CASE STUDY IN HONDURAS:
QUEZUNGUAL SLASH AND MULCH AGROFORESTRY SYSTEM

In the early 1990s, FAO began working with Honduran farmers on the steep hillsides of South Western Honduras to mitigate the effects of deforestation and land degradation, and to develop and disseminate new and more sustainable agricultural practices.
Farmers there have practiced 'slash and burn' cultivation and abandoned the age-old practice of allowing cleared fields to lie fallow long enough for tree cover to grow back and for the soil to recover.
Without trees to anchor the depleted soil, erosion increased which reduced the quality of water and its availability to downstream users. As agricultural production declined, the rates of rural poverty and malnutrition rose sharply.
Recognizing the urgent need to change their cultivation practices, Honduran farmers developed a low-cost, resource-conserving system for growing their crops. Instead of clearing the forests and burning vegetation, they adopted a slash and mulch approach. First, they broadcasted beans and sorghum in an area of well-developed naturally regenerated secondary forest.
After planting, they selectively cut and pruned the trees and shrubs and spread the leaves and small branches on the soil surface to create a layer of mulch. High-value timber, fruit and fuelwood trees were left to grow. Once the beans and sorghum had been harvested, maize was planted. Farmers continued to prune trees to allow sufficient sunlight to reach the crops while leaves, branches and crop residues were used to maintain a semi-permanent soil cover.
Honduran farmers have embraced this system as it is founded on familiar, indigenous farming practices and delivers many benefits. By retaining soil moisture and preventing erosion, QSMAS has made farms more resilient to extreme weather events, such as Hurricane Mitch in 1998.
The system also reduces the time required to prepare the land and control weeds.

Source: Adapted from *Save and Grow in practice: maize, rice and wheat a guide to sustainable cereal production* (FAO 2016).

COMMON BEANS (PHASEOLUS VULGARIS)

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Food and Agriculture Organization of the United Nations

2016 INTERNATIONAL YEAR OF PULSES

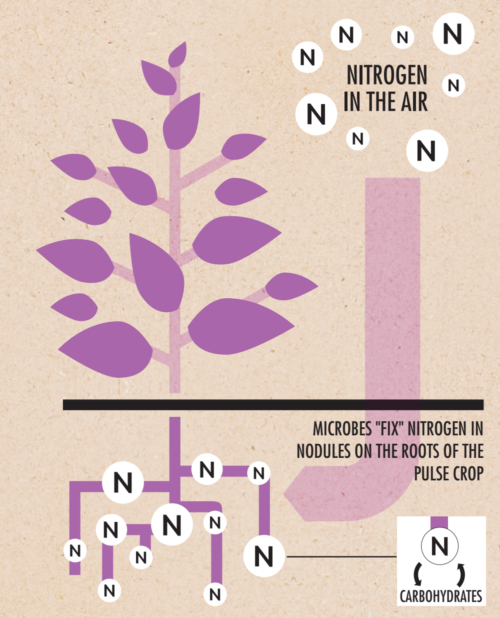
PULSES AND BIODIVERSITY

PULSES ARE ABLE TO INCREASE BIODIVERSITY AS THEY ARE ABLE TO FIX THEIR OWN NITROGEN INTO THE SOIL, WHICH **INCREASES SOIL FERTILITY.**

It is estimated that there are hundreds of varieties of pulses, including many local varieties that are not exported or grown worldwide. The genetic diversity of these crops is an essential component for on-farm soil and pest management, especially for small-scale farmers.

An important attribute of pulses is their ability to biologically fix nitrogen. These plants, in symbiosis with certain types of bacteria, namely *Rhizobium* and *Bradyrhizobium*, are able to convert atmospheric nitrogen into nitrogen compounds that can be used by plants, while also improving soil fertility.[1]

Some varieties of pulses are also able to free soil-bound phosphorous,



and phosphorous also plays an important role in the nutrition of plants.[2] The presence of pulses in agro-ecosystems helps to maintain and/or increase vital microbial biomass and activity in the soil, so nourishing the development of those organisms that are responsible for promoting soil structure and nutrient availability.[3]

A high soil biodiversity provides ecosystems with not only greater resistance and resilience against disturbance and stress, but also improves the ability of ecosystems to suppress diseases.[4] All these features are particularly important for mainstreaming soil health, which is the foundation of food security and health.

COMMON BEANS (PHASEOLUS VULGARIS)

KEY FACTS

- ➤ Good soil health is the foundation of food security and pulses **help** to increase soil **microbial biomass** and activity, thus improving soil biodiversity.
- ➤ Cultivating pulses **in multiple cropping systems** enriches agro-biodiversity, ensures resilience to climate change and **improves ecosystem services**.
- ➤ Pulses have a multiple role in promoting living organisms and ecological complexity to **re-establish** the natural **good functioning of ecosystems**.

MULTIPLE CROPPING SYSTEMS AND BIODIVERSITY

Pulses cannot improve on-farm diversity *per se*. This means that if a farmer changes from cultivating only cereal species to cultivating only pulse species, on-farm diversity does not change. That said, pulses are a crucial component of multiple cropping systems, namely intercropping, crop rotation and agroforestry. These cropping systems have a higher species diversity than monocrop systems. Increasing species diversity of cropping systems could translate into not only a more efficient use of resources, namely light, water and nutrients[5], but also into higher outputs as yields are increased, and a lower risk of overall crop failure. The selection of which multiple cropping system to use is less important because the choice will be determined by the individual attributes of each agro-ecosystem.

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GREEN CHICKPEAS (CICER ARIETINUM)

What is clear is that pulses *should* be an integral part of agro-ecosystems because they bring the agro-systems into balance. Additionally, cropping systems that are more resilient to climate change can be developed through the inclusion of local varieties, such as bambara beans, which are currently not well known or produced.

In multiple cropping systems, services such as nutrient recycling and soil formation are improved through the pulses' abilities to fix nitrogen and free phosphorous and their capacity to increase soil biodiversity. At the same time, when used in multiple cropping systems, pulses also help to curb and control pests and diseases. Additionally, since pulses often promote higher rates of accumulation of soil carbon than cereals or grasses[6], they can contribute to improve the carbon sequestration of agro-ecosystems.

Being **drought-tolerant**, **pigeon peas** (*Cajanus cajan* (L.) Huth) are often intercropped with cereals in smallholder farming systems in Asia, Africa and the Caribbean. As pigeon peas are also deep rooting, they do not compete with maize for water.

BIODIVERSITY BENEFITS OF PULSES IN MULTIPLE CROPPING SYSTEMS

PANAMA

Planting maize on jack bean (*Canavalia ensiformis* (L.) DC.) mulch saved farmers 84 kg per ha in nitrogen applications.

MEXICO

Smallholder farmers grow velvet beans (*Mucuna pruriens* (L.) DC.) in the maize 'off season' leading to significantly higher levels of soil pH, organic matter and nitrogen and a 25 percent increase in yields in subsequent maize crops. Since non-edible legumes such as velvet beans have very high carbon sequestration potential, they can play a major role in protecting the soil's biodiversity.[8]

NIGERIA

Maize, cassava and yams are intercropped with pigeon peas and alternate with an improved fallow period, which means that the ground is left with only pigeon peas growing. This system has a positive effect on soil fertility, weed suppression and, additionally, provide pigeon peas for consumption, which can improve food security for the farming communities.[7]

BOTSWANA

Bambara bean (*Vigna subterranean* (L.) Verdc.) is an under-used pulse species, which is well adapted to the semi-arid regions of Africa. In Botswana, Bambara bean is usually intercropped with sorghum, millet and maize. In areas where population densities are relatively high, this species is cultivated along the railway.[9] Locally adapted pulses have the advantage, such as Bambara bean, that they can be cultivated in marginal areas; thus, improving food security.

CHINA

Pigeon peas are a multi-purpose pulse species for agroforestry systems (a collective name for land-use in which woody perennials are grown in association with herbaceous plants and or livestock[10]), which can provide food, fodder, manure and firewood. The species is planted in mountainous regions of China to fight soil erosion.[11]