Prosopis in Sahelian Forestry Projects: A Case Study from Niger

Rebecca Butterfield
CARE International in Niger
B.P. 10.155
Niamey, Niger

Current Address
Associates in Rural Development
P.O. Box 1397
Burlington VT 05402

ABSTRACT

A review of 20 years of agriculture and natural resource (ANR) projects implemented by CARE International in Niger provides background data for a discussion of the role of *Prosopis* in forestry development projects in the Sahel. All of CARE's ANR activities in the Sahel were intended to address concerns of food self-sufficiency and land degradation. The salient programmatic feature was an emphasis on environmental protection. Within this broad focus project activities evolved from: 1) windbreak establishment and dune fixation, to; 2) tree planting and agroforestry interventions, to; 3) watershed management and soil- and water-conservation activities.

Almost every ANR project over the last 20 years has used *Prosopis juliflora* in one or more of its activities. The most common use is for stream bank stabilization, followed by planting for living fences. It has been tried, unsuccessfully, for both windbreaks and dune stabilization. On a more limited scale it has been used to reforest degraded grazing lands behind stone terraces or in microcatchments.

Advantages of the species include ease of germination and nursery handling, high survival rates, vigorous growth, and nutritious seed pods.

However, the disadvantages are strong enough to deter most farmers from planting the species on their own land. The nasty thorns, aggressive growth, and wide spreading crown of *Prosopis juliflora* make it an undesirable candidate for field planting, and difficult to manage for woodlots and living fences. It is the species of last choice for firewood collectors. The planting of *P. juliflora* has been carried out by development projects on public domain land using food-for-work or paid labor.

Improvements need to be made for greater utilization of the species or alternative species, such as *Prosopis africana*, promoted to maximize benefits to farmers.

INTRODUCTION

A review of 20 years of agriculture and natural resource (ANR) projects implemented by CARE International in Niger provides background data for a discussion of the role of *Prosopis* in forestry development projects in the Sahel (Butterfield and Kauck 1996). The programmatic approaches, technical interventions, and species used in these projects are representative of ANR projects across the Sahel and among various development organizations. Thus, CARE Niger's case history and lessons learned are relevant for other implementing agencies in the region.

Following the disastrous drought of 1968-73, the attention of Sahelian governments, donors, and humanitarian organizations focused upon chronic problems of food insecurity and the degradation of arid and semiarid lands on which rural households ultimately depend for their livelihood. These two problems were understood to be linked and to be deteriorating. In response, the development priorities established by governments and donor agencies focused on increasing food self-sufficiency and implementing antidesertification measures. Food self-sufficiency projects strove to:

- Increase the area devoted to dry season gardening using shallow wells for hand irrigation
- Intensify the use of seasonal and permanent ponds for gardening
- develop small-scale irrigation areas
- diversify production systems through the introduction of fruits and vegetables in gardens

Antidesertification measures focused on reclaiming degraded land and increasing vegetative cover.

Over the last 20 years, all of CARE's ANR activities in the Sahel were intended, in one way or another, to address these concerns. The salient programmatic feature was an emphasis on environmental protection. Project goals and objectives were oriented to "protecting the environment" or "increasing agriculture productivity through environmental protection". Within this broad focus, project activities evolved from: windbreak establishment and dune fixation, to tree planting and agroforestry interventions, to watershed management and soil- and water-conservation activities.

TECHNICAL INTERVENTIONS AND TREE SPECIES USED

Windbreaks and Dune Stabilization

CARE's first agroforestry project, the Majjia Valley, was a response to complaints by local residents about wind damage to crops. Wind-blown sand funneled down the valley, sand-blasting young millet plants. Farmers sometimes had to replant their crop several times, significantly increasing the risk of crop failure. The valley had fertile soil and a high water table, creating an unusually productive site.

The first windbreaks copied existing experimental windbreaks in the valley: double rows of neem trees (*Azadirachta indica*) spaced 4 x 4 m with 100 m between windbreaks (Figure 1). As the trees grew, however, the gap under the crown allowed wind through, diminishing the breaking effect. The project switched to one row of neem trees and, on the windward side, a row of the shorter, wider crowned, slower growing *Acacia nilotica*. *Prosopis juliflora* was also tried as a complementary species to neem but farmers did not want either *P. juliflora* or *A. nilotica* planted in their fields because of the thorns that got underfoot.

On productive sites with high water tables, neem proved to be a good windbreak species due to its fast growth. However, where soil fertility was low and the water table deep, neem did not perform well. A switch to native *Acacia* sp. also proved unsatisfactory due to slow growth and heavy grazing pressures which reduced survival.

In 1976, CARE and the GON (Government of Niger) responded to requests from local residents who were concerned about the encroachment of large shifting dunes on a narrow valley where farmers depended on irrigated gardens for their livelihood. Dune-stabilization techniques consisted of: 1) protecting the area from grazing and farming with fences or guards for two years; 2) constructing 1 to 1.5 km of millet stalk fences per ha (these serve as windbreaks for three years and then fall over and add organic matter to the soil); 3) planting of fast-growing tree species (*Eucalyptus camaldulensis*) as windbreaks followed by native species (*Acacia senegal*); and 4) allowing natural grass and vegetation to reestablish. *Prosopis juliflora* was planted in the early years of dune stabilization but

its use was discontinued in favor of *Eucalyptus* and *A. senegal* which had higher survival rates (N'Tirgny 1983).

Despite the technical success of dune-stabilization activities, it is expensive to implement and requires the cooperation of local residents to enforce grazing restrictions. This cooperation is more likely where valuable resources are at stake, such as dune encroachment on intensive farming systems.

Tree Planting and Agroforestry Interventions

Agroforestry interventions that have been widely disseminated by CARE across the Sahel include: 1) live fencing; 2) tree planting in fields, orchards, or along property boundaries; 3) protection of natural regeneration; and 4) wood lots. All of these are innovative ways to encourage tree planting to increase vegetative cover.

Live fencing

Animals are an integral part of the agricultural system in the Sahel. They graze in forests, open pasture land, and on field stubble after grain harvests. During the rainy season, animals are well tended by herders or taken far from villages in order to protect field crops from grazing and trampling. During the dry season, animals graze near villages. Hungry, wandering animals are a problem for dry-season gardening. Traditionally, people build a barricade of thorny branches or millet stalk fences around their gardens, which need to be renewed annually.

The GON viewed traditional fencing as a constraint to expand the area in dry season gardening and a negative practice contributing to deforestation. Therefore, CARE experimented with alternative fencing options, from 5-strand barb wire to cyclone fencing. The idea of live fences was settled on as a low-cost means for farmers to not only protect their gardens but to enjoy additional benefits, such as reducing the amount of branches cut for traditional fences, reducing wind erosion and sand buildup in gardens, creating a favorable microclimate in gardens, and producing forage and firewood. Many different species and combinations were tried until *Prosopis juliflora* became the standard species for live-fence planting.

However, planting trees around a garden does not make a fence. Trees need to be pruned, their branches woven together, gaps replanted—in short, they need to be managed in order to become an effective barrier against animals. Most live fences that were established were never managed (Figure 2) so they were either ineffective or were reinforced using traditional dead branches. The *P. juliflora* thorns discourage pruning and management, while those same thorns make the dead branches effective animal barriers.

Field enrichment planting

The failure of several projects to successfully establish windbreaks on marginal sites with low water tables led to the idea of planting individual trees in farmers' fields, which would have similar effects in reducing wind erosion and increasing water infiltration while replenishing soil organic matter and providing dry-season fodder for animals. Nitrogen-fixing trees were targeted for their potential beneficial effects on soil fertility. *Faidherbia albida* is uniquely adapted for this as it is the only Sahelian species that is leafless during the rainy season and does not shade the cereal crop. During the dry season, it produces nutritious seed pods which are an important food source for animals. CARE estimates that 40 to 60 mature trees per hectare are ideal for environmental protection of agricultural fields.

However, the general belief in the fertilizer effect of *F. albida* may be overly optimistic given modern grazing pressures on the trees. Farmers indicated that the leaves of the tree serve to enrich the soil. Due to the strong demand on the species for fodder, this effect has likely been restricted to the accumulated manure of animals that congregate under the tree for shade, leaves, and fruit. The

reduced soil and air temperatures under the tree's crown early in the planting season (before it sheds its leaves) invigorates early plant growth as well. However, in areas with heavy pruning for fodder, the crown of the tree is significantly shrunken, reducing leaf fall and shade effects. Furthermore, if the fodder and seeds are removed from the site to feed animals elsewhere, the main fertilizer effect is also lost.

Several projects promoted the planting of fruit trees, (exotic: mango, papaya, citrus, guava; and native: *Balanites aegyptiaca, Ziziphus mauritiana*) and native species whose leaves are used to make sauces (*Adansonia digitata, Moringa oleifera*). These species were popular with farmers but were not always planted on the appropriate sites for adequate growth. When planted in "community lots" trees tended to be neglected and survival low. In contrast, farmers cared for trees planted within their compounds or private fields.

Protection of Natural Regeneration

The idea for promoting the protection of natural regeneration in CARE projects started in the Majjia Valley. Grazing restrictions already in force to protect young windbreaks provided an opportunity to protect the natural regeneration of slow-growing but longer-lived native species in farmer fields. These trees might later serve many environmental functions and eventually replace senescent windbreaks (Figure 1).

A Sahelian-wide study of natural regeneration noted that the most common species to be protected by farmers were: *Faidherbia albida, Balanites aegyptiaca,* and *Hyphaene thebaica* (Cissé 1991). It also noted that the most important agroforestry species were found on fields closest to the village where farmers spend more time and can thus better monitor seedling development.

Probably the most important physical factor limiting natural regeneration is seed source. Field visits revealed heavy pruning of *Faidherbia albida*, resulting in little or no seed production. Seed that is produced is quickly gathered and either fed to animals tethered in the village or sold. In the former case, the return of animal manure containing the defecated seeds to the fields would promote good seed germination. This is also the likely means for the widespread colonization of *Prosopis juliflora* beyond the original sites where it has been planted.

Woodlots - Public and Private

The rational behind the promotion of woodlots was to produce needed construction wood and poles, thus reducing demand on natural resources and native tree cover. CARE's evolution in their approach to promoting this activity mirrors the overall evolution in the entire ANR portfolio, i.e., a gradual shift from community-based activities toward individual actions by private farmers.

The establishment of village woodlots was a standard component in CARE agroforestry projects for 10 years despite limited success. Villages were requested to identify land for the planting of 2 to 10 ha of eucalyptus or neem trees for wood production. Given the land scarcity in many areas, villagers often assigned the most marginal site to the woodlot in an effort to conserve prime farm or pasture land.

Later agroforestry projects changed their approach to encourage the planting of private woodlots. This has been moderately successful for those farmers with excess land to commit to permanent tree crops, i.e., village chiefs or wealthier peasants. Woodlots are managed through coppicing for the production of poles. The most common species used are *Eucalyptus camaldulensis* and neem. Several farmers have harvested wood more than 2 or 3 times and enjoy a modest income from the activity.

Watershed Management and Water and Soil Conservation

After more than a decade of focusing on reforestation and agroforestry activities, the CARE-Niger ANR portfolio expanded to include broader environmental issues at a watershed level. During the 1970s and 1980s, one of the GON's strategies for addressing food security needs was to develop the irrigation potential of Niger's watersheds. A number of small catchment dams and irrigation systems were built during this period. Within the Majjia Valley concern was expressed about evapotranspiration from the windbreaks and possible consequences on the water table. Grazing and woodcutting restrictions in the valley bottom had intensified those activities on fragile valley slopes and uplands. This contributed to reduced vegetation cover, more water runoff, decreased water infiltration, and a perceived decline in the valley water table. The latter negatively affects dry season gardening, irrigated from shallow wells, in the valley.

These factors lead CARE to a more holistic approach in the treatment of environmental problems that involved large-scale public works for soil and water conservation. Public works activities were intended to mitigate the physical deterioration of the watershed(s). They required labor mobilization through incentives and communal work. Principal project activities included:

- **Construction of parallel rows of dry rock walls** along contour lines of the watershed's steep upper slopes. These were intended to slow rainfall runoff, discourage erosion and, to the extent that erosion continued to occur on the treated slopes, to trap sediment behind rock walls. It was also hoped that increasing soil humidity and sediment capture on upper slopes would encourage the regeneration of vegetation and, subsequently, the creation of new top soil.

- **Tree planting.** Trees planted parallel to and between newly constructed rock walls were also intended to slow runoff, hold soil, and assist the regeneration of vegetation and soil on the upper slopes. Tree planting along stream banks was promoted to slow bank erosion.

- **Construction of check dams** was intended to lower water velocity, thus reducing gully erosion and capture sediment before it reached the bed of the reservoir. This intervention is not discussed in this paper.

- **Microcatchments** were used to increase water infiltration on degraded or lateritic soils for reforestation or marginal agricultural production.

These techniques were standard "antidesertification" practices being promoted throughout the Sahel. Many of them were incorporated into public works projects which used food-for-work to mobilize labor while other technical interventions focused on individual farmers and used no outside incentives.

Rock contour walls

The simplest and most widely adopted type of rock contour wall is a single line of rocks along the field contours (*cordon de pierres*). Rock contour lines are traditional soil conservation techniques already in use by farmers. Project staff teach farmers easy methods for determining the contour (a clear hose with water, or wooden poles). The rocks slow water runoff thus protecting downstream crops while increasing water infiltration. Soil also builds up behind the rocks, conserving an important farm asset. Narrow earth berms are also used for the same purpose.

Stone walls, 40 to 70 cm high, are used on the upper slopes of watersheds to reduce water runoff and soil erosion (*murets*). Trees are planted behind the walls to take advantage of better water infiltration and to reforest denuded hillsides. Hardy species are used which are drought resistant such as *Prosopis juliflora, Combretum* sp., and native *Acacia* sp. (*A. senegal, A. seyal, A. nilotica*). On slopes with some soil,

these walls do help to increase vegetative cover and accumulate sediment that would otherwise flow downstream (Figure 3). They are especially effective where slopes meet sandy plains and erosion is acute. However, many *murets* are built on lateritic slopes and show no soil accumulation behind the walls. They may slow water runoff but appear to be unnecessary for soil conservation and ineffective for revegetation.

Stream-Bank Tree Planting

This activity was incorporated into many of CARE's agroforestry projects. It involved planting densely spaced rows of *Prosopis juliflora* along stream banks to reduce bank erosion. Seedlings were provided by the projects, from central, village, or private nurseries, and local farmers were mobilized to plant them. This "biological" control was the only intervention used to reduce bank erosion, no physical barriers were constructed to control water flow (Figure 4).

Where trees were planted far enough away from stream beds to avoid immediate erosion, they thrived and, as larger trees, they seem to be slowing bank erosion. The vigorous growth of this species along stream beds should provide an abundant source of fodder and firewood for local farmers. However, most trees show little sign of harvesting, indicating that they either quickly regenerate or that they are not fully utilized due to the thorns and bushy growth which makes wood harvesting difficult and discourages animal grazing.

Microcatchments

Microcatchments, crescent or V-shaped excavations (*demi-lunes*), were used to reclaim degraded hard-packed soil that has low water infiltration capacity. Grasses, annual crops, and/or trees are planted in the microcatchment where they are able to utilize captured water. Deeply dug trenches around a central shelf, are also used to plant trees and catch runoff (*tranchées*). Despite the recognized success of these methods to establish vegetation or grow a few crops, the high costs and minimal returns are unappealing to farmers. The trenches are unlikely to be tried outside of a project with resources to spend on reforestation. The microcatchments can easily be dug by individual farmers but are only adopted where land is scarce and labor abundant. Other development agencies have planted *P. juliflora* in these demi-lunes as part of public-works projects.

A simpler, cheaper variation of the *demi-lune* are micropockets (*zais* or *tassas*) for sowing seeds. This is a traditional practice which has been "improved" by recommending the addition of animal manure in the pocket and by offsetting each line of pockets in order to capture more water runoff. Where farmers lack decent land for agricultural expansion, the micropockets have been used successfully to grow modest crops (not trees) on previously abandoned land. The technique has been quickly passed from farmer to farmer.

The Role of *Prosopis juliflora*

Figure 5 summarizes the uses of *P. juliflora* within CARE's ANR projects in Niger. Almost every ANR project over the last 20 years has used the species in one or more of its activities. The most common use is for stream-bank stabilization, followed by planting for living fences. It has been tried, unsuccessfully, for both windbreaks and dune stabilization. On a more limited scale it has been used to reforest degraded grazing lands behind stone terraces or in microcatchments.

Advantages of the species include ease of germination and nursery handling; high survival rates; vigorous growth; and nutritious seed pods. Nursery workers who are paid for each surviving tree are keen on *P. juliflora* as they often obtain 100% germination and survival from seedlings. If protected from grazing when very young, the species survives and grows well (especially along stream banks and near gardens). The fruit pods are gathered and eaten by young children who find them a delicious snack. Pods are also gathered and feed to livestock, whose defecations are effective in spreading the species. The Lake Chad basin within Niger is reported to be entirely covered by *Prosopis* sp. (possibly

P. juliflora or *P. chilensis*; W. Mullié, pers. com.), while numerous village roads have been encroached upon by exuberant growth.

The disadvantages, however, are strong enough to deter most farmers from planting the species on their own land. The planting of *P. juliflora* has, for the most part, been carried out by development projects on public-domain land using food-for-work or paid labor (stream-bank protection, along terraced slopes, within microcatchments on abandoned land). The one exception is living fences, but many of these were planted by farmers as a prerequisite to gain access to other project resources such as wells, tools, and/or seeds.

Farmers are reported to have a love-hate feeling toward the species, with the majority of people reporting a strong dislike. Translations of common names given to the tree explain why: "viper", "bastard thorn," and "dangerous thorn" (Z. Tchoundjeu pers. com.; *shejain kawa, mugun kawa* in Hausa: E. Lindenberg pers. com.). Thorn pricks are painful, causing hands and limbs to swell. One unfortunate farmer who stepped on a thorn, developed gangrene and died (E. Lindenberg, pers. com.). In a rural environment with little access to health care and poor hygiene, these concerns are serious.

The nasty thorns, aggressive growth, and wide-spreading crown of *Prosopis juliflora* make it an undesirable candidate for field planting. They also make it difficult to manage for woodlots, or to prune or weave as needed to make an effective living fence. The firewood is appreciated by cooks but it is the species of last choice for wood collecting, again, due to the thorns. Claims of fodder production are unfulfilled as evidenced by the abundant, low-lying, green branches—animals do not eat the leaves. The pods are reportedly underutilized; the nutritive value could be increased by grinding pods for animal feed (Poulsen 1987).

Although the species has proven to be successful in reforestation programs from a silviculture perspective, it's common use around gardens and streams and invasive habit are worrisome. The species does not provide as many benefits as alternative, less thorny, more palatable species might, while it occupies and colonizes sites with higher than average water resources. Improvements need to be made for greater utilization of the species or alternative species promoted to maximize benefits to farmers.

LESSONS LEARNED

The ANR portfolio review identified numerous lessons learned to improve ANR programming and project impact. Two important issues are discussed below: the relevance of tree planting and environmental protection to the needs of farmers and the role of property rights in determining project success and sustainability.

Relevance of Project Interventions

The population of the Sahel has doubled since CARE started its first agroforestry project in the region. Despite the noble intentions of the GON to target food self-sufficiency goals for the country, these goals appear to be unrealistic given the marginal and variable nature of Sahelian agriculture and rapid population growth. Where agriculturalists have expanded into pastoral areas with poor soils and low rainfall, the best development strategy is to minimize risks from agricultural failures and diversify income sources to reduce dependence on harvests (Sumberg 1991). On relatively fertile, higher rainfall sites, interventions need to go beyond environmental protection to include activities for the intensification of integrated farming systems, with a focus on improving soil fertility (Speirs and Olsen 1992).

A central theme of CARE ANR programming in the Sahel has been agroforestry: ostensibly the planting of trees to augment agricultural production. CARE designed or used "agroforestry" systems

that were based on simplistic assumptions that trees reduce soil erosion, increase soil humidity, and add organic matter (Sumberg and Burke 1991). With the single exception of windbreaks in the Majjia valley these assumptions were never tested. Tree-crop interactions can be complex and are not necessarily beneficial, especially when roots compete for water and nutrients. While agroforestry is based on sound agronomic principles, in practice, the actual impact of tree cover on agricultural production is often marginal and is extremely difficult to evaluate. Moreover, in most cases, the economic benefits of increasing tree cover are likely to be realized over the long-term, whereas farmers' willingness to invest typically does not extend much beyond the next harvest.

The real implicit goal of CARE's agroforestry activities was reforestation; the reestablishment of vegetative cover to fight desertification. This goal complied with the priorities of the GON and donors. Tree-planting activities were justified in terms of their beneficial long-term impact on the environment, and thus by association, benefiting agriculture (Sumberg and Burke 1991). The underlying assumptions to these rationalizations are that deforestation has lead to climatic change, which, in turn, causes droughts and threatens agricultural land as the desert advances southward. These assumptions, unsupported by scientific data, were in vogue in the 1970s and 1980s (Denève 1995). The long-term and marginal relationship between reforestation and improved agricultural production casts doubt on the ability of anti-desertification measures to adequately address the real and immediate needs of the rural population (Sumberg 1991). Governments and donors need to reformulate development priorities to reflect realistic assessments of environmental limits and socio-economic constraints to development activities.

Property Rights

Development projects have consistently ignored issues of property rights when trying to implement changes in land-use practices. This arises from two causes: 1) channeling of project resources through government agencies who are often "at odds" with traditional resource management and property rights systems; and 2) the divergence of farmer's interest between public goods and private benefits (Bromley and Cernea 1989; Thomson 1987).

The key constraint to greater tree planting and protection of natural regeneration is linked to economic incentives, specifically, property rights. Forestry laws in Francophone Sahel give the national government regulatory authority over ALL native trees and thus do not create positive incentives for tree planting and protection (Thomson 1987). Although, technically, farmers have rights over the trees found in their fields, the special protection given certain species, such as *Faidherbia albida*, and the arbitrary and excessive levying of fines by government agents for offenses leads to a situation where farmers sneak out at night to "steal" branches from their own trees. Farmers are even liable for trees located on their fields, e.g., if someone else cuts the tree, the forester can fine the farmer. Instead of providing benefits, trees become liabilities. Thus, farmers appreciate fast-growing exotic species such as neem, *Eucalyptus*, and *Prosopis juliflora* since they produce results quickly and are not protected by forestry laws.

The dual role of the GON forest service as repressor and promoter sends mixed messages to villagers. The GON has a system of paid informants within villages to assist with their repression activities. This breeds community conflict and provides strong disincentives for tree planting. Not surprisingly, tree planting activities promoted by the forest service are met with skepticism from farmers who suspect that the government is trying to usurp their land by extending their control of forestry resources. Large-scale planting schemes and communal wood lots met with indifference, neglect, and sabotage. Later projects have attracted greater farmer participation by shifting away from village or communal activities towards interventions implemented by individuals on their own land. The key is to ensure that farmers are able to fully capture the benefits from planting and protecting a tree.

Projects involving large-scale public works such as windbreaks and watershed management face problems of long-term sustainability. The scale and expense of project activities are beyond the means of communities to implement themselves while the open-access nature of the benefits diminishes individual incentives for action. Soil and water conservation interventions can produce both public (reduced downstream flooding, less gully erosion, recharging of the water table) and private benefits (water retention and increased yields). When there is a gap between public and private benefits, incentives are needed to stimulate investment, which means that activities stop when the project ends (Kaimowitz 1993). In such cases, it may be unrealistic to expect project activities to be sustainable beyond the life of the project as long as the long-term benefits continue to flow. Where interventions require little input and farmers can capture all the benefits (rock contour lines, *zais*), they are readily adopted and can spread beyond the project zone.

THE FUTURE OF PROSOPIS IN THE SAHEL

Experience would suggest that *Prosopis juliflora* will continue to be planted by development agencies for public works interventions but where farmers have a choice of species, they will avoid planting it on their own land. The species is invasive and will continue to colonize sites with better than average water availability. There is an opportunity, through development agencies, to introduce thornless or more palatable varieties of the species which will meet farmer approval and have a greater chance for farmer-to-farmer dissemination.

Similarly, the successful domestication of species such as *Prosopis africana*, would meet a receptive audience. This native species was once abundant throughout southern Niger and has become increasingly rare. Villagers use it extensively for medicinal purposes (leaves, bark, and roots) and its wood is prized for mortars, tool handles, and charcoal. The pods are used in a variety of ways for animal and human consumption, with an added advantage of no thorns and highly palatable leaves for livestock (von Maydell 1992).

However, *P. africana* trees and seeds are increasingly difficult to find. Germination rates are low, seedling mortality high, and initial growth rates slow. Researchers at ICRAF (International Council for Research in Agroforestry) have completed a Sahel-wide collection of seed and are working on vegetative propagation techniques (Tchoundjeu pers. com.). The species is likely to be more site selective than *P. juliflora*, requiring high soil moisture, but its uses are more varied and it is already widely appreciated by farmers. The planting of *P. juliflora* should be restricted to the most marginal sites requiring hardy species while more culturally acceptable species, such a *P. africana*, should be promoted on fertile sites.

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Personal Communication

Mr. Eric Lindenberg, Peace Corps Coordinator, Niamey, Niger.
Dr. Wim Mullié, Ecotoxicologist, AGRYHMET, Niamey, Niger.
Dr. Zac Tchoundjen, Associate Scientist, ICRAF, Niamey, Niger.

Figure 1. Maggia Valley Windbreaks, 1995 (note regeneration of trees between windbreaks)

Figure 2. Living Fence of *Prosopis juliflora* (note that trees are not pruned)

Figure 3. Rock Contour Lines with Planted Tree [note grass on uphill (left) side]

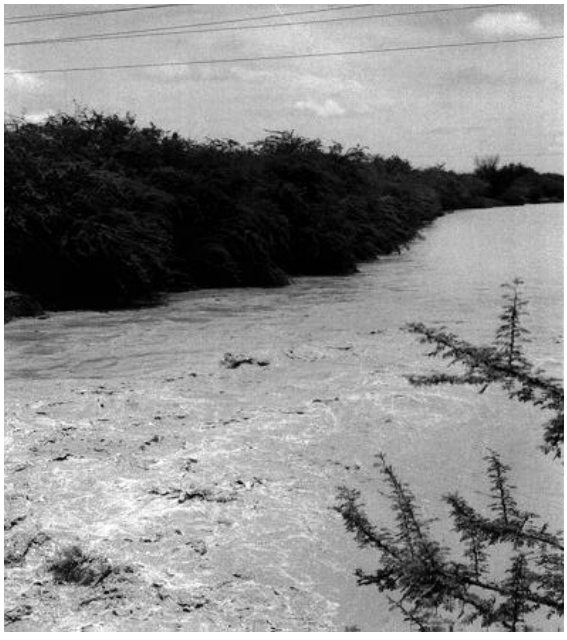

Figure 4. *Prosopis juliflora* Planted for Stream-bank Protection

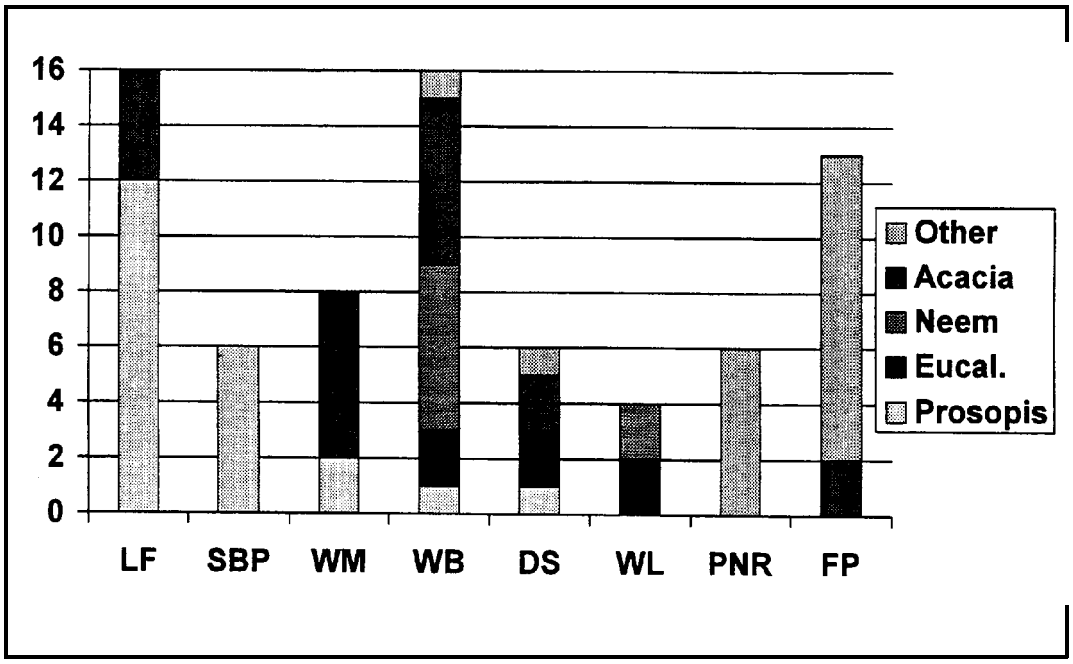

Figure 5. Frequency of Species Use by Activity, Summary of 19 Projects