CONCLUSIONS: MOVING FORWARD

Building resilient societies requires more than leveraging investment from international donors and multinational corporations. In reality, adaptation starts from the ground up, from MSEs embedded in developing communities that are the key to sustainable development and building resilient nations. More than half the population in developing countries relies on MSEs for a living. Similarly, MSEs contribute significantly to countries' GDP. However, because of the limited capacity of many MSEs, they tend to be the most vulnerable segment of the private sector to climate variability and extreme events. To ensure that developing countries—especially the most vulnerable populations—are resilient to climate change, MSEs themselves need to become more resilient. Part of this change has to come through public support.

Policymakers, development partners, and climate funds need to expand their current focus on leveraging private sector finance to include adaptation incentives that support MSEs. MSEs are at the center of the economies and labor markets of most developing countries; their fate helps to determine the poverty or development of men, women, and children. They are the innovators and entrepreneurs who respond with new ideas based on demand from consumers in a changing climate. The positive impacts of these efforts go beyond the single MSE, or sector, or country. The impacts are widespread for the global community—resilient and innovative MSEs could impact global supply chains, improve ecosystem services, strengthen global markets and support the food supply, even in the face of extreme changes in the climate. The extent of the positive effects of focused government interventions could create a multiplier effect and transform the private sector. Targeting MSEs is essential for building resilient societies that will maintain sustainable development even in the worst-case climate scenarios.

What Developing Country Governments Can Do

Adapting from the Ground Up is designed specifically to help developing country governments engage MSEs in adaptation. The actions it recommends could directly support the resilience of vulnerable communities, build up innovation, and maintain the development path of their countries. To facilitate effective adaptation planning, the UNFCCC established the national adaptation plan process for countries, especially LDCs, to implement in the broader context of sustainable development planning. As such, policymakers can use this process to develop policies, processes, and activities to engage MSEs in their countries' long-term sustainable planning to improve resilience to climate impacts.

However, the guidelines to develop the NAPs thus far focus mostly on the public sector's efforts to adapt to climate change and do not address the private sector as a major contributor to building a resilient nation. This report suggests that the adaptation planning process must be inclusive and transparent and must start with a dialogue between the public and private sectors. As countries begin to formulate their NAPs, policymakers need to involve the private sector, especially MSEs and their investors and regulators, from the beginning. MSEs will need to be educated about climate risks, and about the potential assistance they can receive from public institutions with the support of policymakers.

In addition to engaging in a dialogue with the private sector, developing country governments should actively engage with other players who can assist them in implementing these interventions. For example, they should work with multilateral development banks and NGOs with the capacity to provide support and knowledge. They should also engage with multinational corporations, financial institutions, and investors to engage the MSEs in their countries. Linking the public sector with these other stakeholders will bridge a knowledge, resource, and finance gap. Responsibility should also be delegated to the city and local levels, where public officials have more direct contact with MSEs. Civil society organizations can also be used to reach local community groups who might be hesitant to engage with large and unfamiliar institutions.

What Multilateral and Bilateral Partners Can Do

Providing financial and technical support for national activities is the most direct way that multilateral and bilateral partners can support this process. Donor institutions can also act as knowledge banks and facilitate the transfer of information about successful business practices, initiatives, and pilots to other appropriate contexts. Additionally, bilateral partners can support the process of catalyzing engagement in adaptation by ensuring market access for products developed by MSEs in developing countries. For instance, countries can include specific arrangements for vulnerable or priority sectors in least developed countries in their trade agreements. Encouraging trade from these sectors will spur more growth, and therefore, a stronger economic foundation from which to invest in adaptation. Bilateral donors can also work with their own companies that operate in developing countries and provide financial incentives for them to invest in building resilience of small-scale suppliers in their supply chains. Lastly, multilateral and bilateral partners can serve as communicators to inform the global community about the multiplier effect of investing in MSEs for climate change adaptation.

What Special Climate Funds Can Do

Climate funds, such as the Green Climate Fund, can play a catalyzing role by ensuring that they direct funding to programs for MSEs. Climate funds can also act as matchmaker and clearing house for private sector adaptation ideas. The challenge is ensuring that MSEs benefit from the expertise and network support that climate funds can offer. Engaging NGOs can facilitate this process because they can act as an intermediary between global funds and MSEs in vulnerable areas. Climate funds can support and complement national efforts by creating regional or national networks to help MSEs develop product ideas into bankable projects, support capacity development for implementation, and link businesses to possible investors.

What Large Private Sector Actors Can Do

Companies and investors can support MSEs in the supply chain by providing financing and technical assistance to strengthen their resilience to climate change. Financial institutions can also contribute by providing MSEs in low-income countries with better access to finance for adaptation efforts. There is a range of possible measures that the private sector can employ to strengthen MSE resilience because private sector financial resources are relatively more flexible than those of the public sector. Forming strong partnerships between public and private actors could effectively scale up adaptation efforts, given proper planning, implementation, and monitoring.

Closing

As with catalyzing investments in mitigation, catalyzing investment in adaptation will take time. Addressing the barriers facing MSEs will require leadership and a long-term vision. Disseminating useful information and technical assistance on climate change, adaptation, and cost-effective investments will require time and support from governments, development partners, and NGOs. Although some of the interventions proposed in this report will require relatively large investments, with careful planning and engaged stakeholders, institutions, and partners, successful efforts to engage MSEs and raise their levels of investment in adaptation will have far-reaching effects. With an understanding of the potential benefits of increased MSE resilience, it is clear that these interventions can create a sustainable path to more resilient societies. Because impacts of climate change will only become more severe, providing support to MSEs is urgent. Changes in the world's climate are now inevitable and severe weather events are bound to occur. The lives of vulnerable men, women, and children are at stake.

ANNEX 1. CASE STUDY: **ZIMBABWE**

PROJECT: "Coping with Drought and Climate Change in Zimbabwe."

OBJECTIVE: Develop and pilot a range of effective coping mechanisms for reducing the vulnerability to drought shocks of farmers and pastoralists, particularly women and children, in Chiredzi district.

LOCATION: Chiredzi district

DURATION: May 2008–September 2012

IMPLEMENTED BY: The Zimbabwean government's Environmental Management Agency, with support from UNDP

FUNDED BY: Special Climate Change Fund (SCCF)—Global Environment Facility (GEF)

TOTAL FUNDING: US $983,000

BENEFICIARIES: Farmers and pastoralists (micro/small agribusinesses)

RELEVANT INTERVENTIONS

- Farmer field schools promoting diversified crop mix, soil moisture and nutrient management, and mixed production business models
- Testing the resilience of different crop varieties to demonstrate the benefits of a crop mix
- Assisting farmers to start new enterprises or diversify their business (for example, adding livestock)

POSITIVE RESULTS

- 3,000 farmers in total engaged in adaptation activities and climate-resilient livelihoods
- New agricultural knowledge introduced to over 600 farmers through farmer field schools
- Increased agricultural productivity and resilience in times of drought; 40 percent of farmers in the pilot area adopt a climate-resilient crop mix
- Decrease of more than 20 percent in dependence on rain-fed agriculture as the sole source of livelihoods
- Mixed production model including a livestock component adopted by nearly 40 percent of farmers; other income-generating activities introduced in 280 households

Community resilience to climate change in the drought-prone region of Chiredzi, in southern Zimbabwe, requires livelihood development, especially in the agropastoral sector. Building productive, local businesses is crucial for both climate adaptation and poverty reduction. UNDP's intervention showed farmers and pastoralists in the Chiredzi district how to make their MSEs more resilient and profitable. The intervention introduced adaptation measures to develop agricultural resilience to climate variability and drought events, and to shift Zimbabwe's agribusiness from a maize-based economy toward more diversified agriculture.[36] Relevant activities include:

- Organizing farmer field schools, where over 600 farmers were exposed to:
  - Diversified crop mix, including sorghum, pearl millet, cowpeas, groundnuts, and drought-tolerant maize varieties[37]
  - Experimentation with soil moisture management techniques (for example, tied ridges, deep plow-tied furrows, rainwater basins, and flat land preparation) and training on soil nutrient management
  - Livestock farming practices (for example, conservation techniques and adding value to livestock fodder) and market linkages[38]
- Encouraging farmers to grow more resilient crop varieties by procuring improved and resilient seeds, consistent with market demands, and supporting seed multipliers
- Establishing more effective natural resources management as a livelihood development strategy, with a focus on the wildlife farming, safari hunting, and ecotourism industries
- Assisting local farmers and pastoralists to start new businesses, such as aquaculture and crocodile farming
- Supporting community gardens with small-scale irrigation schemes[39]

The project was implemented by the Zimbabwean government, through its Environmental Management Agency, with support from UNDP. UNDP provided oversight and quality assurance. The intervention engaged a range of stakeholders, from farmers to local authorities and agricultural research institutions. For example, the project drew on expertise from the Chiredzi Research Station, which conducts research and offers technology support for farmers in semi-arid regions, and the Makaoli Research Station, which focuses on livestock agriculture. Another major player was the Department of Agricultural, Technical and Extension Services. Extension workers were posted at the village level and kept in daily contact

Table A1 | **Adaptation Interventions for MSEs in Zimbabwe**

BARRIER	INTERVENTION	CHANGE	OUTCOME AND IMPACT
Access to markets: No ready market for some climate-resilient crops and livestock options	Could not improve value chain for all adaptive crops within the project timeframe; focused on supporting those with market potential, such as red sorghum	Partnerships with private sector enhanced value chain	Diversification of agribusiness due to the intervention's pilot projects to stimulate products with ready markets, for example, red sorghum, fish, and livestock
Skills: Lack of technical capacity to use adaptation technologies	Farmer field schools introduced farmers to new adaptation technologies and techniques	Farmers extended their agricultural knowledge and skills	Diversification of crops, improved soil moisture management, and more resilient mixed production models
Information: Lack of information channels to rural areas limiting weather forecast information	Installation of eight weather stations and the development of a customized rainfall forecasting system	Farmers able to plan for climate variability and extreme events	Improved crop cycle planning, drought preparedness, and changed farming practices to protect yields from low-rainfall seasons
Finance: Limited access to finance for investing in adaptation	No direct financial assistance was provided. The only financial support was purchase of high-quality, certified seeds for the crop mix	Demonstrated potential for stronger agribusinesses through use of crop mix	Farmers continued to use a crop mix to diversify and expand their businesses
Institutions: Government policy does not prioritize climate adaptation (does not promote crops with adaptive capacity)	Conducted technical studies (for example, climate risk analyses) for national institutions.[40] Worked with officials to implement other project activities (for example, crop diversification)	Improved knowledge base and capacity of national institutions for climate adaptation. Demonstrated policy-oriented approaches to agropastoral adaptation as a model for policy at the national level	Policy direction and institutional framework are still under development;[41] but the project experience (increased adoption of adaptation measures and increase in agricultural productivity) is likely to contribute to national climate change policy and strategy

with farmers. Local government structures were also important, including district council and local-level leadership. The cooperation of the government ensured a sense of country ownership of the intervention.

The project enabled income generation by providing knowledge, technical skills, and, in some cases, equipment for adaptation such as crop mixes. The farmer field schools were particularly effective at building the capacity of local agribusinesses and persuading farmers to adopt more adaptive business practices. For example, the field schools demonstrated how farmers could get a better harvest during the low-rainfall season by using a crop mix.

The main barrier that remains is access to markets. The case of Zimbabwe demonstrates the importance of opening up access to markets to catalyze business growth. A ready market for selling goods is necessary to incentivize farmers to grow a crop surplus. While this is not an issue for the livestock industry, which is subject to high demand, the lack of an accessible market is a deterrent for growing alternative crops such as cassava. Both the government and broader private sector currently support crops with low adaptive capacities, including maize; instead, they need to join together to develop the value chain and stimulate investment in more resilient crop varieties.

ANNEX 2. CASE STUDY: **CAMBODIA**

PROJECT: "Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia"

OBJECTIVE: Reduce the vulnerability of Cambodia's agriculture sector to climate-induced changes in water resources availability

LOCATION: Preah Vihear and Kratié (Kracheh) provinces

DURATION: September 2009–November 2013

IMPLEMENTED BY: The Government of Cambodia, Ministry of Agriculture, Forestry and Fisheries, with support from UNDP

FUNDED BY: Least Developed Countries Fund (LDCF)—Global Environment Facility (GEF); UNDP

TOTAL FUNDING: US $3,090,350

BENEFICIARIES: Farmers (micro/small agribusinesses)

RELEVANT INTERVENTIONS

- Irrigation schemes, rainwater catchment and conservation technologies to reduce agricultural dependence on rainfall
- Seed purification to produce resilient rice varieties
- Community-based climate information system to assist farmers with planning for climate hazards

POSITIVE RESULTS

- Increased agricultural productivity with adoption of adaptation technologies including six scientifically improved, resilient rice varieties
- Improved water use efficiency. 1,470 households (30 percent of total in the target areas) benefit from 62 pump wells, three community ponds, 41 rain water harvesting containers, 10 solar pumps
- Irrigation schemes allowed farmers to grow an additional 355 hectares of rice during the rain-delayed period, benefiting 2,000 households
- 11,073 households in 52 villages, representing 55.5 percent of the target households, received timely information on weather forecasts to cope with events such as severe floods
- Changes in farmers' knowledge and attitudes to adaptation was observed following the environmental education and training programs

As a country with high exposure and high sensitivity to climate change, Cambodia needs to develop its adaptive capacity, especially in the agriculture sector. Maintaining steady access to water for agriculture is becoming increasingly difficult with climate variability, droughts, and flood events. UNDP's intervention in rural Cambodia drew attention to the need to protect the agriculture sector from the adverse impacts of climate change, with a focus on water management. The intervention targeted individual smallholders and family farms, which comprise the majority of private sector activity in Cambodia's rural communities. The project engaged 3,600 households, most of which were involved in some form of agricultural enterprise as their primary source of livelihood. The majority of beneficiaries were small-scale farmers, including sole proprietors and family-run farms. Small- and medium-sized local companies were also engaged, including irrigation firms and companies that process rice meal for local and international markets from the grains supplied by farmers. The intervention was instigated in two provinces, Preah Vihear and Kratié, "selected for their high vulnerability as well as for differences in agro-ecological and socio-economic circumstances."[42]

1. To improve resilience in agriculture, the project worked with farmers to:

- Introduce improved cultivars and test resilient rice varieties
- Conduct rice seed purification and apply the System of Rice Intensification (SRI)
- Train farmers in diversified agriculture skills such as raising livestock and vegetable gardening

2. To improve water management in agriculture, the project sought to:

- Build irrigation systems to insulate against droughts. Each irrigation scheme benefits multiple households, organized into water user groups
- Improve water-control infrastructure, including rainwater tanks, community ponds, wells, and solar water pumps, to mitigate flood damage

Funded by the LDCF and UNDP, the project was implemented by the Cambodian government, including the Ministry of Agriculture, Forestry and Fisheries (MAFF) and Communes (local administration), working closely with UNDP's country office in Cambodia. Some measures were undertaken in partnership with the International Fund for Agricultural Development (IFAD).

Over its four-year lifespan, the intervention achieved nearly all of its objectives (Phase 1). The activities in Preah Vihear and Kratié increased agricultural resilience by introducing improved water management practices, resilient seed varieties, and an improved climate

Table A2 | **Adaptation Interventions for MSEs in Cambodia**

BARRIER	INTERVENTION	CHANGE	OUTCOME AND IMPACT
Attitudes: Local attitudes, resistance to new farming methods	Demonstrations of benefits (cost and time savings) of using adaptation technologies	Farmers more willing to invest in adaptation technologies	Farmers engaged in adaptation. Hearing of their success, other farmers have expressed interest in the new technologies, such as resilient rice seeds
Skills: Lack of technical capacity to use adaptation technologies	Trainings on effective water management	Farmers able to use solar water pumps and irrigation systems	Use of water catchment and irrigation systems has reduced dependency on rainfall, and increased agricultural resilience to climate events such as droughts and floods; it has also increased the availability of water for drinking and home gardens
Finance: Limited access to finance for investing in adaptation	Grants and subsidies for adaptation measures in agriculture and water	Farmers have access to more resilient rice seed, irrigation, and water-catchment options	With financial assistance, farmers have adopted new agricultural and water conservation practices—improving their agricultural productivity and resilience to climate events
Institutions: Weak institutional framework on adaptation in agriculture and water management; for example, no national water plan	Contributed to revisions of agricultural and water policy, and worked with government to implement the intervention in communities	Government gained a sense of ownership over the project;[43] capacity-building among government officials; greater awareness of adaptation issues	Climate change priorities included in national strategies and policies; provincial development plans in place incorporating climate risks; Commune Councils better understand and take into account adaptation in local policy; government committed to assisting with project implementation in Phase 2
Information: Lack of weather forecast information	Provision of new community-based climate information system on flooding and drought events	Farmers able to prepare themselves to cope with expected hazards	Farmers have changed farming practices, for example, storing water, seeds, preparing soil, replacing late-maturing rice varieties with early-maturing varieties; thus protecting yields from the effects of extreme weather events

information system. Before the intervention, farmers relied heavily on rainfall and did not have the knowledge or tools to implement effective water management. By supporting farmers to adopt adaptation measures, such as irrigation and water conservation tanks, the intervention has improved both the resilience and productivity of local agribusiness. Based on the success of Phase 1, it is now due to be scaled up and replicated in two other Communes, benefiting an additional 1,900 households (Phase 2).[44]

The Cambodian case demonstrates the importance of presenting the business case for adaptation to persuade farmers to change their practices. Farmers' attitudes and habits posed a major barrier to adaptation. Without addressing their resistance to change, there was the risk that new technologies introduced would not be used after the pilot phase was completed. The intervention has had success in transforming agribusinesses, having shown farmers how adaptation measures will improve yields or prevent yield losses during harsh or dry seasons. The measures introduced in the target area are now being replicated in other parts of the country and show strong signs of sustainability.

ANNEX 3 – CASE STUDY: **TAJIKISTAN**

PROJECT: "Sustaining Agricultural Biodiversity in the Face of Climate Change in Tajikistan"

OBJECTIVE: Embed globally significant agro-biodiversity conservation and climate adaptation in agricultural and rural development policies and practices at national and local levels in Tajikistan

LOCATION: Four pilot areas (Zeravshan, Rasht, Baljuvan, and Shurobad), within seven districts (Aini, Penjikent, Tajikabad, Nurobod, Khovaling, Baljuvan, and Shurobad)

DURATION: July 2009–February 2015

IMPLEMENTED BY: The National Biodiversity and Biosafety Center (NBBC) under the purview of the Tajikistan government's Committee for Environmental Protection, with support from UNDP

FUNDED BY: Strategic Priority on Adaptation (SPA)—Global Environment Facility (GEF)

TOTAL FUNDING: US $2,025,000

BENEFICIARIES: Farmers (micro/small agribusinesses)

RELEVANT INTERVENTIONS

- Skills and knowledge to increase farm productivity and food security using climate-resilient agro-biodiversity-friendly practices, including the diversification of crops
- Education on financial management
- Provision of micro-credit schemes
- Trainings on using equipment such as solar dryers

POSITIVE RESULTS

- Produced more resilient and profitable agribusinesses; average income of farmers increased by 40 percent
- Greater access to finance; through micro-finance facilities, 170 households have expanded their home gardens, now covering 250 hectares in total, and established agro-processing shops
- Brought new agricultural knowledge to 3,300 participating farmers, through practical trainings and workshops on adaptation issues

Building climate resilience in Tajikistan requires an understanding of the broad landscape of private agricultural enterprises, including family farms in the informal sector. The intervention targeted micro and small enterprises in the most vulnerable communities as beneficiaries and has helped to grow these agribusinesses through skills training, capacity building, and providing access to finance. The government's cooperation in the project has helped to create an enabling environment for climate-resilient agribusiness by introducing certification and labeling standards for agro-biodiversity-friendly products, which immediately increased their market value.

The establishment of micro-loan schemes has rapidly advanced local farmers' investment in adaptation options such as different crop species and technologies. Before the intervention, access to finance was a major barrier; stories of farmers with intractable debt problems deterred others from taking loans to make investments that would improve their business. The intervention has addressed this fear by conducting trainings on financial skills to show farmers how to avoid debt issues and by spreading success stories of farmers who had profited from investing in adaptation.

UNDP's intervention in Tajikistan addresses the loss of agro-biodiversity while promoting climate-resilient agriculture. The beneficiaries of this intervention are approximately 3,300 local farmers and households with subsistence gardens in the target areas. The intervention enables farmers to expand their agro-enterprises and to better adapt to climate risks through the conservation and use of agro-biodiversity. By strengthening and diversifying the agriculture sector, it also helps MSEs to generate alternative sources of income to offset the negative impacts and shocks of climate change.[45]

The intervention has three aspects:

1. **Changing policy at the national and local level** to incorporate principles of agro-biodiversity conservation and climate adaptation and working at an institutional level to create an enabling environment for agribusinesses, for example, by encouraging the government to simplify certification procedures
2. **Testing modeling using a homologue approach,**[46] which predicts climate conditions and its impacts on agro-biodiversity at sites with a higher altitude, based on current conditions in homologous sites matched in terms of soil and climate, and thereby helps to predict how crops will respond to climate impacts in the long term

Table A3 | **Adaptation Interventions for MSEs in Tajikistan**

BARRIER	INTERVENTION	CHANGE	OUTCOME AND IMPACT
Finance: Limited access to credit; debt issues	Helped with establishment of micro-credit facilities (intervention was partially funded by grants and partially by these loan schemes)	Farmers have access to cheap, available finance to invest in more resilient crops and methods	Farmers have diversified their produce and expanded their business into new markets; by using micro-loans, farmers feel more ownership and responsibility over their business; due to their success, the loan schemes are continuing after termination
Technical capacity: Lack of traditional farming knowledge and skills beyond cotton production	Hydrologists, agronomists, other specialists engaged to give advice to farmers; Jamoat Resource Centers have made up-to-date agricultural information readily accessible[47]	Farmers have extended their agricultural knowledge	Crop diversification, focusing on propagation of climate-resilient traditional species
Attitudes: Local attitudes and risk aversion to new farming practices	Demonstrated economic benefits of transitioning to new methods of farming	Farmers persuaded to try different methods. Intervention also changed attitudes of local authorities, who had favored only annual crops	Farmers more willing to experiment with new adaptation techniques and technologies; however, persistence is required to change farming attitudes in the long term; at an institutional level, local governmental policies and practices now promote diversified crops[48]

3. Working with farmers to improve agricultural resilience and expand agro-biodiversity enterprises

The most relevant activities conducted in the intervention include:

- Promoting the use of climate-resilient, local crop species through local-level authorities, other farmers, resource centers, and the media (for example, project experts published informational brochures and articles in newspapers)
- Building farmers' agricultural knowledge of a broader range of species (such as fruits) and technical capacity to grow them by, for example, hosting demonstrations to show farmers how to use solar dryers, and conducting study tours for farmers across the country
- Increasing the value of local agro-biodiversity products through proper packaging, marketing, state-regulated certification and standardization of seedlings, and promotions at national and local trade fairs
- Expanding access to markets, for example, connecting farmers to supermarkets in the capital and establishing contracts for the wholesale supply of seedlings
- Providing farmers with access to micro-loans for agro-biodiversity enterprises, as well as training in financial skills
- Creating a "knowledge hub" by supporting a nationwide network of more than 100 small, community-based organizations called Jamoat Resource Centers (JRCs). These JRCs provide various agricultural extension services, for example, renting equipment, information about weather, information on fairs for selling produce, information about market prices for different goods in capital and global markets, and help with online marketing

The project was implemented by The National Biodiversity and Biosafety Center, with support from UNDP. Apart from the homologue modeling, the intervention has been successful in achieving its objectives. A mid-term evaluation was finalized in December 2012, confirming that the project had satisfactory progress on most outcomes.[49] The intervention has a strong likelihood of post-grant sustainability, particularly because the micro-loans schemes established by the intervention are due to continue and are gradually being repaid. The success of the project is now spreading, with replication of some initiatives in other parts of the country.

ANNEX 4 – CASE STUDY: **NICARAGUA**

PROJECT: "Reduction of Risks and Vulnerability Caused by and Due to Flooding and Droughts in the Estero Real River Watershed"

OBJECTIVE: Reduce the risks of drought and flooding caused by climate change and variability in the semi-arid area of the Estero Real River Watershed

LOCATION: Eight micro-watersheds in the upper part of the Villanueva River sub-watershed, comprising 29 communities within three municipalities (El Sauce, Achuapa, and Villanueva)

DURATION: March 2011–June 2015

IMPLEMENTED BY: Nicaraguan Ministry of Environment and Natural Resources, with support from UNDP

FUNDED BY: Adaptation Fund (AF)—Global Environment Facility (GEF)

TOTAL FUNDING: US $5.07 million

BENEFICIARIES: Farmers (micro/small agribusinesses) and households

RELEVANT INTERVENTIONS: Improving climate resilience, food security, and water security through interventions targeting smallholder farmers in micro-watersheds, including:

- Developing Farm Agro-ecological Transformation Plans (FATPs) for farmers to promote a transition to climate-resilient and agro-ecological practices
- Investing in water infrastructure
- Improving the efficiency of water use in production processes

POSITIVE RESULTS TO DATE

- Private sector engaged in provision of rainwater collection and storage facilities to 100 family farms. By the end of 2014, construction of 880 water storage structures in the target micro-watersheds was completed
- Farm families trained in water management and use, including irrigation systems
- Two irrigation systems built, benefiting 118 households
- Of 1,005 families living in the target area, 920 were assisted to develop FATPs for their family farms; 840 (more than double the baseline) are in the process of being implemented[50]

This intervention targeted two watersheds in northern Nicaragua, in the Estero Real River Watershed and the River Villanueva, where 65 percent of Nicaragua's population lives. The watersheds on which they depend are increasingly vulnerable to climate variability, including the risks of droughts and floods. The agriculture sector imposes significant pressure on Nicaragua's vulnerable water system. Crop irrigation alone accounts for nearly 75 percent of water resource use. In the absence of effective water management, the rate of water extraction has exceeded groundwater recharge rates. Livelihoods for smallholder farmers in Nicaragua are increasingly vulnerable to extreme weather; high levels of rural poverty prevent investment in adaptation measures.

Despite these challenges, the policy and institutional framework in Nicaragua has been supportive of strengthening the resilience of the water sector. The government's recent national adaptation strategy and new water laws have facilitated progress on adaptation, and the government has since been collaborating effectively with UNDP to implement the intervention.

UNDP's intervention in Nicaragua targets over 1,000 families living on family farms in the pilot area. Applying the principle of subsidiarity, the intervention focuses on eight watersheds, as the "lowest practical socio-political and landscape level" at which policies can be implemented.[51] The intervention works closely with smallholder farmers to develop long-term "Farm Transformation Plans." The objective is to promote agro-ecological and climate-resilient farming practices, including better water management, while increasing the productivity and profitability of the agro-enterprises. The transformation plans specifically promote agro-silvopastoral systems[52] to help poor farmers increase income opportunities by making use of all four seasons and increasing production on small landholdings of one to two hectares. Partnering with farmers, the plans are "collaborative efforts that are tailored to each farm's soil and slope and the capacity and interests of the family."[53]

The intervention has so far achieved positive results in enhancing the resilience of small agricultural businesses and improving water security by:

- Developing Farm Agro-Ecological Transformation Plans (FATPs) for farmers that help to prevent soil erosion and promote healthy soil. Farmers were given training on organizing themselves, expanding and diversifying their agribusinesses, and implementing agro-silvopastoral systems
- Making investments in infrastructure for storing and using rain and surface water, to help both farms and households to meet their water needs

Table A4 | **Adaptation Interventions for MSEs in Nicaragua**

BARRIER	INTERVENTION	CHANGE	OUTCOME AND IMPACT
Information: Farmers poorly informed about climate change impacts and adaptation needs	Through the FATP process, farmers were informed of the benefits of diversification for soil and crop productivity	Behavioral change among farmers during FATP collaborations	Shift from crop monoculture to crop diversification
Technical skills: Farmers lacking in technical skills needed for using new adaptation technologies	Intervention attempted to train farmers on implementation of agro-silvopastoral systems. However, according to the mid-term evaluation, the awareness-raising activities are not the "most effective way to share knowledge to all protagonists, including those that have not had the privilege of acquiring technical skills"[54]	Target farmers have learned new technical skills through trainings and workshops	Farmers have the skills to effectively implement agro-silvopastoral and agroforestry systems, use organic fertilizer (lombrihumus), use communal irrigation systems, and construct water-harvesting methods
Finance: Farmers have limited access to credit for investing in new technologies	Intervention did not directly address this barrier, although funding was provided for activities in the target areas	None; there is still no formal credit or banking system that caters to MSEs because most of them do not have bank guarantees	None
Social attitudes: Farmers attached to tradition and fear experimentation with new practices	The intervention demonstrated and thereby gradually familiarized farmers with new adaptation methods and technologies	Farmers have had more opportunities to experiment and thus reduced their fears	New adaptation methods and technologies adopted

- Improving the efficiency of water use in all production processes, by increasing infiltration, strengthening soil structure, and stabilizing slopes

The intervention was supported by UNDP and executed by the Ministry of Environment and Natural Resources (MARENA) but highly decentralized to the rural areas. Because it was important in the Nicaraguan context, the intervention placed particular emphasis on directly involving beneficiaries, who were redesignated as "protagonists," in implementation.

A mid-term evaluation was published in April 2014, confirming that the project had made satisfactory progress on most outcomes. From the information available, it appears that post-grant financial sustainability will be an issue, unless the government commits to providing ongoing support to the agro-ecological transformation plans. In any case, the intervention is likely to have a lasting impact on farmers' attitudes and governmental policies, which have both become gradually more sensitive to adaptation needs.

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ENDNOTES

1. See blog post: "Costs of Climate Adaptation Explained in 4 Infographics." World Resources Institute. April 23, 2015. http://www.wri.org/blog/2015/04/costs-climate-adaptationexplained-4-infographics

2. These case studies were supported by UNDP with financing from the Global Environment Facility, including Least Developed Countries Fund, Special Climate Change Fund and Strategic Priority on Adaptation, as well as the Kyoto Protocol's Adaptation Fund.

3. United Nations. 2015. "Transforming Our World." Available at: https://sustainabledevelopment.un.org/content/documents/7891TRANSFORMING%20OUR%20WORLD.pdf

4. Economies each have their own definitions of micro and small businesses (Kushnir, 2010). In this report, the authors chose enterprises with 50 and fewer employees, following the IFC's definition.

5. There is, however, a gray area around the exact size of enterprises to be encompassed in this category because many medium-sized enterprises could face similar barriers. Therefore, while the focus is on MSEs, the discussions in this report will be relevant to some medium sized enterprises as well.

6. "Adaptive capacity" is defined here as the ability of a community, household, or individual to adjust and readjust as weather conditions shift and new climate change information emerges (Dixit et al. 2012).

7. Business Facilities Feature Story: Thailand—Nuanced Nation, One-Stop Shop: http://businessfacilities.com/2013/07/featurestory-thailand-nuanced-nation-one-stop-shop/

8. Annual project report 2011 – Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia (NAPA Follow-Up).

9. See, for example, the Community Based Disaster Preparedness project by the Dhaka Ahsiania Mission and Concern Universal in Bangladesh: http://www.preventionweb.net/english/professional/publications/v.php?id=8749

10. For example, SABMiller, see: http://www.nbcnews.com/business/economy/beer-insurance-businesses-bet-climatechange-n124781 and Guinness, see Sanni et al. 2009.

11. Biofils Technologies Ltd. 2011. About Us. Biofil Technologies.

12. For example in: Eriksen et al. 2005; Field et al. 2007; Nhemachena and Hassan 2007; Ingirige et al. 2008; Knox et al. 2010; Stafford Smith et al. 2010; Gifford et al. 2011; Jones and Boyd 2011; Lybbert and Sumner 2012; Clar et al. 2013; Fankhauser et al. 2013; Klein et al. 2014.

13. Their research focused on small firms in the United States but there is evidence that their findings also apply to firms in emerging markets. See, for example: Maquieira et al. 2012; Brijlal and Quesda 2009.

14. Interview with Dr. Leonard Unganai, project manager for Coping with Drought and Climate Change in Zimbabwe. http://www.dewpoint.org.uk/Asset%20Library/ICID18/24-UNGANAI_et_al_ICID+18.pdf.

15. http://www.academicjournals.org/article/article1394810131_Nhemachena.pdf

16. Interview with Dr. Leonard Unganai, project manager for Coping with Drought and Climate Change in Zimbabwe.

17. UNDP, Adaptation Learning Mechanism, Building Climate Resilient Rural Communities in Zimbabwe (2012), accessed June 10, 2014, http://www.undp-alm.org/projects/sccfclimate-resilient-zimbabwe.

18. Project periodic reports—realized thanks to M&E (Monitoring and Evaluation) and regular field visits.

19. Biagini and Miller, 2013. "Engaging the private sector in adaptation to climate change in developing countries: Importance, Status, and Challenges".

20. "Adapting to Climate Change through the Improvement of Traditional Crops and Livestock Farming in Namibia"

21. Project periodic reports—realized thanks to M&E (Monitoring and Evaluation) and regular field visits.

22. Based on "Case in point: How countries' water policies affect multinationals" Washington Post. Accessed on 16 June 2014 and personal communication with Professor Debaere.

23. Servaas van den Bosch. "At first they laughed at me." http://www.met.gov.na/Documents/At%20first%20they%20laughed%20at%20me%20by%20Servaas%20van%20den%20Bosch.pdf.

24. Interview with Yusuke Taishi, Regional Technical Advisor, UNDP.

25. Terminal Evaluation for "Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia" p. 20.

26. Interview with Pinreak Suos, National Technical Advisor, UNDP.

27. Terminal Evaluation for "Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia" p. 8.

28. Honduras, Project Document "Addressing Climate Change Risks on Water Resources in Honduras: Increased Systemic Resilience and Reduced Vulnerability of the Urban Poor", p.39. http://www.hn.undp.org/content/dam/honduras/docs/proyectos/PRODOC_FIRMADO_FA.pdf

29. Honduras, Project Document "Addressing Climate Change Risks on Water Resources in Honduras: Increased Systemic Resilience and Reduced Vulnerability of the Urban Poor", p.39. http://www.hn.undp.org/content/dam/honduras/docs/proyectos/PRODOC_FIRMADO_FA.pdfDraft project brief by Nargizakhon Usmanova, Programme Analyst, UNDP, with insights from the project manager, Professor Neimatullo Safarov.

30. Draft project brief by Nargizakhon Usmanova, Programme Analyst, UNDP, with insights from the project manager, Professor Neimatullo Safarov.

31. Interview with Jessica Troni, UNDP International Technical Advisor.

32. Final Q2 Report April-June 2013 "Strengthening the Resilience of Our Islands and Our Communities to Climate Change Programme", Cook Islands, p.5. http://www.mfem.gov.ck/docs/AMD/Development%20Programmes/SRIC/April%20-%20June%202013%20Report.pdf

33. This is the final report on the "Assessment to Update the Indicators, Baseline and Project Targets for the Strategic Results Framework (SRF) of the UNDP Adaptation Fund Programme "Strengthening the Resilience of our Islands and our Communities to Climate Change (SRIC-CC)" Cook Islands" p. 23.

34. Global project "Weather and Climate Observation Networks (WCON) and Early Warning Systems (EWS) for Development (WCON-EWS)", Project Document, October 2013 version, p.37.

35. See UNDP-GEF, Climate Information and Early Warning Systems in Africa, http://ews-undp.blogspot.com/, last updated 21 May 2013.

36. Terminal Evaluation for "Coping with Drought and Climate Change in Zimbabwe" p. 47.

37. Terminal Evaluation for "Coping with Drought and Climate Change in Zimbabwe" p. 32.

38. Interview with Dr. Leonard Unganai, project manager for Coping with Drought and Climate Change in Zimbabwe.

39. Terminal Evaluation for "Coping with Drought and Climate Change in Zimbabwe" p. 33.

40. Terminal Evaluation for "Coping with Drought and Climate Change in Zimbabwe" p. 29.

41. Terminal Evaluation for "Coping with Drought and Climate Change in Zimbabwe" p. 48.

42. Project Implementation Report 2013 for "Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia" p. 1.

43. Terminal Evaluation for "Promoting Climate-Resilient Water Management and Agricultural Practices in Rural Cambodia" p. 39.

44. Interview with Pinreak Suos, National Technical Advisor, UNDP.

45. Project Implementation Report 2014 for "Sustaining Agricultural Biodiversity in the Face of Climate Change in Tajikistan."

46. This approach relies on pairing sites, based on predictions from GCMs, showing that temperatures in the project pilot areas will have increased by 3ºC in 2050. The adiabatic lapse rate is 6ºC per 1,000 m, which means that climatic conditions at a given site today will prevail in 2050 at a homologous site that is 500 m higher in altitude. Using this approach, sites having substantial agro-biodiversity were identified by the project and matched in terms of soils and climate to homologous sites located at altitudes 500 m higher: MTE 8.

47. Interview with Nargizakhon Usmanova, Programme Analyst, UNDP, with insights from the project manager, Professor Neimatullo Safarov.

48. Interview with Nargizakhon Usmanova, Programme Analyst, UNDP, with insights from the project manager, Professor Neimatullo Safarov.

49. Mid-Term Evaluation for "Sustaining Agricultural Biodiversity in the Face of Climate Change in Tajikistan."

50. Mid-Term Evaluation for "Reduction of Risks and Vulnerability Caused by and Due to Flooding and Droughts in the Estero Real River Watershed" p. 28.

51. Mid-Term Evaluation for "Reduction of Risks and Vulnerability Caused by and Due to Flooding and Droughts in the Estero Real River Watershed" p. 9.

52. Agro-silvopastoral systems are land-use systems involving the combination of forestry, crop farming, and livestock businesses at the same site: see, for example, Russo, R.O. 1996. "Agrosilvopastoral systems: a practical approach toward sustainable agriculture." 7 (4) Journal of Sustainable Agriculture 7 (4): 5-17.

53. "Empowering the Poor in a Changing Climate, Experience from UNDP Supported initiatives on Adaptation" p. 27.

54. Mid-Term Evaluation for "Reduction of Risks and Vulnerability Caused by and Due to Flooding and Droughts in the Estero Real River Watershed" p. 24.

ABBREVIATIONS AND ACRONYMS

AFF	Adaptation Financing Facility
AGRA	Alliance for a Green Revolution in Africa
CARDI	Cambodian Agricultural Research and Development Institute
CDP	Carbon Disclosure Project
CIC	Climate Innovation Centers
CITC	Cook Islands Tourism Corporation
CTI	Climate Technology Initiative
CWRF	Clean Water Revolving Fund
DBSA	Development Bank of South Africa
DEA	Department of Environmental Affairs
EBRD	European Bank for Reconstruction and Development
ECB	European Central Bank
EIF	Environmental Investment Fund
FAO	Food and Agriculture Organization of the United Nations
FATP	Farm Agro-ecological Transformation Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Countries
LDCF	Least Developed Countries Fund
MNC	Multinational Corporation
MSE	Micro and Small Enterprise
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NBBC	National Biodiversity and Biosafety Center
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
OFAT	On-Farm Adaptive Trial
PPCR	Pilot Program for Climate Resilience
PPP	Public-Private Partnership
R&D	Research and Development
SCCF	Special Climate Change Fund
SPA	Strategic Priority on Adaptation
SRI	System of Rice Intensification
UKCIP	United Kingdom Climate Impacts Programme
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute
WWF	World Wildlife Fund

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ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

Our Challenge
Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision
We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT
We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT
We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT
We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

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