Vegetation in the Sertão: Potential Usefulness of Genetic Resources

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The current deteriorating quality of the vegetation in the *sertão* of the *nordeste* in Brazil is readily visible from aircraft, on air photos, on satellite imagery, and from the ground. Desert vegetation is appearing as the steppe and dry forest landscape is logged, burned over, overgrazed, and cut for lumber and firewood (Vasconcelos Sobrino, 1970, 152-175; Warren and Maizels, 1977; Reining, 1978). Indigenous species are succumbing to this process.

Plants native to the sertão are a potentially valuable resource and they must be protected. Before protection is likely to occur, however, politicians, business people, and scientific leaders must be made aware of the potential usefulness of the biota. These wild species need to be perceived as resources, not as weeds. So far, genetic reserves in the area are viewed by most cattlemen, business people, farmers, and peasants in the area as ubiquitous, unimportant, and unworthy of preservation.

Although the protection and utilization of resources can be considered sequentially, they are inextricably interconnected. Genetic reserves are needed in the last disturbed remnants of each of the dozen bioclimates of the sertão to maximise and to **[end p. 68]** maintain large gene pools of all the wild biota (Ferrat~, 1979). As these reserves are protected, new problems emerge. For example, the accumulation of leaf litter and wood fuel may increase the danger of fire in these reserves. Therefore, more than one reserve with several fire-controlled subdivisions are needed in each ecosystem. The first genetic reserves are now being established in the sertão but national planners must take care to preserve a variety of ecosystems and to ensure long-term protection.

Obviously, the genetic reserves need protection against grazing, wood harvest, and fire. This protection may be provided by fencing portions of the open range. Fences not only protect genetic reserves, they also help pasture improve, keep livestock out of newly planted orchards and forest blocks, and enable harvesting of the biota for newly discovered uses. Live fences (hedgerows) are an especially attractive possibility because they can be harvested for new revenue. In deserts, steppes, and dry forests, fences of *avelós, (Euphorbia gymnoclada)* are a likely choice. The avelós is an African plant introduced to the sertão in 1892. It has green stems, lacks regular leaves, and seems to grow anywhere it is planted. Belts of four rows of living avelós can be planted, tended, and then harvested. If the avelós belts are properly tended, they can serve effectively as a livestock fence. To maintain their integrity, the fence rows need to be trimmed annually to about one and one-half meters. These fences can protect the genetic reserves, woodlots, forest blocks, orchards, crops, or pastures in the semi-arid sertão. The fence trimmings are useful as sources of latex, petroleum-like oils, other chemicals, and celluloses used as a carbohydrate for fermentation of ethyl **[end p. 69]** alcohol. Professor Augusto Farias of Recife claims that a chemical in the avelós is anti-carcinogenic. Plant juices from it are used in folk medicine to burn off skin cancer.

Government land should be set aside for chemical, horticultural, genetic, and economic research of the biota in genetic reserves. The land can also be protected by giving local peasants (who guard the reserves) the privilege of harvesting the ~yglQ2~ The alcohol and fuel industry will provide a market for products of the sertão.

The rationale for planning ahead now, for future generations of biochemists, agriculturalists, nutritionists, and energy technologists is that they *are* going to be able to make future use of some of the currently wild organisms as chemical resources. Only in the last few years has the potential worth of these wild genetic resources been recognized.

If a pragmatic land manager is interested in maximizing profits over the entire nordeste he will note that modern technology is planning to use one of the first plants examined for its biochemical components. The weed of the sertão, *marmeleiro* (Croton hemiargyeus) has been analyzed meticulously and found to have a great potential for alcohol production and essential oils. In addition, a previously unknown compound from marmeleiro can yield a sweetner that is 100,000 times sweeter than sugar. Biochemists have also listed several dozen marketable products that come from this one wild species. In the immediate past, farmers in the sertão wished to be rid of marmeleiro but they had great difficulty because it is a well-adapted weed. It sprouts double when it is cut or burned. Now, marmeleiro may be the basis for at least **[end p. 70]** ten distilleries for alcohol production and a complement of other subsidiary chemical industries required to extract the new chemical products before or after fermentation. The plan for utilization of marmeleiro by the chemists at the Universidade Federal de Ceará is now in the primary production stage and the first pilot distillery is operative. The possible use of enzymes, amilases and cellulases, which can be added to bagasse from any plant, including marmeleiro provides a method of breaking down starches and celluloses to sugars that can then be fermented to alcohol. The important solvent furfural, widely used in the petroleum industry and now mainly imported from overseas, can be produced from marmeleiro How variable are all these chemicals in the marmeleiro plants? Surely they vary and surely they can be augmented by plant selection and breeding.

The Brazilian government and most nations need additional sources of petroleum-like compounds. (Cnidoscolos phyllacanthus), a plant found in the caatinga vegetation, has seeds that yield an extremely useful oil compound. In the last several years, favela plants that have a much higher than average oil content have been discovered. The favela's recurving spines are vicious, but recently a form has been developed without thorns that will allow favela cultivation with ease and varieties with nondehiscing pods can now be sought.

In a similar search for oil in mamona or castor bean (Ricinus communis) great variability in size and production of seeds is readily visible in feral and cultivated plants. Oil content also varies; high oil content can be selected, improved, and maintained.

Manisoba or Ceará rubber tree (Manihot **[end p. 71]** glaziovii) provides a source of latex that is under direct experimentation and initial selection from the wild. As the latex from the harvested stem is extracted, the remaining biomass becomes available for fermentation and ethyl alcohol production.

In addition to alcohol, oil compounds, and latexes, there is an ample list of native fruit species in the sertão that may be genetically improved. For example, the *Umbu* (Spndias tuberosa) fruit varies in size, sweetness, and acidity. The larger and sweeter umbus may be genetically improved in a short time through selection and azenic tissue culture instead of the longer process of vegetative reproduction or grafting. Further modifications and improvements can be induced chemically, or different species can be crossed asexually through the fusion of protoplasts of each species to add new features. Recently, umbu juice was found to be the first choice in taste trials of tropical fruit juices by the COXLA Company in Pacajus, Ceará. COXLA is beginning to plant and process umbu for this purpose.

The umbu grows wild in pastures over most of the sertão especially in favorable places with deep soil and irrigation in the driest areas. Children climb after the fruit, and cattle use the tree for shade; yet, few umbu orchards are planted. The tree can be planted, but most people are unwilling to expend the energy. When this lack of planting is discussed with farmers, the most enlightened say that: "No, I have never planted any of that kind of tree, but now that you raise the point, there is a tree on my farm [or on my neighbor's farm] that produces umbu with twice the normal size of fruit, and as a result of its being pointed out I'm going to go plant the big one."

The *caju* or cashew (Anacardium **[end p. 72]** occidentale) is perhaps better known because of the long history of eating the small nuts, cashews, raised in India from seeds sent there centuries ago from the New World. The recognition of the caju as a modified plant for large-scale production is recent. In the last decade over ten million caju trees have been planted in the nordeste. Relatively little has been accomplished, however, through genetic breeding, to increase the size of the "apple" (the enlarged, fleshy pedicel) and "nuts" (the actual fruit) of the present groves. Only recently has selection begun to increase the size of the seed and the size of the cashew "apple," and three to ten-fold increases are now found in the "apple" and "nuts" from this plant.

Table 1

Native and Adapted Fruit Tree Species
in the nordeste of Brazil

Habitat	Family	Common Name	Scientific Name
H	Annonaceae	Ata	Anona squamosa L.
H	Anacardiaceae	Cajueiro	Anacardium occidentale L.
H		Mangueira	Mangifera indica L.
H		Cajá	Spondias lutea L.
H		Umbuzeiro	Spondias tuberosa Arr. Cam.
H	Caricaceae	Mamão	Carica papaya L.
H		Piqui	Caryocar coreaceum Wittn. C. glabrum Pere
C	Euphorbiaceae	Favela	Cnidoscolus phyllacanthus Pax and R. Hoffm.
H	Leguminosae	Tamarindo	Tamarindus indica L.
B	Mirtaceae	Goiaba	Psidium guajava L.
H	Moraceae	Figo	Ficus carica L.
A	Malpighiaceae	Murici	Byrsonima crassifolia H.B.K.
H	Palmaceae	Dendê	Elaeis guineensis L.
B		Licuri	Syagrys sp.
B	Rhamnaceae	Juá	Zizyphus joazeiro Mart.
N	Rosaceae	Oiticica	Licania rigida Benth.
H	Sapindaceae	Pitomba	Talisia esculenta Radlk

Source: Johannessen, 1980.

Habitat Symbol:

H - Highland
C - Caatinga zone mainly
B - Both highland and lowland caatinga
A - Altantic coastal strip
N - Near water in caatinga

Table 2

Native Lumber Trees
in the *nordeste* of Brazil

Family	Common Name	Scientific Name
Anacardiaceae	Aroeira	*Astronium urundeuva* Engl.
	Braúna	*Schinopsis brasiliensis* Engl.
	Cajá-Manga	*Spondias dulcis* Forst.
Apocinaceae	Pereiro	*Aspidosperma pirifolium* Mart.
Bignoniaceae	Pau d'Arco Roxo	*Tabebuia avellanedae* Lor.
	Craibeira	*Tabebuia caraiba* Bur.
	Pau d'Arco Amarelo	*Tabebuia serratifolia* Nicholson
Borraginaceae	Pau Branco	*Auxemma oncocalyx* Taub.
Burseraceae	Imburana	*Bursera leptophloeos* Engl.
Leguminosae	Angico Vermelho	*Anadenanthera macrocarpa* Benth.
	Mulungu	*Erythrina velutina* Willd.
	Jatobá	*Hymeneae courbaril* L.
	Leucena	*Leucena glauca* Benth.
	Angico Branco	*Piptadenia* spp.
	Algaroba	*Prosopis juliflora* D.C.
	Imburana de Cheiro or Chumaru	*Torresea cearensis* Fr. All.

Source: Johannessen, 1980.

Table 3

Native Trees and Large Shrubs
of Lowland Pacific Coastal Deciduous Forests
in or Near Santa Rosa National Park, Costa Rica
Whose Seeds Were Probably Dispersed by Megafauna

Family	Common Name	Scientific Name
Anacardiaceae	Jobo	*Spondias mombin*
	Jobo	*Spondias purpurea*
	Jobo	*Spondias radlkoferi*
Annonaceae	Soncoya	*Annona holosericea*
	Soncoya	*Annona purpurea*
	Anona	*Annona reticulata*
	Palanco	*Sapranthus palanga*
Bignoniaceae	Jicaro	*Crescentia alata*
Bromeliaceae	Piñuela	*Bromelia karatas*
	Piñuela	*Bromelia penguin*
Ebenaceae	Persimmon	*Diospyros nicaraguensis*
Euphorbiaceae	Manzanillo	*Hippomane mancinella*
Leguminosae	Huisache	*Acacia farnesiana*
	Almendro del Monte	*Andira inermis*
	Divi Divi	*Caesalpinia coriaria*
	Ojo de Buey	*Dioclea megacarpa*
	Guanacaste	*Enterolobium cyclocarpum*
	Guapinol	*Hymenaea courbaril*
		Pithecellobium mangense
	Cenizero	*Pithecellobium saman*
	Mesquite	*Prosopis juliflora*
Malpighiaceae	Cerezo	*Bunchosia biocellata*
	Nance	*Byrsonima crassifolia*
Moraceae	Ramon	*Brosimum alicastrum*
	Mora	*Chlorophora tinctoria*
	Higo, Fig	*Ficus* spp.
Palmae	Coyol	*Acrocomia vinifera*
	Biscoyol	*Bactris guinensis*
	Biscoyol	*Bactris major*
Rhamnaceae	Naranjillo	*Zizyphus guatemalensis*
Rubiaceae	Trompillo	*Alibertia edulis*
	Guaitil Blanco	*Genipa americana*
	Mosqueta	*Guettarda macrosperma*
		Randia echinocarpa
Sapotaceae	Nispero	*Manilkara zapota*
	Tempisque	*Mastichodendron capiri*
Tiliaceae	Peine de Mico	*Apeiba tibourbou*

Source: Janzen and Martin, 1982, 22.

There are other fruit trees of similar potential (Table 1), and the list of lumber trees (Table 2) is formidable. These trees can be grown in association with one another as a relatively closed canopy. The saplings need to be protected so they are not grazed or cut for commercial purposes.

I suggest that certain plants (Table 3) be searched for individuals with exceptionally large fruits with high potential value. Few have been studied as sources of germ plasm for new domesticants in the commercial world. Most of the species have large, useful fruits, and are known by those who conduct research in Central America. Many of these plants were obviously also planted by the aboriginal populations and some are still used by the local people.

Researchers can begin the process of domestication of any species and, with modern methods, change them much faster than our ancestors could have prior to genetics and plant breeding. In a decade, technicians could make more difference in the average size of fruit production of several palms or **[end p. 73]** many other species of partly-tended, but unplanted trees, than was made in most of the trees in the thousand years prior to 1850.

Conclusion

Researchers must expand their horizons beyond the pre-scientific attitude of the local farmers and politicians toward the possibilities of effective modification of wild plants, especially the long-lived, woody ones. This earlier attitude has limited the ways in which agricultural specialists have spent their research time over the last century. We will find that a great many plants have potential for domestication. Consequently, we can tremendously increase our ability to benefit from the floras of the world. However, long-term utilization demands immediate protection. The present destruction can be tempered and possibly halted. Without this recognition, 200 to 300 million years of evolution will be destroyed before we know what has been lost in the sertão and other forests of the world.

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