The Potential of Prosopis in the Conservation and Development of Drylands: the FAO Perspectives

E.H. Sène[1]
Chief of Forest Conservation Research and Education Service
Forest Resources Division, FAO

1. INTRODUCTION

The International Convention to Combat Desertification was signed in October 1994 in Paris. It triggered a renewed dynamism in initiatives regarding the conservation and development of drylands and, in particular, in the view to combating desertification and promoting social and economic development of societies in dry lands. Drylands occupy about 3400 million hectares of emerging lands, which harbour over 500 million people who are among the poorest communities and who are among the 800 million people exposed to a number of survival problems, including food insecurity, inadequate access to drinking water and sanitation facilities, inadequate energy supply and heat from fuelwood, etc. Forestry has an important role to play in the conservation and development of drylands. It uses, preferably, multipurpose species that have a role to play in the social, economic, and economic aspects of the conservation or restoration of land productivity. These species, growing under harsh conditions, must resist drought, winds, and strong transpiration and should be adapted. *Prosopis* species are among those species that hold, as abundantly documented, great promise for the conservation and development of drylands. FAO has always given great importance to drylands and under its mandate has developed a number of initiatives to gather and disseminate information concerning multipurpose species for drylands, supported research and networking, and has promoted/implemented projects aimed at developing technologies and training people for a better use of these species in dryland development and conservation.

2. OBJECTIVES IN DRYLAND DEVELOPMENT AND CONSERVATION AND THE ROLE OF MULTIPURPOSE DROUGHT-RESISTANT SPECIES

The use of trees and shrubs in the conservation and development of drylands aims has these major objectives:

- Improve the socioeconomic conditions of dryland communities
- Restore and maintain the productive capacity of drylands
- Restore and maintain the ecological balance

2.1 Improving the Socioeconomic Conditions of Dryland Communities

The major problems in the solution of which forestry or tree planting are needed are numerous but the most important ones relate to supplying energy resources to population, complementing their direct food consumption, and providing fodder to their livestock.

[1] With inputs from Dr. F. Riveros, Chief AGPP and documentation from C. Palmberg-Lerche, Chief FORM.

2.1.1 Energy

The survey of fuelwood needs made in 1982 with projections to the year 2000, indicated 2400 million people will be either unable to meet their minimum energy requirements or will be forced to literally deplete any renewable forest resources as they will be cutting the forest faster than it is being grown. This situation was especially difficult in dry areas, most of which were under prospective deficit or in deficit or acute scarcity. The consumption of fuelwood in the early 1980s was about 1800 million m^3; it is projected at 2400 million m^3 in year 2010; most of these needs will concern dryland communities while the natural formations in these areas are limited and their productivity very low at less than 1 m^3 per ha per year. There is an evident need for important investment in tree planting within land-resources management programmes; there is need for researching the adequate species that are drought resistant and reasonably productive.

2.1.2 Trees and Food Production in Drylands

Dryland communities usually know periods of difficult food situation and recurrent food insecurity. In the corresponding countries, daily calorie intake per capita often ranges from 2000 to 2300 calories (2200 calories are necessary to meet basic nutrition needs) and the worst cases in which intake is under 2000 calories usually arise in dryland countries, especially in those in which poverty is compounded by situations of war and civil strife. In many cases, the direct contribution of plant species critically complement food availability in lean periods. The cases are many in which the gaps are filled with products from the trees the processing of which has accumulated a wealth of technological practices. Indeed, trees and shrubs of drylands have been constantly used for food production, be it as occasional snacks that can provide some support to herders or food items that can substantially complement the diet. Acacias in Australia and in some parts of Africa have been known to provide valuable food. Many other species provide direct food supply or a number of other products (gums, incense, and dyes) that may be tapped and sold for money that contributes to the restoration of food supplies. In selecting tree species for planting in dry areas, this element of contribution to food security should always be taken into great consideration.

2.1.3 Provision of Fodder for Livestock

Raising livestock is the major farming system in drylands. Pastures in these areas tend to be overwhelmed by overstocking and degraded by inadequate practices of lopping and desertification processes. In areas of seasonal rainfalls, bushfires, often cause, even during years of good rainfall, important biomass losses and the initiation of debilitating processes that ultimately may reduce the tree stocking of the pastures. The complement provided by tree browse to the feeding of livestock has been amply documented, especially in dry tropical ranges. There are also a number of trends toward less extensive husbandry modes that call for more feed inputs in which the pods of legume trees can play an important role. All these developments call for more and more fodder trees in pastoral environments.

2.2 Maintaining or Restoring the Productive Capacity of Drylands

A number of dryland species have pioneering capabilities and can be established under harsh or degraded conditions. They then serve as pioneers helping to build up soils and establish or restore new conditions more favourable to biological processes. A number of *Prosopis* and *Acacia* species are suitable for such biological missions and *Prosopis* species have been actually used under such situations.

2.3 Restoring the Ecological Balance

The plantation of resistant species can contribute to the restoration of natural vegetation in many cases in the areas surrounding or neighbouring these plantations as local conditions improve in aspects relating to reduced wind velocity, buffered temperatures, improved water economy at local levels, etc. In many cases the restoration of wild fauna has been noted, especially in small rodents, small carnivores, and bird populations. All these elements help restore ecological processes.

Conversely, cases exist in which the introduction of nonindigenous species has created a number of ecological setbacks that has been resented by local populations and thus created social dissatisfaction. The vicinity of wetlands has been up to now regarded as calling for careful consideration before introducing *Prosopis*, especially *Prosopis juliflora*; but it has been noted active regeneration of *Prosopis* associated with the migration of livestock along transhumance treks in Sahelian grasslands and steppes. The use of *Prosopis* species should consider these possible elements of rejection in some areas.

3. THE CHARACTERISTICS OF SPECIES FOR PLANTATION IN DRYLANDS AND *Prosopis* SUITABILITY

The above developments help highlight a number of characteristics that are needed for plantation in drylands. With the new guidelines promoted by the Convention on Desertification, initiatives should be taken and matured by or with the populations at grass-roots level, conducted in a truly participatory ways, and address the true needs of communities. This means that species and technologies to establish them should be socially acceptable and easily accessible to people. The species that are selected should at least have these characteristics:

- Species adapted to harsh arid conditions and to occasional occurrences of drought:
- Multipurpose species should be recommended that are:
  - **S** Suitable for soils conservation practices;
  - **S** Contributors to the production of service timber (building poles, posts, the important small pieces of wood needed to build sheds and prepare other implements for livestock management and shelters)
  - **S** Suitable for producing fuelwood and charcoal, especially for the need of artisans; for fodder production be it from leaves or pods
  - **S** Eventually, producers of direct food items or other products that can be marketed, thus contributing to income generation and improving livelihood systems in dry areas
  - **S** Favourable to landscape beautification, ecologically suitable, and not critically harmful to the environment.

Prosopis species usually respond to these characteristics. The abundant documentation has shown a large array of services rendered by a number of *Prosopis* species including the American ones, *Prosopis africana* (especially for hardwood for "heavy duty" charcoal and various service timber and material for handicraft), *Prosopis cineraria* in Asia and the Near East whose formations constitute in many areas of this region the last refuge of remaining wildlife species and which still maintain special ecosystems that have been drastically reduced during the last 50 years.

It is under these considerations that FAO has devoted special interest to those multipurpose dryland plant species by supporting them in many field programmes and devoting a sizeable amount of its Regular Programme to their knowledge, handling, and conservation technology.

4. A SHORT REVIEW OF FAO WORK ON *Prosopis*

4.1 Supporting Cooperation and Exchange of Experiences among *Prosopis* Researchers and Developers

Since the late 1970s, FAO (especially the Grassland Group and the Forest resources Division) has been interested in the potential role of *Prosopis tamarugo* in the rehabilitation of arid and desert area in northern Chile. A study was commissioned by FAO to describe in detail the programme the Chilean government developed in the "Pampa del Tamarugal" during 1960 through 1976. This study was intended to illustrate the potential of the species in growing under very difficult conditions (2 mm annual rainfall and high significant rainfall about 250 mm once every 60 to 80 years). The limitations of *Prosopis tamarugo* under strictly dry tropical conditions were perceived later.

An international meeting on *Prosopis tamarugo* was organized in Chile in June 1984 with 18 countries participating due to the interest raised by the above mentioned study. The meeting whose proceedings were published as "The Current State of Knowledge on *Prosopis tamarugo,"* led to setting up a number of national associations dealing with the genus *Prosopis* in Latin America and the idea of establishing an "International Prosopis Association."

In 1986, FAO and the Brazilian Government organized a second International Conference on *Prosopis juliflora* in Recifé, Brazil. The 200 participants from 26 countries established an "International Prosopis Association" based in Recifé. The proceedings were published as "The Current State of Knowledge on *Prosopis juliflora*."

A Prosopis symposium was organized jointly by the Centre of Overseas Research and Development (CORD), University of Durham, in 1992, with co-sponsorship of FAO, and support from the UNESCO MAB Programme, the Technical Centre for Agricultural and Rural Cooperation and the International Prosopis Association. The proceedings were published as "Research and Development Strategies for *Prosopis*," providing guidelines to appropriate and sustainable use of *Prosopis* species in drylands.

These three events have contributed to the creation of national *Prosopis* associations in Argentina, Peru, and Brazil. These events have also served to increase awareness of the value and potential of the genus *Prosopis* when properly introduced and managed into arid, semiarid, and subhumid regions, those areas especially targeted by the Convention on Desertification.

A number of national and subregional events are regularly supported to share experience gained in development operations. In West Africa, a national symposium opened to Sahelian countries was organized in November 1993 by Cabo Verde with the support of FAO to draw national and subregional lessons from the project "Development and Utilization of Forest Resources in Cabo Verde," which accumulated large experience on the establishment, management, and use of Prosopis plantations for more than 15 years. Similar events for stock-taking are envisaged for Mauritania and Niger.

4.2 Work Supported to Better Handle *Prosopis* Species and Their Genetic Resources for Forestry Initiatives

Other activities were and are being developed to promote better knowledge and use of the species suitable for drylands, among which are *Prosopis* species.

The Forest Resources Division (Forest Resources Development Service) has developed since 1979, and upon recommendation of the FAO Panel of Experts on Forest Gene Resources, an international project on the Conservation and Better Utilization of Genetic Resources of Arboreal Species for the Improvement of Rural Living. The general objectives of the project were the conservation and improved utilization of genetic resources of multipurpose arboreal species growing in arid and semiarid areas. The priority of the project had initially gone to the genera *Acacia* and *Prosopis* and these species still remain very strong in the priorities of the Forestry Department. One of the first products of the project were the publication of two booklets on the "Collection, Handling, Storage and Pre-treatment of *Prosopis* Seeds in Latin America" and on "Seed Insects of *Prosopis* Species." A number of specific activities have been conducted through cooperation with the national institutions with catalytic funding and advice.

The FAO Panel of Experts on Forest Gene Resources continues monitoring and updating the list of priority species, among which species of the genus *Prosopis* are featured regularly.

A recent review of the role of *Acacia* species in the rural economy of Africa and the Near East included the very important *Prosopis cineraria* for the Near East.

4.3 Support to Prosopis Work for Animal Husbandry

FAO through its Grassland Group, which deals with fodder production has also provided funds and guidance to national institutions active in applied research on topics relating to better management and sustainable utilization of *Prosopis* species for fodder production. Among these, the following initiatives should be noted:

Argentina: Support was provided in the evaluation of 12 species of *Prosopis*; the development of grafting techniques for various species; taxonomic studies on the genus *Prosopis* in Chile and Argentina; management studies on natural *Prosopis* formations.

Brazil: Studies on the vegetative propagation of *Prosopis juliflora* in northeastern Brazil; use of irrigation techniques in *Prosopis* plantations; provision of processing units to prepare compound feed stuff in three regions of northeastern Brazil.

Chile: Support to the University of Tarapacà with research on pruning of *Prosopis tamarugo*; management of *Prosopis tamarugo* plantations.

Italy: Cooperation with university of Genoa through a research project in some aspects of responses to drought and salinity on *Prosopis juliflora*, *Prosopis tamarugo*, and *Prosopis cineraria*.

Mexico: Support to Centro de Investigación y de Estudios Avanzados del IPN to study quick-growing species of *Prosopis juliflora* through Letter of Agreement arrangements.

4.4 Development of Field Activities for Integrated Uses of *Prosopis* Species and Formations

Activities are developed in many countries to restore fertility on degraded lands, to stabilize moving sand dunes, and to improve the livelihood of rural communities. Three countries that exemplify these

activities, undertaken mostly with *Prosopis juliflora*, are Cabo Verde, Mauritania, and Niger in dry western Africa.

In Cabo Verde, a series of projects have worked since 1978 with a number of dryland species, but particularly with *Prosopis juliflora*, to implement soil and water conservation tasks and provide fuelwood to the populations. More than 15,000 ha of plantations were established, mainly with *Prosopis juliflora.* A number of socioeconomic and ecological positive returns were observed, such as improved availability of fuelwood, with attached income generation through trading wood and charcoal needed by urban communities, to improved fodder production. However, some reservations have been expressed on ecological grounds, which are not ignored, but which will have to be monitored on a continuing basis in close cooperation with the people of this area.

In Mauritania, drought and desertification trends and high utilization pressure have depleted the *Acacia* steppes in many parts of the countries while blowing sand has threatened a number of human settlements since the early 1970s. A programme of sand dune stabilization and regeneration of agricultural lands was started with mainly *Prosopis* species, especially *Prosopis juliflora.* Experience was gained in sand-dune-stabilization techniques, use of many local and introduced species and the organization and participation of people in this process. The project also resulted in diversification of rural activities for income generation. The Manager of this project, who is presenting a paper at this workshop, will provide additional details on the status of this project.

In Niger an integrated project in the Keita valley has abundantly used *Prosopis juliflora* in a number of rehabilitation activities, including water and soil conservation, sand-dune stabilization, windbreak establishment, and establishment of small woodlots for fuelwood. These plantations were only part of a complete land-use planning, restoration, and valuation aimed at conserving productive lands and turning abandoned plateau wastelands back to production. More than 16,000 hectares established within the various "revegetation" models for various objectives, have become intimately integrated in the rural life of the local population.

All these activities are complementary and support the many functions and roles of FAO in its responsibility to support technology development, collect and disseminate information regarding identification, conservation, development, and use of plant genetic resources.

5. FUTURE PERSPECTIVES

Many countries are developing, or will be developing soon, their work programmes to implement the International Convention to Combat Desertification. As already indicated, this Convention, while making restoration of drylands mandatory to parties, stresses participation, local planning, and decentralization. More consultation and consideration in detail of the needs, doubts, and reservations of the major actors and partners, that is, the populations, will be an absolute necessity. These deliberations also involve the choice of species to be used in operations aiming at introducing forest and range species. Then, there will be increased need for hardy and resistant species to use but, at the same time, more say on species selection by local people. This entails a number of important considerations, among which are:

- The information flow on adequate species for multipurpose activities in drylands must be maintained and increased.

- It is absolutely necessary to draw from past experiences to avoid repeating mistakes and to give the most suitable advice to populations who will be gaining higher awareness on their needs and who will be probably showing greater dedication to and appropriation of, dryland restoration activities. In this connection it is essential that all research and development projects in their final phase synthesize in an handy and usable form the

research results and/or technologies and methodologies they have come up with for the benefits of extension services and other development agents.

- Concentrating on particular species is alright to promote the whole potential of single species or genera, but there will be more need to promote a larger group of species and to give greater chance to diversity, use of local species, and related local technical knowledge and culture.

- It is important to associate and further involve institutions of developing countries, especially those from affected countries in a view to strengthening their institutional set up and support capacity building and local, national, and regional initiatives.

- Follow up to the present meeting should consider the elements above and especially to build on and help revive what has already been established with new concerted initiatives and resources. In other words, we are not starting from scratch. The networks that have been established (including the International Prosopis Association, the Dryland Conservation and Development Network in Latin America, the groups around the Desert Development Conference, etc.) should be sensitized, if needed, re-energized, expanded, and used. Thus, the focus could, while continuing to promote single species or genera, highlight the importance of promoting "flexible" multipurpose groups of various species with a view to providing a diversified set of species handy for use in desertification activities most likely to expand considerably in the coming years. Within the activities to be undertaken in the near future the following are important to deliver soon:

- Coordinating efforts between this initiative and the previous ones to see how to conduct business in the future and pool forces.

- Identifying major areas of cooperation especially in further investigating the *Prosopis* species especially those insufficiently known like *Prosopis africana*, and looking at the equitable share and custody of *Prosopis* genetic resources.

- Collecting information and organizing data bases on capabilities and human resources for technical cooperation on *Prosopis* species.

FAO has a broad mandate and experiences on all these issues; such capital is at the disposal of countries and organizations and could provide the general forum that would valorize all initiatives including this and help develop synergical linkages from which all will equitably benefit.