



Final narrative report for “*Underpinning the Resiliency of Agricultural Heritage Systems, Smallholders, family Farmers and Indigenous Communities*”

Final Report

Second Year of Implementation (Grant 2000001000)
(December 2016 – December 2017)

Final Report submitted to IFAD
by Bioversity International

IFAD Project Code: Grant 2000001000

Submission Date: June 2018

Submitted by:

Nadia Bergamini
Grant Manager,
Landscape Management and Restoration Initiative
Bioversity International
Via dei Tre Denari, 472/a
00057 Maccarese
Rome, Italy
Tel. +39- 06- 6118283
Fax +39- 06 -61979661
Email n.bergamini@cgiar.org
www.bioversityinternational.org

Abbreviations used in this Report

ABD	Agrobiodiversity
ASM-Gafsa	Association pour la Sauvegarde de la Médina de Gafsa, Tunisia
CAS	Chinese Academy of Science
CRRAO	Centre Regionale de Recherche de l'Agriculture Oasien
DENR	Department of Environment and Natural Resources
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GIAHS	Globally Important Agricultural Heritage Systems
IGSNRR	Institute of Geographic Sciences and Natural Resources Research, China
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
LGU	Local Government Unit
MSLF	Modified Sustainable Livelihoods Framework
NIAHS	Nationally Important Agricultural Heritage Systems
PMCU	Project Management and Coordination Unit
RCF	Rice-Fish Culture
RFS	Rice-Fish Systems
RIHN	Research Institute for Humanity and Nature
RT	Rice Terraces
TEEB	The Economics of Ecosystems and Biodiversity
WAHF	World Agricultural Heritage Foundation

1. Grant Annual Implementation Progress Report

1.1 Summary Panel

Grant title: Underpinning the Resiliency of Agricultural Heritage Systems, Smallholders, family Farmers and Indigenous Communities
Grant Number: 2000001000
Effective Date of Agreement: 10 November 2015
Programme Completion Date: 31 December 2017
Implementing Organization: Bioversity International
Grant amount: US\$ 496,400
Countries/Other partners: China, Philippines and Tunisia
Task Manager: Nadia Bergamini
Date of Annual Report: June 2018 (covering 2nd year of implementation, Dec 2016-Dec 2017)
Disbursements: 372,300 USD (75% of Grant funds) have been disbursed to date, inclusive of USD 364,854 to Bioversity and USD 7,446 CSP

Main aims and outputs of the Grant:

The main goal of this work programme is to enhance institutional and local capacities of GIAHS communities in three countries through managing the resilient features and heritage added-value in the goods and services produced.

The programme, which is being implemented in South East Asia (China and Philippines) and North Africa (Tunisia), addresses three objectives:

1. Assessment and valuation of the ecosystem goods, services and resiliencies of diversified and small-scale/family farming systems that are globally important (according to already established criteria) in targeted countries
2. Creation of gender sensitive market opportunities including modalities and supportive policies to enable poor rural women and men to benefit from the socio-economic advantages of their agricultural heritage systems including biodiversity, knowledge systems, cultural inheritance and landscapes.
3. Creation of opportunities for knowledge sharing and management of in-situ conservation of biodiversity of global significance harboured in GIAHS, empowerment and capacity development of local communities.

The outputs of the programme thus focus on:

- 1) **Assessing and documenting** selected agricultural heritage systems
- 2) **Creating a network** of in situ conservation of agrobiodiversity harboured in GIAHS sites with **geo-referenced mapping**
- 3) **Capacity building** of local and national stakeholders in conserving and managing GIAHS
- 4) **Dissemination and promotion** of GIAHS knowledge systems and best practices

1.2 Project Implementation Team

Global Coordinator:

Nadia Bergamini: Bioversity International (Italy)

National Coordinators:

China: Qingwen Min. Institute of Geographic Sciences and Natural Resources Research (IGSNRR – CAS)

Philippines: Teresita Borromeo: University of Los Baños

Tunisia : Hatem Zitouni. President, Association pour la Sauvegarde de la Médina de Gafsa (ASM Gafsa)

Main National Partners:

China: Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Science (IGSNRR – CAS)

Philippines: University of Los Baños, Municipal government of Kiangnan, LGU (Local Government Unit)

Tunisia : Association pour la Sauvegarde de la Médina de Gafsa (ASM – Gafsa), Université de Gafsa, Centre Regionale de Recherche de l'Agriculture Oasien (CRRAO)

IFAD supervision/backstopping: Malu Ndavi

Other (specify)- Bioversity's staff located at its Headquarters and Regional Offices:

Parviz Koochafkan (Honorary Research Fellow), Maccaresse, Italy

Keyu Bai (Scientist), Beijing, China

Zongwen Zhang (Senior Scientist), Beijing, China

Loredana Maria (Programme Assistant), Maccaresse, Italy

World Agricultural Heritage Foundation, Staff, CREA, Rome, Italy

Parviz Koochafkan, President, WAHF, CREA, Rome Italy

Stefano Grego, Chair Scientific Committee, WAHF, CREA, Rome, Italy

Charles, Lilin, Consultant, WAHF, Montpellier, France

Giovanni di Matteo (scientist), CREA, WAHF, Rome, Italy

Thomas Price, GFAR, Rome

Henri, Audriac, Scientist, Ecarto, Mexico

Bioversity International and the World Agricultural Heritage Foundation (WAHF) staff carried out the coordination at national, local and global levels through periodic visits to partners, organization of workshops and capacity building missions, as well as through close email contacts. Partners regularly organized national meetings for planning and experience-sharing. Main partners were engaged through Letters of Agreement inclusive of work plan, budget and implementation requirements.

1.3 Narrative Panel

The following sections provide summaries of achievements ('Overall Assessment') recorded from the launching of the project in each of the countries.

INTERNATIONAL WORKSHOPS

African Regional Workshop on the Globally Important Agriculture Heritage Systems (GIAHS), Arusha, Tanzania, 27 February – 3 March 2017

The Food and Agricultural Organization, together with the Ministry of Agriculture, Livestock and Fisheries of Tanzania organized this workshop to further raise the awareness of GIAHS in Africa and enhance the capacity for identification of potential GIAHS sites and elaboration of proposal documents including well planning well-coordinated action plans of those who would be involved in the GIAHS activities.

The workshop was aimed to introduce the fundamental values of agricultural heritage and the important aspects and indicators required to identify and conserve the GIAHS site to the prospective national/regional focal points for GIAHS as well as the International Organizations, NGOs and research institutions.

Bioversity International participated in this workshop and presented the work done on the ground to help countries and farmers' communities comply with GIAHS dynamic conservation approach. Bioversity International works both at farm and landscape scale and has developed different tools that have the potential to assess resilience at landscape level and ecosystem services delivered according to different land use scenarios. The presenter explained these tool and how these are being used in GIAHS landscapes. The audience showed interest in these tools and the presentation of our work as a whole.

The workshop ended by country delegates making action plans as to how they are going to apply the GIAHS concept in their countries to get at least one site in each country that was represented. The head of the GIAHS Secretariat promised to keep Bioversity International and WAHF involved in the GIAHS activities and to keep in touch.

GIAHS Resilience and Ecosystem Services for Climate Smart Agriculture and Sustainable Food and Nutrition Security, Bioversity International, Rome, Italy, 25-26

September 2017

Bioversity International together with the World Agricultural Heritage Foundation (WAHF) and several other partners, organized an International workshop to discuss issues related to dynamic conservation of Globally Important Agricultural Heritage Systems and engage in comparative studies of resilience and ecosystem services assessment of GIAHS sites in China, Philippines and Tunisia. The workshop also created the space to discuss the wider issues of GIAHS nomination in the context of sustainable food systems and necessary support arrangements for future steps and innovative ideas to continue collaboration on GIAHS work.

In this workshop, we explored the inherent characteristics of GIAHS related to sustainable agriculture and food systems that makes them resilient to various external and internal forces, their strength and weaknesses and adaptive capacities in the context of contemporary development paradigms, their biodiversity of global significance, the ecosystem goods and services provided, their climate smart features and a number of ways in which specific Globally

Important Agricultural Heritage Systems (GIAHS) combined with agroecological strategies (e.g. bio-diversification, integrated landscape management and soil and water conservation) can be enhanced and replicated in the design and management of more modern agroecosystems allowing farmers to adopt strategies that both increase resilience and provide socio-economic benefits, including adaptation to and mitigation of global warming.

Specific examples from China, the Philippines, Tunisia and other countries were showcased discussing the issues related to threats that GIAHS sites are experiencing, the different strategies that farmers, local communities and policy makers are undertaking, how to sustain these systems and valorize the products and services deriving from GIAHS and how to design innovative approaches and action plans for their future.

Different stakeholders participated from research and development institutions, academia, donors, executing partners, local NGOs and farmers' organizations in order to create a platform for future research, dialogue and collaboration and to continue mobilizing interest and supporting dynamic conservation of GIAHS around the world.

Common needs highlighted in country presentation include:

- The agricultural Heritage Systems need continuous conservation actions
- Promotion of sustainable use
- Development and identification of markets for diversity-rich products
- Development of traditional products
- Formulation of appropriate policies
- Creation of public awareness (information, communication and education)

As a consequence of these common needs, the working group identified research gaps and priority areas of work that need to be addressed:

- Inter-related and collaborative (informal and formal; traditional and technical knowledge)
- On the ground and national level policy research on:
 - How to make benefits derived from GIAHS sites (e.g. income from tourist industry) flow back to the farming communities, for maintenance and restoration of the sites
 - Payment for other environmental services
- Explore the use of novel information technology tools, like crowd sourcing and citizen science
- More research on the importance of soil dimensions as an important part of GIAHS diversity.

The meeting was closed with the recommendation that all parties are interested in continuing the work in the countries and possibly extending to other GIAHS sites in other countries.

The creation of a network of in-situ conservation of agrobiodiversity of global significance harboured in GIAHS with geo-referenced mapping to contribute to Aichi Targets of CBD and the International Treaty objectives is one of the agreed outputs of this project. To achieve this output, the WAHF and Bioversity International in collaboration with CartoData developed a proposal for crowd sourcing for GIAHS assessment and knowledge data base. CartoData, a Mexican based company specialized in cartography, was responsible for identifying a suitable platform, eCarto, to store data collected from GIAHS sites and also developed a smart phone application, called AgLegacy that can be used on-field to collect data. The application is intended for farmers and is of simple use. The main features of the application include the possibility of:

- Taking up to four photos per site or interest point.
- Recording voice up to 2 minutes of audio.
- Selecting several tags from a list or adding new ones.
- Adding descriptions relevant to the site.

The data base will help in demonstrating the value of the natural and cultural assets that are conserved in GIAHS sites and their contribution to solving global issues of food security, climate change adaptation and mitigation, on farm, in situ conservation of globally important plant and animal genetic resources, thus gaining the recognition and support of local and national governments and of the global development actors.

The application was first tested in GAFSA oasis, Tunisia as part of a training and capacity building program. Details can be found in the capacity building section of this report.

Adopt-A-Terrace Program

Is a program of the Municipal Government of Kiangon, in the Philippines, and was conceptualized with the objective of conserving rice terraces areas, which are both a UNIESCO World Heritage and a GIAHS site, located in Barangay Nagacadan, Municipality of Kiangon. Conservation is intended as the need to keep productive rice terraces, in terms of continuing the use of traditional sustainable agricultural technologies. Conservation in practical terms refers to repairing the rice terraces, following the traditional integrated rice farming system (rice, vegetables, fish and shells) and observing the rituals connected to good harvest.

Bioersivity International agreed to sponsor this program thanks to the funds provided by IFAD, under this grant, and was able to cover the restoration of five hectares of rice terraces that had previously been abandoned. All together 25 farmers benefited from this program and were able to recover rice terraces that were no longer productive. The criteria used to select the beneficiary farmers are:

- 1) The rice terraces are near the Open Air Museum route. This facilitates monitoring of the activities;
- 2) Famers who intend planting traditional rice varieties;
- 3) Farmers in strong need of financial assistance, especially for paying hired labor.

All 25 farmers planted their areas to native varieties (now popularly known as heirloom rice). A few of the farmers did their transplanting in December while most of them planted during the month of January. One farmer planted in February.

Unfortunately, for those farms whose rice seedlings was transplanted in January, the rice seedlings were attacked by the brown plant hopper, a pest that attacks the stem and causes the seedling to wither and die. The brown plant hopper caused considerable damage not just in Nagacadan but in three other barangays as well. This pest attacked not only the heirloom rice varieties but also the lowland rice varieties. Based on reports from the Municipal Agriculture Office, at least 40% of the area still remained planted to the heirloom rice.

Currently, the remaining crops are either at booting stage for those that were planted late or at tillering stage for those that were replanted to replace the damaged seedlings. The farmers who replaced their heirloom rice with lowland rice varieties said that this was done so that their crop could catch up with the harvesting period which is July-August.

The Municipal Agriculture Office has been monitoring this situation and made a report to the Department of Agriculture regional office. Remedies undertaken to save the crop were water management, i.e., instant flooding and draining and spraying using green label insecticide.

In terms of training, the farmers will undergo the Farmers Field School (FFS) Training. The training modules include review of proper land preparation techniques, insect pest management, water management and formulation of organic fertilizers and insecticides. The training is also seen as a way of encouraging the farmers not to give up on heirloom rice production.

The National Anti-Poverty commission (NAPC) has spearheaded a number of workshops for the conservation of rice terraces in the Cordilleras. Kiangnan is included in these workshops and it is hoped that such efforts will bear fruits in terms of both technical and financial assistance for the farmers who continue to produce heirloom rice.

CAPACITY BUILDING

Training course on: Resilience Assessment for Climate Smart Agroecosystems and Communities in Ifugao Rice Terraces, Philippines 12-14 December 2017

The World Agricultural Heritage Foundation (WAHF), Bioversity International (BI) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) organized a training workshop on Resilience Assessment of Climate-Smart Agroecosystems and Communities in the Philippines.

The training focused on (i) understanding and assessing resilience of traditional agroecosystems, and how farmers can cope with climate adversaries; and (ii) the importance of crop genetic diversity and sustainable biodiverse production systems in achieving food security and nutrition.

The participants also gained insights about the International Treaty, its main provisions particularly the conservation and sustainable use of PGRFA and Farmers' Rights.

Noting the usefulness of the knowledge and practical information including its direct relevance to the objectives and component activities of the GCP/PHI/062/GFF project, the Project Management and Coordination Unit (PMCU) organized a similar training with larger audience and participation covering pilot provinces and back to back with the on-going policy review related to seed law. The up-scaled training was aimed to build capacities of the national and local stakeholders about their traditional agroecosystems and associated biodiversity and genetic resources.

The training was held in Ifugao, led by WAHF and in partnership with the Kiangdan LGU and the Bureau of Agricultural Research.

The main Outcomes and Highlights of the Training were:

An overwhelming number of participants, over 50 attendees representing key senior officials and staff from the various government agencies at national and local levels, representatives from the farmer organizations and indigenous peoples, civil society organizations, researchers and academia members, and farmer leaders from Ifugao region participated.

The training was aimed primarily to enhance understanding of the resilience of Ifugao - GIAHS and on the importance of agrobiodiversity in achieving food security and nutrition; to build capacities and to share and exchange knowledge, views and experiences in farming and coping mechanisms to address climate adversities; and to know more about the relevant policies of Dynamic Conservation of GIAHS. FAO- International Treaty on Plant Genetic Resources for Food

and agriculture was also discussed extensively and its relevant articles pertaining to conservation and sustainable use and Farmers' Rights. The training was structured into lectures and open-forums and a one-day walk-in-the rice terraces field exercise using hexagon and resilience assessment triangle. And another day dedicated to opening the public consultation for the 25-year old national seed industry development act.

The training provided the participants with the valuable insights on the importance of agroecological biodiverse production systems and the intrinsic values of many traditional agroecosystems that are repositories of traditional knowledge systems, reservoirs of indigenous cultivars, of which many have social and cultural importance. During the training, participants were very attentive and actively engaged in all the session (in-house lectures and field assessments). Participants showed great interest on the discussion about the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), especially on Farmers' Rights. Participants took note of the provisions and obligations of the government or a Contracting Party shall fulfill, and the discussion on Farmers' Rights had provided an important basis to advocate and articulate the importance of/and the need to support and protect farmers' seeds in the proposed review of the national seed law.

In summary, the main insights of the training were, as follows:

- Description of GIAHS features, their dynamic conservation and resilience as well as the field assessment of resilience using the hexagon and resilience assessment triangle and comparison between GIAHS traditional rice terraces and modern rice paddies;
- Understanding the significance of traditional agriculture and the values of crop genetic diversity in achieving sustainable food systems and environmental/ecological integrity in the face of increasing climate change adversaries;
- Overview of the global/national/local challenges of agricultural biodiversity loss, food security and nutrition, climate change and sustainability;
- Exchange of ideas in creating enabling environment for dynamic conservation and sustainable development of Ifugao Giah;
- Mainstreaming conservation of farmers' seeds / crop genetic resources into policy and legal frameworks;
- Development of strategies and institutional structures to enhance farmers' capacities to deal with climate change;
- Learning about the International Treaty on Plant Genetic Resources for Food and Agriculture and how it addresses the triple challenge of crop diversity loss and food security in the context of climate change;
- Conservation and sustainable use of PGRFA and Farmers' Rights and recognition the role of farmers/indigenous communities and the need to conserve genetic resources for the use of the present and future generations;
- Gathering inputs and comments which underpin support and protection for the informal seed sector (or farmers' seed system) that need to be included in the on-going review process of the national seed law.

Training course on: Resilience Assessment for Climate Smart Agroecosystems and Communities in the GAFSA Oasis, ASM-Gafsa, Tunisia 19-21 December 2017

Similarly, to one in the Philippines the objective of this training course was the capacity building and exchange of knowledge, views and experiences in managing traditional agriculture/ancient farming systems. Participants included local government officials, farmers and scientists from universities and research institutes. All together we had 30 participants of which 10 farmers.

To measure resilience, we used two very similar methodologies and tools:

- Didactic Toolkit for the Design, Management and Assessment of Resilient Farming Systems. Developed by the Latin American Scientific Society of Agroecology (SOCLA)
- Indicators of Resilience in Socio-Ecological Production Landscapes and Seascapes. Developed by Bioversity International and other partners within the framework of the Satoyama Initiative

The first tool is tailored to assess resilience at the farm level and it is usually conducted by single farmers to measure their risk they face, which is directly related to the farm vulnerability and the threat and inversely proportionate to their response capacity.

The second tool assesses resilience at a landscape level and, therefore, engages in the measurement community members who come together for this exercise.

Farmers and researchers working in the Gafsa oasis shared enthusiasm for both approaches. In particular, the community members recognized the usefulness of having, through the use of the indicators, a holistic and multidisciplinary approach to their landscapes. Communities said they felt empowered by expressing their views and aspirations while developing plans for the future of their socio-ecological systems. Communities also felt the need to deepen collaboration among themselves and with extension workers to share and exchange knowledge and experiences. This exercise also demonstrated that bringing disparate types of knowledge into conversation can lead to effective production of new ways of knowing. The resilience assessments have contributed to the understanding and management of complex systems through the lens of world views and values of the local communities managing them.

OVERALL ASSESSMENT IN CHINA

A summary of work undertaken by Bioversity International in China Rice-Terraces (RT) and Rice-Fish Culture systems (RFC) is provided below. Bioversity has signed a letter of agreement with IGSNRR to undertake activities to achieve project outputs.

In China, GIAHS sites are valuable ecologically and economically, contributing to the food and livelihood security of local communities. They also reflect traditional Chinese thought about the unity of humanity and nature, and have become attractive places for tourism. This is changing the lives of the local people, which in turn could threaten farming practices and agricultural biodiversity in the sites. To forestall any possible negative impacts, and to derive broader lessons, Bioversity International collaborated with the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences to assess on-farm management of agricultural biodiversity at two GIAHS sites in China. Three locations in two GIAHS sites were selected for study: Baohua and Xinjie in the Hani Rice Terraces system of south-east Yunnan Province and Longxian in Zhejiang Province, which manages a system of rice–fish culture.

Bioversity International worked with the local government, extension agents, farmers and tourism companies to understand historical and current practices regarding the management of the farm systems. We developed questionnaires and conducted interviews and focal group studies to

compare the current status with baseline data. The most important product of the Hani Rice Terraces is red rice. We found that the value of the crop has increased, with government support in the form of subsidies and free seeds to encourage farmers to grow more red rice.

Companies have helped to develop value chains for local varieties and processed products, and have promoted their value in the market. One farmer in Baohua created a specific brand for the eggs laid by the ducks that feed in his rice terraces. Mr Guo Wuliu won the GIAHS Conservation Practice Award for his branding efforts. Mr Guo is also the founder and leader of the Gata's Duck Association and, during 2017, 24 households of Gata village have joined the association, and duck eggs now sell for 5 yuan each, up from 2 yuan in 2014. Market value also increases as a result of more general labelling and certification as part of the GIAHS programme, and although the process can take a long time, the farmers have found it worthwhile. The Rice–Fish Culture Production Cooperative obtained the National Green Food Certification in 2014.

Resilience indicators developed and tested

We developed a set of 24 indicators to assess the resilience of the farming systems and monitor future changes. These indicators cover the five aspects of natural capital: human capacity (H); natural resources (N); physical capital (P); social ability (S); and economic benefits (E). So, for example, we ask about the extent to which households and the community maintain a diversity of local crop varieties and animal breeds, perhaps in community seedbanks and animal breeding groups. Are they doing anything to enhance plant diversity on their farms, such as crop rotation or intercropping? How diverse is the diet, with respect to different crops and varieties? All these (and others) feed into a summary measure of natural resources. Using these indicators and plotting the results on radar charts showed that in Baohua in the Hani Rice Terraces system, there were increases in social ability, physical capital and, especially, economic benefits. Natural resources and human capacity barely changed (Figure 1). In Longxian in the rice–fish culture system, there were slight increases in human capital, natural resources and social ability and greater increases in physical resources and, again, economic benefits (Figure 2). In both places, farmers and local government recognized the importance of the GIAHS farming system. We would caution, however, that as tourism on the rice terraces has developed so recently and so rapidly, its influence is still unpredictable.

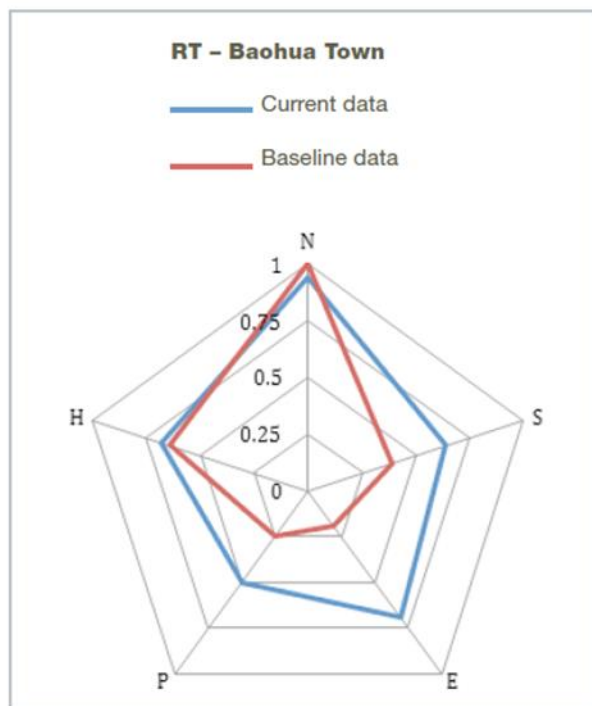


Figure 1– Radar chart of natural capital of Baohua Town Hani Rice Terraces, comparing current data with baseline data (human capacity (H); natural resources (N); physical capital (P); social ability (S); and economic benefits (E)).

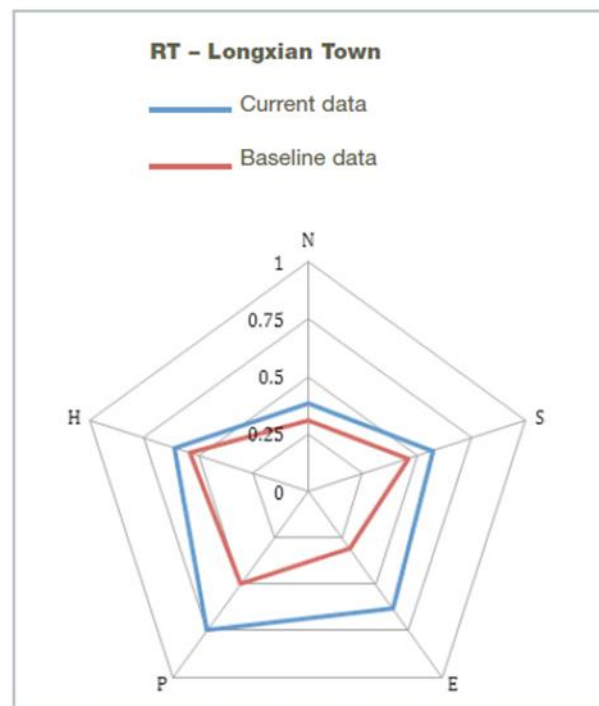


Figure 2 – Radar chart of natural capital of Longxian Town rice-fish culture, comparing current data with baseline data (human capacity (H); natural resources (N); physical capital (P); social ability (S); and economic benefits (E)).

Policy suggestions to increase benefits

Because each GIAHS site is essentially unique, there can be no standard model for dynamic conservation and effective management, although there are replicable principles and processes. Clearly the communities who manage the sites must be motivated and must benefit directly from their management and conservation efforts. External interventions may be important, especially at the beginning, to raise awareness and mobilize the resources needed. The Chinese government is aware of the need to support food security and ecological conservation and is developing policies on monitoring, eco-labelling and ecological agriculture. Eco-tourism to agricultural landscapes is also being promoted. Bioersity International sees good potential to integrate specific policies into the proposed policy changes so that these will support the Hani Rice Terraces, the rice-fish culture system and, potentially, all GIAHS sites.

Looking ahead

Agricultural biodiversity is being recognized as an important component in the development of sustainable agriculture. The practices and experience of managing agricultural biodiversity in GIAHS sites could be replicated in other similar areas in China and the rest of the world. Bioersity and partners plan to adapt and use some of the lessons learned in the test sites and apply them in other similar areas in China to assess their value. In this way, we hope to reduce poverty and improve the environment while empowering more women and men in rural areas, improving food security and enhancing livelihoods.

OVERALL ASSESSMENT THE PHILIPPINES AND TUNISIA

The following activities have been implemented in the Philippines and Tunisia under WAHF responsibility:

- 1- Identification and selection of GIAHS/NIAHS areas with high value of ecosystem services in the Ifugao Rice Terraces (two exploratory mission to the Philippines and Ifugao) and to Tunisia and Gafsa Oasis (two exploratory mission and three training sessions)
- 2- Stakeholder workshop and community involvement for participatory prior informed consent and description and application of sustainable livelihood framework
- 3- Mapping of the GIAHS/NIAHS boundaries and biodiversity Hot Spots, definition of agroecological characteristics and classification of goods and services
- 4- Statistical data collection for valuation of goods and services
- 5- Identification of indigenous knowledge providers, documentation of informal knowledge systems, values, customary rules and cultural practices leading to dynamic conservation of GIAHS/NIAHS through interviews of informants and participatory data collection

Defining and testing methodologies for resilience and ecosystem assessment adopted by WAHF:

Many small farmers cope with and even prepare for climate change, minimizing crop failure through a series of agroecological practices. Observations of agricultural performance after extreme climatic events in drylands of Tunisia compared to Gafsa Oasis have revealed that resilience to climate disasters is closely linked to the high level of on-farm biodiversity, typical of traditional farming systems in North Africa.

Based on this evidence, various experts have suggested that, rescuing traditional management systems, combined with the use of agroecologically based management strategies, represent the only viable and robust path to increase the productivity, sustainability and resilience of peasant-based agricultural production under predicted climate scenarios. In this research, we explored a number of ways in which three traditional agroecological strategies (bio diversification, soil management and water harvesting) can be implemented in the design and management of agroecosystems allowing farmers to adopt strategies that both increases resilience and provides economic benefits, including mitigation of global warming.

Most traditional agriculture is place specific; evolving in time in a particular habitat and culture, and this is both where and why it tends to be successful. Despite the diversity of agricultural systems that evolved in different geographic and cultural contexts, most traditional agroecosystems share a number of structural and functional similarities that underlie their resilience:

- High number of plant species and associated fauna
- High structural diversity in time and space
- Exploitation of the full range of local microenvironments
- Maintenance of closed cycles of materials and waste through effective recycling practices
- Complex biological interdependencies, resulting in a high degree of natural pest suppression

- Dependence on local resources and human and animal energy, thereby using low levels of input technology and resulting in positive energy efficiency ratios
- Use of local and adapted varieties of crops, wild plants, and animals

Most of these agroecological features have been shown by these studies to enhance stability and resilience of the GIAHS farming systems.

OVERAL ASSESSMENT OF THE IFUGAO RICE TERRACES, PHILIPPINES

The Ifugao province is known worldwide for its magnificent rice terraces which are closely intertwined with subsistence, culture and heritage of the indigenous upland farmers.

The upland Ifugao Rice Terraces covers approximately 252000 hectares of which 17138 ha are designated as GIAHS.

In 1996, rice terraces in four municipalities of Ifugao (Kiangan, Banaue, Hungduan and Mayoyao) were inscribed as UNESCO World Heritage Sites (UNESCO, 2002). These terraces, which are considered as evolved living cultural landscapes, were carved on hill and mountain slopes by ancient Ifugaos primarily for irrigated rice production. Above each cluster of terraces is a clan-owned woodlot or forest known as a *muyong* from where the farmers obtain food, timber, fuel, medicinal plants and water. Furthermore, the indigenous sustainable management of the forest-clad *muyong* supports the landscape's intricate irrigation system providing ample water supply for rice production. These rice terraces have enabled the Ifugao communities to utilise steep marginal areas and maximise mountainous lands for sustainable food production using a process that conserved both soil and water.

The enduring beauty and the cultural value of this ingenious agricultural system have attracted tourists as well as scientists from all areas of the globe. However, shifting priorities and interests of the indigenous peoples as compounded by external driving factors, have completely transformed the Ifugao upland agroecosystem and its peoples' way of life.

In 2001, the worsening situation in the Ifugao agroecosystem finally came to a head when UNESCO included it in its List of World Heritage in Danger (UNESCO, 2008). In 2002, the Food and Agriculture Organization (FAO) of the United Nations launched the initiative for dynamic conservation of Globally Important Agricultural Heritage Systems (GIAHS). The Ifugao Rice Terraces (IRT), particularly the clusters of rice terraces in the municipalities of Hungduan and Kiangan was designated as GIAHS in 2008.

Since the turn of the 20th century, rapid changes including global modernization, demographic changes, biodiversity loss, economic instability, and even political tensions, had resulted in increasing vulnerabilities of GIAHS sites to a number of shocks and disturbances. Assessing the level of vulnerability, resilience and adaptive capacity of these socioecological systems has been, therefore, imperative in identification of management strategies to ensure their sustainability and improve their ability to adapt to current and future pressures.

For this study, resilience, biodiversity, and provision of ecosystem goods and services of GIAHS-designated rice terraces in the Municipality of Kiangán were assessed in the face of large scale changes which are presently occurring in these communities. The study also investigated the driving forces that underlie these changes especially in relation to food security, cultural preservation and the general well-being of the Ifugao farmers in Kiangán, Ifugao Province.

Societal changes associated with modernization have transformed the Ifugao agroecosystem, although vestiges of traditional farming systems are still being practiced in some farms. Among the adverse effects of agricultural modernization are, wide scale losses of diversity in the rice fields and the *muyongs* (forests). Due to pesticide use, native fishes and snails have disappeared from the rice fields and which have instead, become infested with the hardy Golden snails (*kuhol*).

Other exotic species which have impacted the Ifugao agroecosystem are the giant earthworm and swamp eels which have contributed significantly to terrace collapse in some areas. Exotic *Gmelina* and mahogany, fast-growing trees which were introduced for reforestation, were observed to dominate *muyongs* in the upper areas. These biodiversity losses are further compounded by the expansion of coffee plantations into forested areas, especially in *Julongan*, resulting in losses of endemic trees and understory vegetation. Another land use related change, which has transformed the Ifugao upland landscape, is the conversion of former rice terraces into roads or commercial gardens for vegetable production.

The commercial vegetable production necessitates intensive use of chemical inputs, which in turn, results in declining soil quality, water pollution and biodiversity losses. Furthermore, the potential health impacts with prolonged pesticide exposure of the unprotected farmers, while spraying, as well as the ingestion of pesticide-laden vegetables require closer scrutiny. Lastly, the shifts to modern agriculture heralds the wide scale losses of priceless crop genetic resources as well as the Ifugao culture that fostered and cultivated them. Interventions of a multi-faceted nature are therefore warranted to rehabilitate the Ifugao agroecosystem along with its associated biodiversity, culture and traditions. The designation of Ifugao Rice Terraces and Adopt Terrace program has increased awareness raising and some policy and technical interventions to halt excessive modernization of agriculture. However, a wider policy support, technical assistance and incentive mechanisms are of utmost importance and payment for ecosystem and social services.

For this study, resilience, biodiversity, and provision of ecosystem goods and services of GIAHS designated rice terraces in the Municipality of Kiangán were assessed in the face of large scale changes which are presently occurring in these communities. The study also investigated the driving forces that underlie these changes especially in relation to food security, cultural preservation and the general well-being of the Ifugao farmers in Kiangán, Ifugao Province.

The sites selected were two GIAHS designated barangays, Nagacadán and Julongan and one non-GIAHS site (Ambabag) (Fig. 3). The inclusion of Barangay Ambabag was done to provide a contrast to the GIAHS areas in terms of assessment parameters such as resilience, biodiversity status and the provision of ecosystem goods and services. Various participatory research activities, organized into an assessment workshop, were carried out in each barangay. Participants, including but not limited to local rice farmers, and representatives from local cooperatives/organizations, tribal elders and women's groups and the barangay council, were identified through purposive sampling. To evaluate the current state of GIAHS and non-GIAHS

RT in the context of diverse environmental, social, cultural, and economic factors affecting community and farmers' resilience, group and self-assessment of social-ecological resilience were conducted following the framework of UNU-IAS et al. (2014).

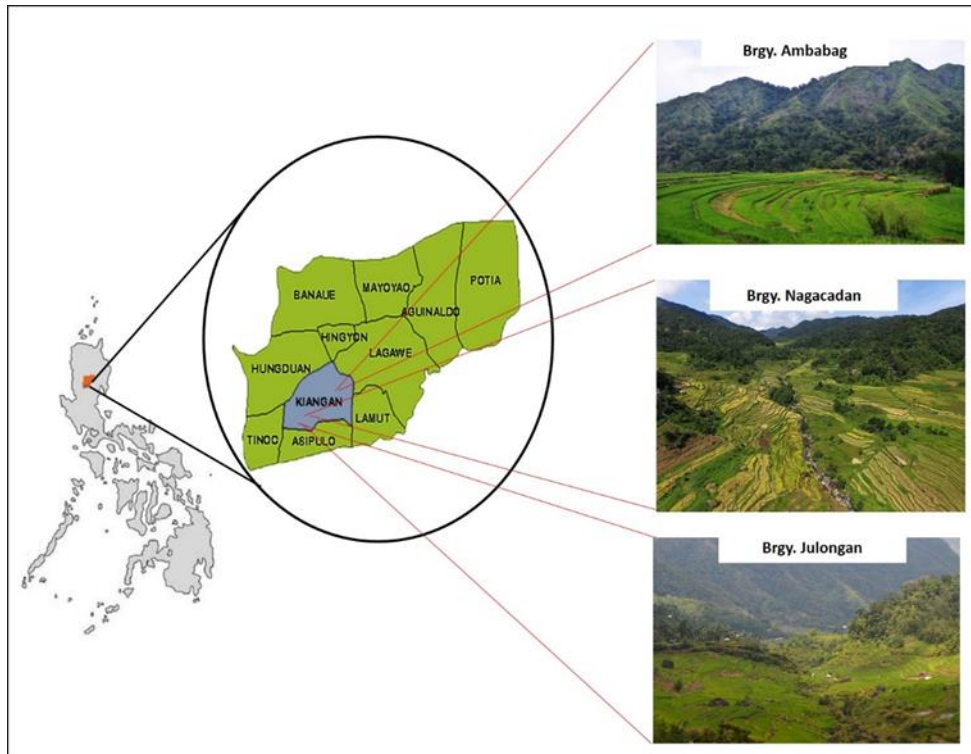


Figure 3: The study sites

Transect walks along and within the GIAHS and non-GIAHS landscapes were carried out to record land use, natural vegetation, cultivation, and other production activities and human settlement patterns (Fig. 4, Fig.5). These also enabled the researcher to inventory aquatic and floristic species in the rice fields, livestock and crop diversity including those planted in the swidden fields. In the context of ecosystem services, this tool was used to identify the availability and distribution of various environmental goods and key resources within the landscape.

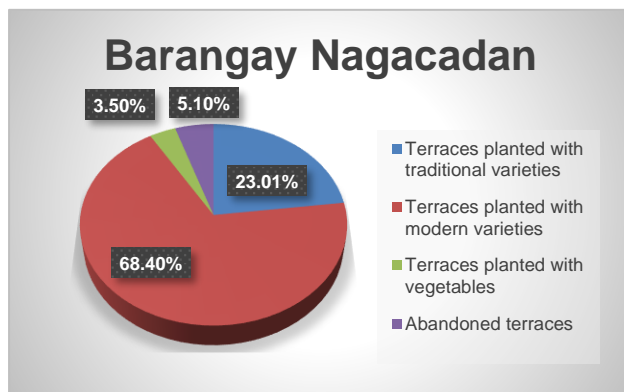


Figure 4: Percentage of terraces in Brgy. Nagacadan planted with traditional and modern rice varieties, vegetables, and abandoned terraces

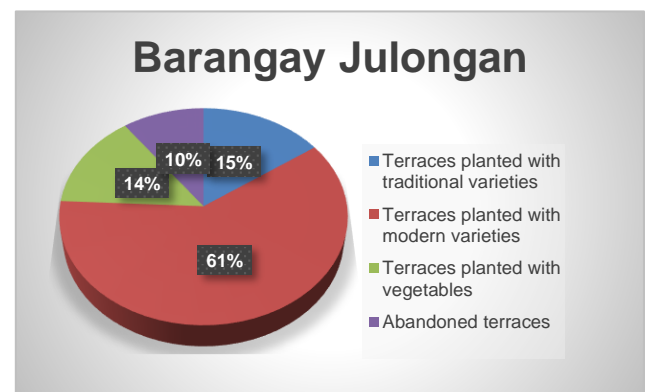


Figure 5: Percentage of terraces in Brgy. Julongan planted with traditional and modern rice varieties, vegetables, and abandoned terraces

Of the three study areas, Ambabag farms were seen to be in the worst condition. cursory examination revealed widespread fungal, viral and bacterial infestation in the rice fields. In these farms, unhealthy looking rice plants struggled for life amidst a profusion of weeds and hardy herbs. On the other hand, farms in Nagacadan and Julongan were relatively well maintained and consequently had few observed symptoms of disease except for some rice plants in Julongan which had telltale signs of leaf folding insect infestation. Barangays Ambabag and Julongan also had the greatest numbers of golden snails resulting in considerable financial losses. Closer examination of young rice plants revealed that many had been eaten up, providing evidence that the golden snails had been hard at work gnawing their tender stalks. In Brgy. Nagacadan which had a larger swamp eel population in its farms, Golden snail population was significantly low. Conversations with farmers revealed that the swamp eels prey on juvenile Golden snails and keep their population in check. These eels, along with the giant earthworms and rats however, are responsible for terrace collapse that was observed in many farms.

Diversity of rice varieties

A total of 16 rice varieties were documented in the three barangays surveyed, of which only six (6) were traditional varieties with sub-classification as “*Tinawon*” and “*Diket/ dayakkot*” (glutinous). Among the three (3) barangays, Nagacadan, had the greatest numbers of traditional varieties during the 2017 cropping season, with *Botnol* and *Bunkitan* as the most widely cultivated *tinawon* and *diket* varieties, respectively. Six introduced commercial varieties were also recorded from Nagacadan, of which C4 and Oakland were most widely cultivated. Meanwhile, in Julongan, five (5) varieties each for traditional and introduced commercial cultivars were observed in farmers’ fields. When interrogated about their varietal preferences, interviewed farmers disclosed that they are inclined to choose *Botnol*, *Bunkitan* (traditional) and C4 (modern) over the rest of the rice varieties. Meanwhile, six (6) modern varieties were observed to dominate the Ambabag agricultural landscape.

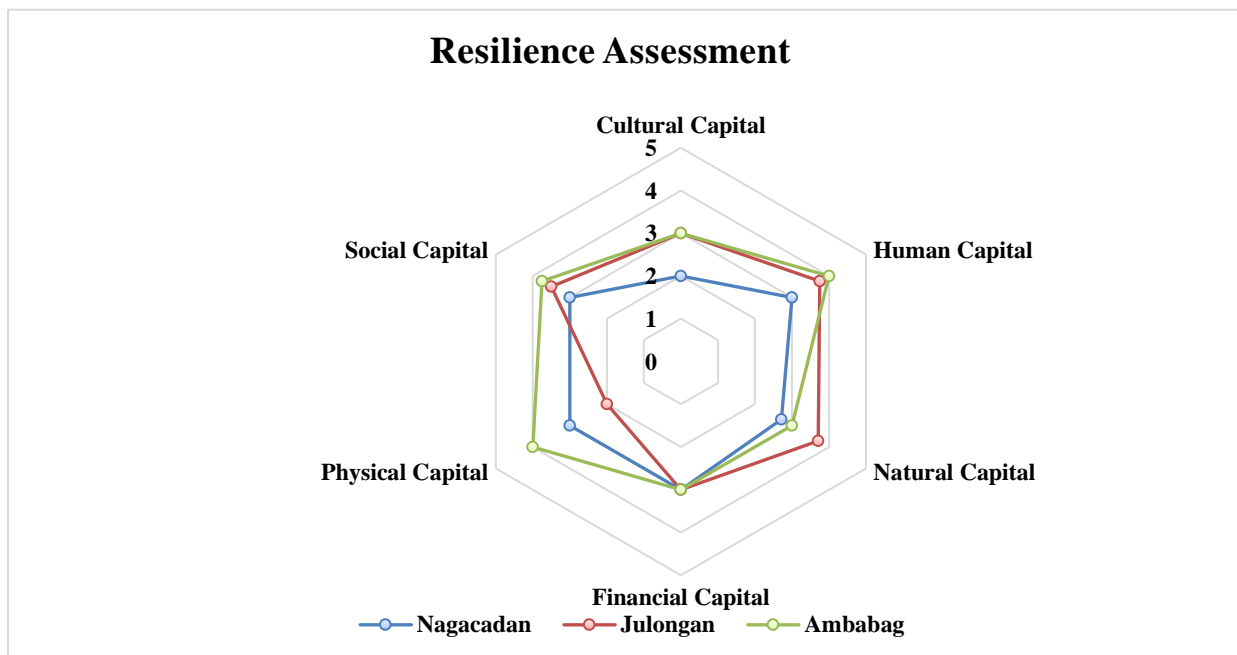


Figure 6: Resilience Patterns of the three Ifugao Barangays based on the Modified Sustainable Livelihood Framework (MSLF)

The following concrete recommendations are the result of this study:

1. Procure seed samples of Ifugao traditional rice varieties which were previously sent to IRRI or PhilRice for safekeeping and distribution of these to farmers for seed increase and subsequent planting
2. Introduce the concept of community-based seed conservation using the *Alang* as seed repositories;
3. Secure the assistance of LGUs for activities involved in production and conservation of traditional rice varieties (included in Adopt Terrace initiative);
4. Identify niche markets for traditional rice (called locally Herloom Rice) and products that can be derived from it, thereby increasing household income of the farmers;
5. Provide *kiskisan* (modified thresher for traditional varieties) to encourage farmers;
6. Access funds and mobilize the community to rehabilitate collapsed terraces and repair damaged irrigation facilities (Adopt Terrace programme is a good example);
7. Undertake further studies on the nature and extent of damage done by swamp eels and other pests;
8. Undertake further studies about the sustainable and integrated management of rice pests in the Ifugao upland farms.

OVERAL ASSESSMENT OF GAFSA OASIS, TUNISIA

The Gafsa oasis covers approximately 700 hectares and as an agroecosystem dates back from XI century. This oasis is located in a marginal biophysical environment – arid climate and difficult topography and poor soils (*Chebka*: a deeply eroded calcareous plateau with narrow valleys and flat valley bottoms), the site is composed of land riverbeds that are seasonally dry. In this difficult environment, farmers use their adaptive management and ingenuity accumulated over time to create palm-based agricultural systems managed through local resource management institutions that enable them to make judicious decisions for sustainable resource use thus maintaining stable and productive oases ecosystems. The ancient underground irrigation system that was invented by Persians in the 1rst millennium BC and called *Qanat* or *Karez*, was spread by Arabs and adopted by Oasis communities (named as *Fogara*) together with community management of water ensures the life of the oasis of Gafsa.

Goods and Services Provided by the Oasis System

The Gafsa oasis assures many environmental services, social and cultural functions. This oasis is a cradle of remarkable biological diversity, animal and plant, domesticated and wild cultivars and species. The willingness to maintain this diversity by farmers is confirmed by the existence of a number of important local varieties and introduced cultivars of date palms, pomegranate, apricot, figs, vegetables, spices, and herbs. In addition, livestock breeds, sheep and goats, and wildlife species find a natural refuge in the oasis ecosystem for survival and protection.

The palm groves constitute an integral part of the *ksar* and from which many products are derived, such as building materials. Agricultural products from the oasis provide an important source of nutrition and income for its inhabitants and for many it is their primary or secondary source of income. Most of the agricultural products derived from the oasis are for self-consumption and guarantees food security that is high in quality and quantity.

The extensive area of palm groves offers shade and lowers ambient temperature. It also serves as a place for recreation year-round for thousands of urban visitors who find enjoyment and peace under the palm and fruit trees.

Local knowledge that has been developed over millennia related to the management of the oasis merits documentation. This is especially the case for knowledge associated with hydraulic systems. Scientific study of traditional water management incorporated into the architecture of the *ksar* could offer useful information for improving the sustainable management of agricultural lands.

Threats and Challenges

Due to its fragility, the Gafsa Oasis is threatened by the following:

- Growing incidences of Bayoud disease that fatally attack date palms resulting in a loss of palm populations and in the range of genetic diversity that destabilizes the integrity of the ecosystem.
- Urban encroachment into the palm groves and abandonment of sections of the oasis
- Fragmentation of the oasis due to parcelling through land inheritance
- Pollution of the environment, water table, and waterways by urbanization and increasing use of pesticides
- Absence of continuous care of hydraulic works and waterways.

Summary of Major Outputs:

In order for an effective and sustainable management of the oasis ecosystem to occur, the following outputs must be achieved:

- The systematic and comprehensive documentation of local and traditional knowledge
- The systematic and comprehensive inventory of agrobiodiversity, animal biodiversity and landscape diversity (soil, water, land)
- Technical and scientific study to create a model that explains surface and subterranean water systems
- The diffusion and extension of lessons learned from other regions for the benefit of other oases and the communities upon which they depend upon and vice versa for cultural and physical survival.

Landscape, land, and water resource management:

The Gafsa oases has a limited area of agricultural land and is therefore managed using a three-tier canopy level system, which includes date palm (the highest tier), arboriculture (middle tier) and annual/pluri-annual underneath crops (i.e. vegetables, forage, medicinal and aromatic plants) at the lowest tier. Management practices and agricultural techniques reflect the amazing skills of local populations in using biodiversity in a sustainable way so as to ensure continued economic productivity of these ecosystems.

Indigenous and Local Knowledge systems

Key to the oases sustainability has always been human interactions that shaped these agroecosystems and enabled them to provide ecological and socio-economic services to meet the needs of the local populations. Gafsa oases are therefore havens of agricultural biodiversity in a constraining environment. Autochthonous and cultivated plants found in the oases are famous for their resilience in adverse conditions. Varieties have been carefully selected from natural ecosystems or human-made introductions over centuries of experimentations. This diversity and its associated knowledge is a fundamental asset for the inhabitants of the oases, a strategic portfolio of livelihood options in their own hands.

Cultural and social aspects

The Gafsa oases include not only a rich range of wild and cultivated plant and animal species and cultivars, but also dedicated farmers of a millenarian civilization that preserves its bodies of knowledge. Traditional management systems of the local resources are directly correlated to social and cultural structures that are based on the solidarity in the elaboration of communal infrastructures such as those for mobilizing water resources (*Khettara*). Oases production systems have therefore allowed local populations to prosper in such extremely fragile natural environment.

Services provided by Gafsa Agroecosystems

Livelihood services

- Agricultural products to address food and nutritional insecurity
- Housing, fuel/energy, health and related needs provided
- Tourism products (hotels, restaurants, bivouacs, camping, guides, etc.)
- Artisan products such as pottery, tanned leather, and wood-crafted items and furniture

- Social and cultural services (fostering equity among community members through shared management of limited resources, cohesion, security, identity, art, values, etc.)
- Quality of life (opportunities, leisure, education and arts, ethics)

Environmental services

- Biodiversity and ecosystem services (conservation, functioning and regulation)
- Soil and water conservation and restoration
- Climate regulation (micro and macro) and carbon sequestration

Policy and regulatory recommendations:

The preservation of the oasis is supported by particular socio-economic factors such as the enthusiasm of its inhabitants and citizens and the encouragement of the State for the maintenance of traditional lifestyles within the oasis. Ecotourism has developed in ways that have not disrupted the socio-ecological integrity of the oasis ecosystem, such as the creation of traditional hotels and residential villas that respect the local environment. The experiences from development programs should be recorded, discussed, and disseminated in order to extend their lessons learned and practices of sustainability.

Restoration projects have been applied only to buildings and structures of the *ksar* and have not concerned the palm groves. It is important that restoration is directed towards improvement of the conditions of the palm groves, which should be recognized as patrimony of humanity. Families that are involved in seed selection risk marginalization if no introduction of fresh seed is made into their seed systems. There are professions and skills related to the pruning and pollination of trees that are also at risk with great consequences for the maintenance of date palm diversity. These skills need to be recognized and supported and are crucial for saving some seed cultivars that risk being lost completely. In addition to pollination by local knowledgeable farmers, there is also a need for studying other means of pollination. The varieties of date cultivars that need to be developed in order to be resistant against diseases and pests that plague the region's cultivars and to discourage the cultivation of inappropriate seed cultivars that have been promoted through national extension services with commercially oriented perspectives.

The decisions and policies concerning the oasis should encourage local producers through innovative methods of adaptive management, and surveys, interviews, observations, and land analysis approaches, should be put into practice in order to collect all the information, species, cultivars, etc. The new AgLegacy App. Invented and designed by WAHF during the implementation of this study have been tested in Gafsa Oasis and have resulted in the contribution of many farmers in providing information (www.Worldagriculturalheritage.org/Aglegacy). The varieties of luxury dates from the regions of Utaqbala and Babati and which have not been categorized or labelled exemplify the need for a systemic taxonomic classification of so much of the oasis' agrobiodiversity.

Conservation and adaptive management methods constitute another rich knowledge source that should be better recognized and valued with the creation of policies that encourage the sustainable management of the oasis and development of local livelihoods and not of highly mechanistic enterprises and factories that depend upon large external inputs.

Local perspectives of land use and plant types should be followed to support the maintenance and conservation of the traditional oases cultural agroecosystem. For example, seasonal calendars and cultural events are important practices that have not been clearly recognized or incorporated into development programs so as to be considered not only as folkloric festivities but as pillars of the oasis cultural identity that support commercial and economic exchanges and

social reproduction. The problems of land fragmentation, unplanned construction, and pollution must also be concretely addressed.

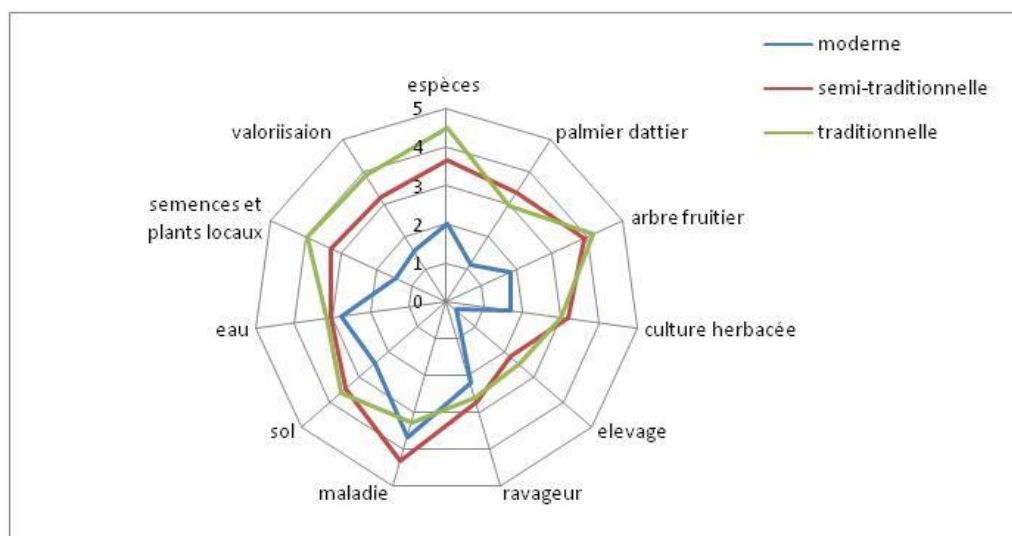


Figure 7: Comparison of environmental resilience indicators in three types of oases: Modern, Semi-traditional and traditional

CONCLUSIONS

The second year of the Grant implementation was very productive across all activities. Following is a brief overview of the highlights of the project implementation in each country.

China: Socio-ecological resilience of the three sites in two GIAHS systems (rice-fish and rice terraces) have shown that, compared to the baseline data, collected when the sites were first nominated more than ten years ago, there have been improvements in the social, economic and physical capitals. Possible explanation is that the potential of GIAHS in improving livelihoods, while conserving biodiversity and traditional knowledge, have been recognized at the local and national level. This has meant the adoption of policies in support of GIAHS and valuation of its' products. Further analysis is recommended, though, on the effects that tourism may have on the conservation of GIAHS, especially the impact of new infrastructures and the loss of biodiversity, including agrobiodiversity. The resilience assessment methodology, developed by Bioversity and WAHF, and applied in this project is a useful instrument to monitor changes in GIAHS systems that may or may not be beneficial to resilience.

Labelling of products with a GIAHS logo has demonstrated that benefits can flow directly to farmers. China GIAHS have advanced the most in labelling and adding value to products and have shared this experience with other GIAHS sites not involved in this project.

Philippines: Diversity of flora and fauna in the three study sites (two GIAHS and one non-GIAHS) have revealed that the non-GIAHS rice terraces harbor less diversity. The reason can be found in the heavy use of chemicals that are employed in modern agriculture and that impact on land and aquatic species. Agrobiodiversity of rice varieties is also declining in all three sites, but while the GIAHS sites still retain a few heirloom varieties and specific work is done at Municipal level to encourage the use and conservation of such varieties (see Adopt a Terrace Program), only modern varieties are found in the non-GIAHS site. The participatory work done in Ifugao also revealed that the provision of ecosystem services (provisioning, regulating, supporting and

cultural) in Kiangnan agroecological system is declining. Positive trends are visible only for increased production of food (rice and other crops), educational values and recreation and tourism. Societal changes associated with modernization have transformed the Ifugao agro-ecosystem although vestiges of traditional farming systems are still being practiced in a few farms. Among the adverse effects of agricultural modernization are wide scale losses of diversity in the rice fields and the *muyongs* (forests). Due to pesticide use, native fishes and snails have disappeared from the rice fields and which have instead, become infested with the hardy golden snails (*kuhol*). Other exotic species which have impacted the Ifugao agro-ecosystem are the giant earthworm and swamp eels which have contributed significantly to terrace collapse in some areas. Exotic Gmelina and mahogany, fast-growing trees which were introduced by the Department of Environment and Natural Resources (DENR) for reforestation, were observed to dominate *muyongs* in the Upper Poblacion area. These biodiversity losses are further compounded by the expansion of coffee plantations into forested areas, especially in Julongan, resulting in losses of endemic trees and understory vegetation. Another land use related change which has transformed the Ifugao upland landscape is the conversion of former rice terraces into roads or commercial gardens for vegetable production. It is therefore apparent that the Ifugao Rice Terraces can be added to the list of world heritage sites which are presently under pressure due to modernization.

Tunisia: The AgLegacy application was first tested in Gafsa Oases, farmers were trained to upload useful information and data on their farming activities and to share it with their peers, thus creating a first network of on-farm *in situ* conservation of agrobiodiversity. The current state of the environmental, economic, and socio-cultural components of modern, semi-traditional, and traditional Gafsa oases is assessed through the evaluation of a wide range of resilience indicators. This allowed to conclude that the three types of oasis, without exception, are vulnerable to environmental stresses and the potential impact of human pressures. However, the comparison of degrees of resilience of the three production systems shows that the historical or traditional oasis of Gafsa is the most resilient in a number of areas: environmental, economic and socio-cultural. Recommendations on how to improve resilience in the different areas are summarized in the country report.

REFERENCES

UNU-IAS, Bioversity International, IGES and UNDP (2014). Toolkit for the indicators of Resilience in Socio-ecological Production Landscapes and Seascapes (SEPLS).