MAINSTREAMING BIODIVERSITY IN PRODUCTION LANDSCAPES

ISBN 978-92-807-3727-1
Job No: DEPI/2211/NA

Cover photos
A young girl helps her mother harvest foxtail millet (*Setaria italica*) in Jumla, Nepal. © LI-BIRD/S. Sthapit

Traditional intercropping of amaranth, finger millet and other crops, Humla, Nepal. © Bioversity/D. Gauchan

Disclaimer
The content and views expressed in this publication do not necessarily reflect the views or policies of the contributory organizations or the United Nations Environment Programme and neither do they imply any endorsement. The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of UNEP concerning the legal status of any country, territory or city or its authorities, or concerning the delimitation of its frontiers and boundaries.

Printed by Malhotra Publishing House, New Delhi 2018

Recommended citation
Mijatović, D., Sakalian, M. and Hodgkin T. (2018) Mainstreaming Biodiversity in Production Landscapes. United Nation Environment Programme

MAINSTREAMING BIODIVERSITY IN PRODUCTION LANDSCAPES

TABLE OF CONTENTS

LIST OF ACRONYMS

ABS	Access and Benefit Sharing
CBD	Convention on Biological Diversity
CBM	Community Biodiversity Management
CGIAR	Consultative Group on International Agricultural Research
CGRFA	Commission on Genetic Resources for Food and Agriculture
CWR	Crop Wild Relatives
FAnGR	Farm Animal Genetic Resources
FAO	Food and Agriculture Organisation of the United Nations
GEF	Global Environment Facility
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
M	Million
NBSAP	National Biodiversity Strategies and Action Plans
NGO	Non-Governmental Organisation
SDG	Sustainable Development Goal
SNAP	Sistema Nacional de Áreas Protegidas
STAP	Scientific and Technical Advisory Panel
UN Environment	The United Nations Environment Programme
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNU-IAS	The United Nations University Institute for the Advanced Study of Sustainability

SUMMARY

Mainstreaming biodiversity conservation and sustainable use into production landscapes is recognized as a key strategy to secure the objectives of the Convention on Biological Diversity (CBD) and as a major objective for projects supported by the Global Environment Facility (GEF). Mainstreaming seeks to integrate biodiversity considerations into the policies, strategies and practices that impact, or depend, on biodiversity. Central to mainstreaming in production landscapes is ensuring the conservation and sustainable use of agricultural biodiversity. The United Nations Environment Programme (UN Environment) and GEF have made a major contribution to supporting agricultural biodiversity, which is of global importance to food production and provision of ecosystem services, particularly in the face of climate change.

Projects undertaken by UN Environment as a GEF implementing agency over the past 17 years have provided a rich body of experience for ensuring the effective conservation and use of agricultural biodiversity. Fourteen projects in 36 countries have been implemented in diverse agricultural landscapes by a wide range of national and international partners, supported by civil society and in collaboration with local communities who continue to maintain and use globally important agricultural biodiversity. The projects have made a substantial contribution to achieving GEF's mainstreaming strategy. This publication highlights some of the main achievements.

The projects explored and developed mutually supportive strategies for integrating biodiversity and ecosystem service perspectives into management practices and policy frameworks. These strategies aimed to: conserve genetic resources in production systems and protected areas; secure access and benefit-sharing of biodiversity; enhance ecosystem services; improve food and nutrition; include biodiversity conservation in markets; and support land restoration and climate change adaptation.

The projects have demonstrated that mainstreaming biodiversity into agricultural landscapes is a multidimensional process involving the creation of knowledge and evidence to guide policy decisions and the improvement of management and conservation practices at all levels of governance. Reaching mainstreaming objectives requires substantial commitments to capacity building and improved awareness of a wide range of actors. Most importantly, it requires deliberate commitment to addressing policy dimensions.

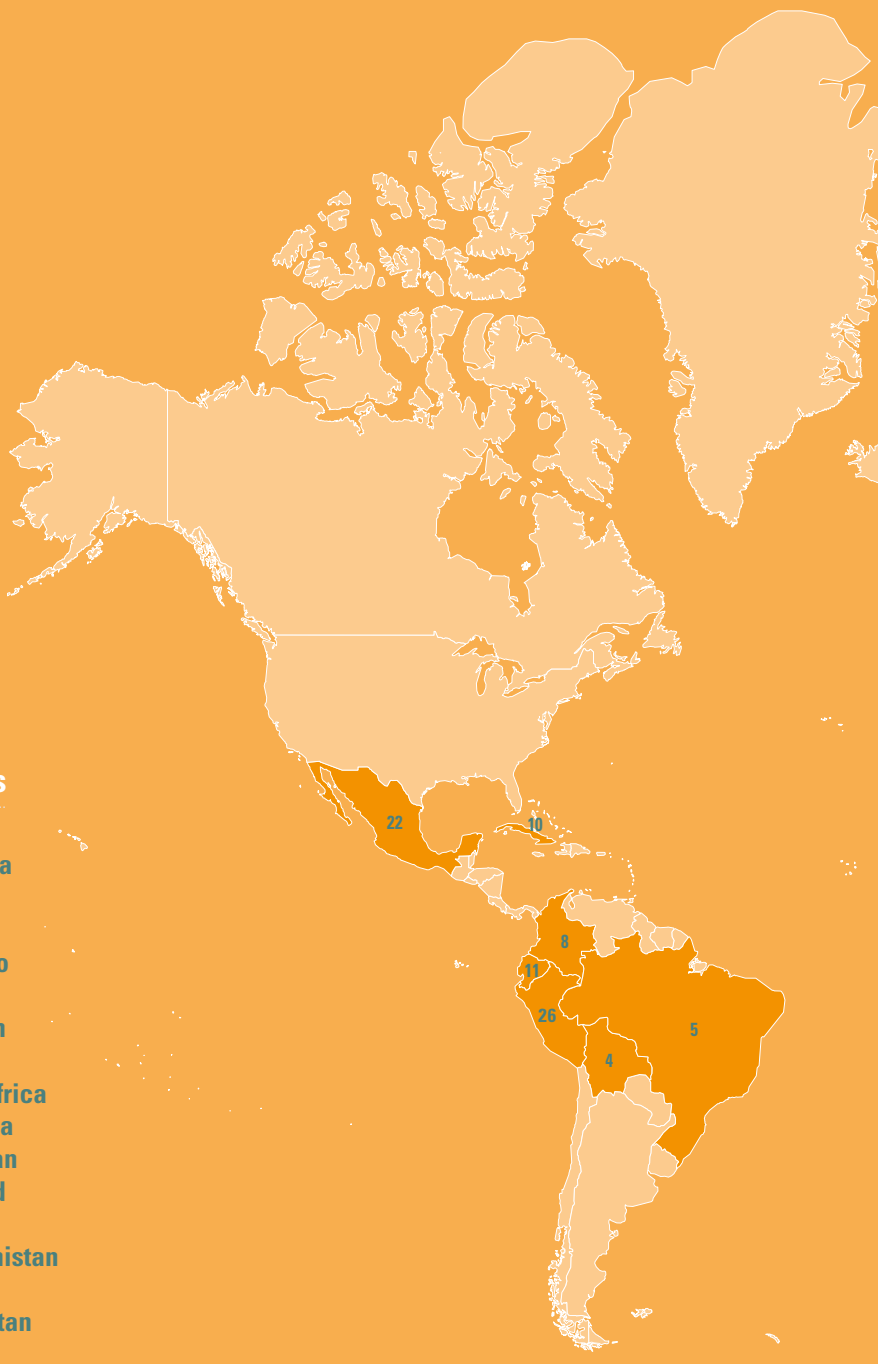
The projects also provided knowledge and developed methodologies for assessing, increasing and conserving diversity in agricultural landscapes. A range of good practices for sustainable use and conservation of agricultural biodiversity have been developed, assessed and promoted in many highly diverse locations. A variety of approaches have been identified to expand the use of these practices beyond the project sites. Capacity building and awareness-raising – a feature of all projects – included farmers and rural communities, national agricultural programmes, extension services, and policy makers. These activities gave the right people with necessary skills to support agricultural biodiversity.

Policy development largely focused on ensuring that agricultural biodiversity is embedded within existing agricultural, environmental, conservation, nutrition and climate change adaptation plans, policies and strategies. Policy recommendations and guidelines were developed as well as guidelines to help national programmes address aspects such as access and benefit sharing essential for effective mainstreaming. Policy change is long-term and beyond the likely capability or reach of any single project. It involves awareness-raising among policy makers, the development of strategies that take account of national policy concerns, and the development of institutional, legislative and regulatory frameworks that support enhanced maintenance and use of agricultural biodiversity. Removing adverse policies, although likely to be equally important, was not a focus of most of the projects and is likely to be even more challenging.

The results provide a preliminary description of the development of a range of successful approaches to mainstreaming agricultural biodiversity. A full evaluation and analysis of the mainstreaming impacts of agricultural biodiversity projects would be an important contribution to the design and implementation of future GEF-supported portfolio development. There is great potential for developing mechanisms that would ensure that projects share experience and expertise in creating and implementing approaches that harness synergies between the different components of agricultural biodiversity in production landscapes.

.

WORKING WITH PARTNERS
AROUND THE WORLD

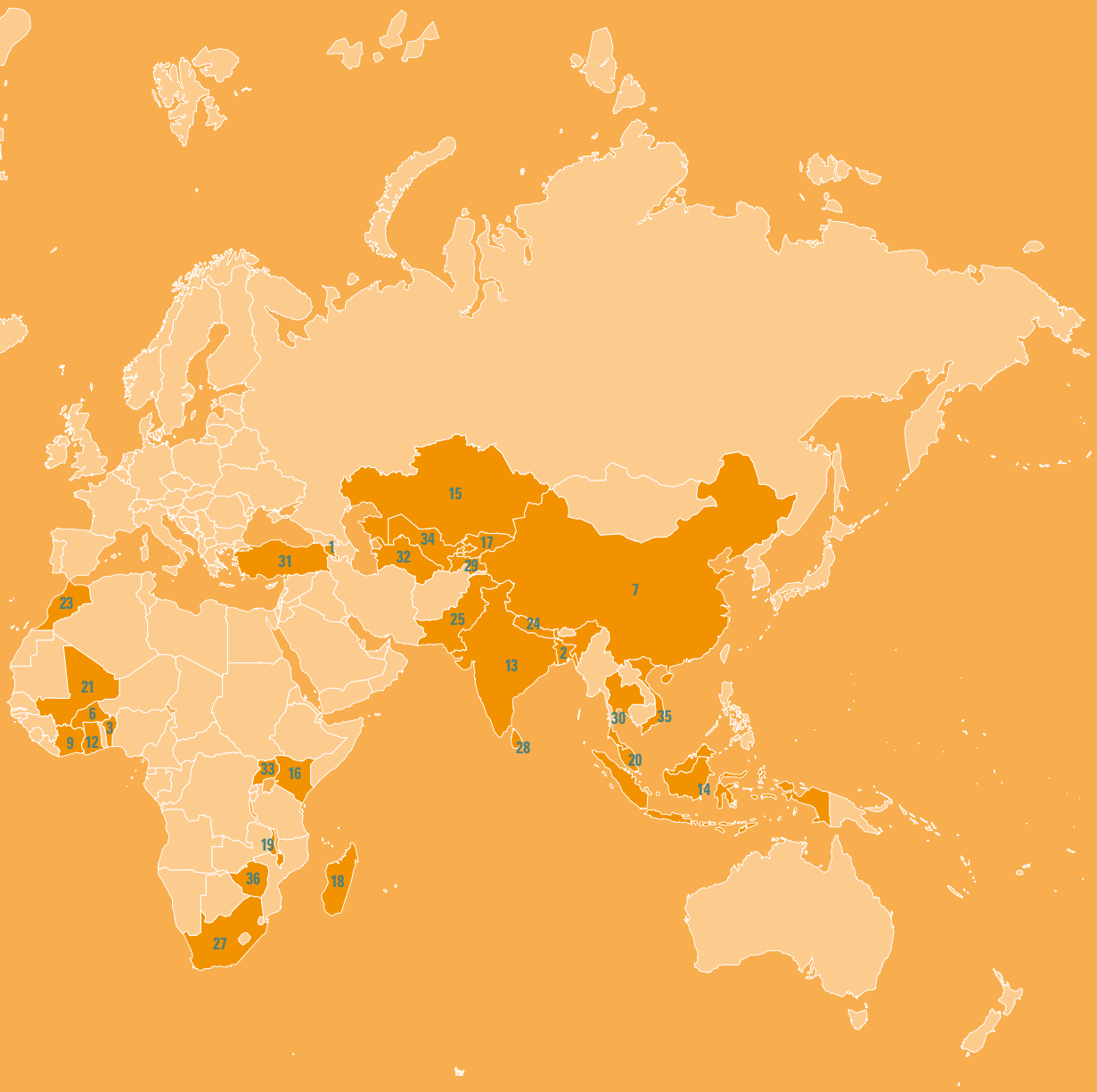


Project partner countries

1. Armenia
2. Bangladesh
3. Benin
4. Bolivia
5. Brazil
6. Burkina Faso
7. China
8. Colombia
9. Cote d'Ivoire
10. Cuba
11. Ecuador
12. Ghana
13. India
14. Indonesia
15. Kazakhstan
16. Kenya
17. Kyrgyzstan
18. Madagascar
19. Malawi
20. Malaysia
21. Mali
22. Mexico
23. Morocco
24. Nepal
25. Pakistan
26. Peru
27. South Africa
28. Sri Lanka
29. Tajikistan
30. Thailand
31. Turkey
32. Turkmenistan
33. Uganda
34. Uzbekistan
35. Vietnam
36. Zimbabwe

36 COUNTRIES PARTICIPATE IN UN ENVIRONMENT GEF-SUPPORTED AGRICULTURAL BIODIVERSITY PROJECTS

UN Environment works in partnership with GEF.
UN Environment's GEF Biodiversity team has been very successful in establishing broad-based effective partnerships at the community, national, regional and global level.



1. INTRODUCTION

Biodiversity and the services provided by ecosystems are essential to the sustainability and resilence of production systems, livelihoods, human wellbeing and environmental health. The diversity of crops and livestock, including their wild relatives, sustain production systems, provide nutrition and enable adaptation to change. Many ecosystem services are provided by an array of soil organisms, pollinators and other wild species. Without diversity in terrestrial and marine ecosystems, the production of crops, livestock and fish would not be possible. Despite its important role, biodiversity in production landscapes remains threatened, undervalued and neglected.

The currently dominant model of agricultural production is based on low diversity and high chemical inputs that undermine long term sustainability of food systems and reduce essential ecosystem services produced in agricultural landscapes. Transition to diversified sustainable productions systems, which is essential and urgent, will depend on our ability to leverage the transformative force of agricultural biodiversity[1]. Such a transition, in combination with improved conservation practices, can reduce pressures on terrestrial and marine ecosystems by securing productivity, restoring ecosystem services and improving ecological connectivity between protected areas.

The importance of ensuring the conservation and sustainable use of biodiversity in production systems has been recognized as a part of the Convention on Biological Diversity's (CBD) Strategic Plan and the Aichi Biodiversity Targets, especially Target 7 (sustainable management of production systems) and Target 13 (maintenance of genetic diversity of crops, animals and other socio-economically important species). The UN Sustainable Development Goals (SDGs) also recognize the importance of biodiversity in production systems through Goals 2 (Zero Hunger), 12 (Responsible Consumption and Production) and 15 (Life on Land). Targets 4 and 5 of SDG2 directly address the importance of securing sustainable production and conservation of biodiversity by 2030.

Increasing emphasis is being placed on mainstreaming biodiversity conservation and sustainable use into production landscapes. Mainstreaming seeks to integrate biodiversity considerations into policies,

1 Agricultural biodiversity - a sub-set of biodiversity vital for food and livelihood security – can be defined as the variety and variability of animals, plants and micro-organisms, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and wild species that provide ecosystem services (soil micro-organisms, predators, pollinators).

◄ Sun drying apricots on stones in Kanibadam, Tajikistan. © B. Tashmatov

▲ Group discussion with local farmers to assess on-farm agrobiodiversity in Chhipra, Humla, Nepal. © LI-BIRD/A. Neupane.

strategies and practices that impact or rely on biodiversity. It recognizes the central importance of landscape-level and sector-wide approaches that engage all relevant stakeholders in securing positive transformation of production landscapes. The importance of mainstreaming is fully recognized in Target 9 of SDG 15: *By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts*.

This publication describes key achievements of projects that the United Nations Environment Programme (UN Environment) has undertaken as a Global Environment Facility (GEF) implementing agency to explore and implement mainstreaming of biodiversity conservation into production systems. The publication is based on information from 14 projects implemented in 36 countries – four single country projects and ten multi-country projects, of which five are global and five are regional. The projects described here were developed during the GEF 4 and GEF 5 programming framework periods.

In implementating the projects, GEF and the UN Environment have worked in partnership with a wide range of national partners that include agricultural and environmental organizations, universities and research centres, as well as civil society and rural communities. They have also worked with international organizations and research centres that have included the Food and Agriculture Organization (FAO) of the United Nations, United Nations Educational Scientific and Cultural Organisation (UNESCO), the CGIAR Research Centers and a wide range of funding and donor agencies. One project contributed to the United Nations Conference on Trade and Development (UNCTAD) BioTrade Initiative, which seeks to support the implementation of the CBD through the trade-related aspects of sustainable use, access to genetic resources, and traditional knowledge.

The projects described in this publication contribute directly to the CBD's Aichi Targets and to the SDGs. They also support the CBD's Programme of Work on Agricultural Biodiversity and its three global cross-cutting initiatives:

- The International Initiative for the Conservation and Sustainable Use of Pollinators;
- The International Initiative for the Conservation and Sustainable Use of Soil Biodiversity; and,
- The International Initiative on Biodiversity for Food and Nutrition.

UN Environment GEF-supported projects included in this publication

(further details on each project can be found in Section 6)

Project title	Short title	Countries	Duration
Community-based management of on-farm plant genetic resources in arid and semi-arid areas of Sub-Saharan Africa	Sub-Saharan Crop Diversity	Benin, Burkina Faso, Ghana, Kenya, Mali, Malawi, Uganda, Zimbabwe	2002-2006
Conservation and sustainable management of below-ground biodiversity	Below-Ground Biodiversity	Brazil, Côte d'Ivoire, India, Indonesia, Kenya, Mexico, Uganda	2002-2010
In situ conservation of crop wild relatives through enhanced information management and field application	Crop Wild Relatives	Armenia, Bolivia, Madagascar, Sri Lanka, Uzbekistan	2004-2010
In situ/on-farm conservation and use of agricultural biodiversity (horticultural crops and wild fruit species) in Central Asia	Central Asia Fruit Tree Diversity	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	2006-2015
Conservation and management of pollinators for sustainable agriculture, through an ecosystem approach	Global Pollinators	Brazil, Ghana, India, Kenya, Nepal, Pakistan, South Africa	2008-2015
Conservation and use of crop genetic diversity to control pests and diseases in support of sustainable agriculture	Controlling Pests and Diseases	China, Ecuador, Morocco, Uganda	2008-2010
Development and application of decision-support tools to conserve and sustainably use genetic diversity in indigenous livestock and wild relatives	Indigenous Livestock Diversity	Bangladesh, Pakistan, Sri Lanka, Vietnam	2009-2016
Sustainable use of cultivated and wild tropical fruit diversity: Promoting sustainable livelihoods, food security and ecosystem services	Tropical fruit trees	India, Indonesia, Malaysia, Thailand	2009-2015
Facilitation on financing for biodiversity-based business and support of market development activities in the Andean Region	Andean Biotrade	Colombia, Ecuador, Peru	2010-2014
Mainstreaming biodiversity conservation and sustainable use for improved human nutrition and well-being	Bioversity for Food and Nutrition	Brazil, Kenya, Sri Lanka, Turkey	2011-2017
Integrating trade-offs between supply of ecosystem services and land use options into poverty alleviation efforts and development planning in the Mixteca	Mixteca	Mexico	2011-2015
Mainstreaming agrobiodiversity conservation and use in Sri Lankan agro-ecosystems for livelihoods and adaptation to climate change	Biodiversity and Climate Change	Sri Lanka	2012-2017
Agrobiodiversity conservation and man and the biosphere reserves in Cuba: Bridging managed and natural landscapes	Agrobiodiversity in Man and the Biosphere Reserves	Cuba	2013-2018
Integrating traditional crop genetic diversity into technology: Using a biodiversity portfolio approach to buffer against unpredictable environmental change in the Nepal Himalayas	Himalayan Local Crop Diversity and Ecosystem Resilience	Nepal	2014-2019

▲ Healthy Ecosystem. © Walter H. Wurst

2. THE IMPORTANCE OF MAINSTREAMING

Over the last decade, biodiversity mainstreaming has become a key approach in the global conservation and sustainable development agenda that aims to *"embed biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved, and sustainably used, both locally and globally"* (Huntley and Redford, 2014[2]).

Biodiversity mainstreaming addresses the challenges of conserving biodversity in production landscapes and seascapes, where biodiversity has received little attention. It seeks to ensure inclusion of biodiversity considerations into development models and strategies. Maistraming aims to make the responsibility for, and ownership of conservation and sustainable use of biodiversity, the concern of not only environment and conservation actors but all stakeholders from policy makers to businesses and local communities.

Through the Cancun Declaration on *Mainstreaming the Conservation and Sustainable Use of Biodiversity for Well-being*[3], the Government Ministers and Heads of Delegations present at the 13th Conference of the Parties of the Convention on Biological Diversity committed to working at all levels to mainstream biodiversity, establishing effective institutional, legislative and regulatory frameworks, tailored to national needs and circumstances, and incorporating an inclusive economic, social, and cultural approach with full respect for nature and human rights.

As noted above, mainstreaming forms an integral part of the work to implement the CBD and has been recognized as one of the main strategies for achieving its Strategic Plan for Biological Diversity 2011-2020 and the Aichi Targets. Countries party to the CBD have given priority to "*mainstreaming the conservation and sustainable use of biodiversity in sectoral and cross-sectoral policies, plans and programs, establishing an effective institutional, legislative and regulatory framework and incorporating an economic and socially inclusive approach*". Countries increasingly see mainstreaming as a central part of National Biodiversity Strategies and Action Plans (NBSAPs) - national instruments that CBD signatory countries are required to develop in order to meet their obligations to the CBD.

As the financial mechanism of the CBD, the GEF supports conservation and sustainable use of globally significant biodiversity and the maintenance of ecosystem goods and services that it provides. GEF's strategic frameworks, which have evolved over time, guide the formulation of the projects that it funds. The projects descibed in this publication were largely developed under the fourth and fifth

▲ Focus group discussion in Jalalabad, Kyrgyzstan. © K. Turgunbaev

GEF strategic frameworks (GEF4 and GEF 5). The importance of mainstreaming was clearly recognized and reflected in the GEF 5 Biodiversity Strategy whose five strategic objectives were:

- Improve the sustainability of protected area systems
- Mainstream biodiversity conservation and sustainable use into production landscapes/seascapes and sectors
- Build capacity to implement the Cartagena Protocol on Biosafety
- Build capacity on access to genetic resources and benefit-sharing
- Integrate CBD obligations into national planning processes through enabling activities.

The GEF projects implemented by the UN Environment have worked to help achieve Objective 2 as well as making contributions to Objectives 1, 4 and 5. GEF continues to give importance to mainstreaming and the results of the projects discribed here can guide the development of future mainstreaming initiatives.

The Technical Paper *"Mainstreaming Biodiversity in Practice: A STAP Advisory Document"* reviewed the progress made on mainstreaming biodiversity and identified a set of determinants and main messages (see also Redford *et al.* 2015[4]). A recent review of biodiversity mainstreaming efforts included an analysis of the final evaluations of completed mainstreaming projects that aimed to identify best practices and lessons learned (GEF Secretariat 2016[5]). The review discerned key factors and project features that are correlated with positive mainstreaming outcomes. These factors included: democratic, transparent, and stable governance systems; strong capacity at individual and institutional levels; availability and use of science-based biophysical and socio-economic spatial information systems and assessments. The review also identified project features or design elements associated with successful mainstreaming which were:

- Project design and operational strategy embedded within a theory of change for biodiversity mainstreaming
- Flexible project duration, financial sustainability, and adaptive management approaches
- Effective project monitoring and evaluation systems implemented
- Strong and responsive teams led by champions
- Effective communication with stakeholders to make the case for biodiversity
- Alignment of mainstreaming initiatives with government priorities and working across sectors.

The GEF has been applying these factors for an ongoing systemtic review of GEF-supported biodiversity mainstreaming projects in order to inform better project design and implementtaion, identify lessons learned and refine the GEF investment strategy in support of biodiversity mainstreaming.

2 J. Huntley, K. H. Redford. 2014. Mainstreaming Biodiversity in Practice: a STAP Advisory Document. Global Environment Facility. Washington, DC.

3 https://www.cbd.int/doc/meetings/cop/cop-13/official/cop-13-24-en.pdf

4 K. H. Redford, B. J. Huntley, *et al.* 2015. Mainstreaming Biodiversity: Conservation for the Twenty-first Century. Frontiers in Ecology and Evolution 3, 137.

5 GEF 2016. Biodiversity Mainstreaming In Practice: A Review of GEF Experience. GEF Secretariat.

▲ Sea-buckthorn (*Hippophae rhamnoides*) in Zaravshan valley, Uzbekistan.
© F. Kabulova

3. MAINSTREAMING AGRICULTURAL BIODIVERSITY

The projects described in this publication focus on different components of agricultural biodiversity: crops and their wild relatives, domestic animals, wild plants, pollinators and soil biodiversity. The projects sought to address various aspects of their management at different scales, from field to landscape, and from local to global. But all aimed to integrate biodiversity conservation into practices, strategies and policies in partner counties.

In order to influence and create more positive policy and regulatory frameworks, the projects worked across sectors, including agriculture, environment, public health and education and with a wide range of institutions, civil society organizations, and local communities as partners (see Section 5). The projects employed a combination of approaches described in the following paragraphs. These approches are mutually supportive and contribute to the interrelated goals of improved productivity, ecosystem services, nutrition and livelihoods.

INTEGRATING CONSERVATION INTO PRODUCTION LANDSCAPES

A primary objective of the projects was the conservation of globally important biodiversity, which included: 1) genetic diversity of domesticated plants and animals and their wild relatives; 2) wild species of high socio-economic, nutritional and cultural value; or 3) functional diversity in production landscapes. Many of the project sites are located in Biodiversity Hotspots or in the centres of origin and diversity of agricultural crops and animals and aim to ensure that effective conservation practices are mainstreamed into relevant land-use plans and management decisions.

LINKING CONSERVATION WITH PROTECTED AREA MANAGEMENT

Agricultural systems found in and around protected areas often have a rich agricultural biodiversity. Protected areas are reservoirs of genetic diversity of wild plants, many of which are relatives of domesticated plants. Because of this, protected areas and their surrounding buffer zones can be important sites of continuing evolution of crops and their wild relatives. Two projects have explicit aims to develop and mainstream practices that secure this diversity in management plans for protected areas and nature reserves and their surrounding areas.

▲ Small scale fishery, Wayamba, Sri Lanka. © Bioversity/S. Landersz

SECURING ACCESS TO AND BENEFIT-SHARING OF BIODIVERSITY

The *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization* provides important support to the conservation of genetic resources together, in the case of crop diversity, with the International Treaty on Plant Genetic Resources for Food and Agriculture. As well as providing appropriate frameworks for access and sharing benefits, these agreements recognize the role and rights of farmers in conserving, using and improving agricultural genetic resources and sharing the related benefits. Several projects support the creation of an enabling environment for access and benefit-sharing of genetic resources.

ENHANCING ECOSYSTEM SERVICES

Several projects promote practices that enhance the flow of ecosystem services such as pollination, improved pest and disease control, soil fertility and water provision. Building institutional capacity and identifying opportunities for improving ecosystem services played an important part, for example, through 1) greater use of crop genetic diversity for pest and disease control and reduced use of chemical inputs and 2) sustainable management of soil and pollinator diversity for increased productivity. One project aimed to integrate ecosystem services management into natural resource use.

IMPROVING LIVELIHOODS, FOOD, AND NUTRITION

The projects provided evidence that improved management of pollinator, soil, crop, livestock and wild species diversity can contribute to income generation. Several projects encourage the use of biodiversity to address food security and malnutrition as part of their mainstreaming plans. Thus, the project on biodiversity for food and nutrition is encouraging sustainable use of a wider range of different varieties and breeds of plants and animals including wild, neglected and underutilized species.

STRENGTHENING CLIMATE CHANGE ADAPTATION AND RESILIENCE

Genetic, species and ecosystem diversity supports the processes of adaptation, diversification and recovery after stresses that confer resilience. Two projects directly focus on the use of diversity to mitigate risk and increase the adaptive capacity of production systems to biotic and abiotic stresses associated with climate change. Scientific knowledge is combined with traditional knowledge to inform conservation and diversification activities to strengthen resilience of farming systems and of the landscapes in which they are embedded.

IMPROVING MARKET OPPORTUNITIES

All projects aimed to identify and enhance the economic value of diversity in order to create incentives for its conservation. This involved improving value chains, promoting new products and encouraging increased demand by consumers. Market mechanisms used in projects include certification of products that contain a diverse genetic base and have their origin in landscapes of high biodiversity value. One project takes this further and has developed and tested new trade models to support biodiversity conservation. Another has explored options for diversifying food procurement and school feeding as an example of a potential institutional market.

RESTORING DEGRADED LANDS

Several projects focused on land restoration. One project guided reforestation and rehabilitation of degraded lands by providing information and tools and good practices in agriculture and natural resource management in several interconnected watersheds. This contributed to higher productivity and improved flow of ecosystem services including soil erosion control. Moreover, in combination with other strategies, it curtailed the pressure on forest ecosystems by reducing the expansion of the agricultural frontier and forest to cropland conversion.

▲ Agricultural biodiversity on display in Busia, Kenya. © Bioversity/D.Hunter
► Land restoration with local apple varieties in Nurata, Uzbekistan. © E. Butkov

▲ Diversity fair in Gampola, Sri Lanka.
© Bioversity/P. de Santis

4. KEY ACHIEVEMENTS AND EXPERIENCES

This section describes the most important mainstreaming results that have been achieved to date in the aforementioned set of diverse and unique projects. A description of the 14 different projects included in this publication can be found in Part 6. While the majority of the projects have been completed, a number of them are still on-going and the mainstreaming results are preliminary.

The projects showed that successful mainstreaming involves application of relevant knowledge, the presence of organizational and institutional capacity, effective communication with all stakeholders and an enabling policy framework and political will. The projects aimed to build these preconditions and to create opportunities and mechanisms to accomplish mainstreaming objectives through four interrelated strategies:

- Generating knowledge and increasing understanding of the contribution of biodiversity to sustainability, productivity, ecosystem services, income, nutrition and climate change adaptation
- Identifying and promoting practices for enhanced conservation and sustainable use of biodiversity
- Increasing awareness and capacity of all stakeholders
- Strengthening policy and legislative frameworks.

These strategies are strongly interrelated and lead to successful mainstreaming only in combination. For example, the development of knowledge and methodologies and tools, and the adoption of sustainable practices need to be inclusive and implemented by all stakeholders, which requires awareness and capacity building. Evidence combined with higher awareness and capacity, then lead to the incorporation of biodiversity concerns into policy instruments and decision-making processes.

4.1 Creating Knowledge and Information

Knowledge of the distibution of biodiversity and the type and extent of threats provides a basis for the development of mainstreaming strategies. All projects addressed knowledge gaps in diversity and ecosystem services and in how they are affected by different practices as well as sectoral and cross-sectoral plans. Important new information has been generated, which has helped identify good production practices and has informed and guided the development of policies and legislative frameworks. The projects have delivered the evidence

▲ Banana diversity at a market in Kandy, Sri Lanka. © Bioversity/D. Hunter

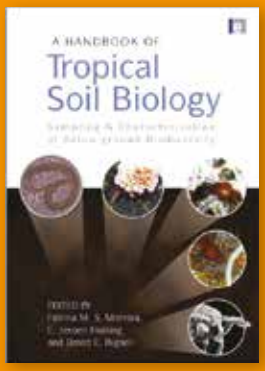
▼ Yellow faced bumble bee on tomato. © M. Vaughan

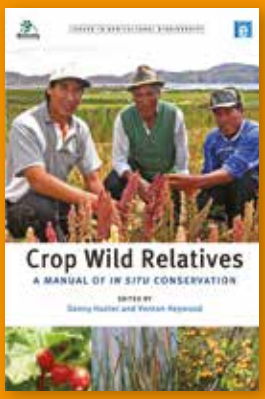
needed to influence policies, programmes and markets to support conservation and use of biodiversity both in the partner countries and internationally. A large body of information has been made available on:

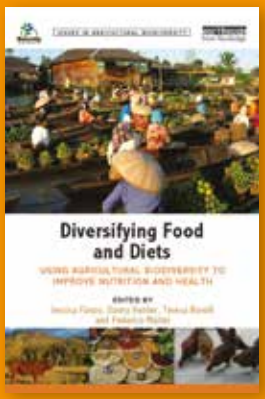
- The diversity and values of crops, animals, wild relatives, soil biota and pollinators
- The diversity of wild plants and their nutritional, medicinal and other values
- Productive and adaptive traits in crops, animals, and wild relatives
- Functional diversity and its importance for ecosystem services and resilience
- Traditional knowledge and local practices of biodiversity management and use.

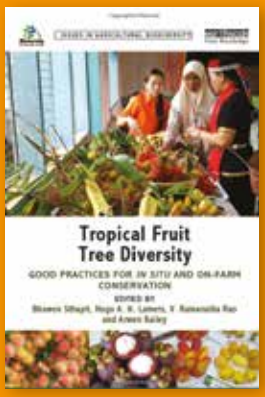
In addition to many scientific articles in peer reviewed journals, in a number of cases the knowledge gained has been published in book form, providing a resource to guide mainstreaming efforts (Figure 1). Thus, the project **Conservation and Sustainable Management of Below-Ground Biodiversity** (the Below-Ground Biodiversity) generated new knowledge as well as tools and methods for carrying out systematic inventories of soil biodiversity, establishing baseline assessments and monitoring losses. Internationally accepted standard methods for characterizing and evaluating biodiversity were developed and published in the *Handbook on Tropical Soil Biology, Sampling & Characterization of Below-Ground Biodiversity*.

The **Conservation and Sustainable Use of Cultivated and Wild Tropical Fruit Diversity** project (the **Tropical Fruit Trees** project) documented the diversity of four globally important fruits and their wild relatives and associated knowledge. The book published through the project, *Tropical Fruit Tree Diversity: Good practices for* in situ *and on-farm conservation*, reviews the status, potential threats and new opportunities in the conservation of tropical fruit diversity. It was written for both researchers and farmers to help them identify and fill knowledge gaps in tropical fruit tree research. The book provides a compendium of good practices for *in situ* and on-farm conservation of tropical fruit tree diversity.









The extensive experiences from the five partner countries and international partners involved in the project ***In Situ* Conservation of Crop Wild Relatives Through Enhanced Information Management and Field Application** (the **Crop Wild Relatives** project), resulted in the publication *Crop Wild Relatives: A manual of* in situ *conservation*, which provides overall guidance on the conservation of crop wild relatives that can be adopted by other countries around the world.

Knowledge products from the projects have included a number of global information systems. The **Crop Wild Relatives** project created a global portal that provides access to the national inventories and to information on crop wild relatives (CWR) at the global level (www.cropwildrelatives.org/cwr/). The portal includes results of the assessments of the distribution, conservation status and values of CWR. The assessments cover 36 priority genera. Through the project more than 310 crop wild relative species were Red List assessed per IUCN guidelines.

The **Conservation and Management of Pollinators for Sustainable Agriculture through an Ecosystem Approach** project (the **Global Pollinators** project) created a global knowledge base that integrates traditional and scientific knowledge on pollinators and pollination services. A Pollination Information Management System (www.fao.org/pollination/en/) has been developed to organize and deliver information on managing pollination services of key crops to farmers, farm advisors and land managers.

The project entitled ***In Situ*/On-Farm Conservation and Use of Agricultural Biodiversity (Horticultural Crops and Wild Fruit Species) in Central Asia** (the **Central Asia Fruit Tree Diversity** project) not only assessed the diversity of local varieties of fruit and nut trees as well as the value of this diversity for sustainable agriculture and ecosystem health, but also made this assessment internationally available. Half a million records can now be accessed through the database at http://centralasia.bioversityinternational.org/en/.

Selected books published from the UN Environment GEF Projects

F.M. S. Moreira, *et al.* Eds. 2008. **Handbook of Tropical Soil Biology: Sampling & Characterization of Below-Ground Biodiversity.** Earthscan, Routledge.

D. Hunter, V. Heywood, Eds. 2010. **Crop Wild Relatives: A Manual of In Situ Conservation.** Earthscan, Routledge.

J. Fanzo, *et al.* Eds. 2013. **Diversifying Food and Diets: Using Agricultural Biodiversity to Improve Nutrition and Health.** Earthscan, Routledge.

B.R. Sthapit, *et al.* Eds. 2016. **Tropical Fruit Tree Diversity: Good Practices for In Situ and On-farm Conservation.** Earthscan, Routledge.

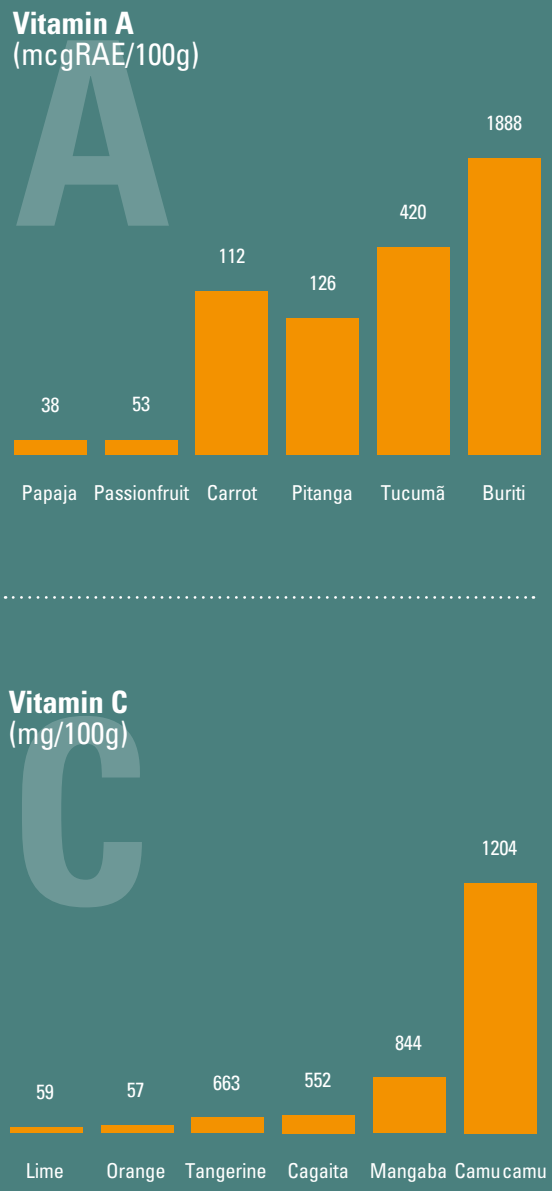
▲ Crop Wild Relatives Global Portal
www.cropwildrelatives.org

Pollination Information Management System
www.fao.org/pollination/pollination-database/en/

All projects developed standards, protocols, guidelines and methodologies that are now widely available and used beyond partner countries (see also the section on Practices, below). For example, 82 scientific manuals were developed by national partners in five countries through the **Central Asia Fruit Tree Diversity** project. These guidelines cover a broad range of issues related to fruit tree management including: cultivation and pruning; establishment of orchards and tree nurseries; grafting and producing planting material; pest and disease control; description of local varieties; traditional knowledge of farmers on the maintenance of local fruit tree varieties, their management practices, processing and storage of fruit; and the use of local fruit and nut tree diversity to combat land degradation and threats.

The projects often make an important contribution to generating the knowledge needed to support sustainable use of agricultural

Figure 1. Comparative levels of Vitamin A in different fruit and vegetables grown in Brazil.



▲ Guava (*Psidium guajava*), Sierra del Rosario, Cuba. © G. Gullotta

B.R. Sthapit, *et al.* Eds. 2012 **Tropical Fruit Tree Species and Climate Change.** Bioversity International.

biodiversity beyond the project sites. The **Mainstreaming Biodiversity Conservation and Sustainable Use for Improved Human Nutrition and Well-Being** project (the **Biodiversity for Food and Nutrition** project) is making such a contribution by providing information on the nutritional properties of many under-used or neglected species such as the high vitamin A content of buriti palm (*Mauritia flexuosa*) (see Fig 1). Eating 100g of buriti fruit per day could satisfy the Vitamin A requirements of nearly all (97%–98%) healthy individuals, helping to deal with the problem of vitamin A deficiency. Brazil, one of project partner countries, is in the process of establishing the nutritional composition data of over 70 native species prioritized by the national Plants for the Future initiative. This information will be made available through the national Information System on Brazilian Biodiversity and will strengthen the inclusion of nutritious species in public policies and programs focused on food security and nutrition including public procurement and school feeding.

A similar example comes from the project **Agrobiodiversity Conservation and Man and the Biosphere Reserves in Cuba: Bridging Managed and Natural Landscapes** (the **Agrobiodiversity in Man and the Biosphere Reserves** project) in Cuba where project sites have been used to test and improve a set of indicators to assess resilience in production landscapes that were originally developed as a collaborative activity under the auspices of the International Partnership for the Satoyama Initiative[6]. Since the first case study in Cuba, the indicators have garnered much interest among NGOs, research institutes and development agencies around the world as a useful tool for participatory landscape resilience assessments.

The **Integrating Trade-Offs between Supply of Ecosystem Services and Land Use Options into Poverty Alleviation Efforts and Development Planning in the Mixteca** project (the **Mixteca** project) in the Oaxaca Region in Mexico was recognized as an important generator of knowledge and tools about biodiversity and ecosystem services. With the understanding that land-use planning is crucial for ecosystem conservation and land restoration, the project generated spatial studies that showed the level and reasons of natural resources deterioration and provided methods and scenarios for restoration. The

6 N. Bergamini, R. Blasiak, *et al.* 2013. Indicators of Resilience in Socio-Ecological Production Landscapes. United Nations University Institute of Advanced Studies (UNU-IAS).

maps also helped raise awareness at the community level and promote better spatial management. One local community representative stated "once we saw the data on the scarcity of the plants and animals, we asked the project to help us with land planning so we could save the remaining ones". The project generated a wealth of information on biodiversity, water, soils and production systems in collaboration with leading research institutions in Mexico and has become a reference point for biological and geographical information on the Mixteca Region.

4.2 Identifying Good Practices

An important part of mainstreaming is the identification, promotion and wide adoption of sustainable and diversity-rich production practices. The projects identified management practices that can provide multiple local, national and global benefits. These benefits include higher productivity, improved nutrition, pest and disease control, and better water and soil conditions. Some projects also showed that these practices can help control encroachment on fragile and biologically significant ecosystems.

When identifying and developing best practices, projects often build on complementarities between traditional and scientific knowledge. After identification of biodiversity-friendly practices, the first step in their wider dissemination involves testing and proving them in project areas. This is followed by establishing pathways that can ensure a wide adoption of the most successful practices. These scaling-out pathways include:

- Diffusion of project results and outputs over a greater area or with a wider range of communities
- Adaptation of new approaches to other situations
- Replication of specific approaches such as community seed banks where the essential feature is their local value
- Realization of value-adding benefits and income generation possibilities
- Continuing use of project innovations over time[7].

4.2.1 Conservation practices

The projects have addressed the challenge of mainstreaming conservation practices in a variety of ways depending on the target species and project objectives. After testing and developing action plans for important target species in the different countries, the **Crop Wild Relatives** project developed generic management and action plans for CWR conservation within and outside protected areas. These can be scaled up to other areas and CWR species within and outside project countries (see Hunter and Heywood, 2010, *Crop Wild Relatives: A Manual of* In Situ *Conservation*).

The ways in which conservation actions can be mainstreamed is also illustrated in the project **Development and Application of Decision-Support Tools to Conserve and Sustainably Use Genetic Diversity in Indigenous Livestock and Wild Relatives** (the

7 R. Alcadi, D. Jarvis. Scaling up Pro-Poor Innovations in Agro-Biodiversity: A review, in preparation.

M. Grum, *et al.* 2008. **Evaluation of Best Practices for Landrace Conservation: Farmer Evaluation.** Bioversity International.

Indigenous Livestock Diversity project), which developed and made available tools to support decision making for the conservation and sustainable management of indigenous animal breeds and their wild relatives in Asian countries and beyond[8,9,10]. Stakeholder groups, including livestock keepers, were provided with tools, including policy frameworks for prioritizing, monitoring and managing animal diversity.

The project entitled **Community-Based Management of On-Farm Plant Genetic Resources in Arid and Semi-Arid Areas of Sub-Saharan Africa** (the **Sub-Saharan Crop Diversity** project) developed and tested a methodological framework for conducting farmer evaluation of crop traditional varieties. The project found that the best way to support conservation and use of traditional varieties is by creating an environment that is inductive to building on the positive aspects of these varieties and the different practices that lead to their conservation, thus providing the necessary framework for developing mainstreaming pathways in the partner countries. These results are summarized in *Evaluation of Best Practices for Landrace Conservation: Farmer Evaluation* (Grum et al. 2008).

To reduce pressure from over-harvesting and encourage wider use of local varieties, the **Central Asia Fruit Tree Diversity** project established 73 demonstration plots/matrix orchards and 59 nurseries for multiplication of local varieties of target fruit crops and promising forms of wild fruit species. Twelve of these demonstration plots/matrix orchards have been established in forest sites to conserve *in situ* wild relatives of target species. These sites harbour 436 local varieties of fruit crops and 117 promising forms of wild nut-bearing and fruit species. Over the last few years the nurseries have produced 1.5 million saplings of local fruit tree varieties to ensure their availability and accessibility by farmers, in turn promoting the continued availability and wider use of traditional varieties throughout Central Asia.

Combining conservation with improved sustainable management practices was also a feature of the **Tropical Fruit Trees** project, which has included a plan to establish a forest genebank in the Sirsi site in India and the completion of a survey by the National Parks Department in Thailand as a basis for establishing a forest genebank.

The **Mixteca** project also made significant conservation achievements by improving management practices along with strengthening conservation activities. About 7500 hectares have been included in different types of protected areas including community managed areas. The project demonstrated that ecosystem management techniques can improve water and soil conditions, as well as agricultural productivity, and thereby decrease habitat disruption and encroachment on wild ecosystems. Moreover, ecological connectivity between protected areas for globally significant biodiversity was increased through community-conserved areas and corridor planning.

8 Training Manual on Village Poultry. Technical Series 01: General Management. First Edition 2013. GEF-UNEP-ILRI-FAnGR Asia Project. Department of Animal Science. University of Peradeniya.

9 Poultry Diseases. First Edition 2013. GEF-UNEP-ILRI-FAnGR Asia Project. Department of Animal Science. University of Peradeniya.

10 P. Silva, Ed. 2013. Indigenous Animal Genetic Resources in Sri Lanka: Status, Potential, and Opportunities. Department of Animal Science, Faculty of Agriculture, University of Peradeniya. Sri Lanka.

B. E. Vaissière, B. M. Freitas, *et al.* 2011. ***Protocol to Detect and Assess Pollination Deficits in Crops: A Handbook for Its Use.*** FAO.

H. van der Valk I. Koomen, *et al.* 2013. ***Aspects Determining the Risk of Pesticides to Wild Bees: Risk Profiles for Focal Crops on Three Continents.*** FAO.

G. LeBuhn, S. Droege, *et al.* 2016. ***Protocol to Detect and Monitor Pollinator Communities: Guidance for Practitioners.*** FAO.

M. Grieg-Gran, B. Gemmill-Herren. 2012. ***Handbook for Participatory Socioeconomic Evaluation of Pollinator-Friendly Practices.*** FAO.

L. A. Garibaldi, M. Dondo, *et al.* 2016. ***A Quantitative Approach to the Socio-Economic Valuation of Pollinator-Friendly Practices: a Protocol for Its Use.*** FAO.

4.2.2 Sustainable production practices

A number of projects have included work on identifying and testing practices that support sustainable use of biodiversity. To date the most important mainstreaming products have been the successful adoption of good practices in the target areas and the development of guidelines that can support their wide adoption. Thus, the **Below-Ground Biodiversity** project identified and tested conservation and management practices in seven tropical countries in global biodiversity hotspots and showed that sustainable intensification of smallholder farming systems involves maintaining land-use mosaics that support conservation of below-ground biodiversity.

The **Global Pollinators** project produced *Pollination Management Plans* which were prepared for project sites covering representative cropping systems in seven countries with a wide diversity of ecological zones and farming patterns. The best practices identified for pollination-friendly agriculture included planting hedgerows, mulching, conservation of pollinator habitat, and judicious use of pesticides. From this work the project developed globally applicable protocols to detect and assess pollination deficits in field situations, to undertake socioeconomic assessments of pollinator-friendly practices and to assess the risk of pesticides to pollinators. A meta-analysis was conducted, and fed into the first *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Thematic Assessment on Pollinators, Pollination and Food Production*.

The project **Conservation and Use of Crop Genetic Diversity to Control Pests and Diseases in Support of Sustainable Agriculture** (the **Controlling Pests and Diseases** project) showed that, in comparison to monocultures of the same varieties, use of mixtures showed positive results with respect to pest and disease control and production. The project has developed globally applicable and relevant criteria, tools and guidelines for using diversity to control pests and diseases. The guidelines, which present a six-step decision-making process that enables farmers and agronomists to determine when the use of on-farm crop genetic diversity would be an appropriate option to minimize crop losses due to pests and diseases, have been published in Chinese, English, French and Spanish and are available through the web. The

D. Jarvis, D.M. Campilan. 2006. ***Crop Genetic Diversity to Reduce Pests and Diseases On-Farm: Participatory Diagnosis Guidelines.*** Version I. Bioversity International Technical Bulletin No. 12.

El Proyecto Mixteca 2014. Manual para la Identificación de los Servicios Ecosistémicos en la Mixteca

El Proyecto Mixteca 2014. Introducción al Enfoque de los Servicios Ecosistémico

best practices have been tested, described and scaled-up through follow up and other projects, for example **Integrating Traditional Crop Genetic Diversity into Technology: Using a Biodiversity Portfolio Approach To Buffer Against Unpredictable Environmental Change in the Nepal Himalayas** (the **Himalayan Local Crop Diversity and Ecosystem Resilience** project) Some of the results from this project were published in a guide for the identification and scoring of diseases of selected mountain crops (amaranth, barley, beans, buckwheat, finger millet, foxtail millet, proso millet and rice) in Nepal:

Through demonstration models, the **Mixteca Project** project promoted sustainable practices for restoring the natural resource base and ecosystem services. The practices include agroforestry, bee keeping and sustainable collection of wild resources. The demonstration models were installed in 12 communities, in which 153 families diversified their cropping systems through agroforestry techniques. Furthermore, a total of 110 family coffee plots were improved by reduced use of chemical fertilizer and pesticides because there was greater awareness of the negative effect of these chemicals on soil and human and environmental health.

4.2.3 Diversification and restoration

In many production systems, important diversity has already been lost, thereby reducing the sustainability and resilience of the landscape. The **Himalayan Local Crop Diversity and Ecosystem Resilience** project is promoting eco-friendly farming practices, the use of intra-specific diversity of mountain crops and the establishment of community seed banks to strengthen the resilience of the mountain agro-ecosystem. Diversity field schools and diversity fairs are conducted in project sites to create awareness, build local capacity and mobilize local communities and stakeholders in mainstreaming traditional crop biodiversity as well as to improve the resilience of high mountain agroecosystems. To encourage farm diversification, mainstream traditional crop diversity and promote the flow of ecosystem services for crop production, farmer-friendly materials, community-based biodiversity management tools and a disease field guide were developed and disseminated (http://himalayancrops.org/).

The **Agrobiodiversity in Man and the Biosphere Reserves** project is also restoring agricultural biodiversity and supporting local seed systems in order to address the loss from hurricanes, drought and other causes and improve the range of species and varietal diversity. The project has supported farmers through the donation of vegetable crop species and valuable fruit seedlings (*Rollinia mucosa* and *Annona muricata*). Other propagated species are pineapple, pigeon pea, Mexican sapote and pepper. Several species of grains, leafy vegetables, bulbs, root vegetables and oilseeds were identified for reintegration into degraded ecosystems due to their adaptability and resilience under changing environmental conditions. Through appropriate policy developments it is planned to extend these developments to other Biosphere Reserves and production systems in Cuba (see below).

▲ Himalayan Local Crop Diversity and Ecosystem Resilience project website https://himalayancrops.org/

An important aspect of the **Mixteca** project was reforestation and rehabilitation of degraded lands and fragile ecosystems, which were identified and mapped at the beginning of the project. Five demonstration sites were established to promote good practices along with nurseries for native tree species. In addition, reduction of fuelwood usage was achieved through distribution of fuelwood-efficient stoves. More than 5000 hectares of land were rehabilitated through restoration and reforestation. The involvement and commitment of local community members and local/state authorities was crucial.

H.K. Manandhar, R.D. Timila, *et al.* 2016. ***A Field Guide for Identification and Scoring Methods of Diseases in the Mountain Crops of Nepal.*** Bioversity International.

4.2.4 Improving market opportunities

Increasing demand and creating favourable marketing conditions is an important mainstreaming strategy elaborated in the **Facilitation on Financing for Biodiversity-based Business and Support of Market Development Activities in the Andean Region** project (the **Andean Biotrade** project). This project contributed to the sustainable use of biodiversity by increasing the access of biodiversity-derived products to markets that reward sustainable extraction and production. Pilot programs for biodiversity-based businesses were supported in the sectors that extensively depend on biodiversity: food; pharmaceuticals and cosmetics; and sustainable tourism. A number of pilot initiatives aimed to strengthen value chains of native fruits. The initiatives included approximately 30 firms involved in processing or marketing these fruits at different stages of the value chain. A direct conservation benefit from the project was the inclusion of 437 hectares of tropical rainforest under non-timber forest product Biotrade principles.

The **Agrobiodiversity in Man and the Biosphere Reserves in Cuba** project is developing nationally recognized marketing programmes for certified and non-certified agricultural biodiversity products. The project puts emphasis on the production and marketing of healthy foods from traditional and indigenous crop varieties with a diverse genetic base. To facilitate processing and commercialization of biodiversity-friendly local products, the *National Programme of Urban Suburban and Family Agriculture* has created a specialized market for natural fresh products

▲ *Mauritia flexuosa*, known as the moriche palm, ité palm, ita, buriti, muriti, canangucho, or aguaje, a palm tree that grows in South America - oil extracted from the fruit is rich in beta-carotene (pro-vitamin A). © F. Tatagiba

in the Province of Guantanamo, where farmers from the reserve can benefit from direct selling to consumers, and a business plan to value organic natural products to the benefit of farmers and consumers.

The **Biodiversity for Food and Nutrition** project is working towards strengthening the knowledge and evidence base for biodiversity's contribution to improved diets and nutrition as well as strengthening policy and regulatory frameworks, exploring market opportunities for biodiversity for food and nutrition by promoting social enterprise at the grassroots and private sector levels and by strengthening links with public food procurement and institutional markets.[11] In addition, improvement of market chains and marketing of underutilised plants has been pursued. In Sri Lanka, the project has worked closely with *Helabojun*, food outlets promoting local foods and local biodiversity. In Turkey, the project has partnered with national food festivals such as the Alacati Festival to promote the nutritional value of wild harvest foods in the country and has partnered with supermarket outlets to develop key value chains. In Kenya, the project works with local entrepreneurs to increase the production and supply of local vegetables and fruits to schools and other institutional markets such as health clinics and prisons. While in Brazil the project is working cross-sectorally at the federal level to support diversification of food procurement and school feeding. Approaches that can also improve farmer livelihoods while supporting environmentally-friendly food production are actively adopted.

One of the main focuses of the **Mixteca** project was supporting local livelihoods through sustainable management of crops and other resources. This included improving value chains for agricultural and wild species. One of the activities was the establishment of nurseries for Crasulaceae species. One of the nursery staff stated: "*We produce Crassulaceae for the market, but first we make sure we have to produce seeds so we do not need to harvest plants from the wild anymore, where they are decreasing; now we produce enough to plant surplus in the wild.*" Other examples of the contribution of sustainable management to livelihoods are improved pine resin collection and diversification of coffee systems. Coffee farmers in the area of Miramar improved management of their coffee farm, and increased production by 40%.

4.3 Capacity Building and Awareness Raising

All the projects include capacity building and awareness raising activities for a range of stakeholders, both directly and indirectly involved in the projects, including local communities, researchers, business and development actors, and policy makers. The projects also aim to build capacity and create awareness of the links between agricultural biodiversity, nutrition, ecosystem services and issues such as climate change adaptation, land degradation and income. Realizing effective enabling environments requires significant attention to novel ways to build capacity, partnerships and alliances, and improving awareness and understanding among many actors.

11 D.M. Beltrame, *et al.* 2016. Diversifying Institutional Food Procurement – Opportunities and Barriers for Integrating Biodiversity for Food and Nutrition in Brazil. Revista Raízes 36:2, 55-69.

▲ Transect walk in a faba bean field to assess pest and disease in Taounate, Morocco. © Bioversity/P. de Santis

► Conducting a household survey to assess diversity, Uganda. © Bioversity/P. de Santis

B.R. Sthapit, H. Lamers, *et al.* Eds. 2013. ***Custodian Farmers of Agricultural Biodiversity: Selected profiles from South and South East Asia.*** Proceedings of the Workshop on Custodian Farmers of Agricultural Biodiversity, 11-12 February. New Delhi, India.

From a mainstreaming perspective, the benefits of capacity building come when the results go beyond those directly involved in the projects themselves. One way of achieving this is the development of manuals and guidelines that can be widely used throughout the countries involved and beyond. The **Crop Wild Relatives** project produced over 50 public awareness and education materials that target communities, students, the general public and policy-makers. Manuals were also prepared through the **Indigenous Livestock Diversity** project and then fine-tuned and adapted through targeted capacity-building and awareness-raising activities, involving key stakeholders (especially farmers, extension agents, researchers and policy makers). National scientists, students and grassroots-level extension personnel were trained, gained knowledge and improved their skills on gathering and utilizing information on genetic diversity and market data on indigenous animals and their products.

Another important pathway to mainstreaming is through the development of tested approaches that empower and enable stakeholders to secure biodiversity maintenance through their own actions. The crop-based projects developed a range of capacity and awareness-raising approaches that are now well established parts of efforts to ensure the maintenance and use of crop diversity. These approaches recognize the importance of traditional farming systems and farmers' knowledge in crop diversity conservation. The approaches include diversity fairs, diversity field fora, community biodiversity registers and community seed banks as used in the **Sub-Saharan Crop Diversity**, the **Central Asia Fruit Tree Diversity**, the **Controlling Pests and Diseases**, the **Tropical Fruit Trees**, and the **Himalayan Local Crop Diversity and Ecosystem Resilience** projects.

The **Tropical Fruit Trees** project has taken this approach furthest and developed an integrated and now widely-adopted approach – Community Biodiversity Management (CBM). The main aim of CBM is to facilitate community-led development that does not undermine

▲ Trading fresh fruits in floating markets, South Kalimantan, Indonesia. © B. Sthapit
► Wild relatives of potato in a greenhouse at Fundación PROINPA, Bolivia. © Bioversity/D. Hunter

the local natural assets through empowerment, capacity building and livelihood enhancement. The CBM approach helped make policy makers become aware of the importance of custodian farmers, who actively maintain, adapt and promote tropical fruit tree diversity. The **Tropical Fruit Trees** project put special emphasis on working with custodian farmers from five partner countries. The **Indigenous Livestock Diversity** project supported farmer associations to empower local communities, promote collaboration and knowledge sharing, and enhance their roles and participation in making decisions related to conservation and management of indigenous animal resources.

Several projects have developed training courses and modules that have been used by the universities participating in the projects. For example, the **Below Ground Biodiversity** project involved degree training of over a hundred students, including MSc and PhD students, during the course of the project. The **Mainstreaming Agrobiodiversity for Livelihoods and Adaptation to Climate Change in Sri Lanka** project (the **Biodiversity and Climate Change** project) has developed an on-line course that provides training in agricultural biodiversity use and conservation to certificate-level agronomists who make up the bulk of the country's advisory and extension staff working at grassroots level. As a next step, it is planned to develop university-level courses. Linked to the **Controlling Pests and Diseases** project, an international agricultural biodiversity centre has been established in China with partner co-financing.

Through partnerships with federal universities in Brazil, the **Biodiversity for Food and Nutrition** project is ensuring that nutritional composition methodology developed by FAO/INFOODS is promoted and embedded in teaching and research across a range of regional universities and research institutes. An education toolkit was developed that targets professionals responsible for public policy development and those providing technical support to the implementation and execution of government initiatives related to food and nutrition security at federal, state, and municipal levels. The toolkit is available through online modules that aim to strengthen capacity to mainstream biodiversity for improved nutrition worldwide.[12]

Using a slightly different approach, the **Andean Biotrade** project promoted an understanding of biotrade and sustainable development through capacity building among public and private partners as well as civil society partners. The project identified financial instruments and sources that were adapted and directed towards biotrade initiatives and provided capacity building to the financial sector to finance biotrade. At the same time, business capabilities of various actors were strengthened within the scope of product value chains based on biodiversity. As a result, 1359 professionals were trained in the public administration of biotrade: 1300 people were trained in governance and biotrade business development; and 100 professionals were trained as partners for the scalability of the project at regional and national levels.

All projects have sought to raise awareness among project partners and local communities, but also more widely. In the **Agrobiodiversity**

12 D. Hunter, *et al.* 2018. A toolkit to Support Biodiversity Mainstreaming for Healthy Diets and Improved Nutrition. Bioversity International. www.b4fn.org/index.php?id=3229

▲ Biotrade Forum in Peru. © PROMPERU

in Man and the Biosphere Reserves project, marketing campaigns help to build public awareness of the biological and bio-cultural values of Cuban Biosphere Reserves at national and international levels. They also serve to improve markets and create opportunities and conditions for public and private investments in agro-tourism and ecotourism that support the protected areas in Cuba. Wider awareness activities (TV and radio interviews and discussions, new reports and open days) have been a feature of all projects, although it is difficult to assess their impact. In some cases these have been transformed into permanent awareness products as in the **Crop Wild Relatives** project, where two agriculture information parks in Peradeniya and Bataata were established by the Sri Lankan Department of Agriculture. These parks are still active and provide a place where visitors can learn about conventional crops as well as wild relatives.

A major target of the **Global Pollinators** project has been enhanced global awareness, in this case in the form of support for the CBD International Initiative for the Conservation and Sustainable Use of Pollinators. The project has undoubtedly contributed to a greater global appreciation of the importance of pollination in food production[13]. At the country level, awareness was raised through campaigns that used a wide variety of means to disseminate information, including print and electronic media, presentations at different fora, and national symposia.

The **Mixteca** project developed and disseminated technical reports, illustrated manuals and toolkits, and internet-based information pages and databases. All information has been made available to government agencies at state level, project partners and local authorities (municipalities, community boards). About 80 staff of agencies were trained in the management of information and application of toolkits for assessing ecosystem services. Two dozen partner organizations collaborated with project activities such as studies, communication events or demonstration models. Field-based activities were a mix between activities promoted by the project and activities demanded by communities' members, who participated in 144 training events.

4.4 Strengthening Policy and Legislative Frameworks

Mainstreaming involves integrating biodiversity considerations into relevant policies and institutional frameworks. The projects have initiated and resulted in changes in policies, strategies, legislation and regulations to shift the balance in favour of diversity-rich approaches. An important startegy was targeting NBSAPs as key national instruments for mainstreaming biodiversity into development policies, plans, and processes of all sectors that have an impact, positive or negative, on biodiversity.

In addition to targeting NBSAPs, the projects have generally adopted cross- and multi-sectoral approaches. Some projects have created cross-sectoral national policy platforms to help shape a number of important policy documents on biodiversity and other

13 See The Assessment Report on Pollinators, Pollination and Food Production, 2016. IPBES.

relevant topics. Several projects have produced global policy briefs to assist countries to take up the policy recommendations and some have contributed to global state of knowledge reviews. Some major achievements are:

- Including CWR in national conservation plans and strategies as in the Crop Wild Relatives project, which serves to strengthen legal and policy frameworks that support the conservation of horticultural and wild fruit species genetic diversity, as in the Central Asia Fruit Tree Diversity project
- Mainstreaming biodiversity in food security and nutrition programmes as in the Biodiversity for Food and Nutrition project
- Including agricultural biodiversity conservation in protected area management as in the Agrobiodiversity in Man and the Biosphere Reserves project.

A first step in ensuring an effective policy framework for the conservation and use of agricultural biodiversity was the integration of specific conservation objectives and actions into national strategies and action plans. In the **Crop Wild Relatives** project, National Strategy and Action Plans for CWR Conservation were developed for several countries and, in Sri Lanka, conservation of CWR was included as a priority in the national and provincial biodiversity action plans. Under the **Agrobiodiversity in Man and the Biosphere Reserves** project in Cuba, an agricultural biodiversity programme has been included in the SNAP (Sistema Nacional de Áreas Protegidas) Strategic Plan 2015-2020 to retain traditional and indigenous genetic resources linked to MAB Reserves. Agricultural biodiversity has been added as a separate component to Cuchillas del Toa (2014-2020) and Sierra del Rosario (2015-2021) Management Plans. The management models designed for the two reserves will be applicable to the other four MAB reserves in Cuba, and can be replicated in other Protected Areas worldwide.

P. Munyi, M. Grum, *et al.* 2008. ***Framework for Transforming Best Practices for Landrace Conservation to Policies.*** Bioversity International.

Similarly, the **Indigenous Livestock Diversity** project laid a strong foundation for the creation of favourable policy environments for indigenous farm animal genetic resources. At country level, policy initiatives were embedded in the national action plans for the conservation of indigenous farm animals. The four project partner countries have endorsed the Global Plan of Action for Animal Genetic Resources. Specifically, in Pakistan, The Pakistan National Conservation Strategy is addressing the need to preserve and improve the genetic quality of livestock breeds. Sri Lanka has launched the National Action Plans for Agrobiodiversity Conservation and Sustainable Utilization and Vietnam's National Conservation Strategy included agricultural biodiversity and the management and conservation of animal genetic resources.

The development of integrated frameworks that can guide policy making are often an important step in policy mainstreaming processes. The **Sub-Saharan Crop Diversity** project developed such a framework that links best practices for on-farm conservation of crop landraces to decision-making and policy creation. The published framework serves as a guideline for development of enabling policy environments for the conservation of crop biodiversity of local and global importance:

I. Lapeña, M. Turdieva, *et al.* Eds. 2014. ***Conservation of Fruit Tree Diversity in Central Asia: Policy Options and Challenges.*** Bioversity International.

I. Lapeña, I. López, *et al.* 2012. ***The Guidelines: Access and Benefit Sharing in Research Project.*** Bioversity International.

Policy analysis and the development of policy recommendations have been a feature of nearly all the projects to a greater or lesser extent. Policy reviews were conducted to investigate the extent to which explicit attention is devoted to soil biological quality under the **Below Ground Biodiversity** project and how much information on soil biodiversity was used to integrate below-ground biodiversity management and conservation into policy frameworks. The project also provided recommendations on land-use practices and an advisory support system for policies that will enhance the conservation of below-ground biodiversity. Partner countries in the **Crop Wild Relatives** project reviewed the legal and policy framework for CWR, and in addition raised awareness on benefit-sharing related to CWR with all levels of stakeholders, especially policy makers. **Global Pollinators** contributed to the development of pro-pollination policies at national and global levels by providing evidence-based information gathered through valuation of pollinator-friendly practises and detecting and assessing pollination deficits in crops (as reflected in the recent IPBES report on pollinators, pollination and food production). Based on the pollination deficit work, the project developed a policy matrix for policy analysis and recommendations. Other projects, such as the **Himalayan Local Crop Diversity and Ecosystem Resilience** project, are also closely engaged in policy analysis and working with policy makers. Obtaining recognition among policy makers has yielded tangible results. The **Tropical Fruit Trees** project has contributed to a significant policy shift in India, through an investment in mainstreaming the on-farm conservation and use of agricultural biodiversity, and in Malaysia, where the project has contributed to the development of the national agricultural biodiversity strategy and played a crucial role in providing a greater emphasis on on-farm conservation.

A number of projects have been able to obtain clear policy-related products. The **Central Asia Fruit Tree Diversity** project provided recommendations to policymakers for strengthening legal and policy frameworks that support the conservation of horticultural and wild fruit

▲ Research team coming back from a crop wild relative collecting expedition, Madagascar. © Bioversity/D. Hunter

species genetic diversity. The policy analysis and recommendations were published in the first publication listed below, while the recommendations made by the project on the establishment of a benefit-sharing mechanism are detailed in the second publication. The primary audience for these guidelines are researchers working with crop genetic resources and related traditional knowledge as well as those employed in institutes and executive agencies that implement genetic resource-related policies and laws. These guidelines are a valuable resource for authorities involved in relevant legislative processes and for local populations who depend on agricultural biodiversity for their livelihoods. Upon a request from the CBD Secretariat, the Guidelines have been posted on the website of the CBD in the section on "Existing instruments, guidelines, codes of conduct and tools addressing ABS:"

The policy work resulted in major achievements in Kyrgyzstan and Uzbekistan:

- Decree number 293 of 2 June 2014 "National program of development of nut production in Kyrgyzstan up to 2025," according to which 3,600 ha of walnut, 1,500 ha of pistachio and 2,000 ha of almond plantations should be established within 10 years.
- Decree number 6 of 16 January 2016 of the Cabinet of Ministers of Uzbekistan, "Establishment of plantations of almond, walnut and pistachio in mountainous and foothill areas in 2016-2018," according to which every year 1,000 ha of these crops should be established, bringing the total to 3,000 ha over three years for each crop.

In Brazil, the **Biodiversity for Food and Nutrition** project has provided recommendations for several national plans, including the *Healthy Food and Nutritional Security and the Sustainable Production and Consumption* plans. Brazil showed that it is possible to include pro-poor and pro-biodiversity policies in government plans through its recent passing of Ordinance Nº 163, through which *Brazilian Socio-biodiversity (Native Food Species of Nutritional Value)* is officially

▲ Quinoa growing in the Andes.
© Bioversity/A. Camacho
► Poster about biodiversity in Oaxaca, Mexico, produced by the Mixteca project.

defined and recognized. Brazil made significant efforts to align its NBSAP process to highlight the importance and value of biodiversity for addressing nutrition. The NBSAP has been revised to include such nutrition-related objectives, targets, and indicators and with dedicated resources and budgets to support implementation of actions[14]. In western Kenya, the project is working with policy stakeholders from Busia County to develop a *Biodiversity Conservation Policy* that takes into account the importance of conserving nutrient-rich traditional foods such as cowpea, amaranth, arrowroot and sorghum to increase diet quality and access to key micronutrients, particularly for mothers and children. The partners are promoting nutritious native biodiversity in school feeding programmes where these exist. Collaboration with the national Food Procurement Programme in Brazil has led to increased purchases of local biodiversity by the school meals programme since the beginning of the project.

An integrated approach that recognizes the importance of policy changes (and the challenges of achieving such changes) is being followed in the **Biodiversity and Climate Change** project. In this project the policy analysis is combined with seminars for policy makers and the development of a multi-stakeholder platform to develop and propose new policies that can support the improved conservation and use of agricultural biodiversity. The project is contributing to a revised *National Agrobiodiversity Strategy* and a supporting framework for mainstreaming agricultural biodiversity into the climate change adaptation and mitigation strategies developed by the Ministry of Mahaweli Development and Environment.

One project, **Andean Biotrade**, directly addressed the policy environment through facilitating the development of policies and financial environment favourable to Biotrade. Establishing priorities and policies for benefit sharing was one of the key issues tackled by the project. Environmental legal guides were drafted, in which 215 existing standards on the use of timber and non-timber products were identified, to promote knowledge at the policy level, and to encourage other sectors (governmental, non-governmental, private, and commercial) to explore options for the sustainable use of biodiversity. Some relevant outcomes regarding a more favourable policy and business environment for biotrade have been achieved in Ecuador through the integration of biotrade under the *National Strategic Plan for Development – Buen Vivir*, in Peru through the creation of the National Commission for Biotrade and the new Sustainable Business Unit within Promperu as well as the creation of the Green Business Unit of the Ministry of Environment and Sustainable Development in Columbia.

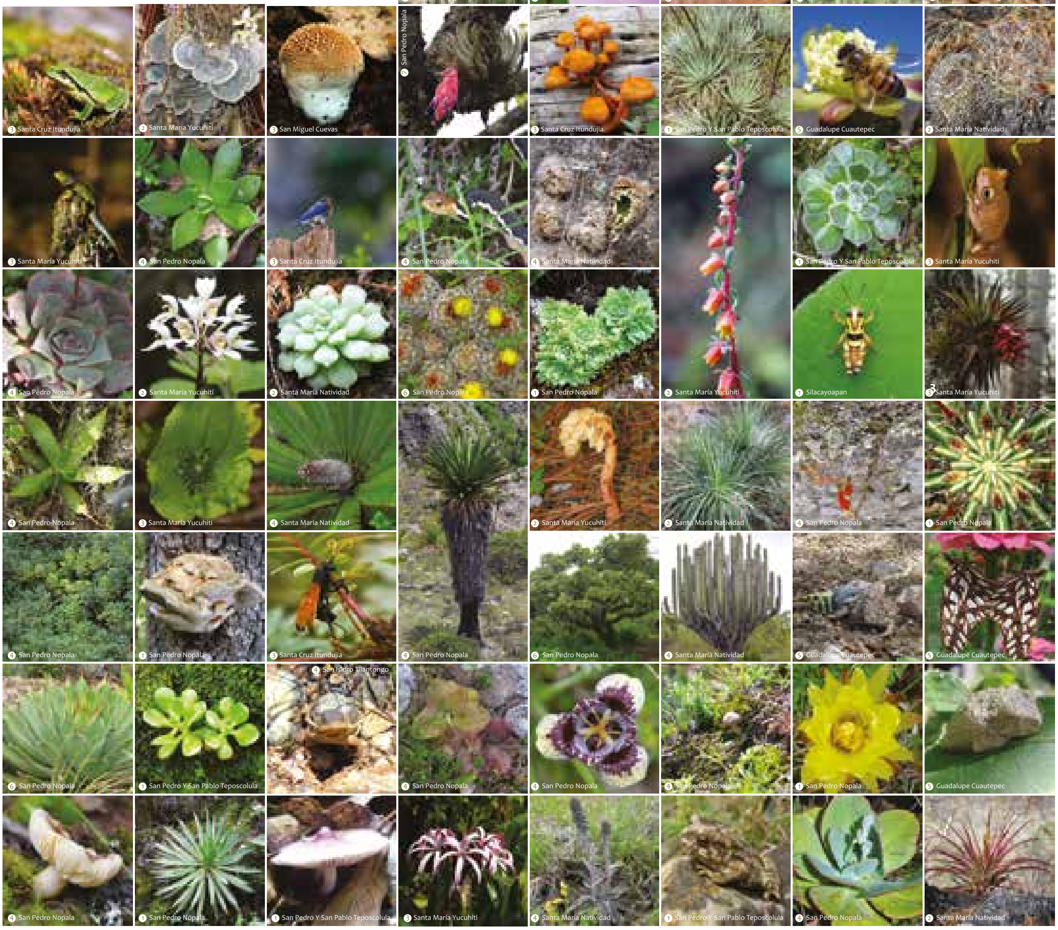
14 D. Hunter, I. Özkan, *et al.* 2016. Enabled or Disabled: Is the Environment Right for Using Biodiversity to Improve Nutrition? Frontiers in Nutrition 3:14.

Proyecto Mixteca

MANTENIENDO LOS BENEFICIOS QUE NOS OFRECE LA NATURALEZA

PNUMA

WWF



Fotografías
1. Martha Alvarado Hernández
2. Lorena Cruz Rivera
3. M. Domínguez Laso / R. Flores Diego
4. Enrique Montes Hernández
5. Ángel Pérez Gallardo
6. Gustavo Sánchez Benítez

La conservación de la biodiversidad y de los beneficios que nos da la naturaleza, depende de las decisiones que tomemos

Na ta´va ichi nuu ntuvi kiti yuku jin ntuvi yutnu iyo yuku-yo jin un etniñu-yo jee yuku, Tee de ña´a kaa ntu tutu tatnu´un-yo ntexe sa´a-yo

En la Mixteca oaxaqueña se han identificado 3,337 especies de plantas, aproximadamente el 43% de todas las especies reportadas para Oaxaca; 150 de ellas son endémicas, es decir, solo se encuentran en esta región, y 87 están incluidas en alguna categoría de protección en las leyes mexicanas (NOM-059-SEMARNAT).

637 de estas especies tienen un valor cultural en la región, donde el uso tradicional de las plantas es todavía uno de los vínculos estrechos que mantienen las comunidades mixtecas con la naturaleza.

En la región se han registrado también 204 especies de aves, 165 de mamíferos, 58 de anfibios y 112 de reptiles; haciendo un total de 534 especies de vertebrados terrestres, lo que representa el 17% de todas las especies. De ellas, 86 están incluidas en la NOM-059- SEMARNAT y 24 son endémicas a Oaxaca.

Es posible que estas cifras sean mayores ya que existen áreas poco estudiadas, lo que indica que la Mixteca oaxaqueña es una región de gran importancia por su biodiversidad a pesar del deterioro ocasionado por el manejo inadecuado de sus recursos naturales, lo que ha puesto en riesgo la permanencia de los bienes y servicios que sus ecosistemas proporcionan a las poblaciones locales.

Oficinas en Oaxaca
Circuito Acueducto 320
Frac. Rincón del Acueducto
Oaxaca, Oaxaca CP 68040
Tel. (951) 5136723 /29 /35

Oficinas en Huajuapan
Av. Lázaro Cárdenas # 5
Col. Las Ánimas
Huajuapan de León
Oaxaca, CP 69000
Tel. (953) 5552347

Oficinas en Tlaxiaco
Aldama #3, Centro
H. Ciudad de Tlaxiaco
Oaxaca, CP 69800
Tel. (953) 5520041

www.proyectomixteca.org.mx

▲ Women carrying forage tree saplings. © IWMI/N. Palmer

5. CONCLUSIONS AND RECOMMENDATIONS

The projects described in this booklet make contributions to the mainstreaming of biodiversity, particularly agricultural biodiversity. They provide knowledge and improved practices, build capacity, create awareness and identify and put forward the policies and approaches required to ensure conservation and sustainable use of biodiversity in production landscapes. Earlier projects were not directly designed with mainstreaming in mind but have still provided outputs that are directly relevant to a mainstreaming agenda. Many of the more recent projects explicitly recognize the importance of mainstreaming.

Knowledge and practices

All the projects have provided information and new knowledge on the importance and value of biodiversity in the agricultural sector. The numerous publications bear witness to this. The knowledge gained supports the implementation of biodiversity-friendly practices by farmers and rural communities and provides the evidence base required to convince policy makers. The projects have shown that these are distinct activities involving different stakeholders and requiring different approaches and products. In both cases, demonstrating the links between agricultural biodiversity and such issues as food security and nutrition and climate change adaptation is important.

The projects have been successful in identifying practices that support the conservation and use of agricultural biodiversity by rural communities. A variety of practices have been developed and tested in a range of production systems in many countries.

The challenge of mainstreaming is to ensure the wider adoption of these practices; the results from the different projects provide only limited evidence

that this has been achieved on any scale. Future projects will need to consider (1) how practices that have been developed for individual agricultural biodiversity components (crops, animals, pollinators etc.) can be combined and integrated; and, (2) how the transition to biodiversity-friendly practices can best be supported so that their adoption does not compromise the livelihoods of farmers as they adopt new practices.

Capacity and awareness

An essential aspect of mainstreaming is the development of the required capacity. Project capacity building has largely focused on those directly involved in project activities. Full mainstreaming will involve a continuing process of capacity building in a much wider constituency that includes, for example, farmers' groups and agricultural officers. One way in which this is being attempted is through the development of curricula that can be used by national colleges and universities. Again, this is a process that may take longer than the lifetime of a project in order to gain the acceptance of the institutions involved and will preferably involve combining information from the different projects to create a capacity building process that supports all aspects of the conservation and use of agricultural biodiversity.
Creating increased awareness has been a part of most projects. Although many of the activities have focused on the stakeholders directly involved in the projects, the projects have also sought to engage wider audiences. From a mainstreaming perspective, the most successful activities seem to be those that can be sustained over the longer term. Displays and exhibitions focusing on useful biodiversity that form part of larger permanent initiatives are one such mechanism.

Policy change

Policy changes have been achieved in a number of the projects. Policy-related activities largely focused on ensuring that agricultural biodiversity is embedded within existing agricultural, environmental, conservation, nutrition and climate change adaptation plans, policies and strategies such as Genetic Resources Plans of Action or NBSAPs. Policy initiatives have also been primarily aimed at favouring agricultural biodiversity-friendly actions rather than at removing existing disincentives, an approach that is likely to be more challenging. Examples of disincentives include inappropriate seed laws that limit the sale of traditional varieties and support for agricultural practices such as pesticide use that reduce pollinator or below-ground diversity. Since both wider dissemination of findings and changes in policy are likely to continue beyond the lifetime of any single project, it is important that all projects develop mechanisms that secure continued support for the activities involved.
Another aspect of policy change is the inclusion of biodiversity perspectives in other agendas. There are many opportunities for this, including the concern to achieve food security and nutrition, increased interest in sustainable intensification, and the importance of adaptation to and mitigation of climate change. A couple of the projects address these opportunities directly but there is potential for strengthening this area in many of the other projects. This potential has been recognized by the Commission on Genetic Resources for Food and Agriculture (CGRFA) in its adoption of the Guidelines on mainstreaming biodiversity for food and agriculture in food security and nutrition and on adaptation to climate change.
The UN Environment GEF-supported projects implemented over the past 17 years have provided a rich body of experiences on the many different aspects of ensuring effective conservation and use of agricultural biodiversity. A full evaluation and analysis of the mainstreaming impacts of this entire portfolio, a component of GEF's overall review of their mainstreaming projects, would make an important contribution to the design and implementation of future GEF-supported initiatives aimed at securing biodiversity in production landscapes.
An important immediate next step would be to bring together the expertise gathered through the different projects to create a more general framework and a more comprehensive basis for future initiatives. The projects have largely been sectoral, so that sharing the different approaches and experiences could provide the basis for a much more effective approach to not only mainstreaming of biodiversity in agricultural production systems at multiple scales but also helping create enabling environments for countries to shift to more healthy and sustainable food systems.

6. PROJECT DESCRIPTIONS

Community-Based Management of On-Farm Plant Genetic Resources in Arid and Semi-Arid Areas of Sub-Saharan Africa

Countries
Benin, Burkina Faso, Ghana, Kenya, Mali, Malawi, Uganda, Zimbabwe

Executing agencies
Benin: Institut National de Recherche Agricole du Benin
Burkina Faso: Institut d'Etudes et de Recherche Agricoles
Ghana: University of Ghana
Kenya: National Genebank of Kenya
Malawi: National Plant Genetic Resources Centre in Chitedze
Mali: Insitut d'Economie Rurale
Uganda: National Agricultural Research Organization
Zimbabwe: Department of Agricultural Research
Global: Bioversity International

Project cost
GEF financing: USD 0.75 M
Co-financing: USD 1.7 M
Total cost: USD 2.45 M
Project start: 2002
Completion: 2006

Project objectives
The project aimed to improve the effectiveness of traditional farming systems for conservation of crop landraces of local and global importance. The specific project objectives include: development of a framework for analysis of best practices for conservation of crop landraces on-farm; development of a framework that links best practices for conservation of crop landraces on-farm to decision-making and policy; building capacity in the application of both frameworks in influencing policies that impact on-farm conservation of landraces. The project focused on community and farmer-based approaches, taking a broad view of on-farm conservation that gives importance to participatory plant breeding, domestication processes and indigenous knowledge of crops and wild relatives in the maintenance of on-farm diversity in arid and semi-arid ecosystems.

Conservation and Sustainable Management of Below-Ground Biodiversity

Countries
Brazil, Cote d'Ivoire, India, Indonesia, Kenya, Mexico, Uganda

Executing agencies
Brazil: Universidade Federal de Lavras
Côte d'Ivoire: Université de Cocody, Abidjan
India: Jawaharlal Nehru University
Indonesia: Universitas Lampung
Kenya: University of Nairobi
Mexico: Instituto de Ecologia, Xalapa
Uganda: Makerere University
Global: Tropical Soil Biology and Fertility Institute (TSBF) of the International Center for Tropical Agriculture (CIAT)

Project cost
GEF financing: USD 9.03 M
Co-financing: USD 9.87 M
Total cost: USD 18.9 M
Project start: 2002 Tranche I; 2006 Tranche II
Completion: 2010
www.bgbd.net

Project objectives
The major objective of the project was to enhance awareness, knowledge and understanding of below-ground biological diversity (BGBD) important to sustainable agricultural production in tropical landscapes by demonstrating methods for its conservation and sustainable management. The project explored the hypothesis that, by appropriate management of above- and below-ground biota, optimal conservation of biodiversity can be achieved for national and global benefits in mosaics of land-uses at differing intensities of management and further result in simultaneous gains in sustainable agricultural production.

◄ Understanding pollination of mango trees. © FAO/D. Martins

In Situ Conservation of Crop Wild Relatives through Enhanced Information Management and Field Application

Countries
Armenia, Bolivia, Madagascar, Sri Lanka, Uzbekistan

Executing agencies
Armenia: Ministry of Nature Protection; Ministry of Agriculture; Institute of Botany of the National Academy of Sciences
Bolivia: General Directorate on Biodiversity, Vice Ministry of Environment, Natural Resources and Forest Development
Madagascar: Ministry of Scientific Research, National Centre for Agricultural Research for Rural Development
Sri Lanka: Ministry of Environment; Department of Agriculture
Uzbekistan: State Committee on Science and Technology, Institute of Genetics and Plant Experimental Biology
Global: Bioversity International

Project cost
GEF financing: USD 5.8 M
Co-financing: USD 7.2 M
Total cost: USD 13 M
Project start: 2004
Completion: 2010
www.cropwildrelatives.org

Project objectives
The global objectives of this project were the safe and effective conservation of crop wild relatives and their increased availability for crop improvement in Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan, together with an international information system that can support crop wild relatives' conservation throughout the world. The project aimed to determine the conservation status of crop wild relatives in the participating countries and to create within each partner country information management systems that bring together information on crop wild relatives held by different institutions. Further, the project aimed to develop and test decision-making procedures that allow countries to identify priority conservation activities and to carry out those of the highest priority.

In Situ/On-farm Conservation of Agricultural Biodiversity (Horticultural Crops and Wild Fruit Species) in Central Asia Countries

Countries
Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan

Executing agencies
Kazakhstan: The Academy of Agricultural Science
Kyrgyzstan: Research Institute of Farming; "Bioresurs" Public Foundation of Research and Innovation Centre of Phytotechnology of Kyrgyz National Academy of Sciences Research Institute of Farming
Tajikistan: Research and Production Association 'Bogparvar'
Turkmenistan: Academy of Science of Turkmenistan Uzbekistan: Institute of Genetics and Plant Experimental Biology
Uzbekistan: Research Institute of Genetics and Plant Experimental Biology
Global: Bioversity International

Project cost
GEF financing: USD 5.7 M
Co-financing: USD 13.1 M
Total cost: USD 18.8 M
Project start: 2006
Completion: 2015
http://centralasia.bioversityinternational.org

Project objectives
The outcomes of this project are the conservation and sustainable use of horticultural crops and wild fruit species genetic diversity in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The project aimed to conserve *in situ*/on farm local varieties of horticultural crops and wild fruit species through enhanced capacity of stakeholder groups, including policy-makers, researchers, agricultural extension workers, farmers and their associations, local communities, and NGOs. Knowledge about levels and distribution of fruit species genetic diversity, and the value of this diversity for sustainable agriculture and ecosystem health, was used to strengthen policy and legislation. The project produced and distributed participatory management models that contribute to the conservation of this important global resource within and outside the five target countries.

Conservation and Management of Pollinators for Sustainable Agriculture through an Ecosystem Approach

Countries
Brazil, Ghana, India, Kenya, Nepal, Pakistan, South Africa

Executing agencies
Brazil: Ministry of the Environment
Ghana: University of Cape Coast
India: G.B. Pant National Institute of Himalayan Environment and Sustainable Development
Kenya: National Museums of Kenya
Nepal: Ministry of Agriculture and Cooperatives, Gender Equity and Environment Division
Pakistan: Pakistan Agricultural Research Centre
South Africa: South African National Biodiversity Institute
Global: Food and Agriculture Organisation of United Nations

Project cost
GEF financing: USD 7.8 M
Co-financing: USD 24.8 M
Total cost: USD 32.6 M
Project start: 2008
Completion: 2015
www.internationalpollinatorsinitiative.org

Project objectives
The immediate objective of this project was to harness the benefits of pollination services provided by wild biodiversity for human livelihoods and sustainable agriculture, through an ecosystem approach in selected countries. The main outcomes of the project are expanded knowledge of pollination services, enhanced conservation and sustainable use of pollinators for sustainable agriculture, increased capacity to conserve and sustainably use pollinators, and enhanced awareness of conservation and sustainable use of pollinators for farmers, land managers and policymakers. The results include a set of tools, methodologies, strategies and best management practices that can be applied to pollinator conservation efforts worldwide. The project showed how the services of pollination can be conserved and used sustainably in agriculture, through the application of the ecosystem approach. Through the development and testing of good agricultural practices for pollination services capacity was increased and awareness raised to promote wise management of pollinators and their services.

Conservation and Use of Crop Genetic Diversity to Control Pests and Diseases in Support of Sustainable Agriculture

Countries
China, Ecuador, Morocco, Uganda

Executing agencies
China: Yunnan Agricultural University
Ecuador: Instituto Nacional Autónomo de Investigaciones Agropecuarias
Morocco: Institut Agronomique et Vétérinaire Hassan II
Uganda: National Agricultural Research Organisation
Global: Bioversity International

Project cost
GEF financing: USD 3.8 M
Co-financing: USD 5.8 M
Total cost: USD 9.6 M
Project start: 2008
Completion: 2010

Project objectives
The project aim was to ensure that resource-poor rural populations benefit from reduced crop vulnerability to pest and disease attacks through increased use of genetic diversity on-farm. The project developed tools to determine when and where intra-specific crop diversity can be used to manage pest and disease pressures by integrating existing farmer knowledge, belief and practices with advances in the analysis of crop-pest/disease interactions. Unlike Integrated Pest Management (IPM) strategies, which have focused on using agronomic management techniques to modify environment around predominantly modern cultivars, this project is unique in that it concentrates on the management of the local crop cultivars themselves as the key resource, making use of the intra-specific diversity among cultivars maintained by farmers.

Development and Application of Decision-Support Tools to Conserve and Sustainably Use Genetic Diversity in Indigenous Livestock and Wild Relatives

Countries
Bangladesh, Pakistan, Sri Lanka, Vietnam

Executing agencies
Bangladesh: Bangladesh Agricultural University, Department of Animal Breeding and Genetics
Pakistan: Pakistan Agricultural Research Council, Animal Sciences Division
Sri Lanka: University of Peradeniya, Department of Animal Science
Vietnam: National Institute of Animal Husbandry
Global: International Livestock Research Institute (ILRI)

Project cost
GEF financing: USD 1.98 M
Co-financing: USD 8 M
Total cost: USD 9.98 M
Project start: 2009
Expected Completion: 2016
www.fangrasia.org

Project objectives
The outcome of this project included development of decision-support tools and the capacity to conserve through sustainable utilization globally-significant farm animal genetic resources (FAnGR) in Bangladesh, Pakistan, Sri Lanka and Vietnam. Decision-support tools will be developed to identify and manage priority FAnGR, and to assess, strengthen and monitor the policies and market structures that support the conservation through utilization of FAnGR and their wild relatives for the benefit of human livelihoods. The tools will be applied through capacity-building and awareness-raising mechanisms that will both emphasize the value (conservation and potential market return) of FAnGR and ensure that the tools are embedded in and used efficiently by institutional programmes and by poor livestock keepers. The project aims not only to conserve globally significant FAnGR within the four project countries, but also to serve as a model for replication in other Asian countries and beyond.

Conservation and Sustainable Use of Cultivated and Wild Tropical Fruit Diversity: Promoting Sustainable Livelihoods, Food Security and Ecosystem Services

Countries
India, Indonesia, Malaysia, Thailand

Executing agencies
India: Indian Council of Agricultural Research
Indonesia: Indonesian Centre for Horticulture Research and Development
Malaysia: Malaysian Agriculture Research and Development Institute
Thailand: Department of Agriculture
Global: Bioversity International

Project cost
GEF financing: USD 3.7 M
Co-financing: USD 14.8 M
Total cost: USD 18.5 M
Project start: 2009
Completion: 2015
http://tft.agrobiodiversityplatform.org

Project objectives
The project aimed to contribute to the improvement of livelihoods and food security of target beneficiaries through the conservation and use of tropical fruit tree genetic resources. The objective was the conservation *in situ* and on-farm of tropic fruit tree genetic resources through strengthened capacity of farmers, local communities and institutions to sustainably apply good practices and secure benefits. This was achieved through improved knowledge of value, use and sustainable and gender-sensitive management practices of tropical fruit tree diversity. The project enhanced the capacity and the leadership skills to apply sustainable and gender-sensitive practices for managing tropical fruit tree diversity for sustainable livelihoods, food security and ecosystem health. The project provided an effective long-term basis for maintaining the genetic diversity and associated ecosystem functions of both the cultivated and wild varieties of tropical fruit tree genetic resources and established a scientific and practical foundation necessary for the development of environmental certification schemes to promote the marketability and mainstreaming of tropical fruit diversity.

Facilitation on Financing for Biodiversity-Based Business and Support of Market Development Activities in the Andean Region

Countries
Colombia, Ecuador and Peru

Executing agencies
Colombia: Biotrade Colombia Fund, Ministry of Environment and Sustainable Development
Ecuador: Ministry of Environment and Cooperation for the Promotion of Exports and Investments
Peru: National Environment Ministry and Peru Export and Tourism Board
Regional: Development Bank of Latin America

Project cost
GEF financing: USD 6.4 M
Co-financing: USD 14.3 M
Total cost: USD 20.7 M
Project start: 2010
Completion: 2014
www.biocomercioandino.org

Project objectives
The project objective is to protect and sustainably use biodiversity in the Andean Region through support to the Biotrade sector. The project supported the participating countries in overcoming the main barriers to Biotrade, attaining environmental externalities on a par with trade benefits. Specifically, the project aimed to (i) facilitate the development and rationalization of policies favorable to Biotrade; (ii) increase the access of products proceeding from biodiversity to markets that reward sustainable extraction and production; (iii) strengthen business capabilities within the scope of value chains of products based on biodiversity and promote an understanding of Biotrade; (iv) improve the acquisition of and access to information on key Biotrade products and markets; (v) leverage financial resources so as to direct them to Biotrade initiatives; (vi) support pilot Biotrade projects for biodiversity conservation; and (vii) agree on information and replication strategies for the project at the national and regional Andean level, including mechanisms for its implementation.

Integrating Trade-Offs between Supply of Ecosystem Services and Land Use Options Into Poverty Alleviation Efforts and Development Planning in the Mixteca

Country
Mexico

Executing agencies
National Commission of Protected Natural Areas
World Wildlife Fund - Mexico

Project cost
GEF financing: USD 5.9 M
Co-financing: USD 46.4 M
Total cost: USD 52.3 M
Project start: 2010
Completion: 2015
www.proyectomixteca.org.mx

Project objectives
The objective of this project was to mainstream biodiversity conservation objectives into natural resource use and development planning for sustainable livelihood options in the Oaxacan Mixteca. This includes integrating tools for assessing and valuing ecosystem services and incorporating these values into policy instruments used in decision-making by government and stakeholders. The project focused on strengthening the knowledge base on ecosystem services for biodiversity conservation, mainstreaming ecosystem services methodologies and tools in federal and state support programs in the Oaxacan Mixteca, promoting good practices in agriculture and natural resource management through the use of pilot demonstration projects, improving the livelihoods of local communities through better management of their biodiversity and natural resources, and broadly disseminating project findings and lessons learned to other projects, programs and areas.

Mainstreaming Biodiversity Conservation and Sustainable Use for Improved Human Nutrition and Well-being

Countries
Brazil, Kenya, Sri Lanka, Turkey

Executing agencies
Brazil: Ministry of Environment
Kenya: Kenya Agricultural and Livestock Research Organization
Sri Lanka: Ministry of Mahaweli Development and Environment
Department of Agriculture
Turkey: General Directorate of Agricultural Research and Policies and Ministry of Food, Agriculture and Livestock
Global: Bioversity International

Project cost
GEF financing: USD 5.5 million
Expected Co-financing: USD 29.5 M
Total cost: USD 35 M
Project start: 2011
Expected completion: 2017
www.b4fn.org

Project objectives
The project aims to contribute to the improvement of global knowledge of biodiversity for food and nutrition and thereby enhance the well-being, livelihoods and food security of target beneficiaries in Brazil, Kenya, Sri Lanka and Turkey through the conservation and sustainable use of this biodiversity and the identification of best practices for up-scaling. The Project Objective is to strengthen the conservation and sustainable management of agricultural biodiversity through mainstreaming into national and global nutrition, food and livelihood security strategies and programmes. The project aim to achieve its objective by demonstrating the nutritional value of globally important agricultural biodiversity, strengthening the evidence base for its role and ensuring that effective policy, regulatory, market and programmatic frameworks are put in place to support future mainstreaming of biodiversity for improved human nutrition and wellbeing.

Mainstreaming Agrobiodiversity Conservation and Use in Sri Lankan Agro-ecosystems for Livelihoods and Adaptation to Climate Change

Country
Sri Lanka

Executing agencies
Ministry of Mahaweli Development and Environment
Department of Agriculture
Bioversity International

Project cost
GEF financing: USD 1.5 M
Expected Co-financing: USD 3.2 M
Total cost: USD 4.7 M
Project start: 2012
Expected completion: 2017
www.bacc.lk

Project objectives
The objective of this project is to ensure that agrobiodiversity in Sri Lanka is optimally conserved and used to meet the challenges of climate change and improve rural livelihoods. The Project aims to develop local community-based approaches, together with the necessary national supporting framework that will allow the conservation and use of agrobiodiversity to be mainstreamed into Sri Lanka's agricultural production and environmental management strategies. It will do this through three inter-linked components that respectively address: adaptive management of agrobiodiversity to enhance sustainability, resilience and adaptability to climate change; improved production benefits for farmers and communities from use of agrobiodiversity-rich practices; and the development of appropriate institutional frameworks, human capacity and partnerships.

Agrobiodiversity Conservation and Man and the Biosphere Reserves in Cuba: Bridging Managed and Natural Landscapes

Country
Cuba

Executing agencies
Instituto de Investigaciones Fundamentales en Agricultura Tropical
Centro Nacional de Áreas Protegidas
Bioversity International

Project cost
GEF financing: USD 1.4 M
Expected Co-financing: USD 2.8 M
Total cost: USD 4.2 M
Project start: 2013
Expected completion: 2018
www.cobarb.co.cu

Project objectives
The project aims to mainstream agricultural biodiversity into the management of the Cuban Man and Biosphere Reserves (MaB) system, specifically targeting two MABs in Cuba: Cuchillas del Toa and Sierra del Rosarioand. By securing the conservation of agrobiodiversity in Biosphere reserves and mainstreaming it into the wider landscapes, the project will provide essential biological resources and knowledge for more diversified and sustainable agricultural production systems in Cuba that build on traditional knowledge and bio-cultural values, and foster community and stakeholder participation.

Integrating Traditional Crop Genetic Diversity into Technology: Using a Biodiversity Portfolio Approach to Buffer Against Unpredictable Environmental Change in the Nepal Himalayas

Country
Nepal

Executing agencies
Nepal Agricultural Research Council
Department of Agriculture
Local Initiatives for Biodiversity Research and Development
Bioversity International

Project cost
GEF financing: USD 2.3 M
Co-financing: USD 5.8 M
Total cost: USD 8.1 M
Project start: 2014
Expected completion: 2019
www.himalayancrops.org

Project objectives
The project aims to contribute to the conservation of globally important crop biodiversity that forms the basis for food security in areas of high environmental instability and variability in many high elevation agricultural systems throughout the world. The project objective is to mainstream the conservation and use of agrobiodiversity in the mountain agricultural production landscapes of Nepal to improve ecosystem resilience, ecosystem services and access and benefit-sharing capacity in mountain ecosystems. The project focuses on supporting the use of the rich and unique crop biodiversity of global importance to mountain agricultural environments to buffer against the increasing unpredictability in the amount and timing of rainfall, temperature extremes, and the frequency and severity of pests and pathogens in the Himalayan Mountains of Nepal.

ACKNOWLEDGEMENTS

The authors thank all national and international partners of the projects presented in this publication who have provided their time, ideas and valuable contributions to the publication. We would like to acknowledge the contribution provided by the late Bhuwon Sthapith. Special thanks to Devendra Gauchan, Danny Hunter, Devra Jarvis, Ibrahim Mohamed, Muhabbat Turdieva, Nadia Bergamini, Paola De Santis, Robert Erath, Teresa Borelli, Gaia Gullotta and Sajal Sthapit.
We are grateful to Mohamed Sessay and Emile Frison for the peer review of the publication and to Judith Thompson, Charlie Bartlett and Rose Robitaille for their comprehensive editorial review. Authors apologize to any individuals inadvertently omitted from this list.

United Nations Environment Programme
P.O. Box 30552, Nairobi 00100, Kenya
Tel: +254 20 7621234
e-mail: unenvironment-publications@un.org

www.unenvironment.org