

Restoring the Degraded Dry Forests of Virgin Islands NP

By Becky J. Brown, Gary J. Ray, and Tamra C. Mendelson

Virgin Islands NP, located on the 48 km² island of St. John in the U.S. Virgin Islands and covering 56 percent of the island, consists of land that has been severely degraded by previous cultivation and livestock grazing. None of the original forest survives; however, a mosaic of secondary forest in various stages of recovery presently occupies almost all of the park. The native tropical dry forest plant community once covered most of the Caribbean islands, including most of St. John. Parts of St. John's natural areas are now inhabited by weedy and exotic species that deprive the land of its previous natural diversity.

Tropical dry forests were once a widespread and important vegetation type on Caribbean islands. While there are few undisturbed dry forests remaining to serve as models for our project, we do know that the typical tropical dry forest community consists of about

40-50 tree species per hectare, and is characterized by a relatively large number of rare and endemic species. Tropical dry forests occur in regions of low rainfall. Rainfall on St. John ranges from approximately 800 to 1500 mm/year and is highly sporadic, without well-defined wet or dry seasons (Fig. 1). Hurricanes in the region have infrequent, but severe impacts on the forest community.

The native plants of the tropical dry forest have developed strategies to deal with a stressful environment. They produce fruit primarily when environmental conditions are favorable, and growth is generally slow. Very little is known about the regenerative process in these forests, and prior to our study almost nothing was known about how to restore dry forest on degraded sites.

The loss of pristine forest on St. John prompted us to

propose an ecological restoration of dry forest on one of the most degraded sites in the park. Initiated in 1988, the project is funded by the U.S. Man and the Biosphere Program (MAB), with additional support from the NPS. The major objectives of this project are to better understand the dynamics of tropical dry forest and to develop techniques for restoring the biodiversity of degraded dry forest habitat.

Mary Point, a peninsula on the north side of St. John, is the site of our restoration efforts. Historical records and aerial photographs indicate that the south-facing slope of Mary Point was heavily grazed for nearly 200 years, before the park was established. Forest recovery since then has been extremely slow. In 1988, about 30 years after the cattle and goats were removed, the area remains a tangle of thorny vines and weedy pioneer trees (Fig. 2). Hurricane Hugo devastated the vegetation of Mary Point in September 1989 and further retarded the recovery process.

A seedling inventory conducted in 1990 documented that although seedling densities were as high as 53 seedlings per square meter, only 6 tree species were represented. More than 98% were *Leucaena leucocephala*, a weedy, exotic tree species. These data show a species-poor seedling community at Mary Point, and suggest that active management may be required to restore the biological diversity of this forest community.

Testing Restoration Techniques

From the more than 100 tree species in the mature dry forest on the island, we selected ten target species for our initial restoration work (Table 1). These include both deciduous and evergreen species from the canopy and the understory strata.

Our goal at Mary Point is to enrich the diversity of the regenerating forest and, if possible, to hasten the recovery process. To reach this goal, we are first trying to determine which regenerative stage is limiting forest recovery. For example, rapid recovery of the forest on severely degraded sites may be inhibited by a shortage of seeds of dry forest species. Such a paucity of seeds would be expected after a long period of livestock grazing. If a lack of seeds is the primary factor limiting forest recovery, then importing seeds to the site may expedite the regenerative process. We are testing this hypothesis by broadcasting seeds of the 10 target species into experimental plots and monitoring germination and seedling survival. In 1990 we introduced 10,800 seeds of 6 species, and by June of 1992, we will have introduced a total of 14,000 additional seeds of 10 species. So far, the germination rates in the field have been quite low. In the shadehouse under more favorable conditions, germination rates on the same species are high (Table 1). The low germination in the field probably reflects unpredictable rainfall patterns, combined with the fact that seeds of many species lose viability quickly after dispersal. Our results thus far suggest that simply importing seeds to Mary Point may not be an effective means for accelerating forest regeneration.

We are also transplanting shadehouse-grown plants (Fig. 3) into the field, in order to test the idea that forest recovery can be accelerated by bypassing the germination and seedling establishment stage. We are field testing plants grown both from seed and from vegetatively propagated stem cuttings. We are growing these plants in shaded and unshaded plots to compare the feasibility of two restoration techniques: (1) planting cleared areas, versus (2) underplanting weedy and exotic species with natives. We are also testing the usefulness of Terrasorb, a soil moisture enhancing agent, in promoting seedling survival and growth. In

Table 1. Regeneration characteristics of ten target species in tropical dry forest restoration project at Virgin Islands National Park.

Species	Dispersal Agent	Germination Rate (%)	Vegetative Propagation (% Rooted)
<i>Bursera simaruba</i>	Bird	59	10
<i>Capparis cynophallophora</i>	Bird	83	0
<i>Coccoloba microstachya</i>	Bird	75	67
<i>Guaiacum officinale</i>	Bird	92	0
<i>Guapira fragrans</i>	Bird	91	17
<i>Guetarda parviflora</i>	Bird (?)	47*	8.7
<i>Pisonia subcordata</i>	Mammal (?)	87	0
<i>Plumeria alba</i>	Wind	96	22
<i>Sabinea florida</i>	Autochory	99	12
<i>Tabebuia heterophylla</i>	Wind	96	36

*Data expressed as percentage of fruits germinated. Multiple embryos per fruit increases germination success to 81 seedlings per 100 fruit planted.

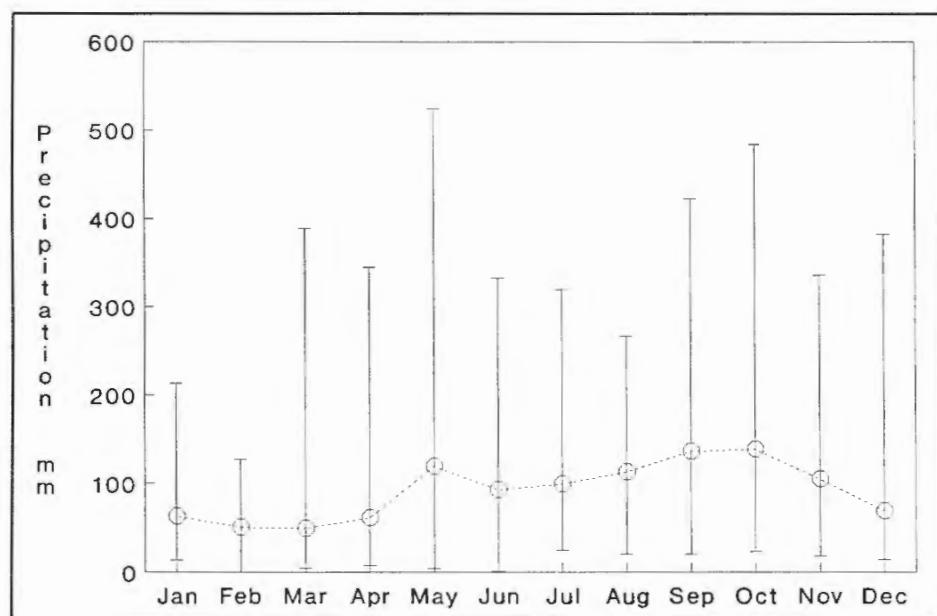


Figure 1. Precipitation at Cruz Bay, St. John, Virgin Islands, 1871-1989. Circles show average monthly rainfall; bars indicate ranges.

1990 we introduced 1152 seedlings of six species into field plots. We introduced 1000 additional seedlings and stem cuttings of 9 species in 1991. After 9 months we will estimate growth and biomass increment of surviving plants. This experiment will give us detailed information about growth requirements of each of the 10 target species.

Our shadehouse tests show that some, but not all, of our target species can be propagated vegetatively from stem cuttings (Table 1). The relative success of transplanted seedlings and cuttings in the field is yet to be determined. If results show high survival rates for cuttings, then vegetative propagation may prove to be an effective method for restoring species for which seed collection and germination are difficult.

Dry Forest Dynamics

Tied to our restoration experiments are ongoing field observations and measurements in secondary dry forests on St. John. Here the focus is on documenting the dynamics of the dry forest community. We are tracking the flowering and fruiting phenology of a total of 300 trees of 15 species. It appears that flowering and fruiting success are closely tied to weather conditions and vary greatly from year to year. Species such as *Pisonia subcordata* produce fruit during spring or early summer when rainfall is likely. Flowering in other species, such as *Sabinea florida*, may be triggered anytime of the year by rainfall after a long drought.

In 1988 we established 11 permanently marked 10 m X 50 m plots at 5 sites on the island. In these plots all mature trees more than 4 cm in diameter were tagged, and subplots were established for monitoring the growth of saplings and tree seedlings. These long-term plots will be monitored to assess naturally-occurring changes in species composition and stand structure.

A few hundred donkeys roam freely throughout the park. Although plans for management of the donkey population are being developed by the NPS staff, currently the donkeys present a serious threat to native vegetation in the park, particularly in the drier habitats. Donkeys show preferences in their choice of forage, and it appears that some native plants are much more vulnerable to donkeys than are others. Our experience indicates that *Bursera simaruba* and *Pisonia subcordata*, two important dry forest tree species, are particularly susceptible to donkey damage. Through their selective feeding, over time, donkeys can seriously alter the composition of the dry forest. Donkeys may in fact be an important factor inhibiting the recovery of the native vegetation at Mary Point. A 10 m X 50 m enclosure established as a part of our restoration project will help to document the long term effects of donkeys on the dry forest vegetation.

Management Implications

Our research is currently in an experimental phase. Results of our field investigations, scheduled for completion in 1992, will provide the ecological information needed to carry out a large-scale forest restoration at Mary Point. Management recommendations based on our research must be adapted to local biophysical and socioeconomic conditions. However, because of similar climate, soils, topography and land use histories on the drier islands of the Caribbean, the basic ecological information from our research should transfer readily for use in designing reforestation projects on other degraded dry sites.

Brown is Assoc. Prof. of Forestry and Environmental Studies at U/WI, Madison 53706; Ray is a graduate Research Assistant in the Institute for Environmental Studies, U/WI-Madison; Mendelson is field assistant and a recent graduate of U/W-Madison.



Figure 3. Shadehouse-grown plants are transplanted into the field, bypassing the germination and seedling establishment stage.

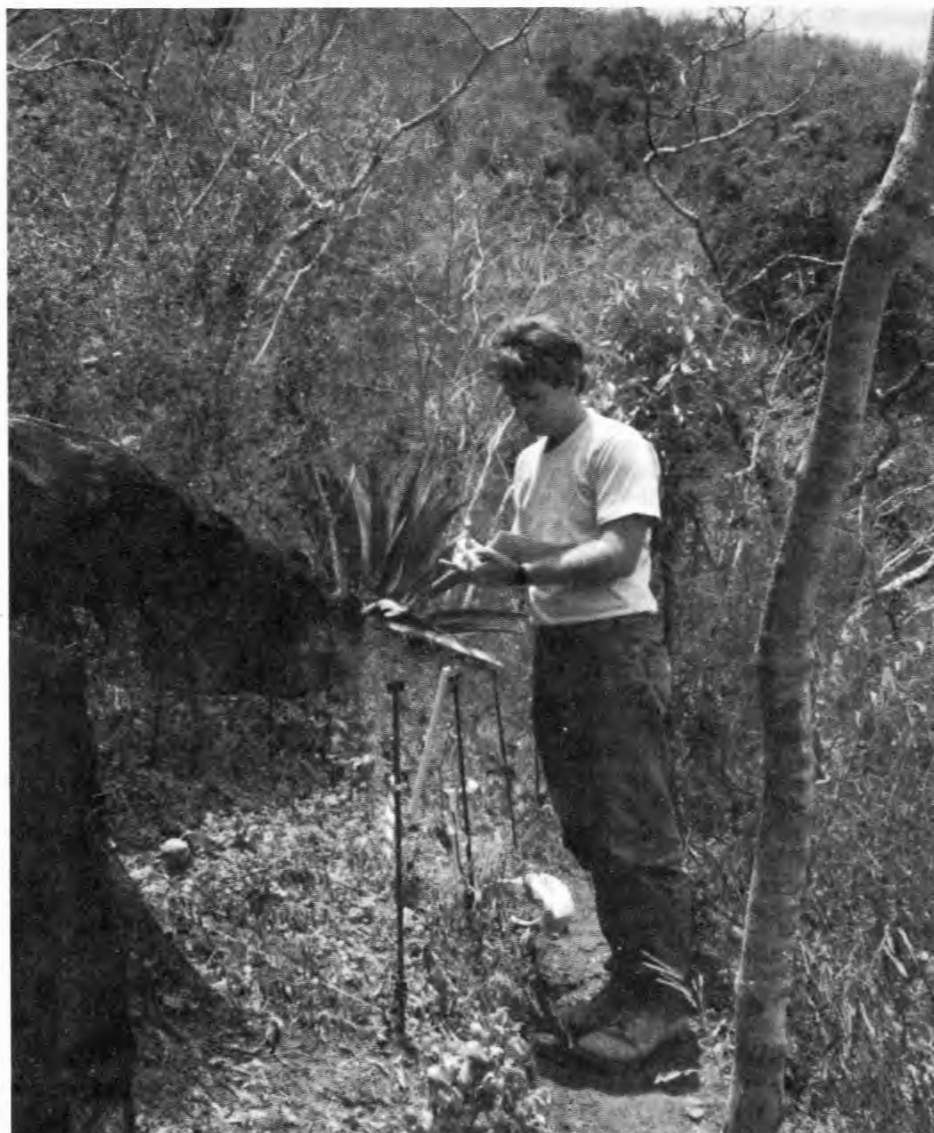


Figure 2. Gary Ray, assessing seedling performance in a weedy, abandoned pasture at Mary Point, the site of the ecological restoration project.