CASE STUDIES: AGROFORESTRY

CASE STUDY 1: *Faidherbia*

Faidherbia albida is a nitrogen-fixing Acacia tree that is widespread throughout Africa, growing in a variety of soils and climates. *Faidherbia* is able to make large quantities of nitrogen available to nearby crops and increase the store of carbon above ground and in the soil. It sheds its leaves in the wet season and retains them in the dry season, allowing for light to pass through in the wet season whilst providing residue in the dry season. As a consequence it is possible to plant and grow maize under the trees. Yields can reach more than 3 tonnes per hectare without fertilisers, depending on the amount of nitrogen fixed by the trees. The trees also contribute 2 tonnes or more per hectare of carbon to the soil and mature trees can store more than 30 tonnes of carbon per hectare.[1]

In Malawi, *Faidherbia* provided 300kg of fertiliser per hectare and boosted unfertilised maize yields from 2.5-4 tonnes per hectare, 200% to 400% more than national averages, when planted every 10 rows.[2] In a survey of 300 farmers in the Dedza district of Malawi, those that grew *Faidherbia* did so in order to improve soil fertility on their farms (starting when the trees are 4 to 6 years old), did not use nitrogen fertiliser and were keen to grow more trees.[3] In Niger, *Faidherbia* has been planted on almost 5 million hectares of land leading to similar benefits.

Faidherbia. Credit, World Agroforestry Centre 2011

The climate change mitigation potential for systems incorporating trees with fertilising properties lies in their ability to sequester between 2 and 4 tonnes of carbon per hectare per year, compared with 0.2-0.4 tonnes of carbon per hectare per year under conventional conservation farming systems.[4] However, *Faidherbia* trees take 6 years to fully develop, making investments hard to justify, particularly if land tenure is insecure and or farmers are dependent on immediate benefits and incomes. At present *Faidherbia* is grown on only 2% of Africa's maize area and 13% of sorghum and millet area.[5]

CASE STUDY 2: Coffee-shade tree systems

Coffee shade. Credit, Rainforest Alliance

In central Costa Rica, coffee trees are intercropped with *Erythrina poeppigiana* shade trees on steep slopes to reduce soil erosion. The shade trees reduce runoff and boost water infiltration into the soil. They can also enhance coffee production by protecting coffee trees against drought. However, introducing these trees into the system can have negative impacts such as harbouring pests and diseases transmitted to coffee trees or intercepting sunlight. Whilst yields are typically higher when

grown in direct light, shade-grown coffee beans are larger, weighing 0.15g per bean as opposed to 0.13g per bean, and have a higher quality.

Credit, Rainforest Alliance

To maximise the benefits whilst reducing competition between the two species, CIRAD (Centre de coopération internationale en recherche agronomique pour le développement) worked with a local coffee cooperative to test a novel way of overcoming these challenges. By dividing the farmers into different typologies based on environmental conditions and socio-economic situations, researchers were able to create a model to provide recommendations tailored to farmers within each grouping. For example, because the plots of the "labour-intensive" and "shaded system" groups receive a lot of sunlight, they could plant more shade trees to control for erosion. In contrast, for “input-intensive” and “extensive” groups, whose plots receive less sunlight but more rainfall and humidity, planting more shade trees would increase the risk of attacks by the fungus *Mycena citricolor*, that causes American leaf spot disease.[6]

The conceptual model helped analyze the key processes and trade-offs for each group and helped make recommendations of adapted erosion control practices. The model also showed that for some groups, less time-consuming erosion control actions such as building drainage canals, terraces or vegetative barriers that do not impact coffee production might be more suitable altogether. In contrast, using shade trees or manual weeding worked better to control erosion as opposed to herbicide use. Overall, the method of prototyping agricultural systems as they respond to different constraints can offer a basis for more productive discussions in participatory research programmes.[7]

CASE STUDY 3: Agroforestry in Shinyanga, Tanzania

Agroforestry in action. Credit, CCFAS 2014

In 1984 the Tanzanian President, Julius Nyerere, visited Shinyana and was shocked to see that decades of deforestation and inappropriate land use, including damage from livestock, had turned the area into the ‘Desert of Tanzania.’ In response he launched the Shinyanga Soil Conservation Programme (HASHI). HASHI ran demonstration sites to teach farmers how to plant woodlots that yield firewood and building timber as well as fruit trees to provide fodder for livestock. The project also supplies equipment such as long knives, wheelbarrows, and watering cans to smallholders.

An important part of the programme is encouraging the use of *ngitili*, a local word for an enclosed area of forest traditionally reserved to produce fodder for livestock during the dry season. Input from the World Agroforestry Centre encouraged the project to introduce a range of agroforestry technologies to build *ngitili*, including the planting of woodlots and

fodder banks and the use of nitrogen-fixing trees to increase fertility and crop yields.

Deoscory Msoma is a smallholder who benefitted from HASHI in 1993 reported, "The HASHI project transformed my life…The profits from my woodlots and orchards meant I could buy extra land, pay school fees for my children and renovate our house." His family can now afford proper medical care and he's been able to buy fertilisers. Where he used to produce 7 sacks of rice from 1 half-acre field; now he produces 20 sacks from the same area. He also benefits from the sale of firewood and building timber. For example, in 2010 he was preparing an order of timber for the local army barracks worth Ksh600,000 (US$420).

Now, approximately 60% of the *ngitili*, are privately owned, and the other 40% are managed by village governments, schools, community-based organisations, churches and mosques. Approximately 90% of livestock farmers and 50% of crop growers now have their own *ngitili* covering around 500,000 hectares.

Ngitili Cattle,Tanzania. Credit ICRAF

The economic impacts are significant: farmers or village members with an *ngitili* derive a monthly benefit of $14 per person; *ngitili* products (such as firewood, timber and medicinal plants) offer additional annual income of $1,190 per household; and the *ngitili* benefit women in particular, who spend an average of 6 hours less per household per day searching for firewood. The higher-quality fodder also has increased milk production from 3 litres per day to more than 10 litres per day. In 2002, the HASHI project was awarded the prestigious United Nations Equator Prize for tackling poverty through conservation and the sustainable use of biodiversity. Although the HASHI project came to an end in 2004, adoption has continued to increase thanks to the tangible benefits which *ngitili* and woodlots can yield. [8]

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