

Case Study

Ometepe Island Biosphere Reserve

Developing climate change adaptation plans at the site level for Ometepe Island, Nicaragua

Key words: climate change adaptation, agroforestry, sustainable agriculture, biodiversity-friendly, agroecology, Nicaragua.

Synopsis

Recently declared a UNESCO Biosphere Reserve, the volcanic island of Ometepe, situated in Lake Nicaragua, is an ideal site to trial new approaches to conservation and sustainable development. Building upon our work to strengthen protected area management and support biodiversity-friendly farming and tourism initiatives on the island, FFI has been piloting a new approach to climate adaptation. Our goal is to build the resilience of Ometepe's people and ecosystems in the face of a changing - and less predictable - climate.

Through our partnership with local NGO Fundación Entre Volcanes, we have worked with local farmers to develop and trial climate adaptation measures on ten demonstration farms. We have helped build adaptation solutions into farm-level, as well as island-level, plans. As a result of this project, Ometepe's farmers are increasingly aware of the benefits of agroforestry in protecting crops from increased rainfall and landslides; mulching in protecting soil cover and maintaining soil moisture in periods of drought and increased temperatures; and reforestation in protecting essential local water sources. Already such strategies are being shared across the island, with farmers advocating their new, sustainable and biodiversity-friendly techniques to other farmers. This work is contributing to the aims of the Biosphere Reserve - where, as a discrete island system, it can become model for sustainable, climate-resilient development and biodiversity conservation throughout its natural ecosystems and agricultural landscapes.

Location

Situated in Lake Nicaragua, life on Ometepe is inextricably linked to the presence and influence of the island's two volcanoes. As a result of its impressive range of altitude, topography and climate, Ometepe boasts an extraordinarily diverse mosaic of forest and wetland habitats within its 276 km² area. Over the years, volcanic ash has made the soil of the island's lower slopes extremely fertile. Today the island has nearly 40,000 residents, who mainly rely on subsistence and commercial agriculture (largely shade-grown coffee, cacao and banana), fishing and tourism for their livelihoods. The allure of its volcanic peaks and idyllic beaches, combined with rich wildlife, cloud forest and ancient petroglyphs, now bring more than 40,000 tourists to visit the island each year.

Fauna & Flora International (FFI) has been working on the island since 2005. Initially our priority was to build local capacity for conservation and protected area management on Ometepe. Following the island's designation as a UNESCO Biosphere Reserve in 2010, FFI's aim is to work with local partners to **make biodiversity conservation and the use of natural resources on Ometepe Island more resilient and sustainable through improved environmental governance, landscape level planning and the promotion of sustainable forest-friendly livelihoods**. As a discrete island "world within a world", Ometepe has real potential to become a respected model of effective, collaborative and sustainable governance of natural resources.



FFI Ometepe Project Manager, Salvadora Morales, surveys the new irrigation system supplying crops on Alexis Alvarez's farm (Photo: Angélica Valdivia / Fundación Entre Volcanes).

Background to FFI's climate adaptation planning approach

There is now strong evidence for the reality of climate change as both a current phenomenon and as a future threat, and it is clear that many natural systems will be seriously affected. Although significant impacts from climate change may be some decades away in many areas, climate change adaptation planning is being seen as increasingly important, to enable local stakeholders to formulate practical 'no regrets' measures that reduce potential risks to natural landscapes and the goods and services they provide. The aim of climate change adaptation planning is to build and enhance resilience to change, through a process that teases out key impacts that are likely to be experienced and deducing which of these can be actively managed, and how.

Fauna & Flora International (FFI) has put together a package of resources and developed a tool specifically to assist site-level climate adaptation planning. We are convinced that while high-level predictive modelling and policy change is essential to tackling the global issue of climate change, so too are small-scale, local level initiatives, to help people make informed decisions in their immediate environments.

This work has been moving forward as part of FFI's work within the British American Tobacco Biodiversity Partnership (BATBP). Over the five years 2011-2015 FFI is piloting the climate adaptation planning tool at site level, and refining the approach specifically in the context of complex agricultural landscapes. This is with the aim of building stakeholder capacity at the local level to increase landscape resilience and maintain biodiversity and natural systems.

Adaptation Planning for Ometepe

The project team began by undertaking a review of the literature and available resources, identifying regional institutions with expertise in climate adaptation, and mapping relevant island stakeholders. Throughout the project, conservationists from FFI worked in close collaboration with our local NGO partner on the island, Fundación Entre Volcanes, who brought specialists in agroforestry, agronomy, local governance and planning to the team. The **field team developed their capacity for climate adaptation planning** through self-learning, knowledge sharing, and direct training in key concepts of climate variability, exposure, vulnerability and adaptive capacity for both people and biodiversity.

In the case of Ometepe it was agreed that the focus of the project should be on **working primarily in the field with agricultural stakeholders** (i.e. beneficiary farmers, their families and communities). The adaptation planning process built upon FFI and FEV's pre-existing work on farm management planning on the island. This programme of work - to promote sustainable forestry, establish biological corridors, and better connect people with the biodiversity upon which they depend - was already very relevant to climate change adaptation. A cohort of 10 beneficiary farms was identified to work with the project, from individual landholders to agricultural co-operatives, covering a range of agricultural crops - including bananas (the main crop in all cases), coffee, rice, tobacco - and landscapes.



Training workshop for farmers on organic composting techniques (Photo: A Valdivia / Fundación Entre Volcanes)

Following a survey to assess the existing perceptions of beneficiaries and communities about climate change, the team began working with farmers to **improve understanding of climate change** and their capacity to begin adaptation planning. This was achieved through discussions and seminars, as well as through video evenings, where films such as Al Gore's *The Inconvenient Truth* (for adults) and *Happy Feet* (for children) were shown and discussed. Recent marked annual variations in Ometepe's weather patterns (2011 was a year with a lot of rain and 2012 a year of drought) means that people are clearly witnessing

local impacts of a changing climate and this has helped project beneficiaries understand that local increases in temperature and seasonal variability are part of global processes of climate change.

The project has also sought to engage other stakeholders, particularly local authorities and protected area managers, to ensure that the process and lessons learnt feed into island-wide Biosphere Reserve management. We have sought to **build linkages for Ometepe with other projects and institutions** focused upon climate adaptation in Nicaragua, such as the climate change project of CIDEA-UCA (Environmental Training, Research and Development Institute of the Universidad CentroAmericana) and the Managua offices of CIAT (the International Center for Tropical Agriculture) and the National Dry Forest Forum. In 2013 the project team coordinated a meeting of specialists focused upon issues of fragmentation, connectivity and climate adaptation measures, presenting preliminary results of this project to ~200 forum members. On the island, the project has linked with the local authorities of Altagracia and Moyogalpa (the two municipalities on the island), the National Forestry Institute (INAFOR), as well as the Ministries of Environment (MARENA) and Agriculture and Forestry (MAGFOR).

The Ometepe team began the process of adaptation planning, through workshops held with project beneficiaries, community leaders and water associations. Feedback from this pilot process has informed the evolution and refinement of FFI's package of resources and tools for site-level climate adaptation planning during the course of the project. Participatory techniques, such as the use of seasonal calendars, community resource maps and hazard mapping, were used to facilitate discussion of future climate scenarios and potential impacts of climate change on local livelihoods and agricultural practices in particular, alongside potential adaptation solutions. This process resulted in the **development (or refinement) of ten farm-level plans**, which now incorporate an analysis of threats and vulnerabilities, and identify a series of specific adaptive strategies tailored to address these, for the ten demonstration farms. These plans will remain living documents, to be revisited and updated on an ongoing basis.

"The tools developed by FFI enable you to work step-by-step to analyse the interrelationships between problems, direct threats to biodiversity and to people, vulnerabilities and adaptation strategies."
 Angélica Valdivia, Agroforestry Specialist, Fundación Entre Volcanes

"The farmers we have been working with now have a better understand of climate change and are applying new knowledge and techniques - for soil management, pest control and irrigation - to improve the resilience of their farms."
 Carlos Barrios, Agronomist, Fundación Entre Volcanes

The project team also worked with municipal authorities to develop a site-level '**Action Plan for Adaptation to Climate Change for the Ometepe Island Biosphere Reserve**', with the intention that this Action Plan may be adopted and implemented by the local authorities and, ultimately, the Biosphere Reserve Commission.

Results

The initial policy and literature review confirmed that agriculture and water are priority areas for adaptation in Nicaragua, reflecting current and predicted climate risks and the location of the country's vulnerable populations. Nicaragua's policy framework is being strengthened, for example through the 'National Strategy and Action Plan on Environment and Climate Change' which was adopted in 2010; however national capacity for implementation of adaptation measures is low. Significant knowledge gaps were identified, for example the lack of detailed climate predictions for Ometepe. General predictions are that temperatures will rise and seasonality will increase and become more erratic on the island.

The process of adaptation planning enabled the field team and beneficiaries to consider and understand the **links between people's livelihood strategies, their resource dependencies, coping responses and the resources they need to strengthen their adaptive capacity**. Climate change is now better understood by local producers, as are the interrelations between climate change, biodiversity conservation, sustainable forest management, and agricultural productivity on Ometepe. The benefits of agricultural diversification, organic agriculture, conservation and reforestation are recognised by the project's beneficiary farmers, who were keen to pilot new methodologies. The project identified a suite of **locally-**

Project: Climate change adaptation in Ometepe Biosphere Reserve, Nicaragua

appropriate and biodiversity-friendly adaptation responses for Ometepe’s communities and habitats. The technical assistance provided by FEV has been critical in piloting these different approaches to sustainable agriculture and forestry on the demonstration farms.

Examples of climate change adaptation responses identified, and now being trialled and adopted within Ometepe’s agricultural landscape, include:

Environmental and social change in evidence: *Community leader and small-scale banana farmer, Wilfredo Barrios, has planted 2000 native trees in a forest plantation on his land since working with the project. He no longer burns his plot and employs organic soil conservation techniques. Because of the knowledge and experience he has gained of sustainable and resilient farm management, Wilfredo has been formally appointed by the local government as a promoter of agroecological practices on the island and now advocates these techniques and provides support to other farmers in the community.*

- **Rainwater harvesting and use of irrigation systems:** Water harvesting and efficiency in water consumption is proving to be one of the best examples of an adaptive strategy on the island. This solution is now enabling beneficiary farmers to harvest three times a year, with eight crops sown in a single cycle, and is increasing income generation. In the words of Alexis Alvarez, one of the farmers working with the project who is already appreciating the benefits: "My tomato crop grown with the irrigation system has given me greater profits in three months, than my banana harvest in one year." Rainwater gauges are also enabling landowners to participate in gathering local meteorological information.
- **Crop diversification and rotation:** Overreliance on a single crop (mainly bananas) can increase vulnerability. Farmers are being encouraged to diversify the range of crops grown, such as vegetables and fruit trees, alongside experimentation with and the adoption of new varieties (over 17,000 seedlings planted) and the use of more organic products. Diversification is a strategy which is likely to reduce overall vulnerability to increased seasonal variability, where appropriate varieties are planted that are resilient to current and predicted climatic conditions and for which there is a reliable market. FEV are also working with farmers to trial and adopt **varieties tolerant to pests and diseases**, which are predicted to rise in response to increased temperatures. Examples include a variety of bean which can be planted even when drought is predicted, and a tomato hybrid resistant to disease.
- **Soil quality and conservation:** Work to improve ground cover and soil quality is one of the most striking changes in farming practice on the demonstration plots. Before the project, farmers commonly burned stubble to clear land, leaving soil vulnerable to erosion by wind and water, to being baked by the sun, and to loss of soil organic matter. Today all the farms that work with the project follow the recommended technique of retaining stubble to maintain ground cover, alongside the use of nitrogen-fixing cover crops (green manure) and mulching, leading to multiple advantages for soil structure, fertility and productivity.
- **Forest management and reforestation:** Forest areas are an important component of Ometepe’s complex agricultural landscape, providing multiple ecosystem services (water, pollination, timber, biodiversity, windbreaks, and so on). Maintaining connectivity between forest landscapes, reducing fragmentation, recovering lost habitats and establishing ecological corridors, is essential to increasing the resilience of the island ecosystem and its biodiversity. The project has built upon existing FFI work with landowners to establish forest corridors, particularly linking the forests of the volcanoes’ slopes, through the forest/agricultural mosaic, to the coast. We are promoting and supporting sound conservation management of forest areas (“conservation zones”) on all ten farms, as



Farmer Nestor Rosales is championing the process of composting using worms (vermiculture). (Photo: A Valdivia / Fundación Entre Volcanes)

well as the reforestation of denuded areas and sustainable agroforestry. The planting of native tree species (12,500 seedlings planted so far), to promote rapid recovery of deforested areas, alongside planting of basic crops, in order to optimize land-use, is helping to promote conservation and ecosystem management amongst farmers on the island.

Whilst these practices are not solely solutions for climate adaptation, they all have relevance for increasing resilience to climate change across agricultural landscapes and the broader ecosystem upon which they depend. Farmer-to-farmer learning exchanges are being promoted, and the need for ongoing learning and monitoring the adaptation relevance of the agricultural practices promoted under the project is recognized. A short film has been produced to showcase the planning process and capture the experiences and practices of climate change adaptation from the demonstration farms on Ometepe.

The project had a focus on increasing knowledge of the specific vulnerabilities of tree species on the island to climate change. We supported continuing monitoring of five permanent vegetation plots on the slopes of Maderas Volcano and established five new monitoring plots within forest patches of the demonstration farms to enable landowners to monitor growth of newly planted trees. Work to date confirms the vulnerabilities of important timber species such as mahogany and *cedro real* (IUCN Vulnerable) to specific pests and diseases and the project team are working with scientists to trial pest control measures. FFI and FEV are also facilitating an alliance with the School of Agriculture and national universities to establish a long-term programme of climate and vegetation monitoring on Ometepe, with a specific focus on increased vulnerabilities generated by climate variability.

The island-level Action Plan for climate change adaptation developed through this project defines priority adaptation strategies for Ometepe and outlines the resources and capacity (finance, governance, expertise and awareness) needed for their application. Following presentation of the Action Plan document to the municipal authorities during 2014, FFI and FEV aim to provide ongoing technical support to relevant stakeholders across all sectors for its implementation.

Key project results on Ometepe:

- Climate change better understood by local people, as are links between climate change, biodiversity conservation, sustainable forestry and agricultural productivity.
- Increased capacity amongst island stakeholders to undertake climate adaptation / foresight planning processes.
- Climate adaptation measures incorporated into farm-level plans for ten demonstration farms.
- Suite of locally appropriate adaptation measures trialled and adopted across ten demonstration farms, and being shared across Ometepe's agricultural landscape.
- Action Plan for climate change adaptation on the Ometepe Island Biosphere Reserve developed and shared with decision makers.

Lessons learnt

A summary of the key lessons learnt from the Ometepe site are outlined below.

- This project has built upon - and has therefore benefitted from - FFI and FEV's **pre-existing work with farmers** on the island of Ometepe.
- Significant benefits can be obtained through establishing linkages with national and regional institutions and networks with expertise in climate change adaptation and related spheres, as well as by **exploring alliances and lessons learned from existing climate adaptation projects**.
- Project beneficiaries welcomed the opportunity to **learn about climate change** and how it impacts their agricultural production. Considerable time and effort is needed to clearly introduce concepts of climate change and adaptation, and to clarify pre-existing confusion around the causes and effects of climate change, and how we can **reduce (mitigate) and respond (adapt)** to these impacts.
- Much of the available literature, technical documentation and tools are only available in English and the wealth of scientific and policy information can be daunting.

- Whilst the current project has enabled us to **understand different people's vulnerability to climate change and their adaptive capacity**, there remains a need to **further explore differences** in specific vulnerabilities and opportunities for adaptation across different sectors of society and clarify what this means for biodiversity.
- The project forged a **"learning by doing"** approach, moving beyond planning for adaptation, to testing adaptation responses.
- It is essential to ensure that projects are supporting *'no regrets'* measures and not encouraging *'maladaptation'* to climate change.
- The **technical support provided to farmers** by FEV - in agroforestry, agronomy and planning - is one of the main success factors of the project and is highly valued by the project beneficiaries, alongside tangible increases in production, gains in income and conservation benefits.
- The process of adaptation planning, once it begins to identify potential adaptation responses, can **raise expectations and concerns** as to how the implementation of adaptation responses would be financed.
- Farmers should be encouraged to take part in on-going, **participatory monitoring of their own adaptation responses**.
- It is important to support farmers to explore all the factors and processes involved in successful, adaptive, farm management (including marketing) so that they are able to continue to make decisions, try out new things and **adapt to change without continuous intensive support in the future**.
- There is substantial **local interest for broader participation** in this project, and therefore significant potential to scale-up its impact, through sharing experiences from the ten demonstration farms on Ometepe and the facilitation of farmer-to-farmer learning.



Project partners observing climate adaptation practices at one of the demonstration farms (Photo: A Valdivia / Fundación Entre Volcanes)

Want to find out more?

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Links to additional relevant tools and case studies:

FFI Tools:

- Fauna & Flora International (2014) *Climate Adaptation Planning: A Toolkit for Biodiversity Conservation Project Sites* Available at: www.fauna-flora.org/initiatives/climate-change-adaptation-planning-toolkit
- Fauna & Flora International (2013) *Participatory Facilitation Techniques (Tools for Participatory Approaches)* Available at: www.fauna-flora.org/initiatives/livelihoods-and-governance-library/#tools

National Plans and Data:

- Adaptation Learning Mechanism (2009) *Nicaragua Country Profile and Climate Data Summary*
- República de Nicaragua (2010). *Estrategia Nacional Ambiental y del Cambio Climático. Plan de Acción 2010-2015*
- Ministerio del Ambiente y los Recursos Naturales (MARENA) (2008). *Estrategia de Adaptación al Cambio Climático de los Sistemas Recursos Hídricos y Agricultura.*

Case Studies:

- CIAT Policy Brief: Läderach, P., *et al.* (2013) "*Mesoamerican coffee: building a climate change adaptation strategy.*" International Center for Tropical Agriculture
- Aguilar, Y., Amado Ordóñez Mejía, and Centro Humboldt. (2011) "*Impactos del cambio climático en la agricultura de América Central y en las familias productoras de granos básicos.*" Observatorio de la Sostenibilidad-Red Latinoamérica.
- FAO (2011). *Effects of Global Warming on Vulnerability to Food Insecurity in Rural Nicaragua.* Agricultural Development Economics Division.
- World Bank (2009). "*Nicaragua - Country note on climate change aspects in agriculture.*" Climate change aspects in agriculture country note brief. Washington, DC: World Bank.

Project Outputs:

- Fauna & Flora International (2013) *Lessons learnt: Developing climate change adaptation plans at the site level for Ometepe Island, Nicaragua*
- Fauna & Flora International & Fundación Entre Volcanes (2013) "*Action Plan for Adaptation to Climate Change for the Ometepe Island Biosphere Reserve*"