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The Quezungual System: an indigenous agroforestry system from western Honduras

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Abstract. Information about traditional and unreported agroforestry systems could be useful as a basis for developing adoptable innovations. The Quezungual System, found in the department of Lempira in western Honduras near the border with El Salvador, is one such indigenous system. The distinctive feature of the system is the existence of various naturally-regenerated trees and shrubs that are pollared to a height of approximately 1.5 metres. Farmers also leave taller trees in the fields and these include *Cordia alliodora* (laurel) and various fruit trees such as *Psidium guajava* (guayabo). A variety of crops is grown within the System including *Zea mays* (maize), *Sorghum bicolor* (sorghum) and *Phaseolus vulgaris* (beans). Advantages of the System, identified by farmers, include retention of soil moisture, production of fruits and timber, and the fact that plots can be cultivated for longer periods than is normal practice before being left in fallow. One of the prerequisites for the establishment of the System is that farmers abandon the practice of burning their fields prior to the beginning of the rains in April. Those practising the Quezungual System are smallholder farmers living in areas with a scarcity of land. Farmers have customary but not legally-recognised title to their land and many of them have fewer than 2.5 ha of land, much of it on slopes from 5% to 50%. There is growing adoption of the System because of the direct benefits to the smallholder farmer.

Introduction

In the 1980s the focus of much agroforestry research and application in Central America was on the establishment of on-farm plantations of fast growing multi-purpose species such as *Gliricidia sepium* and *Leucaena* spp. In Honduras the results have been disappointing in terms of the number of farmers who have actively participated in tree establishment.

In recent years more emphasis has been given to documenting indigenous agroforestry systems with a view to using these systems as a basis for the development of agroforestry. This change in emphasis is part of a wider change that recognises the need to understand more fully the traditional farming systems so that researchers can address appropriate problems in the context of farmers' systems (Thurston, 1992; Shaxson et al., 1997; Critchley et al., 1994).

Several indigenous agroforestry systems found in Central America have been documented (Budowski, 1987; Kass et al., 1993; Current et al., 1995]. The Quezungual System is an undocumented agroforestry system from western

Honduras that is used by smallholder farmers. Many of these farmers have socioeconomic characteristics in common and the documentation of the System might provide a starting point for its refinement and introduction to new zones where similar biophysical and socioeconomic conditions exist.

Research methods

In October and November 1997, towards the end of the rainy season, the first author spent four weeks in the south of Lempira documenting the Quezungual System. Initially background information on the System was provided by extension agents working with the *Proyecto Lempira Sur* (PLS), a rural development project in the region implemented by the Government of Honduras and the Food and Agriculture Organisation of the United Nations (FAO). PLS has been collecting information on the Quezungual System since 1993.

Visits were made to 19 communities in the region where the Quezungual System is both practiced and where it is unknown, accompanied on all occasions by an extension agent from PLS or a local farmer known to PLS. Semi-structured interviews were used and 58 farmers were interviewed (49 practitioners and nine non-practitioners). Farmers were not systematically selected for interview, rather the choice of farmers was dictated by whether they were actually working in their fields at the time of the visit, with field notes written up immediately following the interviews.

Characteristics of the region where the Quezungual System is found

Topography and tree cover

The Quezungual System is found in the southern part of the department of Lempira in western Honduras between 200 and 900 metres above sea level (Figure 1). The region is mountainous and the vast majority of farmers cultivate steep slopes of 5% to 50%. Although the area has suffered from much land degradation, there is still a relative abundance of forest and trees in the landscape.

Soils

The soils have been classified as Entisols and are generally low in phosphorous. Organic matter ranges from 2.8% to 3.9 % and the pH from 4.0 to 4.8 (Benites et al., 1997).

Figure 1. Distribution of the Quezungual System in western Honduras 88°30′ W and 14°10′ N.

Climate

Annual precipitation varies from 1400 mm to 2200 mm per annum and the rainy season lasts from early May to the end of October. The average annual temperature varies from 17 to 25 degrees centigrade. During the dry season from early November to later April, strong winds blow from the North and the enhanced evapotranspiration rates causes a severe water deficit until the onset of the rains.

Agricultural practices

Many of the farmers in the south of Lempira are smallholders with land holdings of fewer than two to three ha. The traditional crops in the area include: *Z. mays* (maize), *S. bicolor* (sorghum) and *P. vulgaris* (beans). Some farmers also grow *Oriza sativa* (rice), *Citrullus vulgaris* (watermelon), and *Saccharum officinarum* (sugarcane).

General characteristics of the Quezungual System

The most distinct feature of the System is the existence of naturally-regenerated and pollarded shrubs and trees, in association with more traditional agroforestry components such as high-value timber and fruit trees. Plots there-

fore have three levels: trees; pollarded trees and shrubs; and agricultural crops (Figure 2). The System is largely asscociated with smallholder farmers. A typical plot is approximately 600 m^2 with numerous pollarded trees and shrubs, and approximately 15 to 20 large trees: found on slopes from 5% to 50%, but more common on slopes of 10% to 25%. The System was named

Figure 2. The Quezungual System found in western Honduras has three levels: trees; pollarded shrubs and trees; and agricultural crops. The dominant tree species in the background of the figure is *C. alliodora*. In order to reduce soil erosion, some farmers also make dead barriers out of the pollarded material.

'Quezungual' by the second author after the community where it was first documented. The name is now widely used by farmers in the region and there are few communities where farmers do not refer to the system by its recently-adopted name.

Trees and shrubs in the Quezungual System

Farmers leave a few higher-value tree species when a plot is cleared and the remaining shrubs and trees are pollarded. In subsequent years the natural regeneration is managed with some trees being allowed to grow whilst others are pollarded. If forest is being cleared, there may be a high density of shrubs and trees at the beginning, however, as trees and shrubs die and the natural regeneration is managed, the farmers achieve an ideal density for the type of crop being grown.

The most common tree species found are fruit trees such as *Byrsonima crassifolia* (nance) and *P. guajava* (guayabo), and timber species such as *C. alliodora* (laurel), *Diphysa robinioides* (guachipilin) and *Swietenia* spp. (caoba). These, together with fruit trees such as *Citrus* spp. (manderina); *Persea americana* (advocado); and *Mangifera indica* (mango), and timber species such as *Simarouba glauca* (aceituno) and *Cedrela odorata* (cedro) are not, in general, pollarded. Many species are pollarded and species diversity in the Quezungual System is therefore high. Trees are pollarded in the dry season in order to reduce the risk of pests and diseases. The pollarded material is often left to dry on the surface of the soil (see below) and at the beginning of the rains, farmers sow agricultural crops through the dead material (see below).

Fruit tree species such as *P. americana* (advocado) *Carica papaya* (papaya) and *Anacardium occidentalis* (marañón) are planted. Few farmers in the area are interested in planting timber or multi-purpose tree species. Marmillod (1987), based on research in Acosta and Pursical in Costa Rica, likewise concluded that the main motivation for planting trees was for fruit production because fruit trees were a non labour-intensive cash-crop. In the south of Lempira, 28 of the 49 practitioners interviewed stated that their lack of interest in planting timber or multi-purpose trees was due to high rates of natural regeneration and relative abundance of forest cover.

Agricultural crops and the Quezungual System

In much of Honduras there are two harvests per rainy season. The *primera* where crops are sown in April/May and harvested in August/September and the *postrera* where crops are sown in August/September and harvested in December.

There are three crops traditionally found in plots with the Quezungual System: *Z. mays*, *S. bicolor* and *P. vulgaris* of which *P. vulgaris* is more

common, especially in the higher altitude areas. Farmers often practice a rotation of crops with *Z. mays* sown in the *primera* and *P. vulgaris* in the *postrera*. Some farmers also forgo the *primera* and only cultivate in the *postrera*. Forty-two of the 49 practitioners interviewed said that the rotation of crops and the decision not to cultivate during the *primera* was in order to reduce the incidences of pests and diseases.

All practitioners of the System do not burn their fields prior to sowing. Vegetation is cleared by hand with a *machete* and in addition some farmers use a herbicide such as paraquat. Seeds are either scattered (this is particularly common with *P. vulgaris*) or farmers make a small hole in the soil and mat of cut vegetation, and sow a few seeds per hole (this is the most common way of sowing *Z. mays* and *S. bicolor*). Eight of the 49 practitioners admitted to using fertilizer after sowing and hence there are few external inputs to the System.

Farmers and external markets

Forty seven of the 49 practitioners interviewed have adopted the Quezungual System to meet household subsistence needs for fruit, timber and firewood, as well as for basic grains. This is consistent with the findings of previous research in Central America and the Caribbean, parts of Asia and in East Africa (Current et al., 1995). Although the south of Lempira is one of the more isolated regions in Honduras, a ready market for agricultural products exists in El Salvador and middlemen called *coyotes*, come from Honduras' second largest city, San Pedro Sula, to buy maize, beans and other agricultural products. Smallholder farmers practising the Quezungual System are increasingly taking advantage of the market opportunities once immediate household subsistence needs have been met.

Management of the Quezungual System

Farmers manage the Quezungual System to ensure that there is optimum shade for the agricultural crops. The density of the trees and shrubs is managed and species are pollarded when crops are sown in the *primera* and subsequently pruned in the *postrera*. The normal practice is to spread the pollarded and pruned material throughout the plot as a mulch, although woody material which is suitable for firewood is collected. Three of the 49 practitioners make dead barriers out the pollarded material (Figure 2). Farmers also remove the lower branches of the trees that have been left to grow, the exception being *C. alliodora* which has a dense crown and therefore causes little shade. When the crops are harvested, farmers will often hang the pods of *P. vulgaris* and cobs of *Z. mays* on the pollarded trees and shrubs in order to dry them prior to storing/selling the harvest.

Benefits and disadvantages of the Quezungual System

The benefits mentioned by the 49 farmers interviewed who have established the Quezungual System include:

- Agricultural production in plots with the System is greater than in plots without (46 farmers). Twenty-four farmers attributed this to the increased levels of organic matter from the pollarded material.
- The System conserves soil moisture (42 farmers).
- Farmers obtain firewood and fruits from the trees and shrubs (47 farmers).
- Timber species such as *C. alliodora* are cut after approximately seven years and the timber is used for house construction and/or is sold (27 farmers).
- Mulch provided by the pollarded material helps protect the soil surface and there is less soil erosion (10 farmers).
- Mulch also reduces the incidence of disease in *P. vulgaris* (34 farmers).
- After the *postrera* and before the following year's *primera*, cattle can feed on the stalks of *Z. mays* and *S. bicolor* without damaging the trees and shrubs (18 farmers).
- Establishment and maintenance of the System does not require much labour (17 farmers).
- Plots with the System can be cultivated for longer periods than is the normal practice before they have to be left in fallow (44 farmers).

The disadvantages mentioned by the 49 practitioners included:

- Trees and shrubs attract birds that in turn eat some of the *Z. mays* harvest (five farmers).
- When it rains heavily, the shade from the trees and shrubs can result in excess moisture and subsequent problems with fungus infections (11 farmers).
- Due to the prevalence of trees and shrubs the System is incompatible with the use of animals in land preparation (10 farmers).

Socioeconomic characteristics of farmers using the Quezungual System

The process of farmer adoption and adaptation of a technology is very complex but those practising the System do have some characteristics in common. All the practitioners interviewed have customary but not legally-recognised titles to their land. Seven of the nine non-practitioners interviewed stated that one of the reasons that they had not adopted the System was due to insecurity of access to land.

More research is needed but there is also evidence that the adoption of the Quezungual System is more common in areas where land scarcity has forced farmers to intensify agricultural production. Farmers may be reacting to land

scarcity in ways described by Boserup (1965) and confirmed in the study of farmers' adoption of agroforestry systems in Central America and the Caribbean by Current et al. (1995). The Quezungual System is very uncommon in areas where land is still sufficient for farmers to practice a slash and burn agriculture. Those practising the System tend to be smallholder farmers with fewer than 2.5 hectares of land. Their land is often divided into several small plots and the System is frequently seen in plots of approximately 600 m^2.

Of the 19 communities visited, six claimed that they have used the Quezungual System for decades, the remaining 13 said that it is a more recent practice. All 49 practitioners agreed that a prerequisite for the use of the System is the abandonment of the practice of burning fields prior to sowing the *primera*; fire damages the trees and shrubs. The Quezungual System has spread from farmer to farmer especially since the early 1980s when the Government of Honduras initiated a programme to encourage farmers not to burn.

The promotion of the Quezungual System

Since 1993, the System has been promoted by PLS and has been introduced into communities with similar biophysical and socioeconomic characteristics to those where the System already exists. Practitioners do not see the System as a soil and water conservation practice per se, retention of humidity and sustainability of the system are seen as far more imporant attrributes (see above). Extension agents, therefore, promote the System in ways that complement the needs and priorities of farmers. When farmers identify the lack of water as a limiting factor to plant production, extension agents from PLS stress the advantages of the System in terms of the retention of humidity, and the fact that agricultural productivity may increase with few additional inputs.

Conclusions

Farmers in general do not value soil and water conservation as highly as scientists and extension agents. They are more concerned with attaining stable and reliable yields (Thurston, 1992). Farmers in southern Lempira are no exception to this rule. Recognizing the poor uptake of soil and water conservation technologies worldwide, the Land Husbandry approach to land degradation focuses on the need to achieve conservation through the adoption of farming practices that are generally conservation-effective and productivity-enhancing (Shaxson et al., 1997), as opposed to more specific techniques such as the establishment of terraces, live barriers and on-farm plantations etc. As land becomes more scarce in southern Lempira, due to population increases and continued inequality in land distribution, the Quezungual System offers

an alternative land use practice that meets many of the local farmers' needs and which at the same time is conservation-effective.

More research is needed to determine the degree to which a growing market can act as a stimulus to farmer-adoption of the System. Research is also needed on whether the System can be adapted so as to make it viable in different agroecological zones and in areas where there are different farm sizes, market conditions, population densities and tree husbandry knowledge levels, to those in southern Lempira.

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