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Brooksmith Consulting

Mangrove Conservation and Preserves as Climate Change Adaptation in Belize, Central America

A case study

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Table of Contents

Mangrove Conservation as Climate Change Adaptation in Placencia, Belize: A case study

Executive Summary

The effects of climate change present growing challenges to low-lying developing nations in the Caribbean Basin. Sea level rise, increasing frequency of large tropical cyclones, loss of reef-building corals and other effects are projected to result in direct economic losses consuming over one-fifth of the gross domestic product of nations in the region by 2100. Resilient mangroves shorelines provide multiple buffers against climate change effects. In addition to serving as habitat for marine species and wildlife, mangroves also provide storm protection for coastal communities, a buffer against coastal erosion, carbon sinks, and additional resiliency for economically important habitat such as coral reef. The World Wildlife Fund (WWF) in Belize has initiated community-based adaptation projects to educate local populations and stakeholders about these emerging problems and to implement "no regrets" adaptation to climate change effects.

Understanding of climate change science varies among demographics and opinion leaders within Belize but the value of mangrove habitat for storm protection and fish habitat is generally accepted. Unfortunately, some also see mangroves as a harbor for biting insects and an unpleasant eye-sore that impedes some kinds of economic development. As a result, most Belizean contractors reflexively remove mangroves when a development project begins, replacing them with seawalls or even leaving shorelines bare. GIS analysis shows that 2% of the total mangroves in the country have been removed, primarily around tourist and population centers like Placencia. Most mangrove clearance has occurred around residential or tourism construction. Currently over 70% of the coast is owned by foreign interests, presumably to be developed in a similar manner at a later date.

This case study describes WWF's programs developed to conserve mangroves for climate change adaptation in and around Placencia, Belize. These efforts have raised local awareness of mangrove habitat as an adaptive tool against climate change, widened the scope of conservation efforts by using national contests to highlight successful efforts to incorporate them into development, educated students of all ages about mangrove conservation and climate change, informed the public of the need for climate change adaptation through workshops, and conserved existing stands of mangrove by soliciting land owners to reserve mangrove forests and planted over 23,000 mangroves.

Introduction

Mangrove Conservation and Climate Change

Effects of climate change including sea level rise and cyclonic storm intensification are challenging coastal communities worldwide and will require adaptive responses to prevent significant disruption to coastal communities and natural resources. Mangrove habitats represent both a vulnerable resource and a potential deterrent to effects of climate change. Mangroves provide significant carbon sinks that hold greenhouse gasses (Boyd 2011) and protect against storms (Granek and Ruttenburg 2007).

Mangrove habitat that cannot grow into higher elevations as sea levels rise will be inundated and lost. However, areas of mangrove habitat that is able to move inland with rising waters will provide valuable buffers from increased strength of cyclonic activity and other ecosystem services (Erwin 2009). Efforts are needed to reduce mangrove loss where such resiliency is possible and to shore up vulnerable mangrove habitats where losses may occur (figure 1).

Mangrove restoration has been undertaken world-wide with varying effects. Although appeals have been made to avoid mangrove planting as a first resort in mangrove conservation, plantings have been successful where proper habitats have been targeted (Hashim et al., 2009). Mangroves plantings in anoxic or highly saline soils or in areas inundated too deeply have experienced high mortality and resulted in local discouragement where communities have been recruited to engage in such efforts (Primavera and Esteban 2008). Economic realities such as land use conflicts, economic support for restoration, also need to be integrated into mangrove conservation planning as they form the major constraints for mangrove conservation. Sustainable programs must address mangrove conservation in the socio-economic context where they occur (Mustelin et al., 2010, Biswas et al., 2009).

Current trends indicate the potential for widespread mangrove removal in the future, but most Belizean mangroves remain intact, providing a significant economic and environmental resource (figure 2). Although only lightly exploited through direct uses such as firewood and lumber, ecosystem services provided by mangroves provide approximately 25% of the Belizean gross domestic product as buffers for storms and coastal erosion and important nursery areas for fish and commercial species (Cooper et al., 2009). Less than 2% of Belizean mangroves have been removed (Cherrington et al., 2010). However, the causes associated with Belizean mangrove removal, population density, real estate development, and tourism, are increasing with the support of the government and populace. Tools are needed to reduce mangrove removal in urban and developing areas where most mangrove removal occurs and where mangroves can provide some of their most critical ecosystem services.

Figure 1. *Mangrove conservation strategies are especially needed around developing population centers where most mangrove removal occurs in Belize.*

Status of Mangrove Habitat

Effects of climate change present complex challenges to the low-lying subtropical nation of Belize. Economic losses associated with climate change are projected to exceed 25% of GDP in the Caribbean Bain by the year 2100 (Bueno et al. 2008). Losses during that period within Belizean tourism alone are expected to be 28.2 million US (Richardson, 2009). Yet decisions affecting the future must be balanced against the present-day economic needs of a developing nation. Effective adaptation to increasing storm threats, sea-level rise and damage to human and coastal resources such as towns, homes, coral reefs, and mangrove will require responses that operate within a the local matrix of social and environmental needs (Richardson, 2009).

The Belizean coast contains a wide array of vital natural resources, but has also become both an ecotourism destination and a prime real estate market for ex-patriot immigrants. The Mesoamerican Reef, designated a UNDP World Heritage site in 1996, lies primarily within Belizean coastal waters. Thirty percent of the Belizean economy depends on ecosystem services provided by the reef and coastal resources. The majority of the Belizean population resides in coastal regions. Additionally, 70% of the Belizean coastline has been sold to foreign nationals, ostensibly for eventual development (Young, 2009). Rapid changes around tourism centers demonstrate the alarming speed with which large areas of mangrove can be removed and the need to develop mechanisms to stave off such changes if mangrove habitat is to survive into the future (Cherrington et al., 2010).

Figure 2. *Most coastal mangrove in Belize remains intact, providing storm protection, habitat, erosion control and carbon sinks.*

Climate Change in Belize

Responses to climate change within the country of Belize have been varied. The national government has lobbied vigorously in venues like the 2009 Copenhagen summit for restrictive caps on carbon emissions. Offices of the Caribbean Center for Climate Change were established in Belmopan in 2008 and non-governmental organizations such as the World Wildlife Fund (WWF) have identified climate change as a major environmental priority. Yet limited understanding of the mechanisms and consequences of climate change exist both among both Belizean nationals and resident and seasonal Western ex-patriots who own much of the coastline property there. For instance, costly real estate

developments continue to be built in low lying areas accompanied by removal of important climate change buffers such as mangrove forest.

A primary goal of WWF has been to identify areas vulnerable to climate change and increase the resilience of those habitat and population centers. Climate change adaptation programs at WWF have adopted a "no regrets" strategy that improves the resilience of human and natural resources along with other necessary conservation and societal goals. Vulnerable and resilient areas have been identified within the country and programs are underway to help local populations to adapt to sea-level rise.

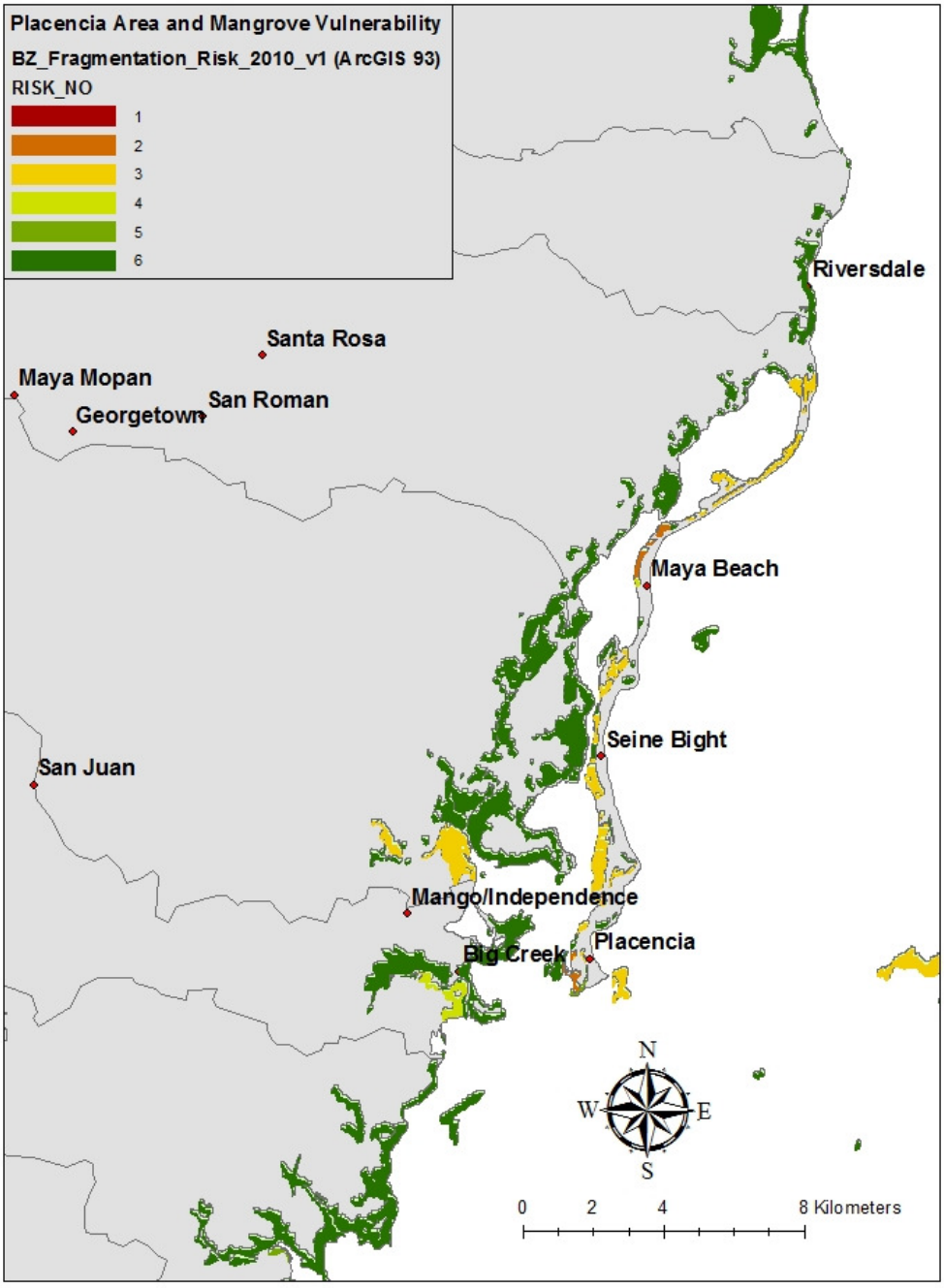
One explicit goal of the no-regrets strategy in Belize has been to reduce the rate of removal of mangrove habitat for development. Mangrove forests reduce damage from cyclones, reduce or reverse beach erosion, provide resilience for adjoining habitats and provide a potent carbon sink. Programs in Belize have undertaken community-based outreach, education, restoration, and preservation initiatives to reverse the trend of mangrove removal. The epicenter of this effort has been Placencia Village.

Placencia Village

Located in the Stann Creek District of Southern Belize, Placencia rests on a narrow, low lying sandy peninsula 19 miles long (figure 3). The 2000 census of Placencia counted 458 residents. The 2009 population estimate is 750. Regionally, 2009 government estimates show a combined population of Stann Creek and nearby Toledo Districts of 32,400 spread over 2,500 square miles (Statistical Institute of Belize). Historically a fishing village, the majority of mainstream income in Placencia now comes from tourism and real estate. Other important regional industries include shrimp aquaculture, banana, citrus, fisheries and a deep water port at Big Creek.

The Southern Barrier Reef Complex (SBRC) lies just offshore from Placencia and provides a major attraction for the local tourism industry. Placencia provides the primary access point for two marine protected areas (Gladden Spit and Silk Cayes Marine Reserve and Sapodilla Cayes Marine Reserve) and one World Heritage national park (Laughing Bird Caye National Park). From a baseline of 5 small family owned hotels containing less than 100 beds in 1990, Placencia now contains over 1400 hotel beds (Personal communication; Placencia Citizens for Sustainable Development). Vacation homes, condominiums, and general population growth have also added to the total number of structures in the village. A substantial percentage of mangrove habitats in the Placencia area have been identified as "vulnerable" to climate change (Cherrington et al. 2010; figure 3).

Figure 3. Map of Placencia region, Stann Creek District, Belize showing local distributions of mangrove habitat ranked by vulnerability to climate change (Cherrington, 2010; red = at high risk for climate change, green =low vulnerability to climate change).



The village of Placencia has been identified as an area vulnerable to the effects of climate change. Placencia faces unique vulnerability to tropical cyclones, sea level rise and loss of income due to damaged human and natural resources. Most income in the local economy depends on habitats already under stress from climate change. In 2001, Iris, a category 3 hurricane, leveled most of the permanent structures there. Much of the peninsula is below 2 meters in elevation, making it susceptible to sea level rise (figure 4). Beach erosion is already prevalent along the northern end of the peninsula.

Conservation Action Planning (CAP) meetings sponsored by the Southern Environmental Association, Wildtracks Consulting, and the Nature Conservancy during 2008 polled attending members from 22 Belizean governmental, non-governmental, business and consulting groups active in natural resources in SBRC to identify relevant conservation targets and assess environmental threats against them. Threats from climate change were rated "very high" overall. Mangrove habitat was identified as one of 8 areas of regional conservation concern with an overall threatened status of "high" (CAP final report: Table 1). Coastal development, aquaculture, and agricultural run-off were listed as the main threats to mangrove.

Threats Across Targets	Littoral Forest / Beaches	Coastal Lagoons and Estuaries	Commercial / Recreational Species	Mangroves	Coral Reef Communities	Spawning Aggregations	Large Marine Vertebrates	Seagrass	Overall Threat Rank
Coastal /Caye Development	Very High	Very High	High	High	Very High	High	High	Medium	Very High
Fishing Pressure	-	Medium	Very High	-	High	Very High	High	-	Very High
Climate Change	Very High	High	High	Medium	High	Medium	Medium	-	Very High
Aquaculture	High	Very High	Medium	High	Medium	Medium	Medium	Low	High
Agricultural Runoff	-	Very High	Medium	High	Medium	Medium	Medium	Medium	High
Oil Spills	Medium	Very High	-	-	Low	-	Medium	Low	High
Poor Fishing Practices	-	Medium	High	Low	Low	High	High	-	High
Visitor Impacts (tourists, researchers etc.)	-	Medium	-	-	Low	Medium	Low	-	Medium
Oil Exploration and Drilling	-	-	-	-	Low	-	-	Low	Low
Overall Threat Status for Targets	Very High	Very High	Very High	High	High	High	High	Medium	Very High

Table 1. *Threat assessment for Conservation Action Planning for the Southern Belize Reef Complex compiled from a consensus of conservation professionals during 2008 (from SBRC CAPS, Wildtracks Consulting).*

Figure 4. *Tropical Storm Matthew (2010) washes over a seawall and enters homes in Placencia, Belize at a site where mangroves have been removed.*

Threats to Mangrove Habitat

Costal Residential Development

Coastal real estate and tourism developments in Placencia are responsible for most mangrove removal there. Public perceptions of convenience and aesthetics continue to drive mangrove removal. Builders and homeowners frequently cut coastal mangroves to increase shoreline access, open sea vistas, provide more breezes, and eliminate refuge for biting insects (figures 5 and 6). Despite progressive mangrove laws that would normally prohibit most mangrove removal, exemptions are readily obtained. Mangrove clearance often occurs without proper permits. Recent legislative reform has sought to amend mangrove clearance laws, stiffening fines and refocusing regulations. However, implementation of these new laws has been slow. The Judge Advocate General set aside the bill on the grounds that penalties exceed the mandate for this type of legislation. Revisions to the act have begun, but the wording of specific changes remains unknown. Developers and contractors continue to remove mangroves as a matter of course and enforcement of mangrove laws remains spotty.

Figure 5 (above): *Site of recent red mangrove removal in Placencia Village, Belize. Small trunks and organic material from a mangrove can be seen in the lower left hand of the photo. Hard engineering such as seawalls shown on the right typically replace more resilient and natural shorelines under current development practices.* **Figure 6 (below):** *Rapid expansion of the tourism and real estate industry have resulted in widespread mangrove removal in Placencia Village.*

Agriculture and Aquaculture

The effect of aquaculture and agriculture on mangroves appears to be substantially less than the effect of real estate and tourism development in the Placencia area. Of the 19 coastal shrimp farms once active in Belize, only the earliest removed more mangrove than was necessary to build intake canals (Figure 7). The remaining farms were constructed in the coastal plains, behind mangroves and littoral forest. Effluent water released from farms filters through coastal mangrove as a natural contaminant filter. The primary impact to mangroves in these sites has been to their morphology and the loss of some sessile aquatic associates. Rapid mangrove growth due to nutrient inputs from farming has occurred at these sites and these trees feature elongated trunks and internodes (Figure 8). In general, the total amount of mangroves around shrimp farms has increased. Some farms have also planted mangroves in waste water canals to augment water treatment and these are heavily used by wildlife (Figure 9). The 6 viable shrimp farms currently operational in Belize are pursuing ecocertification as a strategy for economic sustainability. Mangrove planting programs in effluent areas help them obtain the level of environmental performance they require to meet emerging ecocertification water quality standards. The earliest WWF mangrove planting efforts in the Placencia area supplemented these bio-engineering efforts around shrimp farms.

Figure 7 (Top): *The first shrimp farm in Belize removed coastal mangroves.* **Figure 8 (Middle):** *Shrimp ponds releasing waste water through mangrove stands.* **Figure 9 (Bottom)***: Mangrove plantings added by shrimp farm to improve effluent water quality.*

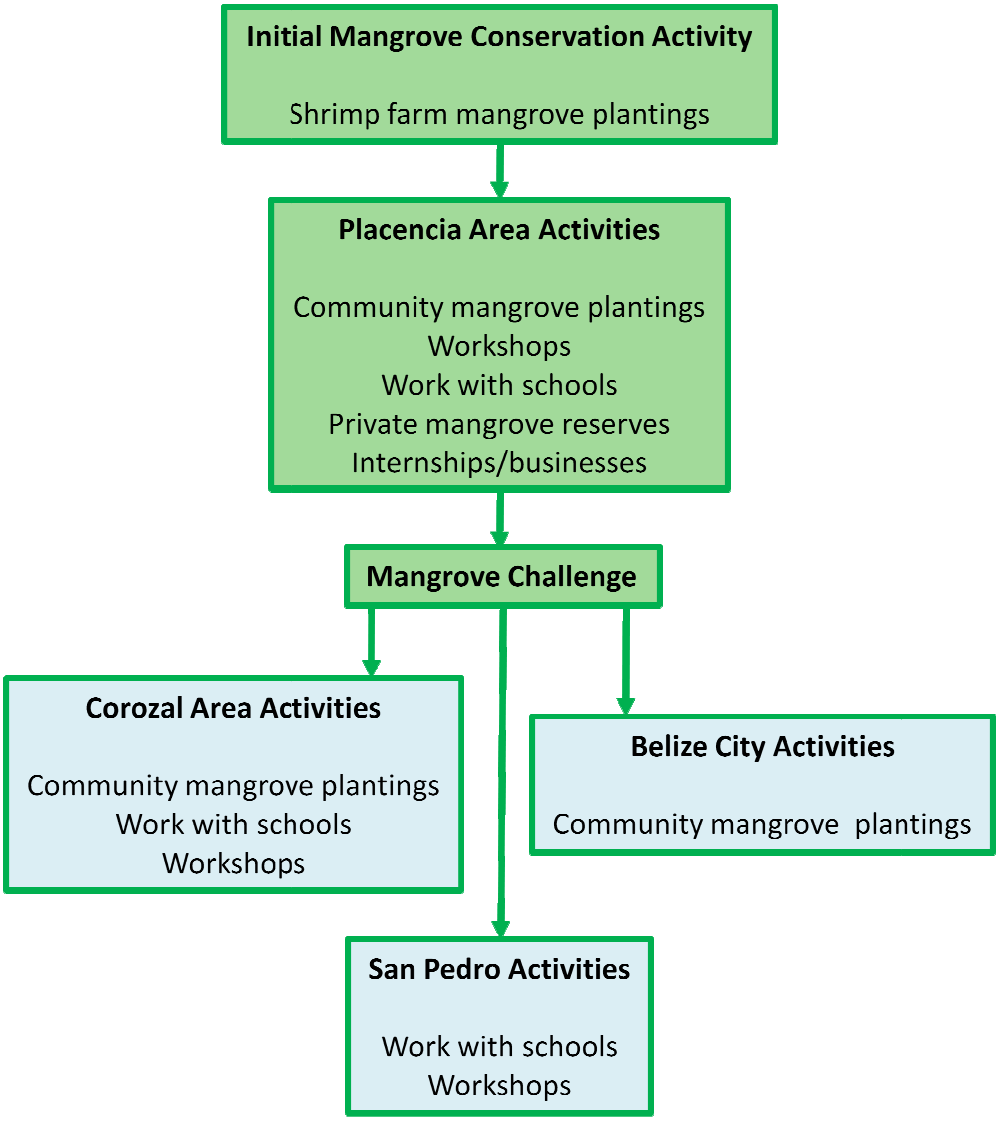
A Programmatic Response to Climate Change and Threats against Mangroves

A WWF-sponsored initiative to increase climate change resilience through mangrove restoration, education, and conservation was initiated in the Placencia area in late 2008. Two consultants, Vernon Consultancy from Belize and Brooksmith Consulting from the United States were engaged to implement the program. Initiatives from this project continued through 2011. Project goals have generally been met. Successes and difficulties from these efforts provide useful lessons for subsequent work in Belize and similar venues. Mangrove conservation programs were undertaken incrementally, with one programmatic intervention building gradually upon another to achieve a multi-dimensional approach with overlapping and complimentary goals that gradually spread across venues to create a national network of entities interested in promoting mangrove conservation (figure 10). The main components of the project are as listed below (table 2).

Table 2: *Activity goals, regional scale, and stakeholders addressed for project activities designed to strengthen community resilience to climate change through mangrove conservation.*

Activity	Stakeholders	Scope	Activity Goal
Community mangrove plantings	Schools, conservation groups, business, general public	Local	Demonstrate techniques for planting mangroves, reforestation and shoreline protection, raise awareness of the need for mangrove preservation
Workshops and educational material	General public	Local, regional, national	Educate the general public about the threats of climate change and the role of mangroves in providing resilience against storms, sea level rise and other threats
Work with schools	Students, teachers	Local	Educate students about the threats of climate change and the role of mangroves in providing protection against storms, sea level rise and other threats
Internships/business	Students, teachers, entrepreneurs	Regional	Provide advanced students opportunities for professional work in mangrove conservation and restoration, and promote businesses with interests and services in mangrove conservation.
Social media	Facebook users with interests in mangrove conservation and climate change	National, international	Inform public of local and international information about mangrove conservation and climate change with a focus on Belizean events and issues and create a venue for networking among persons with an interest in mangrove conservation
Mangrove-Friendly Shoreline Development Challenge	Developers, conservation groups, townships, land owners	National	Highlight development practices that conserve and minimize effects on mangrove shoreline, identify and create networks of mangrove-friendly organizations and individuals
Development of Mangrove Reserves	Developers, land owners, townships	Regional	Locate and reserve mangrove habitat

Figure 10. *Progression of mangrove conservation activities in Belize, Central America. Early activities with shrimp farms transitioned into local activities around Placencia Village. Connections established during the Mangrove Challenge led to connections with other group around the country who then began climate change awareness and mangrove conservation activities in other places in the country.*



The progression of mangrove conservation activities

The interlocking, progressive, and supportive nature of each program component has been the key to the continuing success of mangrove restoration in Belize. Detailed descriptions of project activities are provided in subsequent sections of this document. In their totality, program goals evolved organically from observable needs, and became interconnected through nationally advertised events and networks of interested participants maintaining contact through social media and other means.

Mangrove planting was an inexpensive and simple activity designed to directly increase local mangrove stocks and provide a tangible rallying point for local groups interested in mangrove conservation. Red mangrove propagules were obtained from local forests from May to December when propagules are readily available. Each propagule planted costs between 0.02 and 0.10 USD depending on fuel costs and harvest rate. Early efforts were coordinated through Independence Junior Colleges and directed toward bioengineering efforts in shrimp farm waste water treatment canals and ponds. Shrimp farm sites were originally coastal savannah or sediment deltas in estuarine areas. Mangrove planting was initiated there to trap contaminants and improve water quality of effluents passing through them.

Subsequent mangrove planting efforts targeted village sites where mangroves had been previously cleared. Propagule plantings to re-establish fringe mangroves were undertaken in new and existing canals and on denuded estuarine shorelines in Placencia and Seine Bight and then later in Corozal, San Pedro and Belize City. Planting events provided local individuals and organizations a pro-active outlet for re-establishing habitat near their homes. Information sharing activities such as workshops and schools were linked to mangrove planting wherever possible to connect participants directly to local conservation efforts. Local mangrove restoration businesses and internships established in the area have focused on mangrove planting and educational activity.

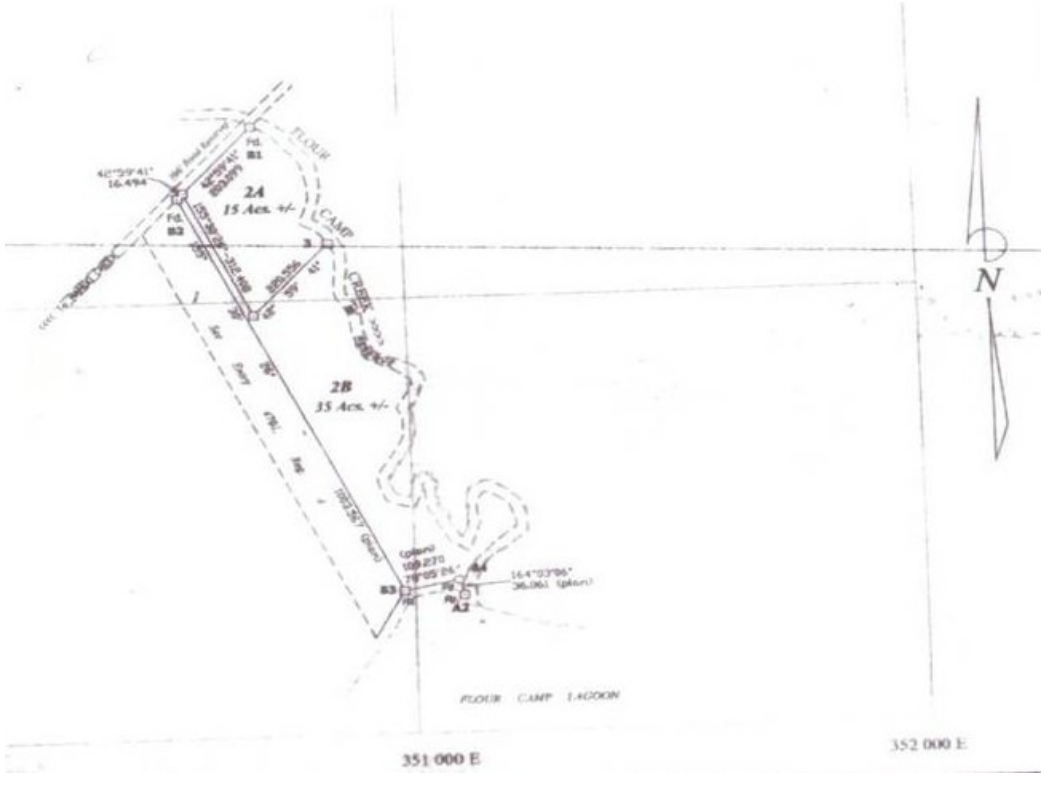
The Mangrove Challenge contest was established to highlight positive use and preservation of mangrove habitat in Belize. It also provided a means to locate and identify areas and individuals involved in effective restoration and conservation throughout the country. Positive conservation practices highlighted in the Mangrove Challenge, included mangrove reserves, parks that utilized mangrove as part of the landscape design, developments that minimized mangrove removal and conservation groups that had strived to conserve mangroves in their local communities. These networks expanded mangrove plantings, workshops and programs within schools throughout the country. Ongoing activities associated with the Mangrove Challenge have also included brief periods of dispute mediation to ensure that terms of the Mangrove Challenge application continue to be met.

Ultimately, preservation of existing mangrove habitat represents the most potent means to conserve their ecosystem services and in Belize a concerted efforts to preserve mangrove habitats have was undertaken in country with several cayes and inshore mangrove holdings entering the Belize Private Protected Areas (BAPPA) private reserve system since 2009. A parallel effort by Placencia Village to create their own mangrove reserve has also been undertaken under the sponsorship of the Vernon Consultancy and several land owners have moved ahead with private reserves outside BAPPA. Private mangrove reserves also provide landholders with certainty of land use that can simultaneously enhance property value and provide certainty in conservation planning. In Belize, private reserves may be more secure than public reserves because they are incorporated into development plans of individuals and are not subject to political whims associated with government de-reservation. Regional preservation efforts have proven promising but complicated involving multiple land owners and value systems. Additional efforts will be needed to integrate mangrove reserves into corridors with existing reserve systems.

Integration of mangrove conservation efforts in Belize has been facilitated by the social media network "Facebook". Membership for the Belizean Mangrove Conservation Network currently stands at 647 and is the largest mangrove conservation site on Facebook. Members include a former Belizean prime minister, political party heads, heads and staff of most of the coastal Belizean NGOs, the mayor of Placencia, regional conservation organizations, local teachers and citizens, interested ex-patriots, and conservation-minded individuals from around the world. Recently, a large number of administrators from these groups were added to the page to increase ownership and use of the Mangrove Network page as a venue for exchanging ideas and views about mangrove conservation and climate change. Their organizational logos have been collected and will be added to the website as active participants in mangrove conservation in Belize.

Ongoing mangrove conservation efforts will require stable institutions and entities with a clear vision of what is possible and desirable regarding mangrove conservation as an adaptive response to climate change. Wherever possible, the creation and encouragement of independent self-sustaining efforts rooted in the Belizean culture has been attempted. WWF has taken a cooperative, facilitative approach, by nurturing ongoing efforts and providing information and organization and a central venue for promotion of further efforts. In the long term, it is hoped that the number of developments in low-lying areas will be reduced, that existing population centers in danger of inundation and storm damage will be made more resilient through mangrove conservation and rehabilitation, that new developments will embrace mangrove shorelines and preserves as part of their landscaping and the information necessary to effectively conserve and restore resilient mangrove habitat will be conveyed in communities, organizations and policies of Belize.

Figure 11. *Plot of a brackish creek-side typical of those put into private reserve through BAPPA. Private nature reserves provide the highest level of conservation value for mangrove habitat, leaving sequestered carbon in place, and natural species associations unaltered.*



Mangrove Challenge

The Mangrove-Friendly Development Challenge (later shortened to "Mangrove Challenge") was designed to highlight developments and community activities that conserve mangrove habitat, or develop aesthetics and appreciation for mangroves by incorporating them into human-dominated habitats (figures 11-15). Cash prizes of 250 to 500 USD were made to winners. Special emphasis was placed on the importance of mangrove reserves where large blocks of habitat have been set aside. Use of mangrove in human-dominated developments was also rewarded, especially projects that provided an opportunity for education, or preserved and restored fringe mangrove where most of the biodiversity and ecosystem and climate change resilience is provided. By pointing out the importance, usefulness and beauty of the mangrove habitat and mangrove species, the Mangrove Challenge contributes to a mangrove aesthetic supporting the intrinsic value of mangrove in Belize, and influencing development to minimize mangrove removal.

The Mangrove Challenge was run on a national scale, but could easily have been expanded or reduced in size. Advertisements announcing were run in the national paper sand applicants were accepted country-wide in 2010 and 2009. A panel of judges including a developer, a government conservation professional and a landscape architect evaluated the submissions, ranked their quality and provided a short justification. As a result of the Mangrove Challenge, seven examples of mangrove conservation have been identified and highlighted in the local press. Winners have ranged from an individual homeowner who restored mangroves on his lot to a community-based tourism group that operates a mangrove reserve to community parks that utilize mangrove to large scale developments that have either used mangrove creatively in landscaping design or set aside mangrove reserves. Applications that were rejected were either plans that had not been initiated, or mangrove replanting projects in an area were extensive existing mangrove had been removed. Specific practices endorsed by the Mangrove Challenge include:

1. Mangrove Reserves (formalized with BAPPA or the government of Belize, figure 15)
2. Building practices that avoid removing mangrove or high quality mangrove (figure 12)
3. Formal landscaping that incorporates mangrove (figure 12)
4. Mangrove hedges in developments (figure 12)
5. Boardwalks in mangrove forests
6. Docks built along mangroves rather than removing mangrove shorelines
7. Aesthetically pleasing mangrove trimming (figure 13)
8. City Parks with mangrove (figures 13 and 14)
9. Conservation and tourism organizations that maintain mangrove reserves

Spin-off effects of the Mangrove Challenge have been substantial. Efforts to conserve mangroves have received wider attention among the general populace and among individuals planning and managing existing developments. More importantly, resulting contacts and publicity have identified a network of active individuals and groups supportive of mangrove conservation. These contacts have furthered additional mangrove conservation efforts and allowed for collaboration and cooperation among groups with similar goals (figures 13 and 14). Perhaps most significantly, the Mangrove Challenge has lead to

the creation of several private mangrove reserves on developments where the owners wish to portray an “ecofriendly” marketing approach (figure 15).

Figure11. *Flier advertising the Mangrove Challenge in national newspapers in Belize.*

Figure 12. *Mangrove challenge winners from developments showing examples of mangroves integrated into the landscape design of coastal developments. Innovations include trimming at Sunset Pointe (top), mangrove edges on formal grounds (middle, Sunset Pointe), and the creation of manicured buttonwood and red mangrove hedges (bottom, Cocoplum).*

Figure 13. *(Top) The mayor of Corozal (right) poses with (left to right) Adrian Vernon, Nadia Bood and Tim Smtih for pictures on behalf of the Town Board of Corozal as a Mangrove Challenge winner for the creation of Mangrove Park.* **Figure 14.** *(Bottom) Local citizen groups including private individuals, real estate developers and biologists and the environmental club at Corozal Junior College helped organize the park and have worked to maintain it since it was created. Efforts such as these with community support provide a venue to expand mangrove conservation work in Belize and elsewhere.*

Figure 15. *(Top) Red mangrove fringe in a mangrove reserve. (Bottom) Plans for a Mangrove Challenge winner that created a development reserving 2/3 of a valuable caye as a private reserve and conserved almost all fringe mangrove on the caye.*

Mangrove Reserves

Preservation of mangrove habitat represents the most efficient means of conserving mangrove ecosystem functions related to climate change and other conservation concerns. This project sought to enroll as much mangrove land as possible into reserves through the Belize Association of Private Protected Areas (BAPPA) in cooperation with the Southern Environmental Association (SEA). Efforts to encourage private preserves were generally successful, but specific needs were highlighted during experiences dealing with land owners and NGOs dealing with private reserves. These are:

1. The need for institutional stability for organizations that create and monitor reserves.
2. The need for a system of incentives supported by the government or the carbon credit market.
3. The need to monitor reserves and their spatial and functional integrity.
4. The need to create regional networks of reserves with corridors in between to facilitate the movement of wildlife between natural areas and increase their natural value.
5. The need for legal help from real estate lawyers to resolve boundary and ownership disputes and ensure the validity of reserve covenants.

Private reserves provide a unique conservation resource in Belize and Central America. BAPPA exists as a wing of the Mesoamerican Association of Private Protected Areas (MAPPA) and reserves accepted by this group are recognized by the government but remain in private control for reserve periods of 10 to 100 years. Currently 500,000 acres of wilderness are under BAPPA protection with new programs in place to expand the reserve system more explicitly into marine areas. Standards and scoring for marine reserves are currently before the Belizean Legislature and should be approved shortly (table 3).

BAPPA was approached at the beginning of this project to help in identifying and enter mangrove forest into governmentally recognized private reserve. To that end, a meeting was held in September of 2009 with about 20 local land holders interested in reserves. BAPPA representative, Paul Walker and Brooksmith Consulting gave presentations outlining the rationale for private reserves and the steps to entry. Subsequent to that meeting, three properties were immediately entered into reserve. Several others were identified that remain interested and will eventually enter reserves of some type (table 4). Subsequent workshops in Corozal (2), Seine Bight, and San Pedro Towns emphasized the need for reserves and landowners around the country have expressed interest in joining the reserve system.

Landowner needs and incentives vary among individuals and groups. Villages such as Placencia Village have needs to preserve hurricane buffers and green space within the village. A reserve is currently being organized there by Vernon Consultancy. In other cases such as Maya Beach, land disputes had arisen over small and relatively environmentally degraded plots in the village and local residents sought reserves to claim control of the property (figure 16). Chairmen from villages holding land that had been informally used by indigenous people was considered by local village chairmen for entry into reserves, but ownership was unclear and conflicts remain within the village over how that land should be used. In contrast, individual land owners tended to have small holdings but were often easy to approach. Civically-minded individuals with known conservation credentials were often eager to make official reserves without incentives. Large developments were also often eager to enter land into reserve, but

generally used the reserves to advertise the certainty of land use (as opposed to further buildings or businesses). Some individual land owners and businesses such as shrimp farms were also interested in reserves, but wanted tax incentives or carbon credits to offset lost development.

Table 3. *Scoring criteria for acceptance to the BAPPA marine reserve system.*

Bio-physical characteristics of PPAs in the Maritime Environment		**Points**	**Site**
Location of property	*Choose only one*		
See note below	Adjacent to a MPA	10	
	Within 5 miles of existing or proposed Marine Protected Atrea(MPA), channelsmight provide a corridor function	6	
	Sub-total	16	
Size of property	*Choose only one*		
	> 500 acres	12	
	>400-499 acres	10	
	50 - 399 acres	6	
	5 - 49 acres	3	
	3- 5 acres	1	
	Sub-total	32	
Special habitats	*Choose only one. Last two choises are for Private PA's only*		
See note below	Particularly rare (< 5,00 acres in Belize) and/or threathened habitat(s) (such as Intact Littoral or Mangrove Forest)	15	
	Property covers habitat not or insufficiently (<10%) covered by existing National MPA System (other than private).	10	
	Property covers habitat that is poorly covered (10 – 20%) by existing Protected Areas System	8	
	Sub-total	33	
Special features	*More than one choice is possible*		
	Important wildlife refugia/source and/or Spawning Ag. Sites	10	
	Property includes features of high landscape/scenic value such as caves, cultural, historic, geological features.	5	
	Property provides significant environmental services (e.g. important for watershed functioning, filtering function, buffer for sensitive areas etc)	5	
	Sub-total	20	
State of habitat	*Choose only one*		
	Ecosystem intact and fully functional	10	
	Partly intervened (grade according to level of disturbance)	2 to 8	
	Regenerating	2	
	Sub-total	20	
Special species	*More than one choice is possible*		
	Contains important breeding/nursery grounds (Bird Nesting Colonies, Iguana, Turtle, Crocodile Nesting Sites, Spawning Sites, etc)	15	
	Contains important roosting sites for birds and/or critical feeding grounds	8	
	Contains species endemic strictly to Belize	8	
	Contains species listed as endangered (IUCN)	6	
	Contains species on National list of critical species (but not listed above).		
	Contains critical habitat for species listed as endangered (IUCN)	4	
	Sub-total	41	
Total Bio-physical Characteristics		162	

General Note: Areas with distinct zones (bio-physical, state, use) can be assessed per segment.

Special Habitats Note: Based on Meerman 2005. Central American Ecosystems Map: Belize - 2004 update. See Ecosystems Map

Special Habitats Note 2: See 2005 National Protected Areas Analysis.

Table 4. *Special issues associated with types of landowners approached to reserve mangroves.*

Land Holder	Size (acres)	Type	Contact status to date	Conservation value	Incentive to reserve	Needs
Shrimp Farms	5,000 to 10	Mangrove, savannah, broadleaf forest	All farms have been approached about reserving land. In some cases, land has been surveyed and the minister contacted to create a government recognized reserve land without BAPPA status. Others are willing to consider BAPPA enrollment if benefits are sufficient.	Large mangrove holdings, large numbers and diversity of wading birds, jaguar, tapir, yellow headed parrot, orchids. Some areas are impacted by shrimp farm effluent waters, others are pristine.	Wildlife corridors for ecocertification, help with enforcement of property boundaries and theft, potential for carbon credits and tax breaks	All shrimp farms require mangrove corridors to help mitigate shrimp waste water and are interested in conserving and protecting those as well as the quality of their intake waters. All the shrimp farms are also interested in ACS certification and the current standards include creation of wildlife corridors. A specific fear here is loss of control over land and the inability to maintain or service existing developments if situations change.
Small land owners	10 to 35	Mangrove, savannah, cayes	Submitted application to BAPPA, entered into conservation to expressed interest	Mangrove holdings with diverse wildlife but inadequate size to independently provide large blocks of habitat to charismatic wildlife	Civic and conservation ethics, potential tax breaks and carbon credits	Individual land owners tend to own smaller lots, but as in Western Placencia Lagoon, where several landowners in a contiguous block own land, the sum of the holdings can be substantial.
Large developments	10 to 40	Mangroves, savannah, broadleaf forest	Greenway and reserves established near developments	Fringe mangrove and secondary forest with minimal wildlife	Marketing of developments as eco-friendly	Large developments use greenways as advertising to show their environmental credentials.
Villages	100 to 5,000	Mangroves, broadleaf forest, savannah	The Village of Placencia is working to establish a mangrove reserve along Placencia Lagoon.	Massively and diverse holdings with the potential to link create a wildlife corridor from the Maya Mountains to Placencia Lagoon.	Eco-tourism development, green spaces, habitat conservation	Political divisiveness and questions of landownership make these reserves problematic, but may result in significant conservation benefits.

Figure 16. *Plot map of Maya Beach (north of Seine Bight) showing disputed lands residents hoped to put into reserves.*

Lessons learned

WWF encouraged developers to set aside mangrove reserves and market themselves as "mangrove-friendly". One was even awarded a Mangrove Challenge Award for putting 2/3 of a valuable caye into a BAPPA reserve. Lot owners within the development soon complained the developer had told them the reserve would be much larger and no further building would occur near their homes. The developer reserve plans submitted to the Mangrove Challenge were consistent with their submission to BAPPA, but later versions of plans did indeed show the intention to clear additional lots on the reserve. The developer was notified that WWF would retract their Mangrove Challenge award if the reserve boundary originally submitted to the Mangrove Challenge was compromised. The developer retracted the new plan and honored the original reserve boundary.

This incident points to the need for reserve monitoring and well thought out plans by developers that they will adhere to carefully over time. Developers in particular have an economic incentive to advertise themselves as "eco-friendly" and then gradually develop reserves at a later date after initial sales are made to customers seeking sites near nature reserves. In the case noted here, the threat of retraction of the Mangrove Challenge award was sufficient to rectify the situation. Follow up by Vernon Consulting will ensure the reserve remains intact. In other cases, more careful institutional monitoring may be required. For instance in some cases, illegal mangrove removal is occurring for lumber and criminal enforcement will be needed.

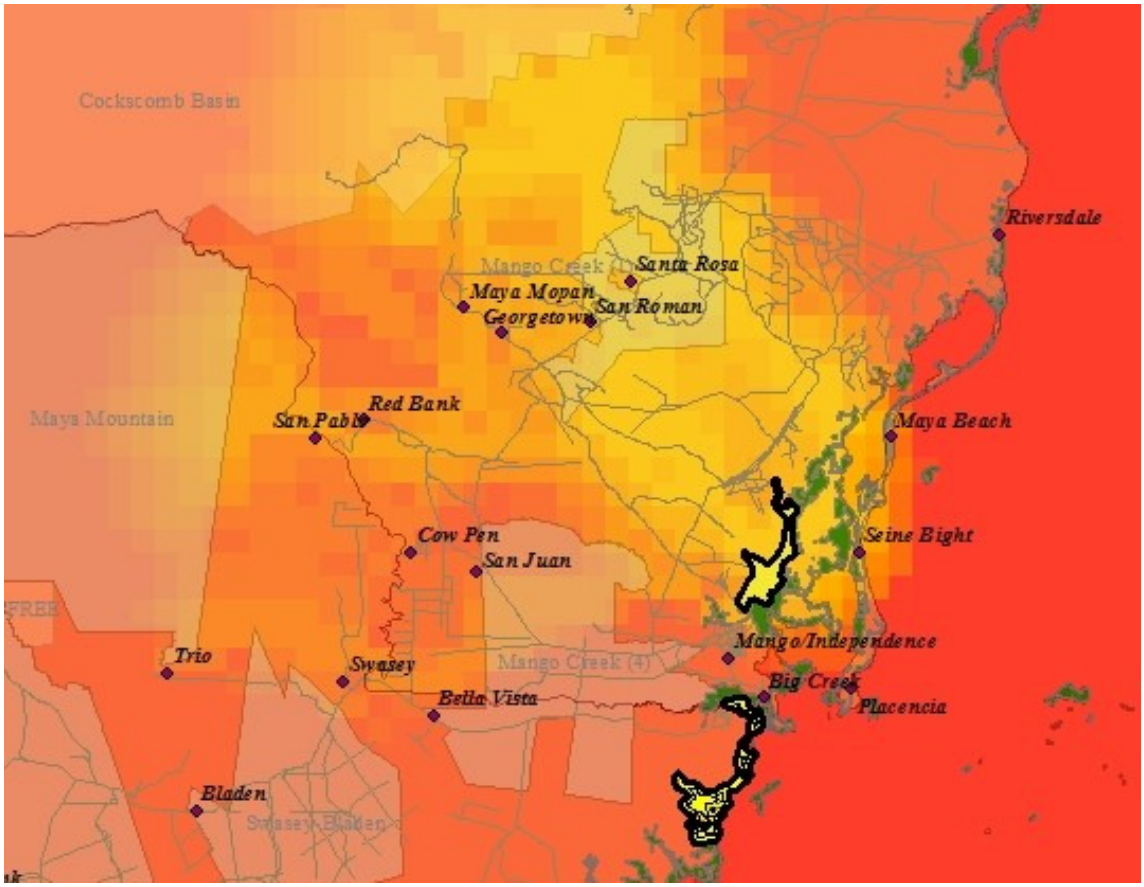
Tax breaks and carbon credits are cited by many landowners as incentives that would encourage them to put mangrove forest into reserve, but these have not been especially well developed in Belize. A former Minister of the Environment circulated a white paper proposing tax amnesties for individuals reserving mangroves, but that effort has made little headway. Although some properties in Belize do

receive carbon credits, those efforts within BAPPA have not yet resulted in carbon sales to reserve owners. Furthermore, the value of carbon credits for mangrove property is likely to remain less than the national property tax rate for the foreseeable future.

The stability of monitoring and stable administrative institutions remains another need for the development of mangrove reserves in Belize. Disruptions in organizational operations have slowed the reserve process. So far, the direct contributions of BAPPA to Placencia area mangrove reserves remains minimal and the argument to formally reserve through BAPPA has been rejected by some. BAPPA currently operates on a small budget with a staff of one individual. When that person died in 2010, a lag time of many months occurred before they were replaced. Contact from the new administrator has been slow and a regional meeting of potential reserve land owners has been postponed due to lack of follow up. One shrimp farm has followed through on personal commitments to reserve land without joining BAPPA for these reasons and due to their desire for personal control of their reserve.

The Southern Environmental Association (SEA), who had expressed interest in monitoring mangrove reserves, also experienced political upheaval and coastal conservation activities fell into disfavor under a past board with multiple commercial interests along the coast. Board turn-over has removed these individuals from positions of authority at SEA, but funds remain limited for monitoring and future changes remain possible. Climate change funding is being pursued during 2012 to provide for these activities. Again, however, these are long term processes have lengthened the time needed to reserve properties and get monitoring in place.

Figure17. *Map showing corridors of high quality habitat in yellow connecting potential shrimp farm mangrove reserves to the Maya Mountains, the Cockscomb Basin, and existing Mango Creek Forest Reserves to create natural passageways for wildlife from the coast to the interior.*



Long term, large scale planning and follow through will be needed to capitalize on the promise of mangrove and coastal reserves in Belize. At present, four properties including two large developments, a shrimp farm and a private land owner representing a total of 400 acres have followed through with mangrove reserves in the Placencia area. Other properties totaling several tens of thousands of acres have also expressed interest in reserves and require follow up and planning. These include several large landowners such as villages and shrimp farms with economic and environmental interests that must be carefully balanced against the value of mangrove reserves.

Integrating regional reserves into coherent entities with viable wildlife corridors between them will be an important process as well. In some cases the ability of several land owners to set aside smaller adjoining areas into one larger area can substantially augment the size and value of private reserves. Western Placencia Lagoon lies in close proximity to the Cockscomb Jaguar Preserve, for instance (figure 17). Linking together private owners, large company holdings and existing reserves could connect a Western Placencia Lagoon reserve to the Cockscomb Reserve and provide contiguous wildlife habitat between those sites.

Again, the creation of regional reserves will be an unavoidably complex long term process. Western Placencia Lagoon contains large mangrove holdings among disparate land owners with varying needs. Some land owners do not wish to be identified as potential reserve owners. Others have development plans that would result in widespread mangrove clearing and undermine the value of an extensive mangrove reserve. In many cases, individual development plans are needed to ensure property owners are economically secure before setting land in reserve. In other cases, such as in Mayan Villages where the status of land ownership is ambiguous, legal help will be needed to establish legal and viable reserves.

Cost effective mechanisms currently in place within this project can augment the number of acres in reserve over the long term. Facebook publicity through the Belizean Mangrove Conservation Network is growing steadily, with increased participation and the addition of numerous conservation groups as administrators. Mangrove Challenge participation is a direct portal for entry into mangrove reserves, providing developers an incentive to set aside reserves within their properties and expanding networks of individuals and organizations interested in mangrove conservation at the national and international level. Education within schools and community mangrove plantings also publicize the need to keep mangrove habitats intact.

More focused efforts are needed to enhance the function of BAPPA, bring legal council to bear on questions of Mayan land ownership, locate aggregators to provide carbon credits for land owners, and facilitate efforts to restructure tax debts to encourage mangrove reserves. Taken together, these efforts have the potential to slow the rate of mangrove removal around developments and conserve the mangrove ecosystem services that add to climate change resilience of coastal communities in Belize.

Belize Association of Private Protected Areas

No. 2, Corner Forest Drive and Slim Lane

P. O. Box 97

Belmopan City, Belize

Central America

Tel: 670-1935

A. Application Form for BAPPA Membership

Objective: to get general and basic information of the applicant and proposed property.

1. Name of Proponent: District:
Age: Gender:

Nationality:

2. Name of PPA: Acreage:
Current:

Proposed:

3. Land Tenure:
   a. Private land
   b. Long term Lease from Private Owner:
   Name of Owner:

Duration of Lease:

4. Situated in:
   Terrestrial ecosystem:

   Coastal / Marine ecosystem:

5. Location of Proposed Property:

   Close to an Existing Protected Areas (please name) ✓

   Close to a nationally identified biological corridor

   Close to towns / villages (please list)

6. **Reason(s) to be established as a PPA:**

7. Willingness to serve as a BOD member:

B. Property Selection Criteria for PPA Designation

Objectives: a) to assess the application for BAPPA Membership and b) to determine whether a more in-depth analysis of justification for inclusion within the NPAS is required.

1. The owner wishes to place xxxxx **acres** of land under conservation management:
   (a) within the terrestrial environment

   (b) within the coastal / marine environment

2. The predominant ecosystem / natural features of this property are:
   (a) forest

   (b) savanna

   (c) wetlands

   (d) caves

3. The property is _____km from the nearest national protected area …….. (name); please indicate whether the property lies within or near a nationally identified biological corridor (map available from BAPPA office).

4. The intactness of these natural resources is rated as xx**%**, on a scale whereby current intensive agriculture would score 0% and forest that has not been logged in 30 years or more and is not exposed to significant hunting pressure would score 100%.

5. The main characteristics of the property are:
   Scenic beauty

   Biodiversity

   Plants

   Animals

   Watershed Potential

   Sustainable Forest Management

Medicinal Plants

Others

6. Please indicate whether there are alternative plans for land management, or whether threats to the natural resources have been identified – and if so please describe.

7. What are the long term plans for the property?

   a. Ecotourism development
   b. Limited agriculture development
   c. agro-forestry
   d. silvo-pastoral (timber trees with grass/legumes for livestock production)
   e. shaded coffee
   f. sustainable resource management/extraction
   g. restoration
   h. protection
   i. other

8. Owner to present legal documents of land tenure and that he/she is the legitimate owner (freehold, or long-term leasehold from private or freehold property). Present the surveyed map of the property.

9. Fill in the Membership Application Form.

10. Sign a Commitment Form: Period of time willing to keep property under protection status.

    30 Years ( )

    60 Years ( )

    100 Years ( )

11. Pay a membership application fee of **$100/year/property** and subsequent annual membership fees. Payment should be made to BAPPA in cheque or cash. A Membership certificate is also issued once payment is made.

C. **<u>Information requested from members to be included in the Membership Directory- Very urgent ant should be submitted before October 15, 2009</u>**

1. **A short description of the property describing its uniqueness, sustainable activities (ecotourism, non-timber forest products use, sustainable timber harvest, sustainable agriculture, agro-sylvo-pastoral system, etc.). A sample is attached.**
2. **3-5 photos of the property with unique scenery, infrastructure, etc.)**
3. **A copy of the survey map with cadastral information of the property.**

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