

# TROPICAL TREE DIVERSITY AND MULTI-FUNCTIONS IN AGROFORESTRY

Graciela M Rusch, senior researcher of the FUNCiTREE project, discusses the role of tree functional diversity in agroforestry systems

**F**UNCiTREE addresses the functional roles of trees in the Sahel and dryland regions in Central America, based on the trees' attributes, for the design of locally adapted multi-functional agroforestry. In these regions, farmers are heavily dependent on agroforestry to provide them with dry season fodder production, shade provision, soil stabilisation, soil fertilisation, food and fuel production, and the potential for adaptation to climate change. However, these agroforestry systems are often based on a small number of widely-disseminated tree species, reducing the stability and adaptability of these systems to climate uncertainty.

## Pasture productivity

Two distinct patterns emerge when comparing the sites in Nicaragua and the Sahel. Trees in Nicaragua appear to have a varying, but consistent, negative effect on pasture productivity, particularly during the rainy season when forage production is perhaps not the major production constraint.

By contrast, the effect of agroforestry trees in the Sahel has either positive or neutral effects on pasture productivity. However, the positive responses observed in the Sahelian sites do not always match the general perception held by farmers, in that local farmers generally believe only a few species to have positive effects on ground vegetation.

## Water use and adaptation to climate seasonality

Tree species can be grouped according to strategies of water use and mechanisms for coping with rainfall seasonality. Some trees maintain comparatively lower leaf water contents throughout the seasons, while others show marked differences between the dry and rainy seasons. These differences may indicate the use of different water sources, and need to be considered in the design of agroforestry systems that cope with climate and land-use change.

## Trees for cattle feed and shade

Shade has little impact on livestock movement during the dry season, meaning that it is therefore important to maintain shade throughout the year. In all sites, interventions need to focus on dry-season forage, as this remains one of the most limiting factors for mitigating the effects of seasonal droughts in the region. Generally, the role of trees as providers of forage in the dry season appears to be undervalued. Studies of nutritional diversity provided by forage species in Nicaragua highlighted some divergence from local farmers' knowledge, and species that farmers suggested had little forage potential were found to be both nutritious and preferred by livestock.

## Communicating functional diversity

The three sites conduct demonstration activities with particular aims adapted to the local context and needs. In Senegal and

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Mali, the activities have been planned in co-operation with the Millennium Villages Programme and integrated within their extension activities. A community and participative approach is fundamental in all the interventions in order to provide training in good management practices and enable ownership by the rural population and wide diffusion.

In Senegal, the focus is on the production of a variety of foods, forages, firewood, timber and many other products for domestic use, while in Mali, all the activities are based on tree production techniques for a diversity of species, along with the plantation and management of the plants by the farmers. 1,000 plants of each of seven of the most important local species have been produced in local nurseries, while a second activity consists of a programme of restoration of degraded agroforestry parks through assisted natural regeneration.

In Nicaragua, we demonstrate how multi-functionality in paddocks can be enhanced, and use participatory scenario modelling of farm multi-functionality based on the production preferences of farmers.



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