

GOAL  
2**End hunger, achieve food security and improved nutrition and promote sustainable agriculture**

Photo: UNDP Lao PDR

*SDG 2 deals with reducing hunger and malnutrition for all, through achieving better agricultural productivity and incomes for small farmers, promoting sustainable and resilient agriculture practices that help maintain ecosystems, and maintaining the genetic diversity of seeds, cultivated plants and farmed animals.*

## How do ecosystems and biodiversity support this SDG?

Biodiversity, especially genetic diversity, underpins and enables agriculture; it is thus a key factor for the achievement of food security and improved nutrition at a global level. Cultivated crops and domesticated animals originate from wild species of flora and fauna, and their selection and breeding over millennia has relied on the pool of diverse genetic resources that is found in their wild relatives. Below-ground biodiversity constitutes and maintains the soil that is required to grow crops, while plant resources comprise the fodder and pasture that sustains livestock herds. A broad range of other ecosystem services also enable, maintain and protect agricultural productivity and output, such as land erosion control, soil fertility, water quality and supply, climate change adaptive capacity, natural pest control, pollination and seed dispersal by wild birds, mammals and insects.

These services are fundamental if global food production is to meet the world's growing need for food. Agro-biodiversity entails the variety and variability of animals, plants, fungi and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem. This diversity of animals, plants and fungi is an essential source of food for rural poor who rely on these agro-ecosystems for their livelihoods and consumption. However, unsustainable agricultural practices such as extensive use of pesticides and mono-cropping are threatening agro-biodiversity and the sustainability of their subsequent agro-ecosystem services. Maintaining agro-biodiversity by cultivating a wide variety of crops and livestock and taking into account ecosystem functions reduces the need for external farm inputs, increases availability of animal and plant nutrients, and reduces pests through natural means. A rich biodiversity contributes significantly to the nutrient recycling processes that support and enable crop production. Additionally, essential plant and crop pollination is provided by many insect, bird and bat species. Some estimates suggest that over 75 percent of crops may depend to some degree upon wildlife pollination.

Further, agro-biodiversity helps to increase the resilience of ecosystems and their capacity to evolve when confronted by climate change. It can reduce farmers' vulnerability to climate change and also to market variability through the diversification of their production. Vulnerable people, especially rural poor, benefit from biodiversity through a variable crop and livestock production as well as wide usage of non-timber forest products that support nutritious diets and sustainable income.

### **Case study:** Mainstreaming agro-biodiversity for food security in Lao PDR – the Agro-Biodiversity Project

The Lao People's Democratic Republic (Lao PDR) is one of the 49 Least Developed Countries (LDCs) with a quarter of its 6.5 million population still living below the poverty line. Rates of chronic malnutrition remain high, with one in five children considered heavily stunted and 40 percent of children younger than five suffering from anemia. Concerns have been raised over the decline in fat and protein intake from reduced consumption of meat and fish, replaced by higher consumption of carbohydrates from rice.

Yet Lao PDR, identified as one of ten global biodiversity hotspots, has a rich biodiversity that can contribute to improved food security in the country. It is a primary center of origin and domestication of Asian rice, harbours five wild rice species known for a huge genetic pool of rice landraces, and is home for some 500 fish species and a significant number of wild edible mushrooms. Other globally-significant agro-biodiversity species include cultivated local and indigenous varieties of maize, bushy peas, fruit trees, and wild tea; wild crop relatives; pollinators and insects; and local and indigenous breeds of livestock.

However, unsustainable land use practices are putting pressure on biodiversity including agro-biodiversity, resulting in a loss of forests and crop and livestock diversity, affecting agro-ecosystems in a way that reduces their resilience and adaptive capacity to climate change. This poses socio-economic risks to the Lao population which is highly reliant on agro-biodiversity for livelihoods and subsistence.

The GEF-funded UNDP project Mainstreaming Biodiversity in Lao PDR's Agricultural and Land Management Policies, Plans, and Programmes ("the Agro-Biodiversity Project") with technical support from FAO aims to provide farmers with the necessary incentives and capacity to conserve agro-biodiversity within the farming systems of Lao PDR in order to improve sustainable production and food security at the household level.

As a partner to the FAO Regional Rice Initiative (RRI), the project contributed to an assessment of aquatic organisms in rice based ecosystems in Phoukhout District of Xieng Khouang Province. It underlined the importance of paddy rice-based agro-ecosystems in villagers' livelihoods and consumption by confirming that they encompass a diverse range of aquatic, semi-terrestrial and terrestrial niches for numerous species, among which 95 species were recorded as useful for the three villages, either for their own consumption or for sale in local markets.

In order to maintain and enhance these essential ecosystems the project works both at the policy level through the inclusion of agro-biodiversity in national plans, policies, laws and guidelines, and at the field level through on-the-job training and conservation activities in the provinces of Xieng Khouang and Luang Prabang. At the policy level the project is currently supporting the government to prepare the second National Agro-biodiversity Programme as well as the Luang Prabang Provincial Biodiversity Strategy and Action Plan. It also provides inputs to the 5th National Report to the Convention on Biological Diversity (CBD), supports the systematic incorporation of agro-biodiversity in the second National Biodiversity Strategy and Action Plan, and has been instrumental in the establishment of the sub-sector working group on agro-biodiversity. By June 2015, almost 500 government officers had participated in capacity building activities on agro-biodiversity.

**PROJECT:** Mainstreaming Biodiversity in Lao PDR's Agricultural and Land Management Policies, Plans, and Programmes

**MAIN DONORS:** GEF, UNDP

**TECHNICAL SUPPORT:** FAO

**LOCATION:** Luang Prabang and Xieng Khouang provinces and Vientiane, Lao PDR

**DATE:** 2011-2016

**WEBLINKS:** [http://www.la.undp.org/content/lao\\_pdr/en/home/operations/projects/environment\\_and\\_energy/mainstreaming\\_biodiversity.html](http://www.la.undp.org/content/lao_pdr/en/home/operations/projects/environment_and_energy/mainstreaming_biodiversity.html)

At the field level, agro-biodiversity conservation and sustainable use activities have been carried out in Phonexay district of Luang Prabang province and Phoukhout district of Xieng Khouang province. A 'train the trainer' approach was adopted to improve staff and farmer's knowledge and skills on agro-biodiversity. Field demonstration and technical modules on sustainable practices such as inter-cropping, biological pest management, introducing fish in paddy rice fields, and the use of organic fertilizers have subsequently benefitted more than 600 farmers. The project is also supporting some 90 farmers in five villages to produce organic native rice. Organic certification has been obtained over a total area of 116 ha (20 percent of total paddy area) in which farmers have received a farm gate price of 4,500 kip/kg for rice compared to the normal price of 3,500 kip/kg.

The project is also completing identification surveys for edible and poisonous wild mushrooms, which are contributing to increased knowledge on sustainable harvests, market information and species identification. In order to introduce cultivation of wild products such as wild tea or mushrooms, the project supported the creation of cultivation groups, thus decreasing pressure from harvesting in neighbouring forests. In addition the project is improving local knowledge on wild vegetables and has recently started domestication and conservation of a threatened forest tree (*Melientha*) from which leaves and flowers are sold as vegetables at local markets.

The project has great potential to mainstream agro-biodiversity conservation practices into Lao's agriculture. It is introducing practical solutions that can both increase agricultural productivity and protect globally-important biodiversity. The conservation and sustainable use of agro-biodiversity will help secure sustainable food production in Lao PDR, providing food security and better nutrition for farmers.



# Nature count\$: Key Impacts of the project on Food Security and Nutrition

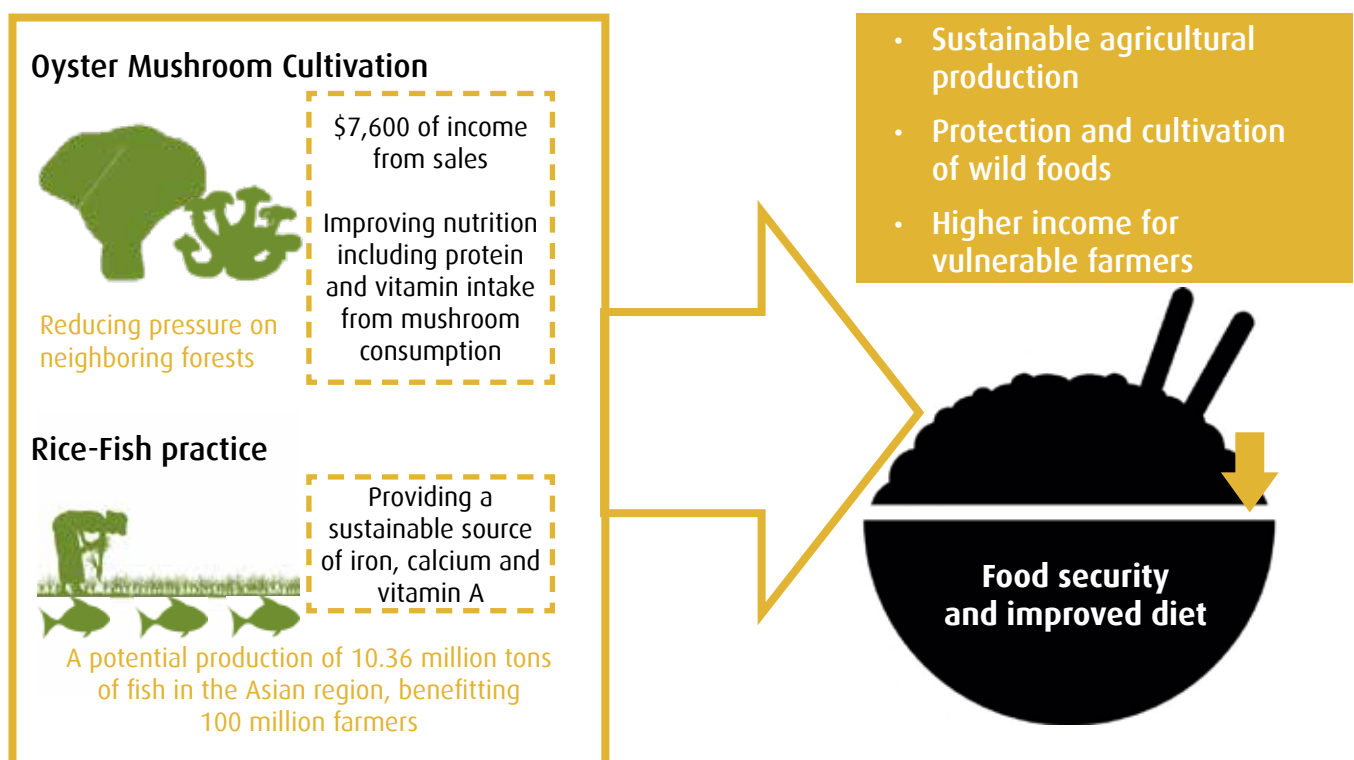
The GEF-funded, UNDP Agro-biodiversity project (ABP) in Lao PDR, with technical support from FAO, has trained more than 500 farmers on sustainable farming practices including the integration of fish in rice fields, soil fertility improvements and pest management as a part of the Integrated Pest Management (IMP) and Farmer Field Schools (FFS) initiative. Another key initiative has been the cultivation of wild mushrooms to reduce pressure on natural forests.

The project has assisted the establishment of oyster mushroom cultivation groups in five villages, where nearly ten tons of mushrooms have been harvested since 2014 generating a total income of US\$7,600. Apart from the household income, the oyster mushrooms also provide better nutrition including a supplementary source of vitamins, minerals and proteins for villagers and other consumers.

The project has promoted the introduction of fish into seasonally flooded rice fields, which offers a great potential in improving nutrition at the local level as well as food security at a regional level if this practice is scaled up. Introducing small fish species in rice fields will improve intake of iron, calcium and vitamin A. This is particularly important in Lao PDR where 45 percent of children under five and 23 percent of women are suffering from sub-clinical vitamin A deficiency.

At the regional level, rice-fish practice has the potential to sustainably produce 10.36 million tons of fish if rice-fish was adopted on only 25 percent of seasonally flooded rice fields in Asia and the Pacific. This sustainable production of fish could thus account for almost 20 percent of the regional production of inland aquaculture food fish and 13 percent of the global aquaculture production, benefitting more than 100 million farmers living in these areas.

## Sustainable use of agro-biodiversity contributing to food security in Lao PDR



In this way the project contributes to reducing malnutrition and undernourishment (✓SDG Target 2.1 & 2.2) by introducing practices that will increase agricultural diversity, and income of small-scale food producers (✓SDG Target 2.3). It promotes sustainable food production by implementing resilient agricultural practices that help maintain ecosystems (✓SDG Target 2.4). By introducing agro-biodiversity into national policies, laws, and guidelines the project assists the country to maintain its genetic diversity of wild and domesticated plants, fungi and animals (✓SDG Target 2.5).

## How the impacts were calculated:

The mushroom cultivation activities piloted by the project have taken place in five villages of Phonexay District, Huayman, Nambor, Huayno, Tapho, and Takham and have generated a total income of \$7,600 from sales. The members were able to save \$5,200, which they are using to invest in “growing houses” to sustain mushroom production (UNDP 2015b). The increased income and availability of mushrooms for private consumption is likely to have improved villagers’ nutrition. There has been no systematic recording of nutrition status in the village but studies reveal that poor rural households in Lao PDR have generally high intake of carbohydrates from rice and low intake of protein, fat and micronutrients such as iron and vitamin A (LSB 2012).

The project has a strong potential to improve sustainable agricultural productivity and food security in Lao PDR through the training of a wide audience of farmers. In June 2015, the project implementation review reported that 562 farmers had the capacity and incentive to mainstream and implement agro-biodiversity at the provincial, district, and community levels. Farmers were trained in many practices such as the cultivation of medicinal plants or the growth of organic rice, and rice-fish practices. The integration of fish culture in rice fields has been observed as an easy means to improve farmers’ diets, with clear impact on food consumption improvement (Jahan et al. 2013). Rice farmers were introduced to the integration of fish in rice fields for natural pest control and better productivity, but no data is available on the scale of implementation of rice-fish practices in Lao PDR for now. If this practice is scaled up it could create great benefits for farmers’ nutrition locally and for food production at a national and regional level.

It was estimated that the introduction of fish in inundated rice fields could increase rice production productivity from 7 percent to 15 percent (Mishra & Mohanty 2004, Gusung & Wagle 2005, Mohanty & Verma 2004). In a study conducted in a village in Bangladesh it was observed that rice-fish practices improved total kilocalorie intake per capita per day by 8 to 11 percent, while farmers and their households consumed 40 percent of fish produced (Jahan et al. 2013, Ahmet & Garnett 2011). In Lao PDR, 45 percent of children under five and 23 percent of women (12-49 years old) are suffering from sub-clinical vitamin A deficiency (LSB 2012), thus an increased consumption of fish could substantially benefit the vulnerable. Small fishes, especially eaten whole, have been identified as a key source of iron, calcium, vitamin A and zinc, micronutrients that are often lacking in the diet of the poor in Lao PDR as well as many other countries (WorldFish Center 2011, LSB 2012).

Lao PDR has around 180,000 hectares of irrigated rice paddy suitable for rice-fish practices (LSB 2014). In order to estimate the potential of rice-fish practices in increasing sustainable fish production, figures were used from Ahmed and Garnett’s (2011) study in Bangladesh which recorded an average production of 259kg of fish per hectare per year from integrated rice-fish practices. If fish is introduced in only 25 percent of the 180,000 hectares of irrigated rice in Lao PDR, it could yield around 11,000 tons of supplementary fish production per year. This represents around 10 percent of the total production of fish from aquaculture which was 108,000 tons in 2013 (FAOSTAT 2013). At a regional level, it was estimated that ten million

hectares of inundated rice land are suited for the introduction of fish, especially in Southeast and South Asia (WorldFish Center 2002). The use of 25 percent of this area for rice-fish represents an opportunity to produce 10.36 million tons of fish per year, benefitting 100 million farmers living in these areas (WorldFish Center 2002). The global production of inland aquaculture food fish was 70.19 million tons in 2013, and 41.65 million tons in Asia the same year (FAO 2015). Therefore the potential production of 10.36 million tons from rice-fish aquaculture in Asia could increase the global and regional production of inland aquaculture food fish by 14.7 percent and 25 percent, respectively. This production would account for 12.86 percent of the global production and 19.92 percent of the regional production of inland aquaculture food fish.



Photo: Doungjun Roongruang

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