expected that those with positive attitudes will tend to participate in PA management activities whereas those with negative attitudes will not participate. These attitudes were analyzed in two ways, using multiple linear regression and logistic regression. This allows for the comparison of the two methods as a model for conservation attitudes and the factors affecting these attitudes. These predictive

attitude models can be used in the development of community management options for the Nariva Swamp to encourage and promote maximum participation by the communities.

Chapter 4 examines the potential impact of the ESA designation of the Nariva Swamp as perceived by community members. A simple matrix method is used to determine the perceived impacts of the households in the communities. The strength, weaknesses, opportunities, threats analysis combined with the Analytical Hierarchy Process (SWOT-AHP) method is also used in a focus group setting in order to have participation by different subsets of interests in the community. These methods provide both an absolute measurement of perceived impacts as well as a comparative measurement of the impacts as quantified by the community. The potential impacts can be incorporated into management by either alleviating them in the case of negative impacts or promoting them in the case of positive impacts.

Chapter 5 covers the management choices of community groups using voting procedures, namely the Borda Count and Approval voting methods. These methods are used within the framework of co-management of the Nariva Swamp between the government and communities in order to determine the community's preferences for management. This chapter also serves to unite the former chapters through a structural equation model that contains selected socioeconomic variables and their effects on resource dependency, attitudes towards protected areas and perception of potential socioeconomic impacts. This allows for the integration of overall results into suggestions for future management strategies in the swamp.

## CHAPTER 2 HOUSEHOLDS' RESOURCE USE PATTERNS AND FACTORS INFLUENCING THEIR RESOURCE DEPENDENCY

### **Introduction**

Rural communities often depend on natural resource extraction as a key part of their livelihood strategy. In developing countries in particular, rural households make extensive use of a variety of products and services from environmental resources (Cavendish, 2000). Natural resource based activities tend to require little skill and monetary investment with associated low returns except in cases of highly specialized resources or products with high market value (Vedeld et al., 2004).

Some of the products obtained from natural resources include fuelwood, plants, medicines, wild food, fiber, grazing material for animals, hunting animals and building materials (Bluffstone et al., 2001; DeBoer & Baquete, 1998; Cavendish, 2000; Vedeld et al., 2004; Heltberg, 2001). Households that depend on agriculture for their livelihood also use the natural resources for crop/agricultural land or grazing land for animals (Bluffstone et al., 2001; Vedeld et al., 2004). In circumstances where there is a wide variety and range of resources available, there is great heterogeneity in how the resource is used by local people (Takasaki et al., 2001).

A meta-analysis of 54 studies in different developing countries around the world was by Vedeld et al. (2004) and showed an average forest income of 22% of the total income of the households. This report also estimated that approximately 60 million people worldwide are heavily dependent on forest resources for their livelihood (Vedeld et al., 2004). The resources may serve to maintain the current income level of the household, act as additional source of income to increase wealth and escape poverty or as a type of buffer against unforeseen decreases in income (Vedeld et al., 2004).

The use of natural resources for local livelihood is often not regulated (Bahuguna, 2000). Thus, resource use can become excessive and lead to the degradation of the environment when local people are faced with poverty and have no other recourse for income generation (Reardon & Vosti, 1995). In cases where agriculture or for example timber extraction in Asia has led to the degradation of these resources, diversification of income sources or alternative livelihood strategies by rural people who have lower negative impacts on the resource should help reduce this degradation (Reardon & Vosti, 1995; Gunatilake, 1998).

Some researchers consider that poor management and inequitable distribution of resources may lead to low economic benefit from common resources (Bluffstone et al., 2001). Due to the strong linkage between rural communities and natural resources, they can be greatly affected by restrictions on resource use or access (Adhikari et al., 2004; Reddy & Chakravarty, 1999). The magnitude and details of resource use and dependency will have consequences for conservation of that resource and strategies for making the resource use sustainable (Vedeld et al., 2004).

In light of this determination by Vedeld et al. (2004), the management of a protected area such as the Nariva Swamp in Trinidad and Tobago must include an assessment of the dependency of the local communities on the natural resources of the swamp. Since this swamp will be an ESA as described previously in Chapter 1, this assessment will allow for the formulation of management strategies in order to ensure the continued livelihood of the communities. This management will need to take into consideration the extent and level of the resource dependency, that is, whether the communities are heavily dependent on the swamp resources or not and the ways in which they use the resource. Management may also have to include alteration of some of the practices in the swamp that may be degrading the resource.

My study strives to answer these questions by assessing resource dependency of the Plum Mitan and Kernahan/Cascadoux communities which are in close proximity to the Nariva Swamp. Resource dependency can be assessed at different levels; the household level is recognized as one appropriate level of analysis and was used in my study. An administered survey was used to collect information on resource dependency in addition to interviews with the local people and government officials. The basic characteristics of the use of the resources of the Nariva Swamp by the Kernahan/Cascadoux and Plum Mitan communities were determined from this survey.

Dependency was estimated by collecting information on the annual income received by households from the swamp as well as their total annual income from all sources. This data was used to calculate an indicator of resource dependency as a ratio of swamp income versus total income. The index was then converted to a binary scale of high and low dependency using the mean as the threshold value; this value was 0.26 or 26% of household income obtained from swamp resources. Logistic regression was then used to analyze the dependency of the communities based on eight variables that based on the literature, influence household resource dependency and the magnitude of the effect of these factors.

This analysis of household resource dependency on the Nariva Swamp has several implications for management of this swamp as an ESA. These suggestions were made based on the factors that affect dependency as well as the generally low level of resource dependency by these communities. These types of pre-implementation studies are important to align management with the actual context of the communities that are dependent on natural resources.

## **Literature Review**

### **Natural Resource Dependency**

Differences in resource use by members of a community arise due to variations in the specific socioeconomic conditions, values, beliefs, goals and preferences of the members of that

community (Adhikari et al., 2004). Each community has its own unique set of factors that affect the nature and level of their resource dependency. It should be noted that resource use by households may vary across a particular community and will not remain static over time, resulting in changing resource dependency over time (Cavendish, 2000).

### **Factors Affecting Resource Dependency**

Geographic and economic conditions are two of the factors that affect how people use a particular resource (Takasaki et al., 2001). The wealth of a household in particular will generally affect the level of dependency on the resource (Takasaki et al., 2001). Wealth would include income as well as landholding and other non land assets such as natural resources, human resources and all physical and financial assets (Takasaki et al., 2001; Reardon & Vosti, 1995). A household has a certain quantity of these assets that is allocated to income generating activities that affect the environment which then feeds into the next cycle of income generating activity (Reardon & Vosti, 1995).

Wealth will therefore affect the choices made by households with respect to livelihood strategies such as agriculture versus fishing or other forms of resource use (Takasaki et al., 2000). Rapid rural appraisal in Peruvian Amazon to measure asset and wealth, showed that in rural communities, landholding and other assets can affect resource use even if these assets are relatively small (Takasaki et al., 2000). Higher income will also lead to greater investment in recreation time and less dependency (Gunatilake, 1998).

It is expected that poorer households will rely more heavily on natural resource extraction and that differences in landholdings will vary resource dependency such that those with less or poorer quality land will exhibit a greater reliance on natural resources (Takasaki et al., 2001; Reddy & Chakravarty, 1999; Vedeld et al., 2004; Cavendish, 2000). Although the poor may be more dependent on forest resources, it is important to note that richer households may use more

land for agriculture and grazing of livestock (Heltberg, 2001). Therefore dependency is not restricted to poorer households; instead households that have fewer sources of income or “consumption smoothing” tend to rely on the resources more than others (Pattanayak and Sills, 2001).

Education will allow for a greater diversity of income generating opportunities for individuals leading to less use of natural resources; education can also act as a proxy for wage earning since education determines wage (Gunatilake, 1998). It is therefore expected that education would have a negative effect on dependency (Gunatilake, 1998; Adhikari et al., 2004). Age will affect dependency because older people may find it easier to collect products from the environment rather than engage in agricultural activities which may be too strenuous (Cavendish, 2000; Vedeld et al., 2004). However, Masozera and Alavalapati (2004) found that age had a negative effect on dependency.

The gender of the head of the household and general composition of the household may affect the types of resources that can be obtained from the environment (Cavendish, 2000; Vedeld et al., 2004). This is particularly true in traditional societies where males and females have specific roles and activities (Cavendish, 2000). Gender may have a variable effect on dependency, if the activities are more male oriented then there would be higher dependency by males or the nature of resource use may be more female oriented leading to the opposite result (Gunatilake, 1998).

Agricultural income, household size as well as access to towns and markets also affect dependency (Masozera & Alavalapati, 2004; Gunatilake, 1998). Agricultural income and market access has a negative effect on dependency whereas household size had a positive effect on dependency (Masozera & Alavalapati, 2004). Greater availability of labor in a household can

lead to a greater variability in income generating activities away from the natural resource and lower dependency (Gunatilake, 1998). However, a household with a large number of people will tend to have higher requirements to live and will then have greater dependency (Gunatilake, 1998).

Those closer to the forest will have higher dependency (Gunatilake, 1998). Those with non-agriculture and non-forest activities are expected to have lower dependency because these tend to be year round rather than seasonal like agriculture is (Gunatilake, 1998). Other factors that influence resource dependency include technology (tools used for collection), debt, male/female ratio, labor availability, number of days spent in other activities and landholding size all have effects on household dependency (Adhikari et al., 2004; Gunatilake, 1998).

Outward migration may also affect dependency but testing this is difficult (Gunatilake, 1998).

Other household characteristics that are important in the consideration of forest dependency include ethnicity and occupation (Vedeld et al., 2004). Also employment unrelated to either forest or agriculture and incorporation into outside markets lead to a lower dependency (Gunatilake, 1998)

There may also be community level characteristics that affect resource dependency such as market access, community averaged income, forest income, limitations on access to resource, institutional issues (organization and administrative), politics and ecology (Vedeld et al., 2004). Also, when agricultural productivity in a community is low, they tend to rely more heavily on the natural resources (DeBoer & Baquete, 1998). If the community is linked with the market economy there will be less dependence on natural resources (Gunatilake, 1998). With higher agricultural productivity in the village there will be lower dependency (Gunatilake, 1998).

## **Measurement of Resource Dependency**

Measuring resource dependency is difficult to quantify absolutely so there are different ways of estimating this dependency. One such method used by researchers is the amount of hours spent in activities related to resource use. This labor allocation can be quantified as time spent collecting products and quantity of products collected can be used as a measure of dependency on the common pool resource (Adhikari et al., 2004; Bluffstone et al., 2001; Pattanayak and Sills, 2001).

Another aspect of resource dependency as exemplified by the case of forest dependency in the Brazilian Amazon, is the use of forest products to alleviate any losses in agricultural activities (Pattanayak and Sills, 2001). This study characterized household collection of forest products as a function of household labor, characteristics and access and quality to the resource (Pattanayak and Sills, 2001). This labor was operationalized by annual number of trips to the forest for products collection purposes (Pattanayak and Sills, 2001). Those who take more collection trips and hence have higher dependency, are those who have lived there longer and know more about the resource (Pattanayak and Sills, 2001).

Resource dependency may also be measured using total income obtained from the natural resource or by measuring forest income as a proportion of total income of the household (Gunatilake, 1998; Masozera and Alavalapati, 2004). This includes calculation of assets of rural households that can be generally considered to be agricultural land, productive assets, nonproductive assets and livestock (Takasaki et al., 2000).

### **Study Site – The Nariva Swamp, Trinidad and Tobago**

Primary socioeconomic surveys and data collection are required in the communities adjacent to the Nariva Swamp to enable the assessment of attitudes, resource use and perceptions of impact of the ESAR. The Nariva Swamp is a freshwater swamp situated on the east coast of

Trinidad (Figure 2-1) and is the largest wetland in Trinidad and Tobago being made up of approximately 6,000 hectares. It is a designated Wetland of International Importance under the Ramsar Convention (1971). The ecosystem types are mangrove swamp forest, palm forest, swamp wood and freshwater marsh which provide a habitat for many rare and endangered species of reptiles, mammals and birds such as the manatee (*Trichechus manatus*), the red howler (*Alouatta seniculus insularis*) and capuchin (*Cebus albifrons*) monkeys (Brown, 2000).

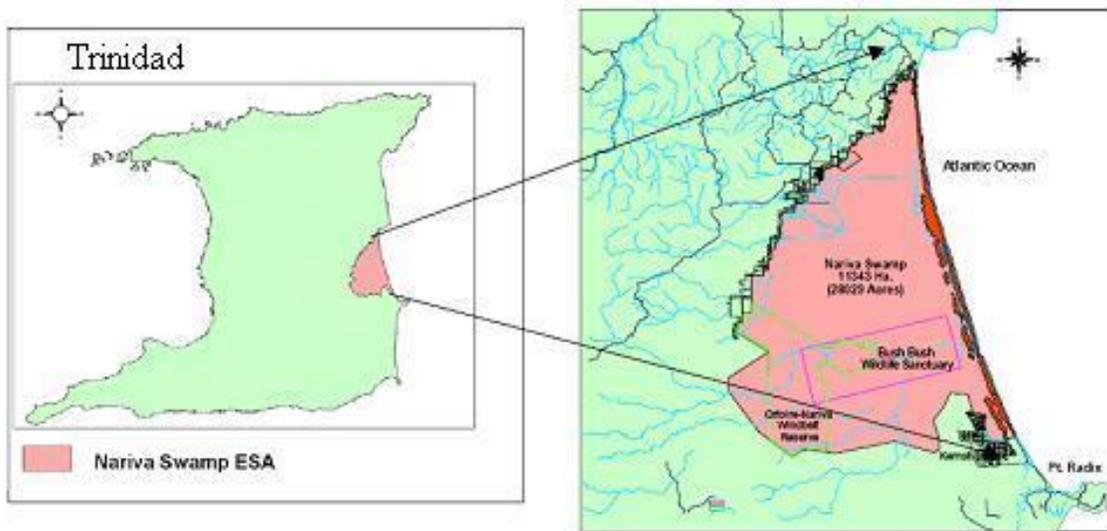


Figure 2-1. Map of Trinidad showing location of the Nariva Swamp.

(Source: EMA, 2005)

In addition, Nariva Swamp is a refuge for migratory waterfowl and a habitat for several species of freshwater fish, 75 percent of the island’s avian species are found there as well as 30 percent of Trinidad’s reptiles and 28 percent of the island’s amphibians (Brown, 2000). Other species of commercial importance found in the swamp include the black conch (*Pomacea urseus*), mangrove oyster (*Crassostrea rhizophorae*) and various crabs (*Cardisoma guanhumi* and *Ucides cordatus*) (Brown, 2000).

The swamp is a state owned area and is a collective resource within the public domain. The site has a complex history which included illegal rice farming in areas of the swamp which

were not zoned for such activity. At present, the site can be characterized according to two main zones, which are not formally demarcated under the existing management regime. The first zone, the Bush Bush Wildlife Sanctuary is a protected area that is accessible through a permit system only and is largely used for scientific research. This zone has no infrastructure and is accessible by walking into the area or by boat and one trail traverses the zone itself. Some villagers use both motorized and non-motorized boats to access this area to bring visitors to the site as well as to fish and hunt in the area.

The second extensive zone is made up of the remaining parts of the swamp, which are used for a mixture of agriculture, fishing, hunting and recreation. This area is relatively easy to access with some parts bordering the main access road with minor roads leading into the area. It is also accessible by boat or kayak along the Nariva River and there are several houses within this area. Some villagers sell their catch, such as fish and crabs along the roadway in small sheds or at their houses. The main communities within and around the Nariva Swamp are the Kernahan and Plum Mitan communities around which this research will focus.

Some land tenure issues exist within the swamp whereby families have short-term leases and in some cases have no leases for the land they live on (Brown, 2000). The activities that take place in the swamp are legal except for those that take place within the Bush Bush Wildlife Sanctuary. This has led to a lack of economic stability of some members of the local community and has affected the way they utilize the resources of the swamp (Brown, 2000). These people would not be inclined to protect the swamp if they do not feel that they have a legitimate long term benefit to gain (Brown, 2000).

## **Method**

### **Household Surveys**

The primary means of data collection was done via a detailed, administered household survey/questionnaire (Appendix A).

#### **Survey Design**

The second section of the survey focused on resource use and dependency of the household. Questions were asked on existing relationships with the natural resources of the swamp such as extent of use for agriculture, hunting, fishing, mariculture and recreation. The frequency of use of the natural resources of the swamp was also queried based on number of trips to the swamps and hours spent there. The proportion of income obtained from use of resources from the swamp was also ascertained in this section. The use of the swamp for ecotourism activity was also determined. The main sources of income for the household, size of landholdings, capital assets and agricultural leases in the swamp (if any) were answered in this section.

Socioeconomic factors were covered in the fourth section of the questionnaire. This section covered demographic factors such as age, gender, education as well as household composition such as ethnicity, religion, occupation of household members, marital status and household size.

#### **Administration of Survey**

The survey instrument was initially tested in the Manzanilla area to avoid reduction of an already small sample pool. Based on feedback from this pre-test and from input by members of government agencies and the wider scientific community, questions were altered or removed as necessary.

Respondents were apprised of the intent of my study before the survey was administered (Reddy, 2002). The questionnaire was orally administered to heads of households from a total of 80 randomly selected households from the Plum Mitan and Kernahan/Cascadoux communities. In the event that the head of household was not available the next available adult member of the household with was questioned. The survey was approved by the University of Florida Institutional Review Board (Protocol #2006-U-541).

## **Dependency Model**

### **Calculation of Dependency**

Based on methods used by other researchers described previously, the proportion of income from the resource was used to estimate dependency. This relative value of resource dependency was used since it is easily calculated from information readily available from respondents, provides an acceptable indication of dependency and has been used in other studies such as by Gunatilake (1998). An indicator of household dependency on the Nariva Swamp was estimated using the ratio of income obtained from the swamp versus total income from all sources (agriculture, labor, swamp, capital assets) as reported in the survey (Gunatilake, 1998). The ratio obtained from this calculation was converted to a binary scale (0, 1) by assuming that a value equal to or greater than the mean of 0.26 (26% income dependent on the swamp) was assigned a value of 1 and below 0.26 was assigned a value of 0.

### **Logistic Regression Model**

Logistic regression analysis is very applicable to socioeconomic and other scientific research in which characteristics or variables can be defined as binary, dichotomous responses such as low or high (0 or 1). This regression methodology uses a model of the general form below and has been used widely in the social and natural sciences (Raftery, 2001).

$$\text{logit}(\pi) = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}$$

where  $X_{1i}$  to  $X_{ki}$  represents the predictors;  $\alpha$  is the intercept;  $\beta_1$  to  $\beta_k$  are coefficients of the predictors and  $\pi$  represents the probability of obtaining a value of 1 as the predicted response variable. For the purposes of my study, this response variable was resource dependency with 1 representing high dependency and 0 representing low dependency.

The variables or predictors used in the model were chosen based on the literature as well as the specific context of these communities. These variables were:

AGE – The age of the respondents was collected in categories which were converted to values from 1 to 5 for the purpose of analysis. It is expected that age would have a positive effect on dependency since it is expected that younger people in these communities would tend to find employment outside of the area and thus have lower dependency on the swamp.

GENDER – Females were assigned a value of 1 and males a value of 0. Gender may have a variable effect depending on the activities that are conducted with the resource (Gunatilake, 1998). If this activity is female oriented then there would be a positive effect on dependency of being female whereas male oriented activity would have a negative effect on this model.

EDUC – Education was categorized based on a range of no school to college level on a scale from 0 to 3. Education is expected to have a negative effect on dependency since more educated people would have a greater range of employment opportunities available.

LAND\_HOLD – This variable, landholding size was the absolute value of land under the control of the household in acres; this variable was used as a proxy for wealth. Since control of land should lead to income generating activities that do not involve swamp resources, this variable should have a negative effect on dependency.

DIVERS – Diversity of labor was calculated based on the occupations reported by the household and ranged from values of 1 to 3 as the number of jobs and hence income generating opportunities, available to the household. The greater number of occupations should lead to lower dependency since there are more options available for earning income besides the use of the resource (Gunatilake, 1998).

HHSIZE – Household size was a categorical variable and was converted into values from 1 to 3. This variable could have either a positive or negative effect on dependency since a larger number of people in a household could provide a greater variety of labor choices and hence lower dependency or the larger number of people may lead to a need for higher income which may require the use of swamp resources (Gunatilake, 1998).

NON\_SWAMP\_AG – Greater agricultural productivity should reduce resource dependency (Gunatilake, 1998). However, in these communities agricultural plots may be located in the swamp. In order to account for agricultural productivity that is not dependent on the swamp, an indicator variable was developed from survey response such that those who controlled agricultural land outside the swamp were assigned a value of 1 and all others, either agricultural land in the swamp or no agricultural land, were assigned a value of 0. It is expected that those with agricultural plots outside the swamp will have lower dependency.

LENGTH\_RES – Length of residency was a categorical variable that was converted to a range from 1 to 4 in the order of increasing residency in the area. It is expected that people who have lived in the area longer would have greater reliance on the swamp resources.

## **Results**

### **Sociodemographic Characteristics of Respondents**

The gender distribution of respondents was fairly even, 51.3% were female and 48.8% were male. In terms of education level, the majority of respondents (67.5%) attended school at

the primary level, 23% attended secondary or vocational school, 1.3% attended college and 7.5% never attended school. Household sizes varied from 1 to 4 persons (52.5%), to 5 to 8 persons (30%) to more than 8 persons (17.5%). Income levels were moderate to low, 58.8% reported annual incomes between TT 12,001 to 50,000, 37.5% had annual incomes lower than TT 12,000 and 3.8% reported incomes of TT 50,001 to 100,00 per year. The age of respondents were comprised of 33.8% in the 50 to 59 year range, 25% in the 30 to 39 range, 23.8% in the 40 to 49 category, 10% over 60 years of age and 7.5% between the ages of 18 and 29.

### **Pattern of Swamp Resource Use**

The Kernahan/Cascadoux and Plum Mitan communities use the resources in the Nariva Swamp mainly for agriculture and fishing (Table 2-1). In the Nariva Swamp area, some agriculture is done in the villages whereas others are done in the swamp itself. Agricultural crops include: watermelon, cucumber, pumpkin, string beans, mango, tomato and ochro with watermelon being the dominant crop planted in and around the swamp. Fishing is done mainly for cascadu, conch and crabs. Other uses of the swamp by the local people are recreation (including hiking, birdwatching, sightseeing), activities related to the Forestry Division, fuelwood and building material collection (Table 2-1). Most respondents (77.5%) actually go into the Nariva Swamp for one of these purposes.

Table 2-1. Numbers and percentages of respondents who enter the Nariva Swamp and their purpose.

Purpose for Entering the Swamp	Agriculture	Fishing	Recreation	Work for Forestry Division	Fuelwood	Building Materials
Number of respondents	16	40	16	2	2	2
Percentage of respondents	20%	50%	20%	2.5%	2.5%	2.5%

The main use of the resources in the swamp is for fishing (50% of respondents), followed by agriculture and recreation (Table 2-1). The other three uses are done on a very small scale by the community. None of the respondents reported income from ecotourism activities, such as tour guiding or handicraft sales, within the swamp. A small percentage of the respondents (22.5%) do not go into the Nariva Swamp at all, the main reason being that it is too far from their homes. Other reasons include: lack of time, interest and fear of officials (Table 2-2).

Table 2-2. Numbers and percentages of respondents who do not enter the Nariva Swamp and their reasons.

Reasons	Too far	No time	Do not want to be charged by Government officials	No interest	Other (unspecified)
Number of respondents	8	4	1	3	2
Percentage of respondents	10	5	1.25	3.75	2.5

### Dependency Model Results<sup>1</sup>

Based on the data collected, only 32.5% of the households in the Plum Mitan and Kernahan/Cascadoux communities were considered highly dependent on swamp resources. The mean number of hours spent in the swamp per week for the reasons described previously was 22.9 hours per week.

The regression model has significant overall predictive power with a model Chi-square value of 23.97 and  $P = 0.002$  indicating that the variables in the model adequately account for the variation in the dependent variable. The model has 70% correct predictive accuracy but the Log Likelihood value was high (81.88) and the  $R^2$  value was low (0.26) indicating that the model although significant overall provided a moderate (approx. 26%) explanation of dependency.

<sup>1</sup> The threshold or cut-off value for conversion of resource dependency to a binary scale was varied to determine the effect of this change on the model results. The results obtained from these models were not significantly different from the model depicted here and so were not included in these results.

These values suggest that there may be variable related to dependency that have not been described by this model.

Table 2-3. Logistic Regression for resource dependency (n= 80)

Variables	$\beta$ (coefficient)	S.E.	Wald	Significance	Exp (B)
Age	-0.636	0.279	5.180	0.023	0.530
Gender	-1.337	0.671	3.974	0.046	0.263
Educ	0.010	0.582	0	0.986	1.010
Land_hold	0.140	0.116	1.457	0.227	1.151
Divers	0.477	0.466	1.049	0.306	1.611
Hhsize	-0.081	0.384	0.044	0.834	0.923
Non_swamp_ag	-0.776	0.837	0.861	0.354	0.460
Length_res	0.834	0.501	2.772	0.096	2.303
Constant	-1.738	2.335	0.554	0.457	0.176

Significant predictors of the probability of high resource dependency were age, gender and length of residency at  $P < 0.1$  (Table 2-3). Age had a significant negative effect on resource dependency ( $\beta = -0.636$ ,  $P = 0.023$ ) at the  $\alpha = 0.05$  level. This negative effect of age on dependency was not as expected since older people are expected to be more dependent on resources. Instead with each unit increase in age, the probability of high resource dependency is multiplied by 0.53. This may be due to the fact that the main activities in the swamp, fishing and agriculture are more labor intensive than resource based activities in other parts of the world in which older people can readily participate. The labor intensive nature of these activities would mean that they are restricted to younger age groups.

Gender was also significant at the  $\alpha = 0.05$  level with females being less dependent than males ( $\beta = -1.34$ ,  $P = 0.046$ ). The effect of gender varies (Gunatilake, 1998) so that this effect is expected. In this community, males do a large proportion of fishing and agriculture so it is reasonable to expect that males will be more dependent on the swamp resources than females.

Length of residency had the predicted positive effect on dependency but at the  $\alpha = 0.10$  level ( $\beta = 0.834$ ,  $P = 0.096$ ). This suggests that those who have lived in the communities longer have a higher dependency on the natural resources. This probably occurs because those who live in an area longer are more familiar with the resource base and have had a longer time to develop efficient uses of the resource. Based on the odds ratio for this predictor, each categorical increase in length of residency will cause the odds of high resource dependency to be multiplied by 2.3.

The other predictors should be mentioned even though they did not have a significant effect on resource dependency. Education has a small positive effect on dependency, landholding size also has a small positive effect on dependency and since this was an indication of wealth it should have resulted in a negative effect (Table 2-3). However, since landholdings reported by respondents would have included lands in the swamp areas, this result is not unexpected for these particular communities. Labor diversification based on number of occupations listed for the household has a positive effect on dependency which again was not as predicted (Table 2-3). This may be due to the use of swamp resources for additional income by households. Household size has a small negative effect on dependency such that a larger household has lower dependency (Table 2-3). Since size of household has a variable effect on dependency, this result is possible since larger households have a greater number of people to generate income from non-resource based activities. The indicator for agricultural holdings that are not within the swamp had a negative effect on dependency meaning that those who have agricultural land outside of the swamp has a lower probability of dependency which is as expected (Table 2-3).

The general lack of significance of these predictors may be due to the generally low level of dependency of these communities so that they did not behave as rural communities in other parts of the world. These results emphasize the need for dependency studies specific to a location and context. Although this analysis was done using a logistic regression, due to the lack of significance of several variables that were expected to have an effect on dependency, the independent variables were tested for multicollinearity by producing a correlation matrix of the Pearsonian correlations for the independent variable (Table 2-4). This result shows that although some variables were considered to be significantly correlated (Table 2-4) none of these correlations were large indicating that multicollinearity was not a problem with these variables. In order to verify this result, the independent variables were also regressed against each other. Multicollinearity exists if  $R^2$  values for any of these regressions approach 1. For all of the regressions between the variables, none of the  $R^2$  values approached 1.

Table 2-4. Pearson correlation matrix for variables in Logistic Regression

	Age	Gender	Educ	Land_hold	Divers	Hhsize	Non_swamp_ag	Length_res
Age	1	0.141	-0.234(*)	-0.043	-0.230(*)	0.027	0.241(*)	0.203
Gender		1	0.276(*)	0.170	0.001	-0.219	0.399(**)	-0.140
Educ			1	-0.063	0.037	-0.194	0.178	-0.184
Land_hold				1	0.248(*)	0.272(*)	0.351(**)	-0.010
Divers					1	-0.001	0.147	0.053
Hhsize						1	0.002	0.185
Non_swamp_ag							1	0.132
Length_res								1

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

## Discussion

The Kernahan/Cascadoux and Plum Mitan communities did not have a large proportion of highly dependent households and the significant predictors of dependency were age, gender and length of residency. This result exemplifies the need for analyses of dependency on protected areas on a case by case basis within their specific localities and communities. The rural nature and general lack of wealth of these two communities would indicate that the communities would be heavily dependent on natural resources found within the swamp. The fact that the findings were actually the opposite of the expected situation may be due to under-reporting of income sources by respondents.

However, it may be also due to the fact that some of the issues that affect other rural communities would not apply in the Kernahan/Cascadoux and Plum Mitan communities. This may be because although these areas are considered rural due to the livelihood strategies employed, income levels and physical location, the small size of the country of Trinidad and Tobago means that no area is truly remote or subject to restrictions such as market access that are main factors in larger countries.

In addition, as stated by Cavendish (2000), household resource use may have changed over time. This is particularly applicable since the local people have said that resources such as fish and crabs have reduced over the years and that agriculture in the swamp is not sufficient to meet their needs. This implies that the resource has been degraded and they may have altered their livelihood strategies over time and become less dependent on these resources. Further ecological studies would be required to confirm this implication.

The need for alternative livelihood strategies calls for a compromise between local livelihood and conservation of natural resources (Heltberg, 2001). Increasing agricultural productivity and providing for opportunities that do not involve either agriculture or the natural

resource will help reduce dependency and any negative impacts (Gunatilake, 1998). It may be necessary to not only diversify income, which may not lead to higher income but instead promote specialized high gain activities (Vedeld et al., 2004). In order to improve the sustainability of forest dependent activities, investment should be made into eco-developmental projects that can both enhance conservation of the area and reduce unsustainable practices (Bahuguna, 2000).

One option for such activities in the Nariva Swamp is the development of ecotourism in the area. The local residents have expressed great interest in such activity but have stated that they lack the capacity to do so and would require assistance from those experienced in such activities. This type of income generating activity is especially important to the communities since jobs generated from reforestation and other ongoing management activities in the Nariva Swamp may not provide great levels of employment for the local community due to the small scale and incremental nature of such activities (R. Cross, personal communication, 2006)

It makes sense that maintaining and enhancing natural resources are in the best interest of rural communities since to some extent, they are dependent on them and although a comparatively small percentage, there are those who are highly dependent on these resources. Management guidelines governing resource use need to focus on changing people's behavior so that the rural poor can generate adequate income while also ensuring that the resource base is protected and improved (Reardon & Vosti, 1995).

Since it is difficult to quantify environmental services (such as the recreation and ecological function aspects of the Nariva Swamp), these services are not included in reported environmental incomes (Vedeld et al., 2004). In fact some communities have developed their own system of contributing or reinvesting to the natural capital without government intervention

(Cavendish, 2000). It is important to include environmental income in national statistics and assessment of the poor (Vedeld et al., 2004).

Despite the fact that the communities around the Nariva Swamp are not highly dependent on the resources based on income, due to their proximity to the swamp, they are closely associated with its resources. It is therefore important for them to be involved in the management of common resources from both an ecological and economic perspective (Adhikari et al., 2004). Common resources have both private and public aspects in that the resources themselves are public but the extracted items are used for private economic gain (Adhikari et al., 2004). Greater equity can be achieved in collective resource management if the needs of the poor are recognized and access to resources are adjusted accordingly in a participatory manner (Reddy & Chakravarty, 1999). In addition, increased awareness and education of the community on the possible impacts of excessive and unsustainable resource use would improve management (Reddy & Chakravarty, 1999).

Households spend less time on resource dependent labor if there are clear institutional rules associated with resource use (Bluffstone et al., 2001). When this time is allocated more efficiently, household members can engage in income generating activities that are not related to the resource and hence reduce their dependence (Bluffstone et al., 2001). The intimate association of communities with the natural resources as well as lack of benefits from resource use and restrictions placed on them by regulations combines to emphasize the need for participatory mechanisms to promote the conservation of the resource by locals (Gunatilake, 1998).

The benefits of biodiversity conservation are typically of national significance rather than local, a shift of benefits to include the local community would lead to better protection of

resources while reducing dependency (Gunatilake, 1998). In order to account for resource dependency by local people and enable the diversification of their income, conservation policies should have clear, negotiated access, withdrawal and responsibilities towards the resource in question (Vedeld et al., 2004). These arrangements need to be both secure and flexible so that changing conditions are accounted for (Vedeld et al., 2004). The community members from Kernahan/Cascadoux and Plum Mitan in focus group sessions as detailed in Chapter 4 were particularly concerned with issues of access to resources and loss of control of their land. Capacity building in all spheres of resource use and marketing should also be captured in the management plans (Vedeld et al., 2004).

The Nariva Swamp's designation as an ESA will have to include all these considerations in its management such that the community is involved in both the formulation of a management plan as well as its implementation. The guidelines of clear rules for access, institutional arrangements and capacity building are all essential for the effective management of this protected area so that the communities that depend on its resources are not negatively affected.

CHAPTER 3  
FACTORS INFLUENCING HOUSEHOLDS' ATTITUDE TOWARDS THE DESIGNATION  
OF THE NARIVA SWAMP AS AN ENVIRONMENTALLY SENSITIVE AREA

**Introduction**

Sustainability of protected areas is dependent on participation and support by local communities (Alexander, 2000). Basic conservation values and principles that are shared by the members of the public can be the basis of management goals and agreements (Miller and McGee, 2001). These community values and opinions are considered central to the objectives of resource management as well as the development of meaningful communication between different stakeholders and managers to develop stakeholder participation in conservation (Miller and McGee, 2001).

By assessing the attitudes and perceptions of local communities towards protected areas, management projects can be altered to better align the project's development with local needs (Alexander, 2000). It is crucial to determine whether local communities understand and are in support of conservation measures, their attitudes toward the PA, the benefits to locals and the extent of these benefits and their attitudes about management of the PA (Alexander, 2000).

As discussed in McFarlane and Boxall (2000), there is a hierarchy of participatory or non-participatory behavior by stakeholders in collective resource management, such that values and beliefs affect people's attitudes such as preferences for management that in turn affect their specific actions or behavior. These actions or behavior can consequently affect natural resource policy and management (McFarlane and Boxall, 2000). Based on this causal relationship, it is important to identify the factors that affect stakeholder attitudes in order to achieve effective policy implementation and sustainable management strategies (McFarlane and Boxall, 2000; Weladji et al., 2003; Alexander, 2000).

My study describes the attitudes of community members towards the designation of the Nariva Swamp, Trinidad and Tobago as a protected area, designated as an Environmentally Sensitive Area (ESA). In order to do this, community members were asked their perceptions on protecting the swamp area as well as the biodiversity contained within it. This was done via an administered survey to establish whether their attitudes are favorable towards conservation or not. The variables that affect these attitudes were then examined using regression analyses, both logistic and multiple linear regressions. Some of the variables that are expected to affect attitude towards protected areas are age, gender, income, education, landholding, dependency and length of residency.

Behavioral intention was also assessed in order to establish the link suggested by the between positive attitude towards PAs and positive behavioral intention, which should then translate into the future participation of community members in management of the Nariva Swamp. The findings of my study could then be used to inform the direction of future management plans to include age-appropriate education and awareness programs, improved communication between community members and government officials and measures directed to promote positive attitudes based specifically on the variables that affect these attitudes in the Kernahan/Cascadoux and Plum Mitan communities.

## **Literature Review**

### **Effect of Attitudes on Behavior**

One definition of attitude involves how a person feels towards an issue, whether this is positive or negative (Ajzen & Fishbein, 1980). There is generally a correlation between values, attitudes and behavior whereby beliefs/values, attitudes, intentions and behavior are thought to build on each other (Vaske and Donnelly, 1999) as depicted in Figure 3-1. The values of

different user groups such as preservationists and extractive users, affects their behavior (Vaske and Donnelly, 1999).

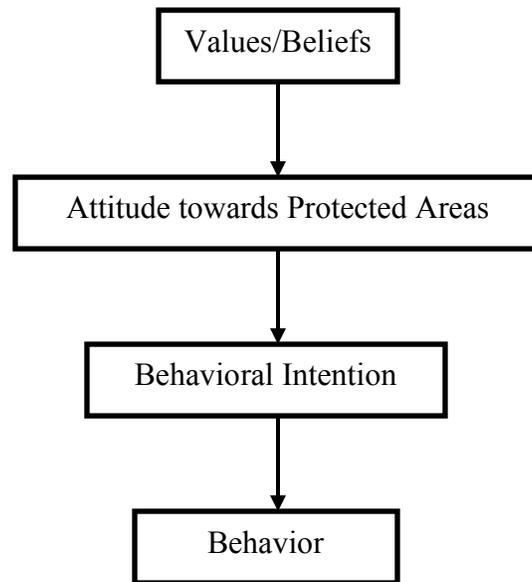


Figure 3-1. Suggested link between attitude towards protected areas and behavior.

When attempting to affect people's behavior, such as in environmental conservation, it is important to determine both their attitudes and beliefs to plan the appropriate conservation programs (Aipanjiguly et al., 2003). Behavior may be affected by altering beliefs and/or perceptions of outcomes of action as well as altering motivation for compliance with the specific behavior being changed (Bright et al., 1993). A study showed that for the National Parks Burn Policy and that changing beliefs about behavior also changes attitudes about this behavior and hence behavioral intention (Bright et al., 1993).

Behavior may be altered by education, institutional changes or technology (Stern, 1999). Persuasive communication can be used to alter beliefs and attitudes about a policy by specifically addressing these beliefs and attitudes (Bright et al., 1993). Communication targeted to changing behavior should also include the consequences of certain behaviors and actions rather than the target of the behavior itself (Bright et al., 1993).

Attitudes of local communities toward PAs will be more positive if they receive greater benefits from natural resource protection and participate directly in PA management (Alexander, 2000). When the local community has a negative attitude towards PAs and do not obtain benefits from the designation, the protection of such an area is more difficult and may not be successful in terms of resource conservation, as was found in PAs in India (Alexander, 2000). To avoid this negative attitude, local communities should be involved in the planning and management of protected areas (PAs) from its initial stages (Alexander, 2000).

For example, in the marine park, Wakatobi National Park (WNP), Sulawesi, Indonesia, management based on rules and regulations alone has led to a lack of equity and efficacy of the Park's management (Elliot et al., 2001). This previous management plan for the WNP did not include sufficient local consultation and failed to meet the needs of the communities that live within the park (Elliot et al., 2001). According to Elliot et al. (2001), several researchers have indicated that increased participation by local people and addressing the needs of these communities can improve the success of PA management plans and may even contribute to achieving resource management objectives at a national and global scale.

In another study of the attitudes of local communities to Bénoué Wildlife Conservation Area (BWCA) and Cameroonian wildlife policy (Weladji et al., 2003), it was found that there was variation in community attitudes among three different communities (Weladji et al., 2003). This was caused in part by the disassociation of local people and their subsistence activities in PAs until the late 1970's leading to negative economic impacts and consequent negative attitudes of the local communities (Weladji et al., 2003). Participatory approaches changed the focus to inclusion of local communities and their needs into sustainable conservation measures thus changing their attitudes to more positive ones (Weladji et al., 2003).

## **Factors affecting Community Attitudes**

There are differing results of studies on the factors that affect the attitudes of communities to conservation and PAs. In a study by McFarlane and Boxall (2000), two user groups were studied on the basis of socioeconomic variables, forest knowledge and values, social influences and preferences about management of the forest. The variables assessed by McFarlane and Boxall (2000) were age, gender, place of residence (proximity to urban centers), education, household income, dependence on natural resources for livelihood, membership in a conservation organization and forest recreation activity.

According to McFarlane and Boxall (2000), other studies as well as their study conducted in Canada have shown that place of residence, education and age are consistent predictors of positive attitudes towards the natural environment. Income and gender were found to be not as consistent when determining environmental attitudes (McFarlane and Boxall, 2000). Based on the results of this and previous studies, it is expected that persons who have greater amounts of knowledge about protected areas and natural resources will exhibit more positive attitudes about natural resource protection than those with less knowledge about these issues (McFarlane and Boxall, 2000). It is also expected that women, younger people, people living in urban areas, more educated people and people who are not dependent on forests for income will be more supportive of sustainable natural resource management (McFarlane and Boxall, 2000).

In the study of the BWCA and towards Cameroonian wildlife policy (Weladji et al., 2003), knowledge of the wildlife policy did not affect support of the policy by locals since most of those with low knowledge still expressed their support (Weladji et al., 2003). However, input into management and benefits from hunting activities were concerns expressed by local communities (Weladji et al., 2003). Results of this study differed from other studies in that level of education and financial status did not positively influence attitude to wildlife (Weladji et al., 2003).

Similarly, in the Greater St Lucia Wetland Park in South Africa, communities did not perceive that conservation and tourism in the PA was of any benefit to them in the past (Picard, 2003). The present attitudes of local communities recognize the integration of conservation and community development and the low socioeconomic status of some communities did not diminish this attitude (Picard, 2003).

Additionally, in Natal, South Africa, it was determined that greater education and financial status indicated positive attitudes towards PAs whereas ineffective involvement of local communities in PA establishment and management as well as inequitable distribution of benefits was associated with negative attitudes to PAs (Alexander, 2000). In Indonesia, lack of access to a sustainable livelihood and poverty were also factors that negatively affected the sustainable use of natural resources by local communities (Elliot et al., 2001). Lack of communication to the communities and the general public about the demarcated or restricted zones of the park also led to negative attitudes (Elliot et al., 2001). Local people were generally in favor of conserving the resources of the park by preventing environmentally unsustainable practices but they believed that this protection should not completely prevent their ability to earn a livelihood in the park or cause a loss in net income (Elliot et al., 2001). This study identified the specific areas that need to be addressed in the park's management such as diversification of economic pursuits and increased development of tourism (Elliot et al., 2001).

## **Methods**

### **Household Survey**

The survey was administered and the study site was the same as described in Chapter 2.

### **Survey Design**

The first section of the survey covered the attitudes of households towards conservation and protected areas (Appendix A). Nine statements were used to assess attitudes and included

topics such as whether biodiversity conservation is a good idea and whether benefits can be obtained from protection of natural resources. They also included specific statements about ESA designation of the Nariva Swamp and if this protection could negatively affect them. Three of the questions were negatively worded to ensure that the answers given were unbiased by the wording of the statements. The respondents were asked to choose their response on a 5-point scale (0 to 4) to determine whether they strongly agree to strongly disagree and 0 if they did not have an opinion on that particular statement.

The final question in this section of the survey asked respondents to rank the issues on a scale of 1 to 5 in order of importance to the communities. These were limited land and food, lack of utilities, lack of access to the swamp and lack of good quality access roads to the community. These questions were used to ascertain some of the reasons for people's attitudes towards protected areas in these two communities. Behavioral intention and by extension predicted participatory behavior, was assessed via a single statement of intention. This took the form of asking respondents whether they would be willing to participate in management of the swamp by attending meetings and other related activities. This question was located in the third section of the survey and a simple yes/no response was required.

### **Regression Models of Attitude towards Protected Areas**

Since researchers use both logistic regression and multiple linear regression (MLR) in assessing conservation attitudes and both approaches are valid methods for this type of analysis, it was considered beneficial to produce both models for comparative purposes. In the case of logistic regression models, the resultant predictions apply to the probability of the favorable event occurring, in this case the probability of a high or positive attitude towards protection of the Nariva Swamp. The MLR model produces a more direct prediction of the effect of

independent variables on the actual attitude towards PAs of the households, rather than the probability, by attempting to fit a linear relationship among the variables.

The same independent variables were used for both regression models. These were:

AGE – The age of the respondents was collected in categories which were converted to values from 1 to 5 for the purpose of analysis. It is expected that age would have a negative effect on conservation attitude since it is expected that younger people would have greater knowledge about conservation and would have more favorable attitudes towards PAs (McFarlane and Boxall, 2000).

GENDER – Females were assigned a value of 1 and males a value of 0. Gender tends to be inconsistent in the prediction of conservation attitude (McFarlane and Boxall, 2000) but for the purposes of this analysis it was expected that females will have more positive attitudes towards PAs.

EDUC – Education was categorized based on a range of no school to college level on a scale from 0 to 3. Education was expected to have a positive effect on attitude because those with higher levels of education should have been exposed to greater knowledge about the importance of natural resource management.

LAND\_HOLD – Landholding size was the absolute value of land under the control of the household in acres and is used to account for property ownership. It was expected that those who had more land under their control would have a more positive attitude towards protection of the swamp since they are less likely to be affected by changes in access to the resources.

TOTAL\_INCOME – This variable was categorized on a scale from 1 to 4 based on the survey results for annual household income. This variable is inconsistent when predicting

conservation attitudes and so may be either a positive or negative predictor in the models (McFarlane and Boxall, 2000).

DEPEN – Dependency was previously calculated (Chapter 2) and is a binary variable (0, 1) representing high and low dependency on swamp resources. Those who are more dependent on these resources will tend to have a more negative attitude towards protection of the swamp.

LENGTH\_RES – Length of residency was a categorical variable that was converted to a range from 1 to 4 in the order of increasing residency in the area. It is expected that people who have lived in the area longer would have a more negative attitude towards PAs since they might view changes in swamp management as changes in tradition and access.

LAND\_LIM – This variable was used as an indicator of householders' perception that the main issue in the community is a lack of sufficient land. Those who considered this important to most important were assigned a value of 1 and all others were assigned a value of 0. This variable was expected to have a negative effect on attitude since protection of the swamp could be considered a further limitation on land available.

FOOD\_LIM – The lack of food was used as an indicator of poverty and was assigned a value of 1 if considered important to most important and 0 otherwise. Poorer people tend to have a more negative attitude toward protection of natural resources.

ACCESS\_LIM – Limitations on access to the swamp and its resources was assigned a value of 1 if the respondents considered this issues to be important, more important or most important and if not, it was given a value of 0. Those who consider access limitations to be an important issue would tend to have a more negative attitude towards PAs.

### **Multiple Linear Regression**

The model of household attitude towards designation of the Nariva Swamp as an ESA is as shown below.

$$Y = a + b_1V_1 + b_2V_2 + b_3V_3 + b_4V_4 + \dots + b_xV_x$$

Where Y = ATTITUDE (dependent variable), a = constant,  $b_1$  to  $b_x$  are the coefficients of the independent variables and  $V_1$  to  $V_x$  are the independent variables as described above.

The dependent variable ATTITUDE was an index calculated by finding the mean of the responses from the nine statements described above after first reversing the values for the three negative statements. This resulted in a numeric variable from 0 to 4.

### **Logistic Regression**

The logistic regression model is shown below:

$$\text{logit}(\pi) = \alpha + \beta_1X_{1i} + \beta_2X_{2i} + \dots + \beta_kX_{ki}$$

where  $X_{1i}$  to  $X_{ki}$  represents the predictors;  $\alpha$  is the intercept;  $\beta_1$  to  $\beta_k$  are coefficients of the predictors and  $\pi$  represents the probability of obtaining a value of 1 as the predicted response variable.

The dependent variable for this model was BINARY\_ATTITUDE which was calculated using the scores for attitude determined above. The median value of 2.5 was used as the threshold value for positive and negative attitudes such that attitude scores equal to or greater than 2.5 were assigned a value of 1 and attitudes with a value less than 2.5 were assigned a value of 0.

Behavioral intention and attitude were regressed against each other using a logistic regression model as described above in which behavioral intention was the binary dependent variable and attitude before conversion to binary form was the independent variable.

### **Results**

The 9 items used on the questionnaire to develop the index for conservation attitude was tested for reliability by calculating Cronbach's Alpha which resulted in an acceptable value of  $\alpha = 0.67$ . Aggregation of the questionnaire items to calculate the attitude index showed that the 80

households sampled in the Kernahan/Cascadoux and Plum Mitan communities exhibited 56.3% positive attitude towards conservation and ESA designation. Among these households, the most important issue was considered to be a lack of adequate quality access roads into the community (Table 3-1) followed closely by a lack of utilities, mainly electricity and water. Community members from Kernahan/Cascadoux indicated that electricity was only supplied to the area eight years ago and many people still do not have a pipe borne water supply.

Table 3-1. Proportion of respondents who consider an issue important

Issue	Percentage respondents
Lack of Adequate Access Roads to the Community	73.8%
Lack of Utilities	67.5%
Limited Food	56.3%
Lack of Access to Swamp	58.8%
Limited Land	43.8%

### Multiple Linear Regression Model of Attitude

The mean value of attitude towards conservation, protected areas and ESA designation of the Nariva Swamp was 2.64 (Std. Deviation = 0.69). The MLR model was significant for the ten (10) independent variables selected with an F-statistic of 4.78 and P-value < 0.001. These ten (10) predictors explained 44% of the variance in this model of attitude towards PAs ( $R^2 = 0.44$ ). Of these predictors, those considered significant were AGE and LAND\_HOLD (Table 3-2).

Age had a negative effect on attitude ( $b = -0.29$ ,  $P < 0.001$ ) meaning that older people have a less favorable attitude towards conservation and ESA designation. This was as predicted from the literature since young people may have had more exposure to environmental awareness at school and may be less concerned with traditional access to the Nariva Swamp. Landholding size had the expected positive effect on attitude ( $b = 0.11$ ,  $P < 0.001$ ) since people who have more personal resources, as indicated by landholding size, tend to have more positive attitudes

towards conservation issues especially since they would be less affected by changes in access to the swamp.

The other independent variables, although not significant predictors of attitudes towards PAs in this model, (Table 3-2) that had the expected effect on attitude were dependency, education, land\_lim and access\_lim. Dependency showed a small negative effect on attitudes (b = -0.07) and education was predicted to have a positive effect on attitude (Table 3-2).

Table 3-2. Multiple Linear Regression of attitudes towards protected areas

Variables	b	S.E.	t	Significance	VIF (Collinearity Statistic)
(Constant)	2.930	0.590	4.964	0	
Total_income	-0.110	0.162	-0.677	0.501	1.959
Depen	-0.070	0.171	-0.409	0.684	1.608
Age	-0.294	0.074	-3.988	0	1.724
Gender	-0.233	0.151	-1.538	0.129	1.428
Educ	0.188	0.127	1.475	0.145	1.329
Land_hold	0.110	0.026	4.262	0	1.576
Length_res	0.109	0.102	1.078	0.285	1.288
Land_lim	-0.249	0.181	-1.373	0.174	2.021
Food_lim	0.224	0.186	1.206	0.232	2.133
Access_lim	-0.025	0.223	-0.112	0.911	3.026

Those who considered lack of land and lack of access to swamp resources as important issues in the community had more negative attitudes towards protected areas. Of the remaining predictors, those with greater income had a less favorable attitude toward ESA designation (Table 3-2) and females had a less favorable attitude than males. Respondents who lived in the area longer and those who considered lack of food as important issues had more positive attitudes towards ESA designation which was not as expected from the literature.

Due to the moderate  $R^2$  value (0.44), multicollinearity among the independent variables was assessed using a collinearity statistic (VIF in Table 3-2). Collinearity is considered to exist if the VIF value approaches 10 which did not occur in this analysis. This results combined with the relatively small values of the coefficients of the predictors suggests that there may be other factors not included in this model analysis that may account for attitude towards protected areas in these two communities.

### **Logistic Regression Model of Attitude**

This model predicted the probability of a positive or favorable attitude towards protected areas and ESA designation. The overall model was considered highly significant, having a chi-square value of 48.97 ( $P < 0.001$ ). The -2 Log Likelihood value, which should be as small as possible was 60.69 and  $R^2$  was 0.61 meaning that 61% of variance in probability of positive attitude was explained by this model. In terms of accuracy, 85% of responses were correctly predicted by the model.

In terms of significant predictors, the results produced by this model were different from those in the MLR model in that there were a greater number of significant predictors (Table 3-3). Age and landholding size were both significant predictors as found in the MLR model but gender and land\_lim were also significant predictors in this model. Age exhibited a negative effect on the probability of a positive attitude ( $\beta = -1.62$ ,  $P = 0.002$ ) significant at the  $\alpha = 0.05$  level. Younger people are 0.2 times more likely to have a high attitude towards protected areas. Landholding size also had a similar effect as the MLR model such that those with more land are 1.82 times more likely to have a favorable attitude towards PAs ( $\beta = -0.6$ ,  $P = 0.001$ ,  $\alpha = 0.05$ )

Gender was predicted to have a significant effect on attitude ( $\beta = -1.58$ ,  $P = 0.08$ ) at an  $\alpha = 0.10$  level. This result indicated that females are 0.21 times more likely to have a negative attitude towards protected areas than males. Limitation on land availability (Land\_lim) was also

a significant predictor of probability of positive attitude at the  $\alpha = 0.05$  level. For this predictor, those who consider a lack of land availability to be an important issue in the community are 0.06 times more likely to have an unfavorable attitudes towards ESA designation ( $\beta = -2.89$ ,  $P = 0.01$ ).

Table 3-3. Logistic Regression of attitudes towards protected areas

Variables	$\beta$ (coefficient)	S.E.	Wald	Significance	Exp (B)
Total_income	-0.275	0.991	0.077	0.782	0.760
Depen	-1.284	0.999	1.653	0.199	0.277
Age	-1.620	0.514	9.914	0.002	0.198
Gender	-1.577	0.906	3.028	0.082	0.207
Educ	0.802	0.776	1.069	0.301	2.230
Land_hold	0.597	0.182	10.805	0.001	1.817
Length_res	0.621	0.536	1.340	0.247	1.861
Land_lim	-2.894	1.171	6.107	0.013	0.055
Food_lim	1.497	0.964	2.414	0.120	4.470
Access_lim	-0.353	1.119	0.099	0.752	0.703
Constant	2.777	3.761	0.545	0.460	16.078

The non-significant predictors: income, dependency and access\_lim all had negative effects on attitude (Table 3-3). Education, length of residency and food\_lim had positive effects on the probability of a high or positive attitude towards PAs (Table 3-3). The results of the regression analyses showed that those with larger landholdings were more positive towards protecting the swamp whereas those with higher incomes were more negative. This would appear to be contradictory since they should both be indicators of wealth and wealthier people were expected to have favorable attitudes towards protected areas.

However, those with more land would consider the effects of ESA designation in a favorable light since any restrictions on the use of land in the swamp would be offset by their

existing landholdings, whereas income may be earned from swamp resources so even if income is higher, these respondents may believe that protecting the swamp could curtail their income. Those who considered lack of food as an important issue also had a positive attitude. In comparison, the logistic model appeared to have greater explanatory power in this case since the  $R^2$  value was higher than the value obtained for the MLR model and more predictors were found to be significant.

### **Logistic Regression of Behavioral Intention and Attitude**

In the analysis of behavioral intention, 70% of the respondents indicated that they intend to participate in management activities related to the ESA designation of the Nariva Swamp. This proportion was higher than the value obtained for positive attitudes which suggests that even those with a low or negative attitude towards PAs in general would be willing to participate in meetings and other management related endeavors.

The regression of behavioral intention versus attitude towards PAs resulted in a significant model (chi-square = 6.32,  $P = 0.01$ ) although the  $R^2$  value was small (0.11) and the -2 Log Likelihood was high (94.58). This  $R^2$  result was not a problem in this instance since it was expected that attitude would not be the only predictor of behavioral intention but rather the analysis was performed to see if this relationship between probability of positive behavioral intention and attitude was significant. The model showed that there was a significant relationship between these two factors and also that a more positive attitude towards PAs would have a positive effect on behavioral intention ( $\beta = 0.91$ ,  $P = 0.02$ ,  $\alpha = 0.05$ ). A person with a more positive attitude towards PAs would be 2.49 times more likely to intend to participate in management of a PA.

## Discussion

The results of attitude studies in relation to natural resources and conservation tend to vary for different communities, countries and regions. This was exemplified by the results of my study of the Kernahan/Cascadoux and Plum Mitan communities in the Nariva Swamp, Trinidad and Tobago, since variables such as income and length of residency did not have the predicted effect on attitude towards protected areas whereas other variables, such as age and landholding size performed as expected. The analysis of attitudes towards protected areas is particularly applicable to the designation of the Nariva Swamp as an ESA since the lessons learned from other regions can be applied to this designation from the initial stages and local communities can be included at this relatively early stage in planning and management.

The comparison of the two different types of regression (logistic and multiple linear) in the analysis of attitudes toward protection of the Nariva Swamp resulted in differing numbers of significant predictors. The MLR resulted in 2 significant predictors, age and landholding size whereas the logistic regression resulted in 4 significant predictors, age, landholding, lack of land availability and gender. Using the results from the logistic regression model, since the  $R^2$  value for this model was higher (0.61), it can be inferred that in order to improve attitudes towards ESA designation of the Nariva Swamp, these are the four variables that must be taken into consideration.

Lack of available land is one of these predictors whereby those who thought this was an important issue had a less favorable attitude towards the protection of the swamp. This was further emphasized by the fact that the community members expressed grave concerns about the loss of their land. Many respondents thought that ESA designation would lead to the government renegeing on the leases they hold or in the cases where there were no legal documents, on the property they live on. The government agencies need to communicate the

exact details of the ESA designation and need to make clear that the Kernahan/Cascadoux and Plum Mitan villages are not included in the ESA and that only illegal activities such as planting crops in the ESA will be removed (R. Cross, personal communication, 2006).

Age as a significant predictor implies that information and participation need to target older groups since younger ones are already more positive towards protected areas. Gender has a similar connotation since females had a more negative attitude towards protection of the swamp than males. This indicates that effort needs to be made to reach out to women in the community and ensure their participation in conservation activities. Specifically designed awareness and education programs on the importance of protected areas and the Nariva Swamp in particular can be presented to older people and women at sessions to which they are personally invited rather than just as a part of the wider community.

It is predicted that positive attitude will lead to positive behavioral intention and hence to favorable action. Based on the analysis of attitude towards protection of the Nariva Swamp, a significant relationship between positive attitude and positive behavioral intention exists thus verifying the validity of this prediction for this particular case study. By extension, those with positive behavioral intention, in this case a willingness to participate in co-management of the Nariva Swamp should actually fulfill this intention and exhibit participatory behavior.

Interpretation of this model as an absolute predictor of positive outcomes should still be done with caution since Sheppard et al. (1988) found that uncertainty exists about the association of behavioral intention and actual outcome. Nevertheless to ensure that behavioral intention translates into participatory behavior, positive attitudes need to be encouraged since the link has been established. Other factors must be implemented in order to promote a desired outcome

including cooperation among groups, such as government, community and NGOs, as well as adequate physical and financial resources to support these outcomes (Sheppard et al., 1988).

Positive attitude towards PAs was exhibited by 56.3% of respondents and 70% of these same respondents expressed the intention to participate in management of the Nariva Swamp. Attitudes towards protection of the Nariva Swamp is considered to have improved over the past ten (10) years since there has been a reduction in poaching and associated fines in restricted areas (D. Boodoo, personal communication, 2006). However, there is still a need to continue to improve this proportion of positive attitudes in order to optimize the probability of achieving successful management of the Nariva Swamp as an ESA. Levels of both positive attitude and behavioral intention should be maximized since actual outcomes often differ from the predicted participation level.

This can be partially achieved by increasing the knowledge of the community members about natural resources and the benefits of protecting the Nariva Swamp. Pro-conservation behavior can also be affected by addressing the underlying values, beliefs and motivations through persuasive communication (Bright et al., 1993). For example, this type of communication to the communities can be targeted to change behavior by explaining the consequences of certain behaviors and actions, in this instance unsustainable use of the swamp resources leading to degradation of the resource itself, rather than addressing only the issues associated with managing the resource.

Another key element of any communication and education programs in the swamp must be the identification of benefits from the designation (Alexander, 2000). Failure to identify discernable benefits of conservation initiatives to local people can lead to a lack of effective protection of natural resources (Picard, 2003). A lack of communication about the Nariva

Swamp, the ESA designation and its boundaries, zones and restrictions to the Kernahan/Cascadoux and Plum Mitan communities was identified as a serious concern by community members.

There are certain decisions that have already been made with respect to the ESA designation of the Nariva Swamp. This information was contained in an administrative record that was open to public comment (EMA, 2006) including information on the ESA Rules and the intention to designate the swamp as a “managed resource” according to IUCN categories. The local media was used to communicate the availability of this record for public comment (EMA, 2005). However, several members of the local communities indicated that they were not aware of this record and never viewed the information. Communication efforts need to be increased and should include transparent and continuous avenues of communication with local communities (Elliot et al., 2001).

Participatory approaches can also lead to more positive attitudes towards protected areas as well as a reduction in future conflict and enforcement requirements (Weladji et al., 2003; Kessler, 2004). Empowerment of the community is important whereby they are allowed to provide information and address their concerns in a manner that ensures that this information is integrated into the management process (Kessler, 2004). Behavior may also be altered by institutional changes (Stern, 1999) so that the communities can be a more integral part of management of the swamp.

Management of the Nariva Swamp needs to change and depart from the old ways of doing things whereby the government makes decisions and the people are expected to comply. The communities feel that in the past, rules and regulations have been put in place to govern the swamp without meaningful consultation with them. This lack of inclusion of the communities in

management does not lead to positive attitudes towards protected areas and given the need for participatory behavior by the communities for effective management and protection of the swamp, they must be included in the present and future decisions about the Nariva Swamp.

CHAPTER 4  
FACTORS INFLUENCING HOUSEHOLDS' PERCEIVED SOCIOECONOMIC IMPACTS  
OF DESIGNATING THE NARIVA SWAMP AS AN ENVIRONMENTALLY SENSITIVE  
AREA

**Introduction**

People's support is required for long-term conservation success but will not provide this support if their costs (negative impacts) exceed their benefits (positive impacts) (Gillingham and Lee, 2003). Although positive perception of impacts is not an absolute determinant of change in behavior, it is one necessary factor in contributing to such changes (Marcus, 2001). Local communities should therefore obtain a significant proportion of socioeconomic benefits from activities such as ecotourism within PAs rather than be burdened by negative impacts (costs) of designation of the PA (Alexander, 2000). Therefore, the relationship of the adjacent human populace to a PA should be examined in order to obtain simultaneous conservation and development (Gillingham and Lee, 2003).

The use of rules and regulations alone, such as restrictions on use of an area, has been ineffective in achieving natural resource management (Elliot et al., 2001). Realistically, developing countries lack the finances and personnel to monitor these restrictions effectively leading to non-enforcement of the rules prescribed by legislation (Elliot et al., 2001). These types of regulations may in fact have a negative effect on the livelihood of the local community who in turn will not support the PA and will not abide by the prescribed regulations (Elliot et al., 2001). In addition, livelihoods of communities that depend on traditional uses of natural resources may be impacted by the protection of these resources for alternative uses (Alexander, 2000). When local communities are excluded from these activities they may also increasingly use the resources surrounding the PA leading to degradation of these areas (Alexander, 2000).

The importance of positive community perception to PA management illustrates the need to identify these perceptions and values when implementing a PA and the necessity of communicating these perceptions to government personnel. In order to achieve this for the Nariva Swamp, Trinidad and Tobago, the two communities in closest proximity to the swamp (Kernahan/Cascadoux and Plum Mitan villages) were asked to identify and quantify the potential impacts that they perceive will occur when the swamp is designated as an ESA. This was done using a matrix analysis approach as well as a SWOT-AHP methodology. Both methodologies were used so that a wide range of opinions could be solicited from both communities through the impact matrix analysis on socioeconomic issues and more specific information could be obtained from people within the community with particular interests on a broader range of impacts using the SWOT-AHP method.

The matrix approach was accomplished via a household survey of the two communities in which respondents were asked to assess the strength of potential socioeconomic impacts and whether these would be positive or negative. Relative weights of impacts were obtained from key informants within the communities and cumulative impacts were calculated using the product of magnitude and weight of impacts. This enabled an additive determination of perceived impacts for the communities as well as a regression analysis of the variables that affect these perceptions on a household level.

SWOT-AHP was also used to quantify impacts based on the analysis of strengths, weaknesses, opportunities and threats (SWOT) followed by the application of the Analytical Hierarchy Process (AHP) to allow for comparisons among these groups. This analysis was done to identify the SWOT factors in a holistic manner so that other potential impacts besides the socioeconomic ones covered in the survey could be identified. This was achieved in a focus

group setting with participants from three categories of interest groups within the community: general community members, members of an environmental group and a small scale ecotourism operator.

The results of the matrix analysis and SWOT-AHP exercise identify the socioeconomic factors that affect the community members' perception of impacts of the ESA designation of the Nariva Swamp as well as the SWOT factors and their relative importance. The combination of these analyses can inform management plans so that strengths and opportunities are maximized and weaknesses and threats are minimized. Similarly, other impacts identified through the matrix analysis can be addressed whereby the positive impacts are emphasized and negative ones are mitigated based on the underlying factors that predict impact perception as identified by the regression analysis.

## **Literature Review**

### **Perception of Impact of Stakeholders in Protected Areas**

Perceived benefits and community involvement in management tend to increase the success of PA management (McClanahan et al., 2005; Marcus, 2001). Whereas the PAs may be primarily established for the conservation of biophysical resources, it is important to include stakeholder perception in the ways in which this protection is implemented to include the perceived benefits of impacted communities (Alexander, 2000). As in the case of wildlife crop damage in six PAs in Tanzania, perceived impacts may be overestimated as compared to its real value but perceived impacts of villagers must be given consideration and it is important to understand the factors affecting this perception and ways in which negative impact perception can be made more positive (Gillingham and Lee, 2003).

Socioeconomic impacts of PA designation include people's way of life, change in status of employment, their culture, their community, their environment and resource management, their

health and wellbeing, their fears and aspirations and their local economy (Vanclay, 1999; Vanclay et al., 2000; Fortin and Gagnon, 1999). The expected positive impacts of a PA include employment opportunities from conservation activities and improved living conditions (Alexander, 2000). In Belize, there were few perceived problems by the local stakeholders caused by the creation of a wildlife sanctuary (Alexander, 2000). Of the few problems that were reported, temporal changes in local management and uneven benefit distribution from tourism employment were identified (Alexander, 2000). Perception of these problems arose when benefits were no longer experienced on a personal level such as education and economic benefits from tourism revenue (Alexander, 2000).

Other perceived negative impacts included land use restrictions but the local people perceived that long term benefits such as tourism revenue and infrastructure offset these negative impacts (Alexander, 2000). Some of the concerns of local communities near the wildlife sanctuary in Belize included fair distribution of employment benefits, inclusion in management and effectiveness of this management, amount of local participation and education of the community on natural resources (Alexander, 2000). These issues are especially problematic in developing countries where populations are increasing and financial and human resources needed for the effective management of PAs are lacking (Alexander, 2000).

### **Socioeconomic Impacts of Carbon Sequestration and Reforestation Projects**

In the past, forest conservation projects in developing countries have not been economically viable despite an increase in activities such as ecotourism (Hardner et al., 2000). It is therefore important to assess the distribution of benefits, views and awareness of the local communities about the long-term implications of protected area programs (Reddy, 2002). The socioeconomic benefits and/or impacts from such projects tend to be highly variable and are unique to the location of the project in question because they will depend on the specific context

in which the project is implemented with regards to existing land use practices and proposed changes to these uses (Kueppers et al., 2004; Hardner et al., 2000).

The complexity of rural, low income communities indicates that a lack of involvement of local stakeholders and access by these stakeholders to resources will not succeed (Boyd et al., 2005). This stakeholder participation and buy in will contribute to long term project success because the local community will monitor the area for fire and pests, illegal logging and illegal encroachment (Boyd et al., 2005). In addition, climate change mitigation projects that improve or maintain the socioeconomic environment will tend to obtain the support of local communities and have a higher probability of success (Kueppers et al., 2004). A project that produces greater negative impacts will tend to face resistance by locals (Kueppers et al., 2004). Impacts on livelihood, traditional rights and equity across stakeholders are important especially when projects occur in rural, low income communities (Asquith et al., 2002; Boyd et al., 2005).

Equity involves inclusion and fairness of the distribution of present and future benefits (Brown and Corbera, 2003). This may take the form of financial benefits to locals who might lose short term benefits to obtain long term ones (Brown and Corbera, 2003). Equity also involves the inclusion of all stakeholders in decision-making processes so that power and knowledge are not factors that exclude some members of the community (Brown and Corbera, 2003). Property rights are one aspect of equity that must be considered since some communities have informal systems of access to natural resources which may exclude them from obtaining benefits from reforestation projects (Brown and Corbera, 2003).

Social and economic welfare must also be an important component of carbon projects, such as reforestation or agroforestry projects, to ensure social viability (Brown and Corbera, 2003). In order to obtain benefits to both natural resources and local people, projects should be

formulated to ensure that locals are empowered and social capital is created and enhanced (May et al., 2003). Research is lacking on the benefits that may be created for the local communities impacted by these projects (May et al., 2003). Villagers in a study by Reddy (2002) indicated that a plantation in Southeast Asia used for carbon sequestration was also a source of employment and an economic source both from local use of its products as well as sale of these products on the market (Reddy, 2002). Negative perceptions of this carbon sequestration program included concerns that benefits from the program would not reach the poorer segment of the community (Reddy, 2002). Villagers were also in favor of community participation in resource management (Reddy, 2002).

Benefits of these carbon sequestration projects may take the form of new resources for the development of the local community, increase in rural income, maintenance and improvement of the environment of the community (Kueppers et al., 2004). In a carbon sequestration project between Costa Rica and Norway designed to combine natural resource conservation and enhancement of local quality of life and livelihoods of communities, only positive impacts were reported (Miranda et al., 2002). The local benefits were increased awareness of environmental issues through environmental education activities, community participation in the project and employment from non-timber forest products and ecotourism (Miranda et al., 2002).

Sustainable forestry can also contribute to the well-being of rural communities by changing crops that may produce low levels of product to forest and agro forest as well as by other alternative means of income (Miranda et al., 2002). There is also a potential for secondary socioeconomic benefits such as increased employment and income from subsidiary activities, improved quality of life, improved social welfare by alleviating poverty, increase in relative

values of forested land, food and fiber security (Boomfield et al., 2000; Miranda et al., 2002; May et al., 2003).

In a study of Brazil and Bolivia, May et al. (2003) examined the ways in which carbon projects can be implemented to contribute to sustainable development and local benefits (May et al., 2003). The Noel Kempff Mercado Climate Action Project (NKMCAP) which involved local, regional and international partners expanded a national park to stop logging and aimed to conserve forests to prevent CO<sub>2</sub> emissions from deforestation (May et al., 2003). The project allowed access for sustainable uses by local communities and provided funds for environmental projects (May et al., 2003). The community initially lost their jobs from logging and was excluded from participation in the project so that benefits were not realized until the community was more fully involved in the project (May et al., 2003). The benefits eventually created were improved land tenure arrangements and increased income from local sustainable forest management (May et al., 2003). This project also contributed to local community development of sustainable agriculture and forestry with its associated benefits (May et al., 2003).

The Bananal project in Brazil made social aims a main priority to integrate social development and forest protection (May et al., 2003). The Bananal project included environmental education for the community, seedling distribution and agroforestry implementation (May et al., 2003). However, income and employment were not generated to a great extent (May et al., 2003). A forest project in Plantar provided employment to local people from tree planting and maintenance but this benefit was reduced after the project was implemented (May et al., 2003). The experiences from this project indicate that environmental education can help integrate a carbon/reforestation project with the local communities but that

direct involvement of local users of the land would provide more significant contributions to sustainable development (May et al., 2003).

The potential negative impacts of carbon sequestration and reforestation projects may be reduction in income generation, loss of soil fertility and food security (Kueppers et al., 2004). Land tenure may be a problem to the implementation of forestry projects in developing countries due to the short term nature and size of such land arrangements (Miranda et al., 2002). Brown and Corbera (2003) found that stakeholders considered that change in income was the most important social impact followed by participation in the design of the project and access to resources. The clarification of property rights and organization of the community were also important to stakeholders for the realization of socioeconomic benefits (Brown and Corbera, 2003).

Multi-species community-based reforestation has been suggested as one option to provide benefits to these low income communities if designed carefully (Boyd et al., 2005). It is also important for communities to have access to information about the project, be involved at all stages of the project and have ownership of components of the project (Boyd et al., 2005). Adaptive management strategies that encourage innovation among small farmers may be the best approach to capture the benefits of reforestation and carbon sequestration projects in the local community and provide resilience to changes and uncertainty in dynamic systems (Tschakert and Tappan, 2004). As found in Mexico, these negotiations among stakeholders must be done to ensure that this project and future ones contributes to equitable local socioeconomic development by assessing the needs of the poor and the ways in which this may differ from other stakeholders (Brown and Corbera, 2003). The NKMCAAP example showed that carbon projects should be

decentralized, have clear objectives and activities as well as provide adequate access to resources and communication with the local communities (May et al., 2003).

### **Socioeconomic Benefits of Ecotourism in Protected Areas**

When local people are fundamentally linked to the use of natural resources for their socioeconomic wellbeing, depletion of this resource will negatively impact their status (Ngugi, 2002). Ecotourism is considered one way in which the environment can be protected while generating a supplementary or major means of income for local people who may have decreased income from PA designation or resource degradation (Ngugi, 2002; Alexander, 2000). According to Scheyvens (1999), ecotourism can provide both cultural and environmental benefits as an integral part of the activity.

One of the benefits is the greater involvement and active participation of the community in the ecotourism effort at this site which will contribute to a greater level of community pride and cooperation. Scheyvens (1999) referred to this as social empowerment, which maintains and enhances the local community's equilibrium and improves community cohesion as individuals and families work together to build a successful ecotourism venture. There will also be political empowerment as defined by Scheyvens (1999) that is equal consideration being given to all members of the community including their questions and concerns about ecotourism activity within their community. Economic empowerment refers to ensuring that the local community obtains long-term economic benefits and that this is shared equitably among the community and for community development purposes, e.g. to build schools or improve roads (Scheyvens, 1999). This would also ensure that the low-status section of the community (women or youths) would have increased status (Scheyvens, 1999).

The community will also be able to use their native or inherited skills or products to earn a living which would help foster these traditions rather than letting them disappear over

subsequent generations. Wallace & Pierce (1996) mentioned that cultural exchanges with visitors could be an opportunity to experience authentic two-way interaction with local residents. In turn, the locals will recognize the importance of their culture, environment and traditional knowledge (Scheyvens, 1999). This leads to improved self-esteem of the community as a whole and working together of the community. This would spur community members to further enhance their training and education (Scheyvens, 1999). This has also been referred to as "biocultural restoration" via educational and recreational activities for locals (Wallace & Pierce, 1996).

Ecotourism is a potential source of additional or alternative income for the community either directly through participation in tours or through supplemental enterprises such as food, local crafts etc. Ecotourism, according to Wallace and Pierce (1996), "directs economic and other benefits to local people that complement rather than overwhelm or replace traditional practices (farming, fishing, social systems, etc.)." This should consequently lead to a better quality of life and positive feedback into the resource from which they earn a living. For example, the Maori communities in New Zealand sustainably use their natural resources by engaging in ecotourism activity to provide employment for locals by training tribes to provide information to visitors, such as in Whale Watches (Scheyvens, 1999). They plan to use ecotourism to revive respect for traditional knowledge in a socially and economically sustainable manner (Scheyvens, 1999).

Economic benefits should include employment, improved infrastructure, increased business for local stores in a non-consumptive manner that is at the same time financially promising (Stem et al., 2003). In the Amboseli National Park, its financial value that was mostly attributed to tourism, was US\$40/ha, as compared to less than US\$0.80/ha when used for

agriculture (Stem et al., 2003). There are spin-off businesses possible from ecotourism (Stem et al., 2003) for community members to sell their goods as well as offer accommodation to visitors.

The desired socioeconomic benefits for the communities around the Nariva Swamp will only be achieved with appropriate policies and careful planning, including education, training, and enhanced access to capital for local residents to facilitate their involvement (Wall, 1997). In order to maximize the socioeconomic benefit to local communities, there must be long-term participation of locals at an early stage in the decision-making process (Wallace & Pierce, 1996). Also, residents of Namibia are forming conservancies, which will legally give them rights of conditional use of wildlife and are developing plans for ecotourism ventures (Maclaren, 2002).

Economic gains that may accrue to the community are similar to those obtained from South African National Parks; park entrance fees, accommodation, equipment rental (kayaks etc.), food sales (local cuisine), merchandise sales (equipment, local clothing and cultural souvenirs) (Eagles, 2001). Wunder (1999) in studying the Cuyabeno Wildlife Refuge found that the sale of local handicrafts would be appropriate only if done in the context of a holistic cultural experience such as traditional dances and rituals if the local communities are willing to share these experiences with the visitors.

In the Rotal Chitwan National Park in Nepal, ecotourism failed to improve biodiversity conservation (Bookbinder et al., 1998). This was due to a paucity of direct economic benefit to the local community, which was integrally linked, with the tendency of locals to conserve biodiversity. Empowerment of locals is an important aspect of ensuring their full participation in ecotourism programs in order to share costs and benefits among all stakeholders (Scheyvens, 1999).

## **Factors Affecting Impact Perception**

The variables identified that influence differences in attitudes and perception of benefits of stakeholders in Kenya as well as in other studies were age of the protected area, income, occupation, diet, education, property ownership, redistribution of wealth from the designation, ethnicity and relationship with government personnel (McClanahan et al., 2005). It is also expected that the existence of community programs adds to the perception of benefits but does not have as significant an effect as age of the PA (McClanahan et al., 2005). Surveys of socioeconomic variables have also shown that communities closest to the PA experience a greater proportion of costs/negative impacts of PA designation (McClanahan et al., 2005). Issues that emerged from the study of PAs in Tanzania as those affecting perception of impacts included property rights of the land on which villagers lived and farmed, in other words the lack of direct rights over the benefits and costs they faced from park designation (Gillingham and Lee, 2003).

In a study of a PA project in Masoala, villages that experienced benefits from the project or understood the project's aims as target villages had a more positive attitude towards the park than people from villages who were not a focus of the project (Marcus, 2001). Higher socioeconomic status should lead to positive perception and vice versa but this is not necessarily the case because there was no significant relationship found in the Masoala study (Marcus, 2001). There was also a positive correlation between educational level (attended school and/or are literate) and positive perceptions of the park (Marcus, 2001). Respondents indicated that alternative viable economic measures than the Park will encourage change in land use (Marcus, 2001).

Economic gain such as from the sale of crops will contribute to a positive impact perception whereas ethnicity was not a significant factor but location of dwelling was important

(Marcus, 2001). Factors such as age, gender and sex were not contributing factors to positive perceptions (Marcus, 2001). Local communities need to be made aware that conservation of resources is not just a luxury that they will be sacrificed financially to achieve (Marcus, 2001). In examining the economic impact of the Mombasa Marine National Park in Kenya on local fisherman to determine who bears the cost of PA designation, it was found that communities will probably have a negative attitude towards PAs especially in poor areas, but those implementing the PA should attempt to instill a positive attitude in local people (Ngugi, 2002). Ensuring that local communities feel that they are partners in the conservation initiative is important and this can be achieved by seeking their input in the location of conservation site itself such as zoning, rules that will be applied to the PA and the timing of various projects in particular those people who may lose or reduce existing income and will require alternative sources of income need to be consulted (Ngugi, 2002). One way in which the government can achieve collaboration is through facilitating capacity building (technical, human resources, managerial and financial) within both conservation agencies and local communities (Ngugi, 2002).

Nature-based tourism should be developed to ensure that income from such ventures will contribute to the economic viability of the park and associated economic benefits to local people from sustainable activities (Singleton et al., 2002). They should develop a different economic regime of earning livelihoods that are based on sustainable use of natural resources (Singleton et al., 2002). Such livelihoods should accrue financial gains to the communities without negatively affecting the natural resources as may be done by their existing practices or land uses (Singleton et al., 2002).

## **Methods**

### **Socioeconomic Impact Assessment**

Social research on policy has been done via social impact assessment which has been defined by Becker (2001) as "the process of identifying the future consequences of a current or proposed action which are related to individuals, organizations and social macro-systems".

Socioeconomic impact assessment can be used as a predictive tool to determine the potential or future effects of a policy on physical and psychological health, well-being, lifestyles and interpersonal relationships (CERM, 2002). An impact can be a real or perceived experience that is experienced by an individual, household, or a community or society (Vanclay, 1999).

Socioeconomic impact identification and measurement must include community input, perceptions and participation in order to be relevant and representative (GHD, 2005; CERM, 2002). People's expressions of opinion can be used to ascertain their values by determining the numeric measures of a variety of statements that address facets of a particular value (Miller and McGee, 2001). Perceptions of impact are important in determining what socioeconomic issues are considered important by residents (Asquith et al., 2002). This type of assessment can elucidate the stakeholders' perception of the project and indicate the points to be negotiated with the government and stakeholders in subsequent discussions (Brown and Corbera, 2003).

### **Socioeconomic Impact Matrix**

The analysis focused on the socioeconomic impact of the ESA designation of the Nariva Swamp on local communities using a compiled matrix of potential impacts from May et al. (2003), Kueppers et al. (2004), Proctor et al. (2002), Brown and Corbera (2003), Reddy (2002), Vanclay et al. (2000) and Fortin and Gagnon (1999) to assess the perceived impacts of this policy and its management actions. This matrix was included in the third section of the household survey described in Chapter 2 (Appendix A). The respondents were asked to value

impacts based on a Likert-type scale from a range from +5 to – 5 with +5 representing a highly positive impact and -5 representing a very negative impact and 0 representing no effect or not applicable (Kueppers et al., 2004).

The socioeconomic impacts on socioeconomic variables were broadly categorized as living conditions, way of life, household income, involvement in your community, access to the resources of the swamp, property rights, traditional uses of the swamp, culture, education, health and wellbeing and children's future. The potential impacts used were intended to allow a range of people with varying levels of education and knowledge to be able to understand and evaluate them (Brown and Corbera, 2003). Key respondents from the community were also asked how important each individual impact is to them on a scale of 1 to 10 (relative impact weighting). The weights would indicate the relative importance of each impact; impacts with a similar weight would have the same importance according to community members (Kueppers et al., 2004).

Total values for each impact were calculated as the product of intensity/magnitude of impact and weight of impact. These totals can be summed for each category of impact such as on livelihood, social capital etc. and the cumulative perceived impact score for the ESA designation policy can be determined after Kueppers et al. (2004) by summing all these products for each household. Individual matrices for households was then aggregated to determine the community level impacts for Kernahan and Plum Mitan to give an indication of overall perceptions of impact.

An open-ended question about perceived impacts was also included in the questionnaire to ensure that impacts unique to the Plum Mitan and Kernahan/Cascadoux communities were identified and were not restricted to the impacts found in the literature. This was done to ensure

that the unique effects perceived by the community due to the specific relationships, histories, social values and other factors within these communities was taken into consideration (Becker et al., 2004).

### **Multiple Regression Analysis**

The quantitative data from total perceived impact of the ESA designation of each household was statistically analyzed using multiple linear regression (MLR) analysis in order to determine the statistical significance of sociodemographic variables as determinants of perceived impacts. The regression analysis also indicated how much variation in the dependent variable (perceived impact) was explained by the equation or model. The multiple regression analysis will assess the relationship of factors such as education, socioeconomic status, age, employment, swamp dependency etc. to each of the perceived benefits or impacts (McClanahan et al., 2005). Similar to the analysis of attitudes, it is expected that perception of impacts will be affected by several influencing socioeconomic variables.

The regression model and variables used in the analysis of attitudes in Chapter 3 can be applied to impact perception as well.

$$Y = a + b_1I_1 + b_2I_2 + b_3I_3 + b_4I_4 + b_5I_5 + b_6I_6 + b_7I_7$$

Where Y = total household impact perception of ESA designation

a = constant;

I<sub>1</sub> = age (expected negative effect on impact perception);

I<sub>2</sub> = income (expected positive effect on impact perception);

I<sub>3</sub> = dependency (expected negative effect on impact perception);

I<sub>4</sub> = gender (effect on impact perception may be negative or positive);

I<sub>5</sub> = education (expected positive effect on impact perception);

I<sub>6</sub> = property ownership/landholding (expected positive effect on impact perception) and

$I_7$  = length of residency (expected negative effect on impact perception)

(Chapter 3 contains details on calculation of the independent variables).

The results of these analyses indicated the most important variables that contribute to people's perceptions of impacts in these two communities.

### **Analytical Hierarchy Process (AHP)**

Analytical Hierarchy Process (AHP) is a tool originally developed in the business world by Saaty in the late 1970's and has been applied to various situations, including natural resource management, that require multi-criteria, complex decisions by aggregation of performance indicators (Schmoldt et al., 2001; Ananda and Herath, 2003). AHP allows decision makers/participants to determine relative utility values/priorities based on the alternatives and information presented/provided (Schmoldt et al., 2001).

The hierarchical nature of this process leads to definition of a main goal/objective which is then broken down into lower levels of the hierarchy of more specific criteria related to this main objective (Schmoldt et al., 2001). Pairwise comparisons are then made at each level of the hierarchy on a nine-point importance scale to obtain priority values which then allow for the calculation of overall priorities using the eigenvalue method (Schmoldt et al., 2001; Mardle et al., 2004). AHP allows for greater consideration given to such comparisons and can be used in public participation (Schmoldt et al., 2001).

It is important for PA management to be based on quantitative, transparent and credible reasoning and AHP can be used to achieve his aim (Ananda and Herath, 2003). It provides a tool for different participants representing varying interests and values to use a similar method for analysis and decision-making in protected area and natural resource management (Schmoldt et al., 2001). The complex decisions in natural resource management occur because of the various uses for these resources and the often large number of stakeholders involved (Ananda and

Herath, 2003). Since AHP is not lengthy or cumbersome it can simplify this type complex decision making (Schmoldt et al., 2001).

The AHP methodology was used to develop resource management projects for the National Park Service Unit in the US (Schmoldt et al., 2001). This was done to decide on projects based on criteria other than project cost (Schmoldt et al., 2001). By comparing each project alternative, clear objectives and decisions were made and water quality and sensitive wildlife for example were chosen as priority projects (Schmoldt et al., 2001). Similarly, in an example of forest management in Kalimantan, Indonesia, AHP was used to select criteria and indicators in a bottom-up approach in order to assess sustainability of forest management and using a wide range of stakeholders of varying education backgrounds (Schmoldt et al., 2001). Decisions were made based on AHP results as to whether criteria and indicators should be retained or rejected (Schmoldt et al., 2001).

The multi-dimensional and multi-criteria nature of environmental impact assessment (EIA) lends itself to analysis using AHP (Ramanathan, 2001). The need for various experts to make choices about different environmental issues in EIA can be facilitated through the use of AHP (Ramanathan, 2001). The flexibility and versatility of AHP especially with regards to dealing with both qualitative and quantitative indicators also makes it appropriate for use as a tool for EIA (Ramanathan, 2001). AHP is easily used and understood by non-technical people including general members of the public (Ramanathan, 2001). AHP was applied in a socioeconomic impact assessment of an LPG plant in Maharashtra and both the numerical significance and perceived relative importance by stakeholders was determined using AHP (Ramanathan, 2001). This allowed for the systematic analysis of impacts and prioritization of the environmental plans for this plant (Ramanathan, 2001).

### **Strength Weakness Opportunity Threat- Analytical Hierarchy Process (SWOT-AHP)**

SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis has been often used in the fields of business and has been extended to that of natural resource management, to assess a given decision, project or policy directive in a systematic manner (Schmoldt et al., 2001). This analysis attempts to identify strategic factors related to the issue under consideration (Schmoldt et al., 2001) Since SWOT on its own does not provide a means of weighting the factors obtained, the final decisions tend to be made on a qualitative basis of the importance of these factors (Schmoldt et al., 2001). In order to circumvent this problem and enable the SWOT analysis to be more quantitative in nature, it can be merged with the AHP process. By doing this, priority measures can be assigned to the factors obtained through SWOT analysis to facilitate the process of making decisions in a multicriteria framework in natural resource management (Schmoldt et al., 2001).

In an application of SWOT-AHP technique/methodology in Nyungwe Forest Reserve, Rwanda among different stakeholders, a non-governmental organization, a government agency and local community were asked to analyze the community-based management of this reserve (Masozera et al., 2006). The methodology was able to capture the different preferences of such groups for comparative purposes and to suggest future management (Masozera et al., 2006). The analysis was able to show that these three groups did not agree on the efficacy of the CBM approach to managing the reserve with the community placing greater emphasis on income opportunities and the two other groups emphasize the negative aspect of CBM of uncertainties of government decisions and lack of control of government agencies (Masozera et al., 2006).

SWOT-AHP was performed for the ESA designation of the Nariva Swamp using the methodology below as adapted from Schmoldt et al. (2001). The analysis was done over a period of three days in a focus group with a total of ten participants. These participants

represented different specific interests within the community and were five members of the general community, four members from an environmental community-based organization (ECBO) and one small-scale ecotourism operator.

Stage 1 – The groups referred to in the analysis are the strengths, weaknesses, opportunities and threats of the ESA designation and the final result of this SWOT-AHP analysis was an overall priority for each of the alternatives being examined (Schmoldt et al., 2001). The hierarchy of the SWOT analysis is depicted in Figure 4-1. The first stage in the combined SWOT-AHP analysis was the identification of factors within each SWOT group. This number of factors should be ten (10) or less for each of the four groups (SWOTs) to facilitate the application of AHP. The generation of these factors was accomplished by brainstorming in the focus group to generate a list of SWOT items. These items were then grouped into summary factors to facilitate further analysis via pairwise comparisons.

Stage 2 – The second stage was the pairwise comparison of these factors for each group (SWOT). This was done using a questionnaire format. In this process, the factors under the strengths group for example, were compared with each other to determine which was of greater importance and the magnitude of this difference was determined on a scale of 1 to 9. If no difference in importance was in the pair then a 1 was assigned and if one is more important than the other the strength of that difference was assigned from 2 to 9; 9 representing maximum importance in comparison to the other member of the pair. Expert Choice software (Version 11.5, 2006) was used to facilitate these calculations which are based on the eigenvalue method.

Stage 3 – The resulting values were priorities of the factors within each group and were used to obtain a representative factor within each group based on the highest factor priority. This resulted in four factors, one factor from each group (one strength, one weakness, one opportunity

and one threat) being brought forward for comparison with each other. Pairwise comparisons were made among the four and again Expert Choice software (2006) was used to calculate priority values for these factors. These values were considered to be group priorities or scaling factors which were then multiplied by the priority values obtained in stage 2 above to give the required overall priority values for each of the strategic factors of each SWOT group.

Stage 4 – These overall priority values can then be used to determine importance and management strategies. Tables and graphs of the priority values obtained in the SWOT-AHP analysis were then created for comparison of the priorities among the three interest groups. It is considered that this method can assess both qualitative and quantitative criteria in decision-making. When one factor is found to be of greater priority than others, the strength, opportunity, weakness or threat can be addressed more directly. In the case of positive impacts, they can be emphasized and in the case of negative impacts, they can be minimized when the designation is implemented.

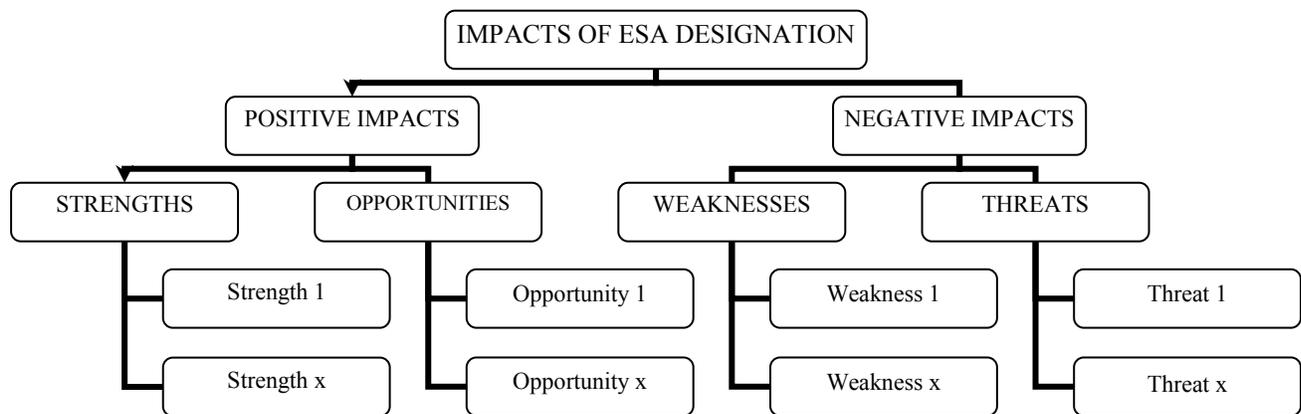


Figure 4-1. Generalized hierarchy for SWOT-AHP analysis of the ESA designation of the Nariva Swamp

## Results

### Socioeconomic Impact Matrix Analysis

The results of the cumulative community-level socioeconomic impact assessment (SIA) are shown in Table 4-1. The most important socioeconomic impact by relative weight was property rights followed by employment, community involvement and access to the swamp resources which were all assigned a relative weight of 9 according to the community members (Table 4-1). Based on the cumulative impact, community members perceived that all the socioeconomic impacts would be negative except for their children's future. The greatest cumulative negative impacts were perceived as being on access to the swamp resources and on property rights. Other impacts that were mentioned by community members in the open-ended question were the possibility of relocation, the need to move their family and start over, that the restrictions caused by the designation would mean that it would be more difficult to make money and they would have to work harder to do so.

At the household level of analysis, the MLR model was analyzed with the full seven (7) independent variables listed in the methods section. This model was found to be non-significant with an F-value of 1.74, P-value of 0.114 and  $R^2$  of 0.15. In light of this result a forward stepwise regression was necessary to determine if any model using the independent variables was significant for impact perception. Based on the change in  $R^2$  values of the stepwise regression, the largest change was 0.106 for the model with four (4) variables: age, gender, education and landholding. This model also had the largest F-statistic (3.01) and smallest P-value (0.02) so that the model was significant at the  $\alpha = 0.05$  level and is the "best-fit" for this data for the given suite of independent variables. Multicollinearity among the independent variables was previously analyzed in Chapter 3.

Table 4-1. Cumulative scores of potential impacts of ESA designation of the Nariva Swamp as perceived by the Kernahan/Cascadoux and Plum Mitan communities

Potential Impact	Relative Weight of Impact	Cumulative Impact Score
Employment	9	-783
Living Conditions	6	-678
Way of Life	3	-297
Household Income	8	-528
Community Involvement	9	-747
Access to the Resources of the Swamp	9	-1269
Property Rights	10	-1240
Traditional Uses of the Swamp	5	-540
Culture	3	-75
Education	6	-114
Health and Wellbeing	5	-135
Children's Future	7	35

Gender and landholding were both significant at the 0.05 level (Table 4-2); gender has a positive impact on impact perception so that females had more positive impact perceptions than males. Those with larger landholdings had a more negative perception of the impacts of the ESA designation of the swamp (Table 4-2) which would be related to the perception the community has of property rights changing in the village and not just in the demarcated areas of the swamp. Although not significant, age had a negative effect on impact perception (Table 4-2) which was as predicted since older people were expected to have a more negative perception of the impacts of ESA designation. Education unexpectedly had a negative effect on impact perception (Table 4-2) since those with higher levels of education were predicted to have a more positive perception of impacts.

Table 4-2. Multiple Linear Regression of perceived impacts of ESA designation

Variables	B	S.E.	T	Significance
(Constant)	-29.51	96.87	-.031	.762
Age	-3.85	21.00	-0.18	.855
Gender	104.73	48.72	2.15	.035
Educ	-16.41	42.77	-0.38	.702
Land_hold	-22.66	7.47	-3.03	.003

### SWOT-AHP

The initial stage of the analysis resulted in four (4) strategic factors in the strengths group, three (3) in the opportunities group and two (2) in both the weaknesses and threats groups (Table 4-3). The details obtained in the focus groups for each factor are in Appendix B and the resulting SWOT-AHP questionnaire based on these factors is in Appendix C.

Table 4-3. SWOT analysis for ESA designation of the Nariva Swamp

Group	Factors
Strength	S1 - Additional source of income and/or employment S2 - Management benefits (better management of the swamp) S3 - Reduction in illegal activities in the swamp S4 - Better protection of plants and animals in swamp
Opportunities	O1 - Better community and government agency relationship O2 - Improved awareness and education on environment O3 - Increased community involvement in management of swamp
Weaknesses	W1 - Limited income and/or employment generation from swamp W2 - Loss of access to some areas and uses of swamp
Threats	T1 - Conflicts between community and government personnel who enforce the laws T2 - Limited involvement in decisions about the swamp

## **General Community Members**

Based on the factor priority scores within each group, the general community members considered management benefits to be the most important strength accounting for 50.5% of the total strength of the ESA designation and increased involvement in management of the swamp as the most important opportunity, 77.5% of that group (Table 4-4). Limited income was considered the more important weakness and lack of involvement in decision-making was the higher ranked threat (Table 4-4). In terms of group priority, opportunities were given the highest priority (48.4%) by general community members and then weaknesses, strength and threats in descending order (Table 4-4). This means that the community members consider that the positive opportunities provided by the ESA designation outweigh the negative aspects.

Figure 4-2 provides a graphical representation of the final result; the overall priority values for the SWOT factors for the general community members. The positive factors (strengths and opportunities) are shown at the top two quadrants of the graph and the negative factors (weaknesses and threats) are represented by the lower two quadrants. Clearly, increased community involvement in management of the swamp was the highest overall priority of all the SWOT factors for the general community members.

Limitation on income and employment in the swamp was seen by the general community members as the most important negative factor of the ESA designation. Based on overall priority, management benefits was the greatest strength and limited involvement in management decisions was the most serious threat, both of which received lower overall priority scores than the highest priority opportunity and weakness. In the opinion of members of the general communities of Plum Mitan and Kernahan/Cascadoux, positive impacts of the ESA designation of the Nariva Swamp accounted for 67.3% of the strategic factors associated with this

designation. This result differed from that obtained from the matrix analysis in which negative impacts outweighed positive impacts.

Table 4-4. SWOT-AHP analysis showing priority scores

	Factor Priority Scores			Overall Priority Scores		
	Community	ECBO	Eco-Op	Community	ECBO	Eco-Op
Strengths				<u>0.189</u>	<u>0.16</u>	<u>0.196</u>
S1	0.227	0.082	0.248	0.043	0.013	0.049
S2	0.505	0.705	0.471	0.095	0.113	0.092
S3	0.085	0.164	0.123	0.016	0.026	0.024
S4	0.183	0.049	0.158	0.035	0.008	0.031
Opportunities				<u>0.484</u>	<u>0.549</u>	<u>0.075</u>
O1	0.047	0.137	0.091	0.023	0.075	0.007
O2	0.178	0.568	0.091	0.086	0.312	0.007
O3	0.775	0.295	0.818	0.375	0.162	0.061
Weaknesses				<u>0.289</u>	<u>0.033</u>	<u>0.541</u>
W1	0.667	0.111	0.1	0.193	0.004	0.054
W2	0.333	0.889	0.9	0.096	0.029	0.487
Threats				<u>0.039</u>	<u>0.258</u>	<u>0.188</u>
T1	0.125	0.1	0.1	0.005	0.026	0.019
T2	0.875	0.9	0.9	0.034	0.232	0.169

\*The italicized, underlined values are the group priorities or scaling factors

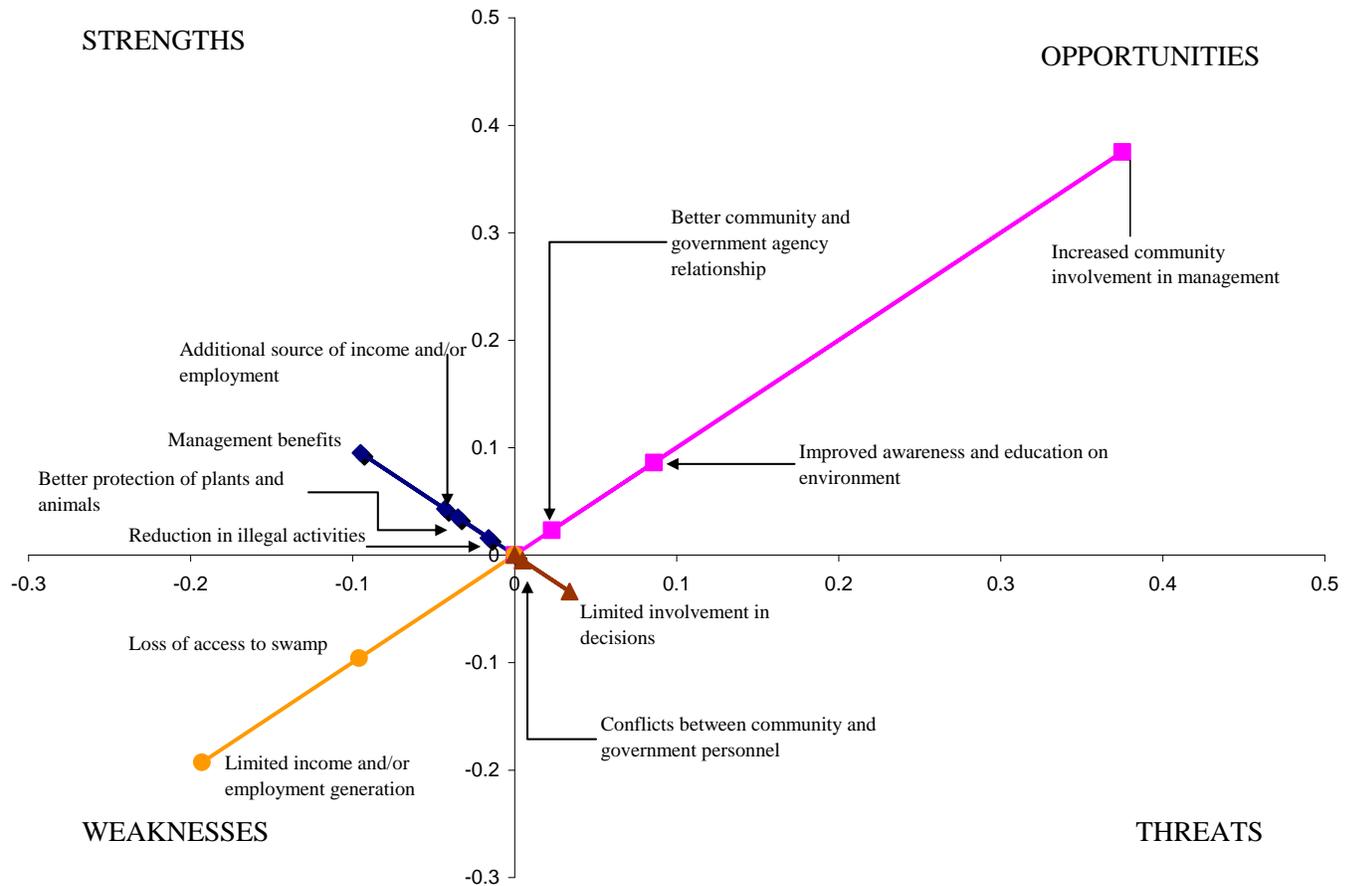


Figure 4-2. Overall priority values for SWOT-AHP analysis for general community members

**Environmental Community-based Organization (ECBO)**

The ECBO members considered the greatest strength of the ESA designation of the Nariva Swamp to be management benefits (Table 4-4). The most important opportunity was considered to be improved environmental awareness which differed from the general community members and the most important weakness was considered to be loss of access to the swamp; another difference from the community members (Table 4-4). The greatest threat was similar to that for the community members which was lack of involvement in decision-making for the swamp.

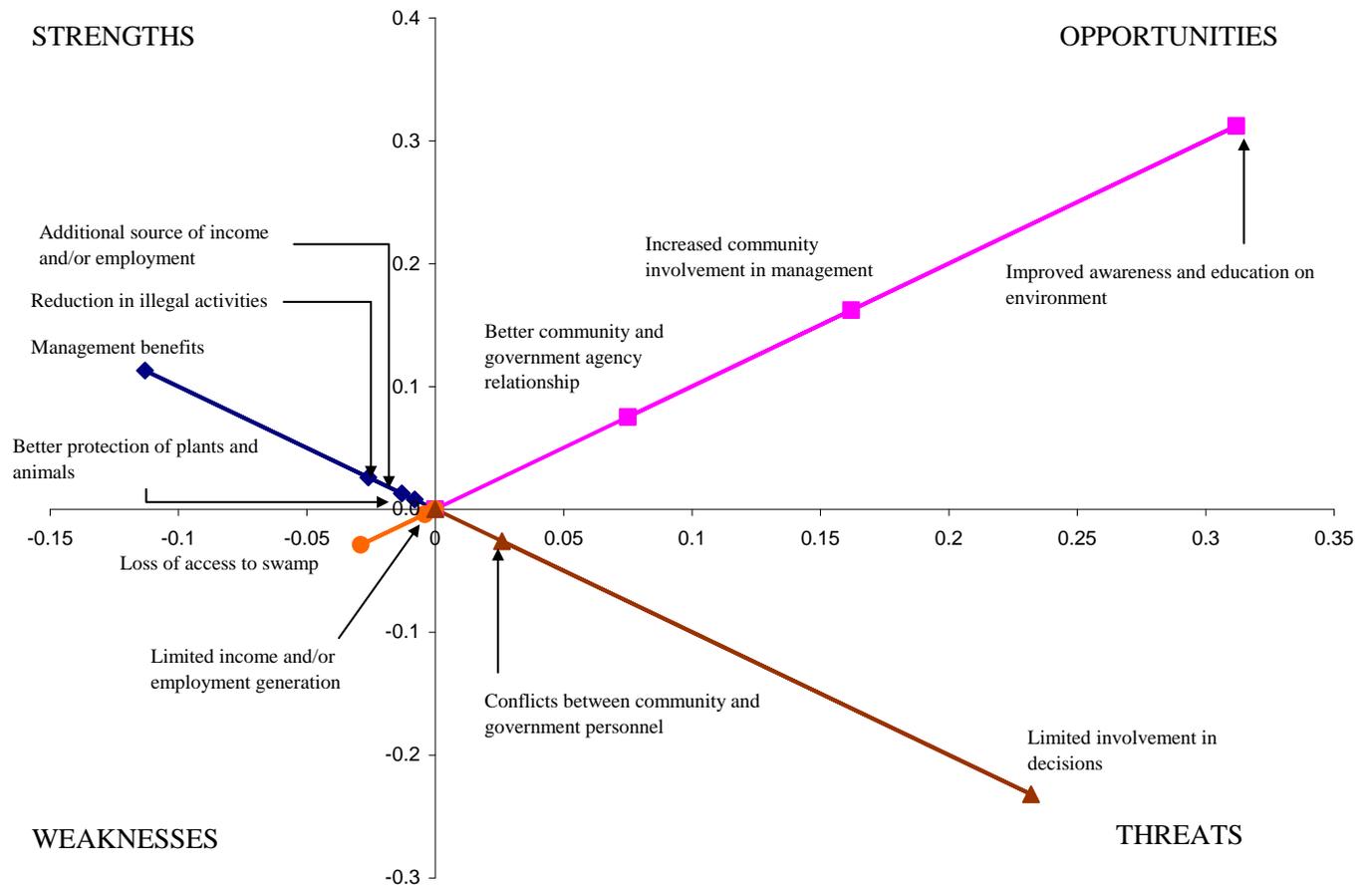


Figure 4-3. Overall priority values for SWOT-AHP analysis for environmental community-based organization (ECBO)

The members of the environmental organization placed greatest importance on opportunities, similar to the general community members, assigning this SWOT group a weighting of 54.9%. Positive impacts in the upper quadrant of the graph (Figure 4-3) accounted for 70.9% of the overall priority of the SWOT factors.

## Ecotourism Operator (Eco-op)

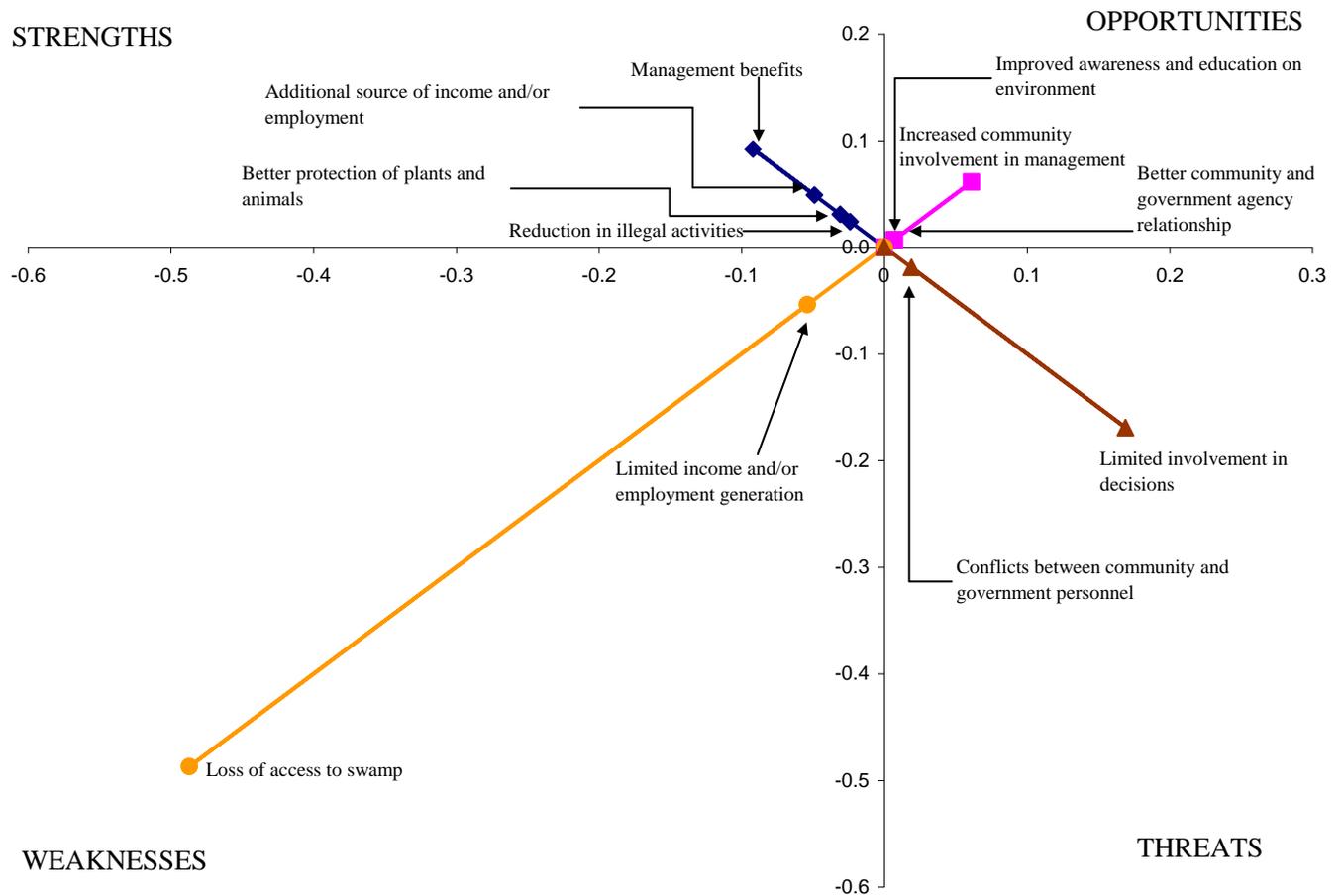


Figure 4-4. Overall priority values for SWOT-AHP analysis for ecotourism operator

The ecotourism operator who formed part of the focus group shared the opinion of both the community members and the ECBO members that the greatest strength of the ESA designation would be the management benefits to be derived and the greatest threat would be limited involvement in decisions about the swamp (Table 4-4). Similar to the general community members, the ecotourism operator considered community involvement in swamp management was the most important opportunity and shared the opinion of the ECBO members that loss of access to the swamp would be the highest priority weakness (Table 4-4).

Unlike the other community members and ECBO members, the ecotourism operator placed greatest weight on weaknesses assigning this group 54.1% of the priority of ESA designation whereas opportunities garnered only 7.5% of this support (Table 4-4). Figure 4-4 above shows that the lower quadrant or negative impacts of the ESA designation accounted for the highest overall priority and represented 72.9% of the importance given to the SWOT factors by the ecotourism operator.

The AHP methodology included an analysis of consistency to assess whether intransitivity occurs in the comparisons being made by a particular individual or group (Mardle et al., 2004). Ideally, the consistency ratio should be  $\leq 0.1$ ; in this analysis several of the comparisons exceeded this value. This inconsistency may occur because the person(s) making the pairwise comparisons does not fully understand the issue under consideration (Mardle et al., 2004). However, the complexity of natural resource management issues and possible conflicting relationships among management aims can also be the cause of this inconsistency and so the consistency ratio calculated in AHP may not give an accurate indication of validity (Mardle et al., 2004). Since the SWOT factors were developed in conjunction with participants, comparisons were explained as fully as possible to the participants in the focus group and unbiased judgments were required for the analysis, the inconsistency was tolerated for my study.

### **Discussion**

The positive or negative impact of conservation measures to stakeholders may determine the success of a policy and so, the perceptions of these stakeholders to the PA and the policy implementation are important in conserving the area (Weladji et al., 2003). Some of the suggested ways to mitigate both real and perceived impacts include increased education and training and identification of alternative livelihoods to sustain the economic viability of local people who are excluded from conservation areas (Singleton et al., 2002; Ngugi, 2002).

Education of the community and other programs to achieve participation could identify and communicate indirect benefits of PA designation to local people so that restrictions of use in some areas of the PA can be appreciated for their long term potential benefits (McClanahan et al., 2005).

The socioeconomic impact matrix analysis resulted in the quantification of the significance of predicted effects of the ESA designation of the Nariva Swamp. By determining the significance of the independent variables, the government agencies can understand the issues that are important to the Kernahan/Cascadoux and Plum Mitan communities and can address or mitigate these negative impacts so that the benefits are greater than the costs for the communities in order to obtain their support for the protected area (Gillingham and Lee, 2003). The results of the SWOT-AHP analysis enable the development of strategic, long term plans for the Nariva Swamp.

The fact that the future of the community's children was the only cumulative positive impact in the matrix analysis shows that perceived impacts were based on short term costs although there is recognition by the community that there are long term benefits to be obtained by designating the swamp as an ESA. Gender and property ownership were the significant predictors of impact; females had more positive perceptions of the impact of ESA designation than males and those with larger amount of property had more negative perceptions of impact.

This effect of property ownership is related to the fact that community members are concerned about loss of their land due to the ESA designation and as expressed via the household survey and during focus groups, some members of the community believe that they may be asked to relocate out of their community. Loss of access to swamp resources was also of great concern both in the matrix analysis from the household survey and the SWOT-AHP by the

ECBO members and the ecotourism participant. The communities would be concerned with this impact because of the potential loss of their traditional uses of the swamp, such as for agriculture, as well as the inability to conduct tours in the swamp. Although the present levels of ecotourism in the swamp was reported by the community members as being very low to negligible, they expressed interest in expanding this activity in the future.

The general community members were concerned about the negative impact on income generation and employment from the swamp and expressed the opinion that the ESA designation would lead to curtailment on their current means of employment from fishing without providing sufficient alternative means of employment. Management plans for the swamp need to include alternative means for income generation by community members and allow for sustainable levels of access and use of swamp resources.

The ECBO considered improved awareness and education on the environment to be of high priority in this ESA designation since they would like to be involved as tour guides in the swamp and also because one of the purposes of the group is the protection of the environment of the Nariva Swamp. All interest groups in the SWOT-AHP exercise indicated that they consider the opportunity to increase their involvement in the management of the Nariva Swamp as the most important benefit from the ESA designation.

The greatest negative factor identified by the ECBO was the possibility of little involvement on the management of the swamp. This group believed that they have not been involved enough in swamp management in the past and would like this situation to change. The intention to have participatory processes in the management of the swamp as an ESA needs to be fulfilled so that this opportunity is realized. Acknowledgement of the benefits of the PA by stakeholders is more probable if they are allowed to be fully involved in its designation and

protection (Kessler, 2004). This can be accomplished in part through constant communication and information among the community and the government agencies in a collaborative approach to management so that the local communities feel that they are partners in the management of the PA (Ngugi, 2002).

Capacity building is another measure government agencies can use for reducing perceived negative impacts. This can take the form of the provision of both technical and human resources (Ngugi, 2002). In the case of the Nariva Swamp, there is a need for instruction on sustainable agricultural practices and other uses of swamp resources. In addition, community members require assistance in establishing and maintaining successful ecotourism initiatives. This would include training as tour guides as well as information on other enterprises associated with ecotourism, managing a business and marketing their ecotourism services.

The benefits of the designation of the Nariva Swamp as a protected area need to be communicated more effectively to the communities in the area in order to reduce the overall negative perception currently held by many households in these villages. Innovative means of education and communication with the communities need to be implemented since the results of my study indicate that past initiatives have not been successful in fostering positive perceptions about this designation. The inclusion of environmental groups within the community in awareness and communication measures is one way of achieving an increase in positive perceptions within the communities due to the relatively small size and close-knit character of these villages. This is necessary because in order for community members to participate in management activities in the swamp and abide by protective measures that may be necessary to conserve swamp resources, the perceptions of these communities towards ESA designation need to become more positive.

CHAPTER 5  
PREFERENCES OF THE COMMUNITY MEMBERS FOR MANAGEMENT OF THE  
NARIVA SWAMP AS AN ENVIRONMENTALLY SENSITIVE AREA

**Introduction**

The Nariva Swamp will be designated as an Environmentally Sensitive Area (ESA) under the ESA Rules, 2001 (EMA, 2005). Specifically, the ESA will be “The Nariva Swamp Managed Resource Protected Area” (EMA, 2005). There exist general guidelines for the allowed and restricted uses for the swamp but no detailed management plan for the swamp as an ESA. General aims for the Nariva Swamp as an ESA include controlled ecotourism activities, reforestation of degraded areas of the swamp and integration of sustainable resource use within a framework of participatory management of the swamp (EMA. 2005)

This participatory management will include the communities in and around the swamp and is an example of collective action with respect to a common pool natural resource. As such, the management decisions made will be subject to the rational choices of community members as well as the potential problem of ‘free riders.’ The preferred outcome is for community members to fully participate in sustainable management of the swamp. This can be achieved through the inclusion of the communities in management decisions at an early stage in the planning process.

One strategy for including the community members in a participatory manner in management planning for the Nariva Swamp is through the early identification of their choices for management strategies. In order to determine the preferences of community members from Kernahan/Cascadoux and Plum Mitan with respect to management in the Nariva Swamp, voting methods were used. The two methods used were the Borda Count and Approval Voting, both of which were applied in a focus group setting to six management options.

These options were based on level of community involvement in management of the Nariva Swamp and ranged from minimal involvement in management to complete transfer of

management responsibility to the community. Focus group participants were asked to make their choices from the options and rank them according to the two voting methods. The use of both methods allowed for comparison of the results using different voting techniques for protected areas management. In addition, the preferred management option by the communities could be identified to inform future management plans.

This chapter also includes a confirmatory analysis performed using the structural equation modeling (SEM) technique to summarize and validate some of the analytical findings of the three (3) previous chapters. This model provided confirmation of the relationships predicted previously.

## **Literature Review**

### **Rational Choice Theory**

The concept of rational choice refers to the idea that individual preference and beliefs influence the option chosen by a person with an emphasis on the pursuit of personal goals (Satz and Ferejohn, 1994; Johnson, 1998). Rational Choice Theory based on this concept is a predictive theory in which people are considered to be rational beings who are “purposive and intentional” (Friedman and Hechter, 1988). In this theory, it is assumed that the alternatives available, the benefits of each choice and preferred order of benefits and outcomes of each choice are known (Simon, 1955).

Rational Choice Theory can also be applied to social ranking of alternatives based on the aggregation of these individual choices (Hechter and Kanazawa, 1997; Johnson, 1998). Social choice based on Rational Choice Theory is about how collective decisions should be made even though there is a great diversity of individual perspectives and contexts (Peter, 2003). Arrow tried to operationalize decision-making to merge individual choices into social preference ordering (Peter, 2003).

Arrow's Impossibility states that ordering or choice is democratic and that all individual preferences are known (unrestricted domain) (Peter, 2003). There is also the assumption of independence of irrelevant alternatives that is choice is not affected by preference for alternatives that are not in the choice set (Peter, 2003). It is also based on a weak Pareto principle which is if all individuals choose one choice over another then the social preference ordering should also regard that choice as better and that there is no dictatorship (Peter, 2003).

### **Collective Action in Natural Resource Management**

Based on this framework of Rational Choice Theory, Olson says that groups will not voluntarily organize to achieve social/public good except if there are enough benefits to counteract any costs of being in this group (Ostrom and Ostrom, 1971). Nevertheless, successful Collective Action is desirable in order to avoid the "Tragedy of the Commons" that often occurs with respect to common pool resources (Ostrom, 1998). This occurs when individuals act only as self-interested, short term maximizers resulting in 'free-riders' who want others to pay for the public benefit (Ostrom, 1998).

Common pool resources, such as protected areas, as managed by multiple users are sometimes successful and other times not depending on certain conditions (Ostrom, 1999; Ostrom, 1998). In PA management, the social dilemma in the management of this public good is whether people will choose to participate in management or not. If all choose not to participate, there will be no benefit for anyone (Ostrom, 1998). There may be a Pareto-superior outcome which can provide maximum benefits to those affected by the action (Ostrom, 1998).

Developing countries have often restricted use of the resource but without the necessary monitoring and money for enforcement, these arrangements did not work well (Ostrom, 1999). Research has exhibited that management of common-pool resources is possible without external pressure such as government enforcement (Ostrom, 1998; Frey and Meier, 2004). There have

been instances where local communities have been able to work together to manage resources and avoid the tragedy of the commons (Ostrom, 1999).

Both empirical and field experiments show that persisting regimes of collective action have local leaders, clear rules and boundaries, restrictions in resource use, benefits proportional to inputs in view of local conditions, self-monitoring and graduated sanctions (Ostrom, 2000). Communication is one way to overcome self-interest but it must be used in conjunction with other strategies (Ostrom, 1998). Reciprocity is also a successful strategy that includes identifying who else is involved, assessing if they will cooperate, if they do cooperate whether they will trust others and a rule of no cooperation with non-reciprocal individuals and a system of punishment for those who do not comply (Ostrom, 1998). If people expect cooperation from other people, they are more willing to cooperate because an individual's actions depend on the actions of others (Frey and Meier, 2004).

Successful resource policies have been those where individuals participate in institution design that has some effect on them so they can cooperate and devise their rules (Ostrom, 1998). More local responsibility in management leads to more moral behavior because locals are knowledgeable and know who is trustworthy so that instructions restrict behavior in collective interest according to rational choice theory (Jentoft et al., 1998; Ostrom, 1999). The rules are made specific to that resource and context; there are lower monitoring costs and several small management units over an area so that there is a smaller risk of failure (Ostrom, 1999). Collective property management also works better if the group is cohesive and homogeneous such as in traditional societies that are not developing or growing (Walker et al., 2000).

Even in the best scenario, the free rider problem or cheating will never completely go away (Ostrom, 1999). Some efforts will fail to self-organize; there may be local tyrants, no

innovation, no scientific information and internal conflicts (Ostrom, 1999). Other threats to successful collective action include migration (out or in) where you lose economic resources for out migration or there is no trust of those who migrate in (Ostrom, 2000). Other problems are government rules, technology changes and availability, generational flow of information, aid from others such as international groups, corruption, conflict resolution as an institutional arrangement is not in place and educational and extension facilities do not exist (Ostrom, 2000). In less developed countries, collective action breaks down from economic stresses and rapid population growth, inequality increases and poverty (Walker et al., 2000).

Self organized groups for collective action can be considered complex adaptive systems in that they use different sorts of decision rules to determine collective choices (Ostrom, 1999). The complexity of these systems means that there is no single/simple solution and the institutional arrangements need to be diverse and specific to each situation (Ostrom, 1998).

### **Community Participation in Management of Protected Areas**

Community conservation can be defined as ‘those principles and practices that argue that conservation goals should be pursued by strategies that emphasize the role of local residents in decision-making about natural resources’ (Adams and Hulme, 2001, p13). Ideally, community conservation should improve the socioeconomic standards of local communities (Kellert et al., 2000).

Despite the great variety of management strategies that may fall under this definition including initiatives such as community forestry and participatory multipurpose projects, they all include the participation of local communities and institutions, devolution of management authority from government to local communities, linkage of socioeconomic development with natural resource conservation, emphasis on local property rights and inclusion of traditional knowledge and marginalized people in management (Kellert et al., 2000).

Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) program is one example of success which has led to increased wildlife as compared to management by the state agency (Child, 2004). However, there have been disappointments as well as successes in the implementation of community conservation. These disappointments arise because of the challenges to community conservation which includes the fact that there are multiple institutions and interests that must be involved in community conservation namely local, national, international (Kellert et al., 2000). The establishment of new organizations that integrate all these interests leads to complex situations that are difficult to manage and guide under existing institutional arrangements (Kellert et al., 2000).

Co-management is necessary whereby authority for the resource is shared between government and local organizations since many government agencies lack the capacity to manage the resource without local management (Pomeroy, 1995). There is also a need for socioeconomic development and scientific considerations to be considered in tandem with each other along with institution building and reform (Kellert et al., 2000). Self organization within conservation initiatives is based on the attributes of the community that uses the resources of the area (Gillingham, 2001). There is a multiplicity of these socioeconomic factors that should be considered within tropical environments that affect conservation success (Bawa et al., 2004).

The multiple objectives that must be fulfilled by the areas that are being managed under community conservation strategies are often disparate and conflicting such as socioeconomic development, biodiversity conservation and sustainable use of resources with the result that one goal may be emphasized at the expense of another (Kellert et al., 2000). The achievement of the conservation objectives may be best done through incentives incorporated into conservation efforts to alleviate institutional problems (Child, 2004; Kellert et al., 2000).

Community conservation is also prone to the problem of “free riders” in which people may not bear the costs of managing the common property resource but receive the benefits (Jentoft et al., 1998). However, social capital and strong institutions and leadership can help avoid this issue (Jentoft et al., 1998; Pomeroy, 1995). The devolution of authority and management to the community allows for the adoption of innovative approaches to conservation and lends itself to adaptive management (Child, 2004). It is also necessary to have a structure in place for monitoring efficacy of the management structure (Child, 2004).

The situation in which one resource was the focus of the conservation effort tended to be more successful where there were strong legislative frameworks, developed organizations and financial support and infrastructure (Kellert et al., 2000). Public education and institutional capacity building towards the idea of community conservation are also important to the success of community conservation efforts (Kellert et al., 2000).

In order to achieve effective conservation it must be expected that differing stakeholder groups will conflict with each other, that there will be heterogeneity among these groups and local conditions, that institutional building is necessary, that education will be required to achieve community support and that large areas may be required for some ecosystems or species that may conflict with the needs of locals (Kellert et al., 2000).

The assumption of homogeneity of societies around protected areas has led to ineffective community efforts towards conservation (Gillingham, 2001). Incorporation of the unique or variable socioeconomic characteristics and institutions of the communities involved in conservation would improve conservation projects (Gillingham, 2001). Lack of consideration of these issues had led to inappropriate social organizations arising from conservation interventions

that consequently lead to a lack of compliance with regulations governing the resource, lack of equity of benefits and access to the resource (Gillingham, 2001).

The promise of community conservation as an ideology or concept is still valid but adaptive management structures are crucial. The issues mentioned above are those that must be considered in order to have successful community conservation programs. These lessons learnt from empirical case studies from around the world are valuable tools that can lead to more effective implementation of this management strategy in protected areas.

## **Methods**

### **Semi-structured interviews**

Interviews were held with members of the government agencies with responsibility for the Nariva Swamp: the Forestry Division and the Environmental Management Authority (EMA). The semi-structured interviews covered topics such as land tenure, use of the swamp, agricultural activities, management plans for the swamp and tourism activity. This also included information on the uses and benefits of the swamp as well as potential changes in this use from the ESA designation. These interviews were intended to obtain information from governmental stakeholders on the future management of the swamp as well as the views on ecotourism potential in the swamp.

### **Voting Choice Methodology – Borda Count and Approval Voting**

Voting is a tool that can efficiently facilitate decision making (Kangas et al., 2006). Choosing alternatives in collective decision making can result in different decisions or “winners” based on the voting system used and the aggregation systems associated with this method (Hannu, 1995). Some voting methods lead to the most preferred alternative being considered while all others are ignored (García-Lapresta and Martínez-Panero, 2002). In some instances,

such as when there is consensus among voters on the alternatives, the result from different voting systems will be the same (Hannu, 1995).

When making social choices, such as natural resource decisions, the components of the decision framework are: voters/participants, alternatives from which to choose, information on the preferences of participants and an aggregation method such as a voting method (Kangas et al., 2006). Participation in these decisions should be fair, transparent and representative and voting theory can be applied to natural resource management to achieve this (Kangas et al., 2006).

Voting methods are useful in this context because they can handle the ordinal nature of both preferences and data on the alternatives that are being voted on (Kangas et al., 2006). These methods are also comprehensive, simple, quick and can be used in large groups with varying interests (Kangas et al., 2006). This is especially useful in participatory processes in natural resource management because a large proportion of the decisions might be made by participants or stakeholders (Kangas et al., 2006).

Borda Count uses the entire list of alternatives where each participant votes for each alternative (Kangas et al., 2006). The most preferred alternative receives the highest number which is equal to the number of alternatives,  $n$ , from which the choice is to be made (Kangas et al., 2006). The second most preferred alternative is ranked as  $n-1$  after which this pattern is continued until the least preferred alternative is given a rank of 1 (Kangas et al., 2006). The alternative with the greatest number of votes is the chosen decision (Kangas et al., 2006). This method usually achieves the aim of the chosen alternative being the most preferred by voters (Kangas et al., 2006).

This Borda Count method is considered representative and straightforward but may not allow for a person's freedom in scoring nor give an accurate indication of the merits of the alternatives (García-Lapresta and Martínez-Panero, 2002). Borda Count tends to assure consistent outcomes and unique decisions (Saari, 2006). This method has also been criticized as violating one of Arrow's principles by allowing for irrelevant alternatives that are not independent (García-Lapresta and Martínez-Panero, 2002).

Due to the way in which the votes are assigned, the alternative chosen by the Borda Count may be based on the number of alternatives under consideration (Kangas et al., 2006). Voting methods are vulnerable to the problem of strategic voting once the alternatives are greater than two but the Borda Count is considered to be one of the methods that is more resistant to this type of voting manipulation (Saari, 2006). In order for this method to be manipulated through strategic voting the order of the preferences must be changed but this can only be done with prior knowledge of the Borda scores (Kangas et al., 2006).

Approval voting is another means of making decisions in natural resource management. In approval voting, each participant votes for all the alternatives preferred by that participant and the alternative with the greatest number of votes is chosen (Kangas et al., 2006; García-Lapresta and Martínez-Panero, 2002). This may lead to the moderately preferred alternative being chosen over the others (Kangas et al., 2006). This method is considered to be flexible, practical and lends legitimacy to the result since it is not easily manipulated (García-Lapresta and Martínez-Panero, 2002). The potential problems with approval voting include possible inequality among voters and a lack of preference ordering (García-Lapresta and Martínez-Panero, 2002).

Other systems for decision-making include plurality and pair-wise comparisons such as Condorcet which were not considered in my study. There is no optimal voting method for

natural resource management decision making since it is a social choice scenario so that various voting systems are available that might produce different results in a given situation (Kangas et al., 2006).

Borda Count and Approval Voting were used to assess six (6) options for management of the Nariva Swamp which differed based on the amount of involvement of the community. These scenarios were developed based on information contained in Kessler (2004) on natural resource management. Ten community members participated in a focus group in which one of the tasks was to express their preferences for these six options using both voting methods. The six management options on which the participants voted were:

Option A – Minimal – This is the situation where you have little or no involvement or responsibility with managing the Nariva Swamp and obtain benefits only as a by-product of the protection of the swamp.

Option B – Informing – This is where information is obtained from government agencies (like the Forestry Division) and you may give information to them but there is no exchange of ideas or discussions and again you obtain whatever benefits everyone else can obtain from protecting the swamp.

Option C – Active Consultation – You are consulted on issues about the swamp and how it is used and managed but government agencies make the final decisions which you are then informed of. You obtain a greater proportion of the benefits from swamp protection.

Option D – Negotiation – There are discussions back and forth with government agencies so that contracts and agreements on the role you play in managing the swamp and the benefits you gain are agreed upon by all parties concerned. You obtain about 30% to 40% of the benefits obtained by protecting the swamp.

Option E – Sharing Authority – This is an interactive, complete 50/50 partnership with government where there is a constant, frequent exchange of information, ideas and responsibility. You share in the decision-making about management of the swamp with the government agencies and also share in the benefits.

Option F – Complete Transfer – This is a total transfer of all responsibility and decision-making to you. You get all the benefits and all the responsibility to manage the swamp with no assistance from government agencies.

For the Borda Count method, participants were asked to rank the management choices based on their preferences from 6 to 1 with their most preferred option obtaining a rank of 6 and their least preferred a rank of 1.

Approval Voting was done using the same 6 options and participants were asked to rank all acceptable options as 1, options that they have no preference for was given a rank of 0 and unacceptable options received a rank of -1.

### **Structural Equation Modeling (SEM)<sup>2</sup>**

SEM is a type of causal analysis that allows for the analysis of multiple, interrelated dependence relationships through the development of structural equations and associated path diagrams. The analysis uses a correlation or covariance matrix as the input and allows for the representation of unobserved (latent) variables and measurement errors. The measurement model that was developed for this analysis was based on the analyses conducted in Chapters 2 to 4 and serves as a simple, confirmatory model of these analyses. The number of variables was restricted to four (4) exogenous, four (4) endogenous and four (4) error (latent) variables to

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<sup>2</sup> The validity and generality of the results of this SEM analysis should be treated with caution since the sample size was relatively small (n = 80)

compensate for the relatively small sample size. AMOS 6.0 (2006) software was used for these analyses; this software facilitates the development of the covariance matrix from the raw data.

The structural equations used in this analysis are as follows:

$$Y_1 = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + E_1$$

$$Y_2 = b_5X_1 + b_6X_2 + b_7X_3 + b_8X_4 + b_9Y_1 + E_2$$

$$Y_3 = b_{10}X_1 + b_{11}X_2 + b_{12}X_3 + b_{13}X_4 + b_{14}Y_2 + E_3$$

$$Y_4 = b_{15}Y_2 + E_4$$

Where  $X_1$  = Age,  $X_2$  = Gender,  $X_3$  = Landholding Size,  $X_4$  = Length of Residency;

$Y_1$  = Dependency,  $Y_2$  = Attitude,  $Y_3$  = Impact Perception,  $Y_4$  = Behavioral Intention and

$E_1$  to  $E_4$  are latent error terms associated with measurement error of the endogenous variables.

The path diagram for these equations is depicted in the results section (Figure 5-1). After the parameters for each pathway were estimated by the software, the model was analyzed for its “goodness of fit” and for possible modifications to the paths based on indices calculated by AMOS 6.0 (2006). The measurement model is usually adjusted by the researcher as required to facilitate an improve model fit while maintaining the theoretical foundation of the model. The final or accepted model is considered the structural model. In this analysis, the structural model was the same as the measurement model (refer to results section).

## **Results**

### **Semi-structured Interviews**

The interviews held with government agencies provided details on the expected activities associated with management of the Nariva Swamp as an ESA although the arrangements for co-management have not yet been decided.

## **Existing Management**

It is expected that activities that are currently licensed under the Conservation of Wildlife Act and the Forests Act will be allowed to continue but may be modified based on studies that will be conducted on the present status of the natural resources in the swamp (D. Boodoo, personal communication, 2006; Cross, personal communication, 2006). This licensed activity includes the harvesting of crab, cascadu and conch which are done for subsistence by members of the community (D. Boodoo, personal communication, 2006).

## **Restoration and Reforestation**

There are some areas on the southwestern boundary of the swamp that are demarcated for restoration that are currently being occupied illegally; these people will have to be removed from this prohibited area (D. Boodoo, personal communication, 2006). The northern areas of the swamp have already been reforested; this has been approximately 20 acres in the past 3 years (R. Singh, personal communication, 2006). The expected reforestation will be about 1000 hectares (R. Cross, personal communication, 2006).

## **Agriculture**

The agricultural extension services will have to be improved for the area (D. Boodoo, personal communication, 2006). Agricultural practices will have to become more sustainable; activities such as slash and burn or the application of fertilizers will have to be stopped or changed to more suitable practices for protection of the resources (R. Singh, personal communication, 2006). The agricultural lands that were distributed many years ago by the Ministry of Agriculture fall under their jurisdiction and will continue to be used (R. Cross, personal communication, 2006). Lands within the Kernahan/Cascadoux village will not be affected by this designation and past arrangements whether informal or legal will be recognized under this designation (R. Cross, personal communication, 2006). Only illegal activities that

have always been prohibited under previous management regimes for the swamp will continue to be illegal and will be removed (R. Cross, personal communication, 2006).

### **Livelihood**

A few of the community members are presently employed for regular activities involved with management of the swamp such as clearing water courses and building cages in the swamp for reintroduction projects of native birds that have been extirpated (D. Boodoo, personal communication, 2006). This builds service for future employment opportunities that will arise from the ESA designation (D. Boodoo, personal communication, 2006). The employment expected from restoration activities include actual reforestation as well as nurseries that will be set up in the surrounding communities but exact numbers are not yet known (R. Cross, personal communication, 2006).

The numbers of visitors to the swamp for ecotourism both present and future are unknown but this will hopefully increase, although the exact details have not yet been determined, so that the community can achieve socioeconomic benefits from this and that education of both local and foreign tourists can form a part of this activity (R. Cross, personal communication, 2006). The community needs to be trained for this type of tourism activity (R. Singh, personal communication, 2006).

### **Management Structure for the ESA**

The ESA designation allows resource use but it will be more defined and restricted to certain zones (R. Singh, personal communication, 2006). The management activities that will affect the members of the community include the removal of people conducting illegal activities. Expansion of such activities will be restricted especially into the ESA area (R. Cross, personal communication, 2006). The EMA under whose purview rests the ESA Rules, 2001, do not have the personnel to effectively manage the swamp so that the Forestry Division personnel including

the Wildlife Section will have to continue to monitor activities under this legislation (D. Boodoo, personal communication, 2006; R. Cross, personal communication, 2006).

A small, cohesive management unit is needed so that research can be translated into action (R. Cross, personal communication, 2006). There is a need for a Nariva Management Authority that is physically based at the Nariva Swamp to coordinate and is made up of government agencies and community members so that management action can be undertaken in a timely fashion (R. Cross, personal communication, 2006). This is especially necessary because of the different agencies that have jurisdiction within the swamp under previous legislation (R. Cross, personal communication, 2006).

The community involvement in management of the Nariva Swamp can follow a similar model to that of the nearby communities in the Matura area who initially worked closely with the government agencies in the protection of sea turtles that nest on the beaches in the Matura area (R. Singh, personal communication, 2006). Eventually, the responsibility for the protection of the turtles devolved almost entirely to the community groups in the area with some general training and supervision by the government agencies. Much participation is still to be facilitated to inform management (R. Cross, personal communication, 2006).

### **Community Management Choices**

The community preferences for their involvement in management of the Nariva Swamp can be seen in Table 5-1. Individual voting preferences are detailed in Appendix D. The two methods resulted in Option E (shared authority) as the preferred alternative (Table 5-1). This alternative would mean a full partnership among government agencies and the community and indicate a strong preference by the two communities to be actively involved in all aspects of management of the swamp and in receiving benefits from these activities. The “second choice” obtained using the Borda Count was active consultation (Option C) which expressed a similar

intention as Option E of being involved in management but with less responsibility, benefits and decision-making. According to the Borda Count method, Option E would be chosen and management plans would be made accordingly.

The Approval Voting process resulted in two “winners” Option E as discussed above as well as Option D (negotiation) both of which received 10 votes. This is one of the characteristics of Approval Voting whereby a clear choice is not always obtained since voters are allowed to vote for all their preferences rather than ranking them. Option D would be a participatory type of management as well with decisions being made by government which are then negotiated through a participatory process resulting in agreements and contracts. This type of management would ensure that the community members are involved but will require less effort in their part than Option E and consequently they would receive fewer benefits.

One of the advantages of the Borda method in this example is that a unique choice was made whereas with the approval method, two winners were chosen. The alternative chosen by the Borda Count is usually the one most preferred by the voters (Kangas et al., 2006).

Participants were not aware of the voting methods that were to be used so strategic voting should not have been an issue with the voting methods chosen (Kangas et al., 2006).

Table 5-1. Voter choices for management of the Nariva Swamp

Management choices	Borda count	Approval voting
Option A – Minimal	17	0
Option B – Informing	23	-4
Option C – Active Consultation	47	6
Option D – Negotiation	43	10
Option E – Sharing Authority	50	10
Option F – Complete Transfer	30	0

Note: The values in bold are the options most preferred by the participants

Community members also indicated that they want to be involved with ecotourism activities but believe that the money from such activities is not accruing to them thus supporting the results of the voting which indicated their preference to have a significant role in management of the ESA. The community members also do not want to be restricted from access to the swamp and do not want to be moved from their land. They believe that their rights as farmers will be ignored and that agriculture is their main source of income that may be curtailed. According to the communities, the hillside farmers appear to be in the ESA boundary based on what the members who have seen the plan say. Farmers should be given alternative areas to farm and not just removed from where they have been all their lives. They need access to the ESA on a seasonal basis for fish in the dry season as part of their livelihood and not simply for recreation.

#### **Structural Equation Model for Resource Dependency, Attitudes, Socioeconomic Impact Perception and Participation in Protection of the Nariva Swamp**

The overall model fit was good with a chi-square value of 13.96 (d.f. = 13) and P-value of 0.38 which means that there is a failure to reject the null hypothesis. In this analysis, this is the required condition for a good fit since the null hypothesis is that the model fits the population perfectly; failure to reject the null means that the model can potentially fit the population. In SEM, the model is always based on a failure to reject rather than complete acceptance of the model.

Other relative “goodness of fit” statistics are shown in Table 5-2, all of which indicate that the model is a “good fit” for this suite of variables. The RMR (root mean square residual) is the only value that is large when the desired results is as small a number as possible. This value is based on differences among variances and covariances in the sample and model. Since the absolute value of the standardized residual covariances (Appendix E) for all the variables were

less than 2, this indicated that the correct model was achieved for these variables despite the high RMR value.

Table 5-2. Model fit statistics for Structural Equation Model (SEM) shown in Figure 5-1

	RMR	GFI	AGFI	RMSEA	TLI	CFI
Model_1	167.207	0.961	0.891	0.031	0.969	0.986

The other indices, GFI (goodness of fit index), AGFI (adjusted goodness of fit), RFI (relative fit index), TLI (Tucker-Lewis Index) and CFI (comparative fit index) should all be as close to 1 as possible, with a value of 1 indicating a perfect fit. These values were all close to 1 for this model again confirming a good relative model fit. The remaining index, the RMSEA (root mean square error of approximation) of about .05 or less usually indicates a close fit of the model with respect to the degrees of freedom. The RMSEA for this model is well below this value indicating that despite the small sample size, the model fits with respect to the degrees of freedom, probably because of the small number of variables used.

Table 5-3. Standardized causal effects of variables in SEM model

	Effect	Length res	Land hold	Gender	Age	Depen	Attitude
Depen	Total	0.264	0.042	-0.257	-0.361	0	0
	Direct	0.264	0.042	-0.257	-0.361	0	0
	Indirect	0	0	0	0	0	0
Attitude	Total	0.067	0.399	-0.117	-0.426	0.005	0
	Direct	0.066	0.398	-0.116	-0.425	0.005	0
	Indirect	0.001	0.001	-0.001	0.001	0	0
Beh_intent	Total	0.019	0.111	-0.033	-0.119	0.001	0.279
	Direct	0	0	0	0	0	0.279
	Indirect	0.019	0.111	-0.033	-0.119	0.001	0
Impact	Total	-0.039	-0.323	0.227	0.001	-0.001	-0.164
	Direct	-0.028	-0.258	0.208	-0.069	0	-0.164
	Indirect	-0.011	-0.065	0.019	0.070	-0.001	0

Modification indices were calculated by the software so that the pathways among the variables could be changed if necessary. The specified default threshold of change in chi-square was 4 and no modification indices (variance or regression) were obtained indicating that none exceeded this threshold; so none of the model parameters or pathways were modified.

Table 5-3 and Figure 5-1 show the values obtained for the causal (regression) effects of the variables in the model. These values are standardized so that they give the amount of change in the endogenous variable with a standard deviation unit change in the exogenous variable. For example, one standard deviation unit change in age leads to a reduction in dependency by -0.36. The significant variables obtained were the same as for individual regression analyses namely age, landholding and length of residency were significant predictors of dependency; landholding and age were significant variables for attitude and landholding and gender significantly predicted impact perception (Appendix E). Attitude was a significant predictor of behavioral intention and a unit standard deviation change in attitude results in a change in behavioral intention of 0.28 (Appendix E).

Table 5-3 provides additional information on the proportion of the total effects that are direct and indirect. The noteworthy results are the indirect effects on behavioral intention and impact perception. Attitude was represented as an endogenous variable in this model and so, the exogenous variables that affect attitude also have an indirect effect on behavioral intention. Landholding size had an effect of 0.11 per standard deviation unit on behavioral intention and age had a -0.12 effect on this variable as well. Similarly, a proportion of the causal effect of the socioeconomic variables on impact perception can be attributed to their indirect effect on attitude (Table 5-3) which is a variable on the impact perception pathway.

## Discussion

The SEM analysis confirmed the results obtained in Chapters 2 to 4 and provided a summary model for the dissertation showing that socioeconomic variables affect dependency, attitude and impact perception and by extension participatory behavior in collective resource management.

The use of voting in the participation process for management of the Nariva Swamp appears to a viable method due to its fair, transparent and representative characteristics (Kangas et al., 2006). The application used in my study to choose management scenarios is very similar to the kinds of choices that will be made in future participatory activities and my study can be used as a framework for such decision-making exercises. Comparatively, the Borda Count gave the clearer decision whereas Approval Voting resulted in two preferences for management which may be problematic when one choice must be made for resource management.

Based on the result of the voting exercise, the Kernahan/Cascadoux and Plum Mitan communities chose equal partnership in management decisions in the Nariva Swamp. The communities want real consultation processes and not just agency management, they do not want to find about things after they are already happening. This feeling of lack of empowerment and involvement in decisions about the swamp were reflected in the preferred option for management in which they share authority with government agencies. This would enable them to know all the decisions that need to be made and will be completely involved in the decision making process as well as the actual management of the resources in the swamp.

If the individuals who make up these two communities act in a completely “rational” or self-interested manner, then community participation in management will not be effective and the problem of “free-riders” will occur. For community participation in management to avoid the potential problems identified by rational choice theory and by extension collective action

initiatives, it is important to include people early on in meaningful participation. As indicated by the results of the voter choice exercise, the community is willing to share in management of the swamp and collective action can be successful in this instance if certain conditions are met.

These conditions include the fact that management strategies must be based on the common objectives of resource managers and local people in order to be applicable to developing countries. The traditional knowledge and rights of local people are also important in managing PAs to proactively address site specific issues and create a feeling of appreciation and ownership of the resources in the PA (Kessler, 2004). There should also be equitable distribution of management and benefits so that the needs of the local people in and around the PA are fulfilled (Elliot et al., 2001).

Based on the experiences of other researchers in collective action, successful participation in management of the Nariva Swamp will also require local leadership, clear rules and boundaries, restrictions in resource use, benefits proportional to inputs in view of local conditions, more local responsibility and incorporation of local knowledge in management, self-monitoring and graduated sanctions (Jentoft et al., 1998; Ostrom, 2000). There will also be a need for creation of new institutional arrangements, conflict resolution mechanisms and education and extension services to achieve community support (Kellert et al., 2000; Ostrom, 2000). Problems that need to be avoided include economic stresses and rapid population growth, inequality increases and poverty (Walker et al., 2000).

Further analyses are needed on the management preferences of the two communities with respect to the Nariva Swamp in order to have detailed management structures and plans. The results of this initial analysis prove that this must involve significant devolution of authority from the government agencies to the community so that authority can be shared. This process may be

a long term solution and should lead to more equitable access to the PA, improved implementation of management strategies and improved resource management in the Nariva Swamp.

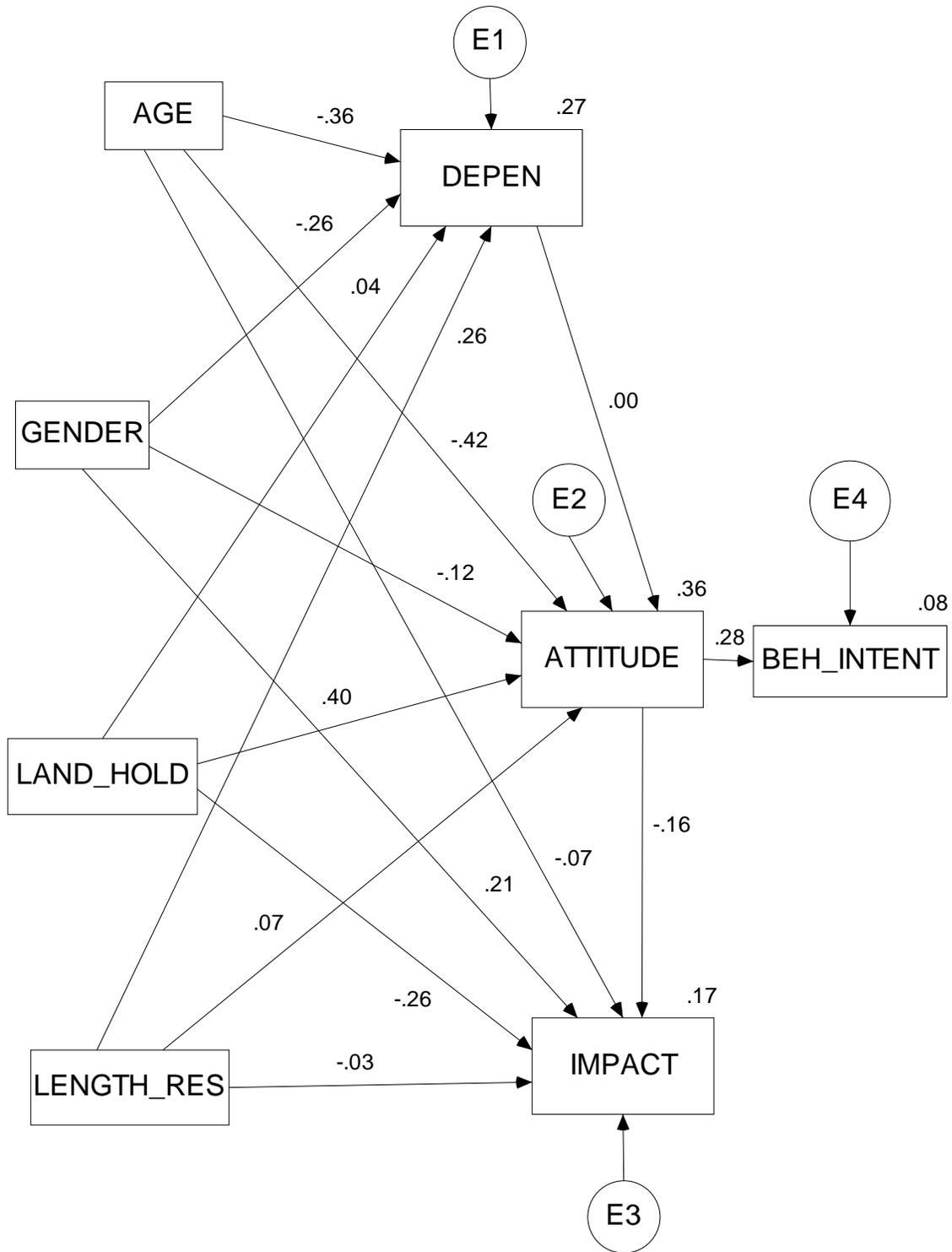


Figure 5-1. Path diagram of SEM showing standardized regression coefficients along pathways and R<sup>2</sup> Values above the endogenous variables

(Note: Although the diagram shows a value of 0 due to rounding by the statistical program for the path from dependency to attitude, this value is in fact 0.005.)

APPENDIX A  
HOUSEHOLD SURVEY QUESTIONNAIRE

**Introduction**

The School of Natural Resources and Environment at the University of Florida is conducting an independent research study about the Nariva Swamp, Trinidad. In order to understand the factors affecting conservation, research assistants are conducting face-to-face interviews with households around the swamp. The households are being selected, in order to get representative data from the Kernahan and Plum Mitan communities around the swamp.

You have been selected from this community to be a respondent. Privacy is a key principle of this survey. There are no wrong or right answers, most importantly candid and honest answers are the most useful. If you have any questions about this survey, please feel free to contact the principal investigator: Cindy Chandool, University of Florida, Gainesville Florida, 32611 (phone 352-846-5999).

Village: .....

Date and time: .....

Occupation : (list all) .....

**Section I. Attitude Questions**

Please tell us how you feel about the following statement using the scale of 0 to 4, 1 being Strongly Disagree (SD), 2 being Disagree (D), 3 being Agree (A), 4 being Strongly Agree (SA) and 0 being Don't Know. Circle one appropriate number of every statement.

1.

	SD	D	A	SA	Don't Know
Is the protection of plants, animals and natural areas important?	1	2	3	4	0

2.

	SD	D	A	SA	Don't Know
a. Protection of the swamp has taken my land thus I don't have enough land to cultivate	1	2	3	4	0
b. Wild animals damage my crops	1	2	3	4	0
c. I have reduced my access to swamp resources/products because of conservation	1	2	3	4	0

3.

	SD	D	A	SA	Don't Know
a. I have benefited from existing conservation in the Nariva Swamp	1	2	3	4	0
b. Land allocation ensures my ownership of the land in the Nariva Swamp	1	2	3	4	0
c. I can get more income because of swamp protection and management activities	1	2	3	4	0

4.

	SD	D	A	SA	Don't Know
a. Protecting the Nariva Swamp as an environmentally sensitive area is important	1	2	3	4	0
b. Zoning the swamp into different areas for specific activities (such as ecotourism, agriculture etc.) will benefit me	1	2	3	4	0

5. Rank the following issues or problems currently facing your community in order of 5 (most important) to 1 (least important).

Problems	Most important (5)	More Important (4)	Important (3)	Somewhat important (2)	Least important (1)
Limited land	5	4	3	2	1
Limited food	5	4	3	2	1
Lack of electricity and/or water	5	4	3	2	1
Lack of access to swamp resources/products	5	4	3	2	1
Lack of adequate access roads to community	5	4	3	2	1

**Section II: Dependency Questions**

6. Do you ever go into the Nariva Swamp? \_\_\_\_ Yes/No (If no, go to # 7, if yes go to #8)

7. If NO why don't you ever go there?

- a) Fear of wardens or forestry officers interest
- b) Fear of animals
- c) No interest
- d) No time
- e) Too far
- d) Other- Specify

8. If YES, why do you go there?

- a) Health related
- b) Hunting/Fishing
- c) Building materials
- d) Fuel wood
- e) Grazing animals
- f) Recreation
- g) Others - specify

9. How many working hours do you spend per trip, including time of travel to and from, to collect items from the swamp? \_\_\_\_\_ hours

10. How many trips do you make per week? \_\_\_\_\_ trips

11. How many people from your household collect items from the swamp? \_\_\_\_ persons

12. What is your income from the swamp (if any) per month?
13. What is your total household income per month?
14. Do you benefit from the tourism industry of this SWAMP? Yes / No [if No go to # 17]

If Yes, please specify in which way

- a) Sell handicrafts
- b) Act as a tour guide
- c) Sell other items from swamp
- c) Others – specify

15. What is your income from this business per month? \_\_\_\_\_

16. What are the main sources of cash income for your household?

- a) Sale of farm produce
- b) Labor of a member of household
- c) Assistance from a daughter/ son / relative
- d) Trade
- e) Others (specify)

17. How big is the size of the land that is under control of your household (ha)?

18. What main crops do you grow and what was the average production (kg) last season?

19. For each crop, is the crop produced for the market or for the household consumption? If for the market, what quantity of the production is sold?

Crop	Household consumption	Market (quantity)
1. Watermelon		
2.		
3.		
4.		
5.		

20. How many hours do you travel to reach the market for your crops?

21. Please indicate ownership of the following assets and year that the asset was purchased (for livestock, indicate numbers owned):

Items	Number
Bicycle	
Motorcycle	
Motor car	
Boat	
Radio	
Television	
Chickens	
Pigs	
Goats	
Cows	
Land with agriculture (ha)	
Land without agriculture (ha)	

22. Do you have an agricultural field in the swamp?

23. What was the size of your field in the previous season, 2005-2006 (ha)?

24. What is the size of your agricultural fields this season, 2006 (ha)? Did you clear the land for your field? If NOT why?

**Section III: Perception of Impact Questions**

25. Are you aware of the Environmentally Sensitive Areas Rules that was passed in 2001?  
Yes No

26. If yes, are you aware that the Nariva Swamp is one of the sites that are planned for designation as an Environmentally Sensitive Area?  
Yes No

The proposed management actions associated with this designation include three main plans that have the potential to affect the Kernahan and Plum Mitan communities: 1) restoration of cleared areas of the swamp to regenerate native plants and animals in the swamp, 2) increase in ecotourism activities within the swamp and 3) relocation of existing illegal agricultural activity in the swamp to legally demarcated areas.

Please tell us whether these actions to protect the Nariva Swamp will affect you in any of the following areas and how much it will affect you on a scale from -5 to +5 with -5 being affect you very negatively, +5 affect you very positively and 0 not affect you at all.

27. Do you believe that the designation of the Nariva Swamp as an Environmentally Sensitive Area may potentially affect the following and what is the expected strength of this impact?

Potential impact	Yes/No	Score (-5 to +5)
a. Your employment (new job or becoming unemployed)		
b. Your living conditions		
c. Your way of life (how you live, work and interact in the community)		
d. Your household income (change in income)		
e. Your involvement in your community (involvement in community groups, involvement in management of the swamp)		
f. Your access to the resources of the swamp		
g. Your property rights (changes in lease)		
g. Your traditional uses of the swamp		
h. Your culture (customs, values, beliefs)		
i. Your education		
j. Your health and wellbeing (stress, quality of life, standard of living)		
k. Your children's future		

Are there any other effects that you think this designation will have on you and your family and is so, what are they?

28. Would you be willing to participate or assist in the management of the Nariva Swamp as a protected area by being involved in community groups, attending meetings and other required activities?

Yes                      No

**Section IV: SOCIO-DEMOGRAPHIC QUESTIONS**

29. What is your gender?

- Male
- Female

30. What is your ethnicity?

- African
- East Indian
- Caucasian
- Chinese
- Other, specify \_\_\_\_\_

31. What is your religion?

- Muslim
- Hindu
- Catholic
- Protestant
- Other

32. How long have you been settled in this area?

- Less than 10 years
- 10-19 years
- 20-30 years
- more than 30 years

33. What specific part of Trinidad did your family originate from?

34. What is your highest level of education?

- Primary School
- Secondary School
- Vocational School
- College/University
- Graduate Degree

35. How many people live in your house (including you)

- 1-4 persons
- 5-8 persons
- more than 8 persons

36. What is your current annual household income from all the members of the household?

- Less than TT 10,000
- TT 10,001 – 30,000
- TT 30,001 – 50,000
- More than TT 50,000

36. To what age group do you belong?

- 18-29
- 30-39
- 40-49
- 50-59
- above 60

37. What is your marital status?

- |             |            |
|-------------|------------|
| a) Single   | b) Married |
| c) Divorced | d) Widowed |

APPENDIX B  
FOCUS GROUP DETAILS FOR SWOT FACTORS

Strengths

1. Additional source of income and/or employment
  - make more money from ecotourism
  - generate income from reforestation and from other work for Forestry Division
2. Management benefits
  - improvement in management of the swamp
  - more organized management of the swamp
  - more personnel will be available for management
3. Reduction in illegal activities in the swamp
  - people from outside the community will no longer come in to conduct illegal agriculture and over-fishing
  - clearing of areas in the prohibited areas in the swamp will stop
4. Better protection of plants and animals in swamp
  - animals such as crabs and conch will increase; presently they are low in numbers
  - trees will be replanted

Opportunities

1. Better community and government agency relationship
  - more information will be given to the community from the agencies
  - more meetings will be held with government agencies
  - agencies will actually ask for input from community and not just implement projects without letting the local people know
2. Improved awareness and education on environment
  - knowledge will be obtained on swamp; this can help with giving tours to visitors
  - children will gain education about the swamp
3. Increased community involvement in management of swamp
  - agencies will ask for input from community
  - community opinions (what they have to say) will be taken into consideration in management
  - community will get to participate in day to day management



APPENDIX D  
VOTES FOR MANAGEMENT CHOICES OF INDIVIDUAL PARTICIPANTS

Borda Count Results

Management Choice	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10
Option A – Minimal	3	1	1	1	1	2	1	2	3	2
Option B – Informing	2	2	3	3	2	1	4	4	1	1
Option C – Active Consultation	5	5	4	4	5	5	6	3	4	6
Option D – Negotiation	1	6	6	6	6	3	3	1	6	5
Option E – Sharing Authority	6	4	5	5	4	6	5	6	5	4
Option F – Complete Transfer	4	3	2	2	3	4	2	5	2	3

Approval Voting Results

Management Choice	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10
Option A – Minimal	1	0	-1	1	0	-1	1	0	-1	0
Option B – Informing	1	-1	-1	0	-1	1	-1	-1	0	-1
Option C – Active Consultation	1	0	1	0	1	1	1	1	0	0
Option D – Negotiation	1	1	1	1	1	1	1	1	1	1
Option E – Sharing Authority	1	1	1	1	1	1	1	1	1	1
Option F – Complete Transfer	-1	1	0	-1	1	1	0	0	0	-1

APPENDIX E  
REGRESSION WEIGHTS AND COVARIANCES FOR SEM MODEL OF PARTICIPATION  
IN PROTECTION OF THE NARIVA SWAMP

Maximum Likelihood Estimates  
Regression Weights (Unstandardized)

		Estimate	S.E.	C.R.	P
Depen	<--- Age	-.150	.040	-3.756	***
Depen	<--- Gender	-.241	.090	-2.675	.007
Depen	<--- Land_hold	.006	.015	.438	.662
Depen	<--- Length_res	.175	.064	2.743	.006
Attitude	<--- Depen	.007	.154	.044	.965
Attitude	<--- Length_res	.063	.091	.697	.486
Attitude	<--- Land_hold	.089	.020	4.418	***
Attitude	<--- Gender	-.158	.128	-1.231	.218
Attitude	<--- Age	-.257	.059	-4.341	***
Beh_intent	<--- Attitude	.191	.074	2.578	.010
Impact	<--- Length_res	-8.313	30.571	-.272	.786
Impact	<--- Land_hold	-17.699	7.831	-2.260	.024
Impact	<--- Gender	87.383	43.494	2.009	.045
Impact	<--- Age	-12.823	21.636	-.593	.553
Impact	<--- Attitude	-50.523	39.385	-1.283	.200

Standardized Residual Covariances

	Length_res	Land_hold	Gender	Age	Depen	Attitude	Beh_intent	Impact
Length_res								
Land_hold	-0.092							
Gender	-1.247	1.512						
Age	1.804	-0.386	1.256					
Depen	-0.324	-0.274	-0.697	0.128	0.025			
Attitude	-0.658	-0.017	-0.016	-0.166	-0.103	0.019		
Beh_intent	0.514	0.709	0.444	1.168	-0.827	0.007	0.001	
Impact	-0.251	0.329	-0.428	0.339	-0.385	0.027	0.508	-0.142

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## BIOGRAPHICAL SKETCH

Cindy Chandool is a citizen of Trinidad and Tobago where she pursued her tertiary education at the University of the West Indies, Trinidad (UWI). She completed both her bachelor of science (BSc) and masters (MPhil) degrees in Zoology at UWI in 1996 and 1999 respectively. In 1999, she began her career at the Environmental Management Authority (EMA) in Trinidad and Tobago where she functioned as a regulatory compliance officer. In this capacity she was able to participate in the review of environmental impact assessment reports and other conservation oriented activities for the sustainable development of her country.

In order to continue her education, she applied for and received a graduate scholarship from the Organization of American States (OAS). This scholarship facilitated her pursuit of a doctor of philosophy (PhD) degree in interdisciplinary ecology at the School of Natural Resources and Environment, University of Florida. She began her studies at the University of Florida in August 2003 and received her PhD in August 2007. She intends to continue her career in natural resource management in her country, utilizing the interdisciplinary perspective she has gained through her PhD studies.