Vascular Plant Inventory and Mapping of Buck Island

Buck Island Reef National Monument

St. Croix, U.S. Virgin Islands

Gary Ray

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[cover image: Buck Island from the southwest during rainy season]

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INTRODUCTION

This report documents a terrestrial vascular flora of Buck Island, St. Croix, U.S. Virgin Islands, and it describes a digital mapping of the island's plant communities in order to track ecological change following the eradication of its large and destructive arboreal rat (*Rattus ratus*) population in 2000. The success of that eradication program has been well established by National Park Service resource managers with repeated trapping efforts subsequent to its completion. Numerical abundance data collected during this study, when organized spatially, can greatly facilitate land management, including exotic plant control or removal, rare plant conservation and restoration, long-term community monitoring and associated wildlife protection projects.

As our project began in June 2001, signs of vegetation recovery were everywhere in evidence. Trees consisting entirely of branches that had been severely pruned by gnawing of rats in recent years were beginning to form more natural, umbrella-shaped canopies. Plentiful fruit providing a diet for native birds and bats was maturing on the branches, and even falling to the ground to set the stage for seedling recruitment and regeneration became plentiful. Successful nesting of seabirds, shorebirds, and birds from wetlands and upland habitats substantiated our impressions. Future research and management efforts can build on these benchmark data, expanding upon our botanical focus to encompass the entirety of the biota and its ecology.

Overview of Prior Work

This report succeeds two recent documents, a detailed inventory completed more than 25 years ago by Roy O. Woodbury and Elbert E. Little entitled, "Flora of Buck Island Reef National Monument, U.S. Virgin Islands" (Woodbury and Little 1976), and a brief reassessment that included a listing of plants new to the island in 1996 (Eleanor Gibney, unpub. data). Historical floras of St. Croix also have been published (West 1793; von Eggers 1879; Millspaugh 1902; Britton 1918; Britton & Wilson 1923-30).

The existence of a population of a rare plant, Stinging bush, or *Malpighia pallens* (currently *M. infestissima*), was documented by Woodbury and Little (1976). Its presence was confirmed in the early 1990's by a field party that included Eleanor Gibney and the author. Another rarity, Wooly nipple cactus (*Mammilaria nivosa*), had been sighted in a coastal location. Vital to their protection, more detailed Information was needed on the population status of rare and endangered plant species. The current study has contributed to this conservation work.

The Physical Setting

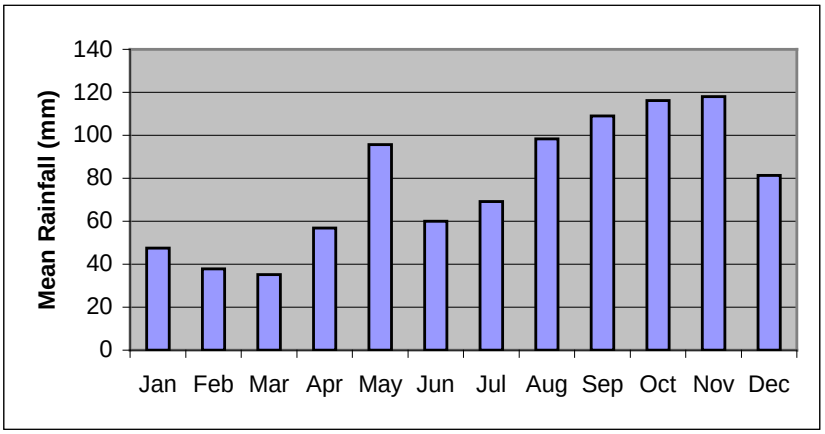
Buck Island's biotic communities cover 71.25 hectares of mostly sloping terrain. Its most prominent topographic feature is a single, 1.6-km ridgeline running approximately east-to-west. The ridge rather evenly divides it shrublands into north and south orientations, adding a measure of microclimatic variability to an otherwise uncomplicated environmental setting. It is located at 17^0 47' N, 64^0 37' W, and separated by a 3-km channel from the north shore of St. Croix off the main island's eastern section. Topographic relief and variation are low. The

highest point is just over 100 m, and nearly seventy percent of the island consists of slopes ranging from 20 – 70% (Davis 1998). Significant bottomlands include a basin mangrove swamp with a salt pond, perimeter saltgrass marsh and adjacent flatlands amounting to five hectares on the island's south-central coast, and a small coastal plain of 2.7 ha occupying the west to northwest coastline. The mean annual temperature in the Virgin Islands is 77^0 F (USDA, NRCS unpublished data). The mean monthly temperature varies only 5 to 7^0 F through the year (72^0 – 78^0 F), while mean daily maximum and minimum temperatures in warmest months range from 74^0 – 88^0 F and the coolest months from 68^0 – 82^0 F. Relative humidity (airport measures are typically drier than forests) is high year-round, with mean nighttime levels at 86% and mean daytime levels at 69%. Mean monthly nighttime relative humidity ranges from 81% in the driest months to 90% in the wettest months. Mean monthly daytime ranges are 63% in January (driest) to 73% in August and September (wettest). Northeast trade winds blowing in winter months at 10-20 knots for 60% of the time, and > 20-kt winds 25% of the time (increasing periodically with northerly Christmas winds) add greatly to desiccation effects. Trades are continuous most of the year, abating somewhat by middle to late summer and returning well by middle autumn.

Fig. 1. An aerial view of Buck Island, St. Croix, U.S. Virgin Islands

The projected mean annual rainfall accumulation is 925 mm, based on 36 years of complete monthly totals reported from East Hill, a NOAA weather station four kilometers south of the island on St. Croix (NOAA, unpublished data). While the temporal distribution pattern for rainfall is generally erratic, long term data indicate a bimodal trend, with peak rainfall in the months of August through November along with a brief rainy period in May (Fig. 2). Drought conditions predominate. Monthly totals of less than 100 mm (a commonly accepted tropical drought threshold), on average, occur in seven to eight months of the year.

Figure 2. Mean monthly rainfall in millimeters for East Hill, St. Croix (near Buck Island) based on the 36 years of complete data sets, 1956-1997. Total mean annual rainfall for these years is 925 mm.



The soils of Buck Island (*sensu* Davis 1998) are dominated by the Victory-Southgate complex (VsE and VsF) covering virtually all of its volcanic slopes and ridges – 68% of its land area. Victory–Southgate complex soils are very stony, shallow (depth to bedrock 0.5 – 1 m), well-drained, of moderate permeability and low to very lower water capacity. Natural fertility is low to moderate, and organic matter content is generally moderate.

Figure 3. Soil map of Buck Island from USDA-NRCS Digital Soil Survey of the Virgin Islands. A minor modification of soil series labeling for the salt pond and its perimeter (legend & details, Table 1).

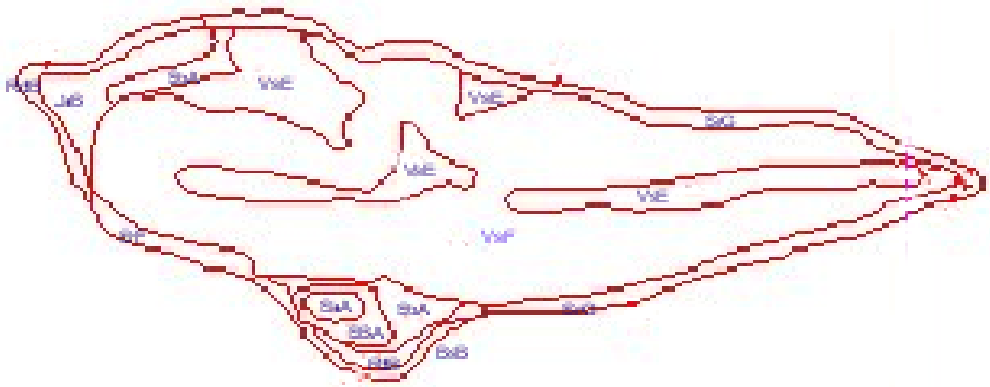


Table 1. Soil Series codes, descriptions and areal extent from the USDA-NRCS detailed soils map of Buck Island (see Fig. 3).

Series Code	Series description	Area (m^2)	Topographic description
SaA	Salt flats, ponded	5716	Salt pond
SBA	Sandy Point - Sugar Beach 0-2% freq flood	11034	Saltgrass marsh and pond perimeter
SoA	Solitude gravelly fine sandy loam 0-2% slope	15961	Dense thicket wrapping east and south
RdB	Red Hook extra stony sand 0-5% rarely flooded	8206	landward of sand beach
BsB	Beaches, sandy	9759	sand beach
RdB	Red Hook extra stony sand 0-5% rarely flooded	14605	Sandy beach west end
VsE	Victory-Southgate 20-40% slope	43122	Lower NW valley (above bottomland)
JaB	Jaucus sand 0-5% slope, rarely flooded	27032	Coastal flats west (beach forest)
SoA	Solitude gravelly fine sandy loam 0-2% slope	11135	NW access trail to coast
SrG	Southgate Rock outcrop complex 60-90% slope	68885	Shoreline N, E, S
SrF	Southgate Rock outcrop complex 40-60% slope	12731	Shoreline SW
VsF	Victory-Southgate 40-70% slope	409414	Slopes, north and south facing
VsE	Victory-Southgate 20-40% slope	6691	Ravine and slope, north central coast
VsE	Victory-Southgate 20-40% slope	37470	Ridgeline, central to east
VsE	Victory-Southgate 20-40% slope	30780	Ridgeline, center-west to west
		712541	**TOTAL AREA (m^2)**
		71.2541	**Total area (ha)**

Buck Island's vegetation is designated as subtropical dry forest, a bioclimatic life zone classification developed by Holdridge (1967). This forest system is similar to other well preserved natural communities in the northern Virgin Islands (Ray et al. 1998; Ray and Brown 1995). The plant communities associated with dry forest in the Caribbean tropics, as elsewhere, are adapted to frequent drought and high evaporation rates associated with warm temperatures and windy conditions. Characteristic adaptations to these conditions include deciduousness (leaf loss), small, thickened or pubescent evergreen leaves often with recessed stomata (pores) to reduce moisture loss during photosynthesis, low growth habit, and numerous other physiological and anatomical features. There are four distinct plant community types on the island. A scrub thicket (dense shrubland) consisting chiefly of shrubs under 2 m in height covers most of the island. A semi-deciduous dry woodland that features a full canopy 4-6 m tall, but of very limited extent, is restricted to the banks of ravines and some basin areas. A mangrove community, absent the red mangrove, surrounds a small salt pond. A beach forest is intermittent on a coastal sandy substrate on the island's west end. It includes a conspicuous, Manchineel-dominated (*Hippomane mancinella*) association, but more diverse inclusions of taller trees are also present. Minor but distinctive communities also include extensive beach strand vegetation, a marshy saltgrass glade at the perimeter of the salt pond, and a second Manchineel community proximal to both the mangrove and the back dune zone. Topographic relief and slope aspect act in concert to produce an array of microhabitats, adding greatly to the within-habitat and among-habitat species diversity. The south-facing slopes are drier and more sparsely covered by shrubs and some trees. The north side exhibits a generally higher shrub and tree canopy density.

Figure 4. Shrubland is the dominant plant community of Buck Island. This view is from central ridgeline (foreground) looking west. North-facing shrubland continues into distance along slope.

Figure 7. Interior, dry semi-deciduous woodland – featuring close-up of the trunk of *Eugenia rhombia*.

Figure 8. Salt pond at center of basin mangrove community, south shore of Buck Island.

Figure 9. Interior view of Manchineel-dominated beech forest of the southwest coastal plain of Buck Island.

Figure 10. Beach strand community of Buck Island – a low-growing association confined to the primary sand dune from the supratidal fringe zone to landward boundary of mineral soil.

Project Objectives

In collaboration with Zandy Hillis-Starr, chief resource manager for Buck Island Reef National Monument (BUIS) we intended to produce a comprehensive list of vascular plant species for the island, collect and prepare voucher specimens for all non-threatened species, and create a database of abundance information for all species encountered. Near the completion of this study we took initial steps to establish a permanent monitoring program to document vegetation recovery, and to provide the NPS recommendations for exotic plant control. Data files were to be produced with sufficient integrity to be effectively used by BUIS land managers and NPS offices (including the South Florida / Caribbean Inventory and Monitoring Coordinator) to create ArcView shape files for myriad functions. With these products GIS experts from the National Park Service produce FGDC compliant metadata to describe the GIS data, and to transfer spreadsheets into an Access database for permanent archiving and convenient analysis.

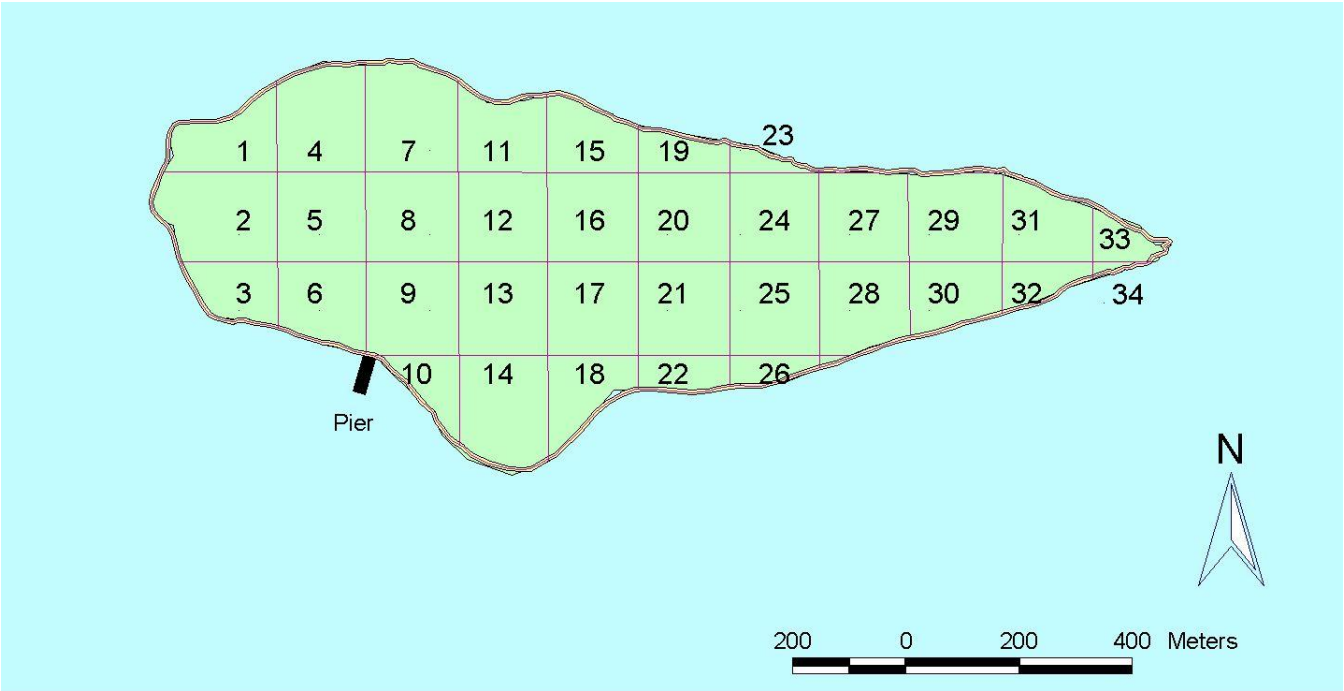
METHODS

Species Abundance & Mapping

The Mapping Grid

Building upon the existing 40-m square grid system utilized for the rat eradication project in 1999-2000, we constructed mapping units of 160-m X 160-m square cells. Each was produced by combining 16 of the 40-m x 40-m blocks already established on the ground. This procedure generated 34 mapping cells for the island as a whole. Latitude and longitude coordinates were recorded for cell corners using a GPS navigational device.

Figure 4. Locations of 160 m X 160 m mapping cells (total of 34) for Buck Island species abundance database.



Plant Community Assessment

Within these 34 cells, we traversed west-to-east and north-to-south most of the grid trails, recording each new species encountered. I scored each cell for canopy cover of every species, assigning each to an abundance category, using a modified Braun-Blanquette cover abundance scale (Table2).

Table 2. Categories for estimating percent canopy coverage for all plant species in each of 34 mapping cells during the Buck Island vegetation inventory and mapping project.

Cover class	Percent cover
1	< 1 %
2	1 – 5 %
3	6 -25 %
4	26 – 50 %
5	51 – 75 %
6	76 – 95 %
7	> 95 %

Each of the 34 mapping cells contains a species list with relative abundance based upon cover class estimates for every species. A comprehensive species table consisting of all vascular plant species and their corresponding cover class in each of 34 mapping cells is the composite raw data source for species distribution maps island-wide, and for species abundance analysis for the island flora.

Voucher collection techniques

Vouchers in duplicate of every species recorded on the island-wide list were collected to assure data integrity. The author (with field assistance from NPS staff, subcontractor and volunteer field crew members) assembled a duplicated collection of plant species encountered on Buck Island (BUIS) and entered these data into species abundance maps of the 34 mapping cell plant lists. Plants were pressed in the field, dried and identified to species. Specimens were shipped to the Fairchild Tropical Garden (FTG) in Coral Gables, FL for mounting. FTG and BUIS will each retain a full collection set. Label data for each specimen collected included collector, collection number, collection date, description of habit, reproductive condition, and morphology, habitat information, elevation, and locality data, specifically latitude and longitude coordinates.

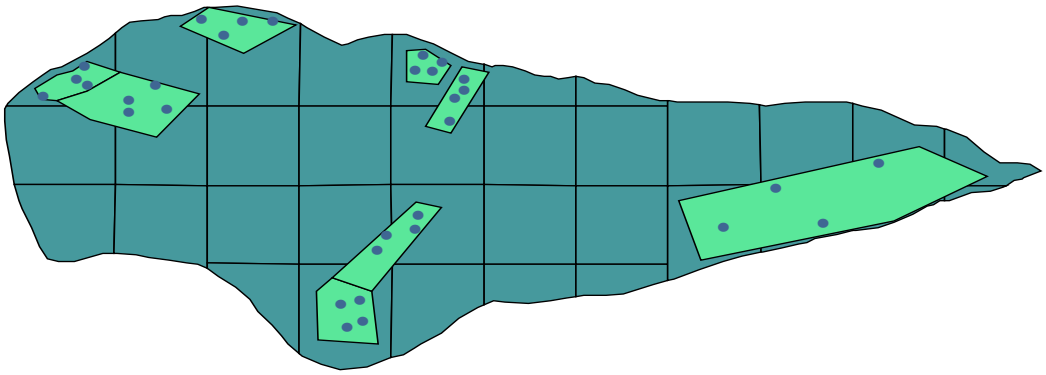
Figure 4. Field collection of plant specimens ably assisted by James Rebholz.

The author also produced digital photo-imagery, not included in a contractual agreement, of numerous selected plants, and will make copies available to the NPS upon request.

Long-term Monitoring of Plant Community Change

The field crew initiated the establishment of a series of 32 permanent monitoring plots designed to evaluate intensively the dynamics of plant community structure among the major vegetation types (Fig. 5). The study will yield a wealth of detailed information on present and future composition, growth rates, mortality and response to disturbance of constituent populations.

Figure 5. Distribution of monitoring zones (polygons) and randomly generated locations of permanent plots (points) among the 34 mapping units (bounded by grids) for Buck Island, St. Croix.



RESULTS

Statistical Summary of the Flora

The number of vascular plant species documented from Buck Island in this study was 164, (see Appendix 1). This number includes 143 (87%) native species and 21 (17%) naturalized exotics. This ratio closely matches the flora of St. John (Acevedo-Rodriques 1996), in which 86% of the flora is indigenous to that island. I recorded 132 genera from 55 flowering plant families in this inventory. I encountered no ferns or gymnosperms.

The mean number of species per family is 2.85; the mean number of genera per family is 2.40. Approximately 81% of the genera are monospecific (single taxon per genus). These data indicate that the taxonomic diversity is concentrated mainly at the generic level; indeed the ratio of species to genera is only 1.2. Also, family representation is remarkably high (30% of species richness) for a small island lacking in elevation and in topographic variation.

Although it is likely that the Buck Island flora has actually diminished since 1976, this is difficult to confirm due to differences between the two inventories with regard to collection schedules (both their timing and duration) and the variation of weather.

Table 3. Comparison of species richness among the best represented vascular plant families on Buck Island from Ray (2003) and Woodbury & Little (1976).

Plant Family	Species Richness (Ray 2003)	Species Richness (Woodbury & Little 1976)
Poaceae	14	22
Euphorbiaceae	12	17
Boraginaceae	8	9
Cactaceae	7	7
Verbenaceae	6	7
Rubiaceae	5	8
Asteraceae	4	9
Bignoniaceae	4	3
Capparaceae	4	5
Malpighiaceae	4	4
Malvaceae	4	9
Myrtaceae	4	3
Nyctaginaceae	4	5
Polygonaceae	4	4

A floristic inventory produced by Roy O. Woodbury and Elbert L. Little, Jr. (1976) totaled 228 vascular plant species. Woodbury and Little (1976) describe four collecting trips covering only seven days to assemble their flora: June 22, 1966, April 14, 1967 (exclusively Elbert Little's collections), June 9-10, 1969, and November 10-12, 1970 (Woodbury and Little as a team). They remark that their 1969 and 1970 collecting trips were subsequent to heavy rainfall periods and that specimen condition was near optimal (Woodbury & Little 1976).

This inventory was accrued in 25 field days: June 11-23, 2001, December 17-21, 2001, and May 17-23, 2002, with effort evenly divided between plant collecting and ecological sampling. The most favorable collecting conditions were met on the December 2001 trip, yet most of the work occurred during times of dormancy for many herbaceous plants. A comprehensive listing would require either more frequent wet-season collecting or a year-round sampling effort.

Of the current total of 164 species, 160 were sampled, pressed and identified in our voucher collection. Four species observed on the island were not collected for various reasons. *Mammillaria nivosa* was not collected its habitat is highly restricted to rocky coastal cliffs, and the clonal colony is one of only two known to exist on the island. Two exotic species, *Cocos nucifera and Agave missionum*, require specialized collecting and pressing techniques to convert them to herbarium specimens. Both species are destined for removal from the island. A fourth species, *Guapira fragrans*, was missed due to an error in handling.

As a consequence of this effort to obtain high-quality herbarium specimens in flowering or fruiting stages, many species are represented more than once in this collection.

Fifteen new species not recorded by Woodbury & Little (1976) were encountered in this survey (Table 3). Eight of these were non-natives; three grasses among them. Two shrubs of the diverse Myrtle family, *Eugenia cordata*, and *E. procera*, were added to the Buck Island flora. The more common *E. axillaris* and *E. rhombea* having been documented previously brings the total *Eugenia* count to four. The Beach pea (*Ipomoea pes caprae*), common elsewhere in the tropics, had not been recorded previously by Woodbury & Little. It is uncommon, but was encountered in this study in two habitats – a beach strand and a north-facing slope.

Table 3. Vascular plant species not previously published as present on Buck Island.

No.	Scientific name	Author	Family	Status of Origin
1	*Agave missionum*	Trel.	*Agavaceae*	planted (N. VI)
2	*Bromelia pinguin*	L.	*Bromeliaceae*	exotic
3	*Chamaesyce mesembrianthemifolia*	(Jacq.) Dugand	*Euphorbiaceae*	indigenous
4	*Convolvulus nodiflorus*	Desr. In Lam.	*Convolvulaceae*	indigenous
5	*Dactyloctenium aegyptium*	(L.) Beauv.	*Poaceae*	exotic
6	*Dalbergia ecastaphyllum*	(L.) Taub.	*Fabaceae*	indigenous
7	*Digitaria insularis*	(L.) Nees.	*Poaceae*	exotic
8	*Eugenia cordata*	(Sw.) DC	*Myrtaceae*	indigenous
9	*Eugenia procera*	(Sw) Poir	*Myrtaceae*	indigenous
10	*Ipomoea pes caprae*	(L.) R. Br. In Tuckey	*Convolvulaceae*	indigenous
11	*Morinda citrifolia*	L.	*Rubiaceae*	exotic
12	*Panicum chapmani*	Vasey	*Poaceae*	exotic
13	*Plumbago scandens*	L.	*Plumbaginaceae*	exotic
14	*Sida repens*	Dombey *ex* Cav.	*Malvaceae*	exotic
15	*Tecoma stans*	(L.) Juss. *Ex* Kunth.	*Bignoniaceae*	exotic(?)

Exotic Invasions

Introduced species do not contribute significantly (5.94%) to species importance within the Buck Island plant community as a whole. In total, only 21 (13%) of 163 documented species were non-natives. Among the top 52 species (based on relative importance) only 2 species, Guinea grass (*Urochloa maxima*) and Tan-tan (*Leucaena leucocephala*), were non-native. Despite their low importance the spatial distribution of these two non-natives is widespread. Guinea grass was observed in nearly 75% of the mapping cells, and Tan-tan occurred in 19 (56%) of the cells. It should be noted that Tan-tan seeds are well represented in the soil seed bank in the Virgin Islands, owing to its popularity as a fodder crop for livestock locally, its resilient seed coat and a tendency to remain dormant for long periods. I collected 39 herbs, at least 27 of which were native to the region (a single herb has not been identified). All 14 herbaceous vines were indigenous to the island. We encountered one exotic and 8 indigenous woody vines (lianas).

Table 4. List of vascular plant species documented in this survey believed to have been introduced to Buck Island.

No.	Scientific name	Common name	Family	Origin	Habit	Relative Import
1	*Urochloa maxima*	guinea-grass	*Poaceae*	Africa	herb	1.66
2	*Leucaena leucocephala*	tan tan	*Fabaceae*	Mexico	tree	1.09
3	*Chloris barbata*	fingergrass	*Poaceae*	neotropics	herb	0.69
4	*Tamarindus indica*	tamarind	*Fabaceae*	India	tree	0.42
5	*Tecoma stans*	ginger thomas	*Bignoniaceae*	neotropics	shrub	0.40
6	*Panicum chapmani*	panic grass	*Poaceae*	Bahamas	herb	0.27
7	*Abrus precatorius*	jumbie bead	*Fabaceae*	Africa	vine	0.20
8	*Thespesia populnea*	Haiti-haiti,	*Malvaceae*	pantropical	tree	0.20
9	*Agave missionum*	century plant	*Agavaceae*	Northern VI	herb	0.15
10	*Boerhavia erecta*	alena	*Nyctaginaceae*	pantropical	herb	0.15
11	*Cocos nucifera*	coconut	*Arecaceae*	Pacific rim	tree	0.10
12	*Melicoccus bijugatus*	kenip	*Sapindaceae*	South America	tree	0.10
13	*Morinda citrifolia*	painkiller	*Rubiaceae*	W. Pacific	shrub	0.10
14	*Sida repens*	Creeping mallow	*Malvaceae*	Asia	herb	0.10
15	*Bromelia pinguin*	wild pineapple	*Bromeliaceae*	Gr. Antilles	herb	0.07
16	*Aloe vera*	aloe	*Liliaceae*	Mediterranean	herb	0.05
17	*Bothriochloa pertusa*	hurricane grass	*Poaceae*	Old World tropics	herb	0.05
18	*Cleome viscosa*	cleome	*Capparaceae*	Asia	herb	0.05
19	*Dactyloctenium aegyptium*	Egypt grass	*Poaceae*	Africa	herb	0.05
20	*Mollugo nudicaulis*	mollugo	*Molluginaceae*	Old World tropics	herb	0.05

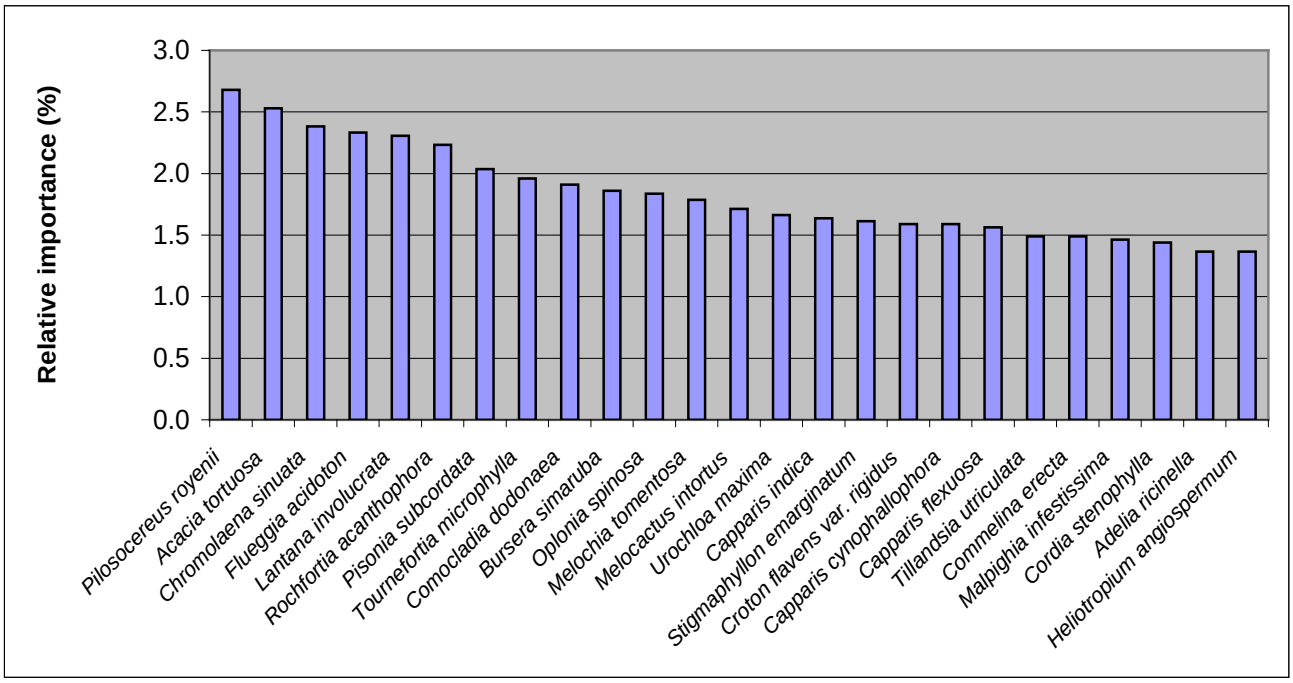
Plant Community Structure

Floristic Diversity

Shannon-Wiener diversity (H') island-wide is 4.57. This value is based on the use of species *cover class estimates* to calculate the 163 species proportions, rather than using species density. For a shrub-dominated community, this modification may well provide a better measure of species richness and relative abundance due to the relatively small size and resource demand of many of Buck Island's woody species.

In a manner similar to many tropical forest communities, and dry forest communities in particular, no species is clearly dominant over the remaining community members (Fig 3). The most abundant species represented only 2.75 % of the abundance rankings, and no two species differed in abundance (Importance Value, IV) by more than a fraction of a percent.

Figure 3. Species Importance, as a percentage of overall importance, for the 25 top-ranking species of the vascular plant community on Buck Island, St. Croix in June 2002. Importance Value, in this instance, was based on the summation of two abundance measures: relative frequency and relative dominance (estimated as canopy coverage class). Each absolute value for species importance was converted to a percentile to reflect its importance within the community of 163 documented plant species.



Frequency

Species *frequency* is a measure of how effectively a plant distributes itself across the landscape, regardless of microhabitat. Four plant species occur in all 34 mapping cells on the island. Type of dispersal mechanism is apparently of little consequence. Bird-, gravity-, and wind-dispersed plant species are all represented among the most ubiquitously distributed plants. These species are a tree cactus (*Pilosocereus royenii*) distributed by birds, a woody legume beset with large thorns (*Acacia macracantha*) an dispersed primarily by gravity, the wind-dispersed shrub (*Lantana involucrata*), and the bird-dispersed Turpentine tree (*Bursera simaruba*), a signature tree of the Virgin Islands dry forest.

Coverage

Canopy coverage and related measures such as basal area are ways of expressing community dominance of a particular species or cluster of species relative to its neighbors. The Pipe organ cactus (*Pilosocereus royenii*) ranked highest in cover as well as frequency. A couple more species, *Acacia tortuosa* and *Lantana involucrata*, also ranked very highly in both categories. However, other common species ranking much lower in frequency from one mapping cell to the next, exhibited greater dominance where they did occur. Examples are the spiny shrub, *Flueggia acidoton*, and a common large tree, Water mampoo (*Pisonia subcordata*).

Table 5. Top ten plant species on Buck Island ranked by dominance (based on canopy cover estimates) as compared to frequency rankings.

Scientific name	*Family*	Freq Rank	Dom Rank
Pilosocereus royenii	*Cactaceae*	1	1
Flueggia acidoton	*Euphorbiaceae*	23	2
Acacia tortuosa	*Fabaceae*	1	3
Chromolaena sinuata	*Asteraceae*	13	4
Lantana involucrata	*Verbenaceae*	1	5
Rochfortia acanthophora	*Boraginaceae*	8	5
Pisonia subcordata	*Nyctaginaceae*	21	7
Tournefortia microphylla	*Boraginaceae*	10	8
Comocladia dodonaea	*Anacardiaceae*	8	9
Oplonia spinosa	*Acanthaceae*	16	9

Table 6. Anti-herbivory defenses of fifteen species with highest importance values among 165 plants documented in this study.

No.	Scientific name	Family	Defense type	Common name	Form	Relative Importance (%)
1	*Pilosocereus royenii*	*Cactaceae*	physical	Pipe-organ cactus	shrub	2.68
2	*Acacia tortuosa*	*Fabaceae*	physical	Casha	shrub	2.53
3	*Chromolaena sinuata*	*Asteraceae*	2^0chem		shrub	2.38
4	*Flueggia acidoton*	*Euphorbiaceae*	thorns		shrub	2.33
5	*Lantana involucrata*	*Verbenaceae*	2^0chem	Sage	shrub	2.31
6	*Rochfortia acanthophora*	*Boraginaceae*	physical		shrub	2.23
7	*Pisonia subcordata*	*Nyctaginaceae*	none apparent	Water mampoo	tree	2.03
8	*Tournefortia microphylla*	*Boraginaceae*	none		vine	1.96
9	*Comocladia dodonaea*	*Anacardiaceae*	2^0chem	Christmas-bush	shrub	1.91
10	*Bursera simaruba*	*Burseraceae*	2^0chem	Turpentine tree	tree	1.86
11	*Oplonia spinosa*	*Acanthaceae*	physical		shrub	1.84
12	*Melochia tomentosa*	*Sterculiaceae*	2^0chem	Broom weed	shrub	1.79
13	*Melocactus intortus*	*Cactaceae*	physical	Turk's cap cactus	shrub	1.71
14	*Urochloa maxima*	*Poaceae*	none apparent	Guinea-grass	herb	1.66
15	*Capparis indica*	*Capparaceae*	none	White caper	shrub	1.64

Buck Island's dominant plant community, covering about three-fourths of the island, is a shrubland. It was classified by Woodbury and Weaver (1987) as "thorn scrub", a compositionally diverse formation composed primarily of low to tall thicket of shrub species (Fig. 4). Physiognomic variants of this shrubland are not always floristically distinct, although canopies from a shrubland in a south-facing or windward site may be barely 0.5 to 1m in height, while its neighboring association on a north slope or leeward of a ridge may range from 2-3 m tall. Shrublands intergrade with "dry semi-deciduous woodlands" where more moisture is within reach of the root zone. This occurs only along the banks of major guts (ravines) or on slopes below perched water tables (Fig. 5), amounting to less than 5% of the island's vegetation. Canopies of these drought-deciduous communities are intermittently open, typically reaching 4-5 meters in height, with scattered emergent trees to approximately 8 meters tall. A basin mangrove inclusive of a salt pond is a third type of Buck Island community (Fig. 6), occupying about 7% of island plant communities. The mangrove is not fully developed floristically – lacking red mangrove trees typical of larger swamps or those with more frequent surface and subsurface contact with the seawater. The pond is dry much of the year, leaving a salt flat absent of vegetation. Manchineel grove communities on Buck Island are associated with coastal fringe and back-dune environments, and occupy the one to two percent of the island's vegetation found on the perimeter of the mangrove swamp or in the beach forest (Fig. 7).

DISCUSSION

Seventy-seven plant species listed on the Woodbury & Little (1976) report were not documented in this study (Appendix A). Many (33) of these species are seasonal in their growth response. For example, a parasitic vine (*Cassytha filiformis*) grows profusely during rainy weather; dry periods prompt seed set followed by vegetative dormancy. Other species are intolerant of prolonged dry conditions, and Buck Island populations of these species may have suffered massive mortality since Woodbury's floristic inventory. These taxa may have been eliminated from the island flora as a consequence of the catastrophic drought of 1994-95, or perhaps lesser droughts since the mid- to late-1960's, when most of the Woodbury and Little (1976) collections were made. For instance, *Tetrazygia elaeagnoides*, a common tree of canopy gaps and north-facing forest edges, but rare to Buck Island in 1976, was killed in great numbers on St. John during the historic Virgin Islands drought of 1994-95.

It is clear that the total number of vascular plant species presently on Buck Island exceeds 164. The previous estimate of 228 species, however, may have been too high due to overestimates of the number of taxa recorded by Woodbury & Little (1976) within genera of weedy annuals, such as *Sida* (6 species) and *Chloris* (3 species). Yet it must be assumed that prior workers never encountered some minor fraction of the flora. Species richness has likely diminished since the previous inventory. The number of species recorded by Woodbury & Little (1976) not encountered in 2002 greatly outnumber new species listings from this inventory. Species extirpation due to drought (January 1994 to May 1995) combined with high browsing stress by the enormous rat population may well put the actual number of plant species today in the neighborhood of 200.

The flora of Buck Island, while diverse in many respects, has been shaped inextricably by its land use history. Anthropogenic alteration of natural plant communities regionally may be summarized in four categories: high-value timber extraction, cutting for charcoal, fire (to open the canopy for livestock) and intensive livestock pasturing. Goat grazing epitomizes disturbance to these native plant communities. Anti-herbivore defenses are a powerful presence, both physical and chemical. High densities of armed woody plants, spiny cacti, and toxin-laden leaves of many unpalatable shrub species have crowded out many taller shrubs and trees that typify Virgin Island shrub and woodland communities. In fact, of the most abundant 10 species with a mean distribution of 91% of all mapping grids, only one species, Water mampoo (*Pisonia subcordata*) lacks obvious anti-herbivore defenses. Plant species once termed "disturbance increasers" in the parlance of range science, are clearly prevalent, if not dominant as a group in the shrub communities of Buck Island. Responding positively to a history of disproportionate goat grazing and related perturbation against their competitors, shrub species such as *Acacia tortuosa*, *Chromolaena sinuata, Lantana involucrata, Flueggia acidoton*, *Rochefortia acanthophora, Oplonia spinosa,* and *Croton spp.* perhaps were left behind in high densities as a consequence. The question remains: how stable is this preponderance of armed and unpalatable species in the context of long term community floristics? The permanent monitoring work provides a means of addressing this and other questions of community change over time.

Rare Plant Considerations

The rarity of only two vascular plant species from Buck Island is of particular note*:* *Malpighia infestissima* and *Mammilaria nivosa* (Wooly nipple cactus)*.*

Malpighia infestissima is relatively common on Buck Island. It has been collected on St. Croix in the past. Apparently, however, the species no longer occurs there. It was collected by West in 1906 on St. John, but has not been seen in recent years (Acevedo 1996). *M. infestissima* is sufficiently restricted in geographic range to warrant federal listing as threatened or in danger of extinction. The population appears to demonstrate recruitment deficiencies in many areas, but it has withstood substantial browsing of branch tips by the throngs rats (*Ratus ratus*) in the years prior to this survey.

Wooly nipple cactus was observed in only a single clump of less than 0.25 m^2 on the island's south shoreline. A second tiny colony, sighted on the northwest coastline in 1995, was not subjected to a rigorous search during this study. For conservation reasons this species was not made part of the voucher collection. *M. nivosa* has a broad geographic range in the Caribbean. Its rarity lies mainly in its restricted habitat – rocky shorelines. Threats to its viability are mainly ecological – its weak dispersal capacity and its small genetic populations. Populations in the Virgin Islands tend toward asexual propagation in small, scattered clonal aggregations. Fruit production is typically very sparse.

Figure 9. Wooly nipple cactus (*Mammilaria nivosa*) with fruit on rocky coastal bluff, Buck Island, June, 2001.

Bird recovery

Based on years of observations by BUIS resource managers and researchers, the avifauna of Buck Island appears to be making an impressive recovery. Our systematic traverse of north- and south-facing slopes intercepted numerous active nests during the spring 2002 field excursions. We encountered three different bird species nesting in a single afternoon. These nests were created by the White crowned Pigeon (*Columba leucocephala*) nesting in a pipe organ cactus, White-cheeked Pintail duck (*Anas bahamensis*) ground-nesting beneath a dead bromeliad clump a considerable distance from the sea, and a Least Tern (*Sterna antillarum*) along the vegetation line on the south shore. The vegetation of the island and its relative isolation makes it an important rookery site for pelicans (*Pelecanus occidentalis*) and frigatebirds.

A large proportion of the Buck Island flora provides nutritional and nesting resources for birds, and is pollinated or dispersed by them. Frugivorous bats disperse *Cassine xylocarpa*, *Cordia ricksecker*i and other larger-fruited plant species. The return of birds and bats to Buck Island will be an important factor in the regeneration and recovery of its vegetation.

Figure 10. Eggs in nest White Crowned Pigeon (C*olumba leucocephala*) established in Casha tree (*Acacia tortuosa*) on Buck Island, mid-May 2002.

Figure 11. Immature Brown pelican (*Pelecanus occidentalis*) in scrub canopy of north central shrubland rookery of Buck Island, June 2001.

Problems of Exotics Management

We assessed in detail the distribution of the non-native flora. Some of these plant species are recent introductions in adventitive (early) stages of invasion while others have longer histories dating to earlier human settlement. Not all of these species represent a serious threat to the stability of diverse native plant communities. A few that might present such a risk should receive urgent attention by land managers, whether the goal should be population growth containment, reduction, or complete eradication.

Ginger thomas (*Tecoma stans*), a fast-growing shrub *not* recorded by Woodbury and Little in the 1970's, likely dispersed downwind in recent decades from St. Croix's east end. Presently, it occupies 8 of 34 mapping units, mostly on the south-facing slopes of the island's windward eastern flanks. Although its distribution is somewhat restricted at this time, this species is likely to spread rapidly throughout the island in the coming decades. It grows in extremely high densities in some locations. Over the longer term, such "opportunists" are typically out-competed in species-rich native communities. However, in the wake of long periods of over-grazing and rat infestation, the present sparseness of the Buck Island canopy and its short stature offer this shade-intolerant species a relatively open niche.

By contrast, the population of Tan-tan (*Leucaena leucocephala*), despite its high levels of dispersion (present in 56% of the mapping grids), is represented by few saplings and seedlings and its standing population is likely to decline on its own in coming years. Like Ginger Thomas it is a prolific seed producer, but its thick seed coat and impressive longevity in the soil seed bank confers an added dimension to Tan-tan as an invasive threat. Any natural or anthropogenic disturbance that opens the canopy invites the spread of this species.

Wild pineapple (*Bromelia pinguin*) and Aloe (*Aloe vera*) were planted by some of Buck Island's earlier residents above the west beach (cell 2) for ornament, medicine or livestock management purposes. These plants are relatively slow-spreading by virtue of the lack of seed set (by *Aloe vera*) and the dominance of proliferation by stolons rather than by sexual means. Despite the casual pace of dispersion, both species pose some threat to natural communities, as there seems to be little resistance to their advance on the part of their native competitors. Rather easily, *A. vera* may be completely eradicated by uprooting and bagging of individuals. Wild pineapple is well armed but has shallow fibrous roots. Removal of seed heads will slow its spread. Overturning it in the field during the dry season may be an alternative means of control if resources are unavailable for removing all bagged individuals from the island.

A third herbaceous monocot, the century plant (*Agave missionum*), was planted by NPS personnel working with volunteers in the early 1990's. This northern Virgin Islands native that does not occur naturally on St. Croix is an extremely important nectar source during the dry season for the indigenous fauna. *Agave missionum* is a sister species to *A. eggersiana*, a species deserving of federal listing as an endangered species. It is endemic to St. Croix. The exact rationale for planting *A. missionum* is unknown to the author, but for past several years Buck Island has served as a refuge for this species under siege by a parasitoid boll weevil introduced to the northern Virgins from Mexico, apparently via the Florida landscape industry. From the perspective of this author, establishing living collections, seed storage banks and

related ex situ conservation programs for *A. missionum* are appropriate management directions. Introducing *A. missionum* to one of the last protected refuges of its close relative, *A. eggersiana*, unnecessarily precludes a key conservation option for a critically imperiled species. The current distribution of *A. missionum* on the island (it occupies 3 mapping units) is limited and the size of most individuals is still manageable.

It is widely accepted by biogeographers that Genip (*Melicoccus bijugatus*) was introduced to the Virgin Islands prior to European contact by aboriginal settlers from South America. It is dispersed short distances by bats and pigeons. The Buck Island population is small and concentrated in the vicinity of the west beach picnic area (cells 2 & 3), and is likely therefore to have been established by island visitors or previous residents. Eradication should not present a problem.

Tamarind (*Tamarindus indica*) is distributed in about 25% of the mapping cells – all in the western and central zones of the island. While their historic significance as survey-marker specimens of the 17th and 18th centuries may present a management quandary for park officials, their great size and capacity to dominate locally are serious ecological concerns for the island's vegetation as a whole.

Coconut (*Cocos nucifera*) is a Pacific region species that is easily eradicated with a chain-saw. However, its popularity, ubiquity and ocean-dispersal characteristics all conspire to guarantee its return to the land manager's docket once it is removed.

An occasional arrival on beachheads throughout the region, Painkiller (Morinda citrifolia) was introduced to the Virgin Islands during the plantation era. It becomes prolific in basin environments near the coast, but only sparsely escapes into dry scrub areas.

At least five species of grasses have invaded various natural communities on the island. Guinea grass (*Urochloa maxima*) is found throughout the island and its removal would pose a challenge to managers – although it is large and easy to locate. Finger grass (*Chloris barbata*) and its close relatives reported from the island by Woodbury and Little, occur mostly along the trails and on the eastern slopes. Its slight habit makes its discovery more difficult. Panic grass (Panicum chapmani) and its relatives vary in size, but can be challenging to find as well. Hurricane grass tends to concentrate locally. It is small and probably more widespread than this study indicates because it was dormant during most field work. Egypt grass (*Dactyloctenium aegyptium*) is very small but probably not broadly distributed. It can be locally abundant in the picnic area.

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REFERENCES CITED

Acevedo-Rodriquez, P. 1996. Flora of St. John, U.S. Virgin Islands. Memoirs of The New York Botanical Garden, Vol. 78, Bronx, NY, USA. 581 pp.

Britton, N.L. 1918. The flora of the American Virgin Islands. Brooklyn Bot. Gard. Mem. 1:19-118.

Davis, J. 1998. Soil Survey of the U.S. Virgin Islands. USDA, Natural Resources Conservation Service.

Eggers, H.F.A. 1879. The flora of St. Croix and the Virgin Islands. U.S. Natl. Mus. Bull. Vol. 13, 133 p.

Gibney, E.F. A floristic inventory of Buck Island, St. Croix, U.S. Virgin Islands. NPS contract, May 1996. Unpublished.

Holdridge, L. R. 1967. *Life Zone Ecology*. Tropical Science Center, San Jose, Costa Rica. 206 Pp.

Millspaugh, C. F. 1902. Flora of the island of St. Croix. Field Columbian Mus. Bot. 1: 441-546.

Ray, G.J., F. Dallmeier and J.A. Comiskey. 1998. The structure of two subtropical dry forest communities on the island of St. John, U.S. Virgin Islands. In Dallmeier, F. and J.A. Comiskey, (eds) *Forest Biodiversity in North, Central, and South America, and the Caribbean: Research and Monitoring*, Man and the Biosphere Series, Vol. 21. UNESCO and the Parthenon Publishing Group, Camforth, Lancashire, UK.

Ray, G.J. and B.J. Brown. 1995. The structure of five successional stands in a subtropical dry forest, St. John, U.S. Virgin Islands. *Caribbean Journal of Science* 31(3-4):212-222.

West, H. 1793. Bidrag til Beskrivelse over Ste Croix med en kort udsigt over St. Thomas, St. Jean, Tortola, Spanishtown og Crabeneiland. Copenhagen, 363 p. [Ger. Ed., 274 p., Copenhagen, 1794.

Woodbury, R.O. and Weaver, P.L. 1987. *Vegetation of St. John and Hassel Island, US Virgin Islands*. Research/Resources Management Report SER-83. USDI, National Park Service, Atlanta, GA.

Woodbury, R.O., and E.L. Little. Jr. 1976. Flora of Buck Island Reef National Monument (U.S. Virgin Islands). USDA, Forest Service Research Paper ITF-19. Rio Piedras, Puerto Rico. 27 pp.

Appendix A. List of plant species recorded on Buck Island during this vegetation inventory.

No.	Scientific name	*Family*	Common name	Form
1	*Abrus precatorius*	*Fabaceae*	jumbie bead	liana
2	*Abutilon umbellatum*	*Malvaceae*		shrub
3	*Acacia tortuosa*	*Fabaceae*	twisted acacia	shrub
4	*Achyranthes aspera*	*Amaranthaceae*	better man better	shrub
5	*Adelia ricinella*	*Euphorbiaceae*	cotorro	tree
6	*Agave missionum*	*Agavaceae*	century plant	shrub
7	*Aloe vera*	*Asphodelaceae*	aloe	herb
8	*Amyris elemifera*	*Rutaceae*	torchwood	tree
9	*Antirhea lucida*	*Rubiaceae*	palo lloron	tree
10	*Argythamnia candicans*	*Euphorbiaceae*		shrub
11	*Avicennia germinans*	*Verbenaceae*	black mangrove	tree
12	*Ayenia insulaecola*	*Sterculiaceae*		shrub
13	*Boerhavia coccinea*	*Nyctaginaceae*	kalaloo bush	herb
14	*Boerhavia erecta*	*Nyctaginaceae*		herb
15	*Bothriochloa pertusa*	*Poaceae*	hurricane grass	herb
16	*Bourreria succulenta*	*Boraginaceae*	pigeon-berry	tree
17	*Bouteloua americana*	*Poaceae*	three-awn	herb
18	*Bromelia pinguin*	*Bromeliaceae*	wild pineapple	shrub
19	*Bunchosia glandulosa*	*Malpighiaceae*		tree
20	*Bursera simaruba*	*Burseraceae*	turpentine tree	tree
21	*Caesalpinia ciliata*	*Fabaceae*	yellow nicker	shrub
22	*Cakile lanceolata*	*Brassicaceae*		herb
23	*Canavalia rosea*	*Fabaceae*	bay bean	vine
24	*Capparis cynophallophora*	*Capparaceae*	Jamaica caper	tree
25	*Capparis flexuosa*	*Capparaceae*	limber caper	shrub
26	*Capparis indica*	*Capparaceae*	linguam, wh caper	tree
27	*Celosia nitida*	*Amaranthaceae*		shrub
28	*Celtis iquanaea*	*Ulmaceae*		liana
29	*Cenchrus echinatus*	*Poaceae*	sandbur	herb
30	*Centrosema virginianum*	*Fabaceae*		liana
31	*Chamaecrista glandulosa v. swartzii*	*Fabaceae*		shrub
32	*Chamaesyce mesembrianthemifolia*	*Euphorbiaceae*		subshrub
33	*Chloris barbata*	*Poaceae*	fingergrass	herb
34	*Chromolaena sinuata*	*Asteraceae*		shrub
35	*Cissus trifoliata*	*Vitaceae*	sorel vine	vine
36	*Cissus verticillata*	*Vitaceae*	pudding vine	vine
37	*Citharexylum fruticosum*	*Verbenaceae*	fiddlewood	tree
38	*Cleome viscosa*	*Capparaceae*		herb
39	*Clerodendrum aculeatum*	*Verbenaceae*	chuc chuc, haggarbush	shrub
40	*Coccoloba microstachya*	*Polygonaceae*	uvilla	tree
41	*Coccoloba swartzii*	*Polygonaceae*	ortegon	tree
42	*Coccoloba uvifera*	*Polygonaceae*	seagrape	tree
43	*Coccoloba uvifera x krugii*	*Polygonaceae*	hybrid seagrape	tree
44	*Cocos nucifera*	*Arecaceae*	coconut	tree
45	*Commelina erecta*	*Commelinaceae*	day-flower	herb
46	*Comocladia dodonaea*	*Anacardiaceae*	christmas-bush	shrub
47	*Conocarpus erectus*	*Combretaceae*	button-wood	tree
48	*Convolvulus nodiflorus*	*Convolvulaceae*		vine
49	*Corchorus hirsutus*	*Tiliaceae*	jack switch	shrub

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4	*Achyranthes aspera*	*Amaranthaceae*	better man better	shrub
5	*Adelia ricinella*	*Euphorbiaceae*	cotorro	tree
6	*Agave missionum*	*Agavaceae*	century plant	shrub
7	*Aloe vera*	*Asphodelaceae*	aloe	herb
8	*Amyris elemifera*	*Rutaceae*	torchwood	tree
9	*Antirhea lucida*	*Rubiaceae*	palo lloron	tree
10	*Argythamnia candicans*	*Euphorbiaceae*		shrub
11	*Avicennia germinans*	*Verbenaceae*	black mangrove	tree
12	*Ayenia insulaecola*	*Sterculiaceae*		shrub
13	*Boerhavia coccinea*	*Nyctaginaceae*	kalaloo bush	herb
14	*Boerhavia erecta*	*Nyctaginaceae*		herb
15	*Bothriochloa pertusa*	*Poaceae*	hurricane grass	herb
16	*Bourreria succulenta*	*Boraginaceae*	pigeon-berry	tree
17	*Bouteloua americana*	*Poaceae*	three-awn	herb
18	*Bromelia pinguin*	*Bromeliaceae*	wild pineapple	shrub
19	*Bunchosia glandulosa*	*Malpighiaceae*		tree
20	*Bursera simaruba*	*Burseraceae*	turpentine tree	tree
21	*Caesalpinia ciliata*	*Fabaceae*	yellow nicker	shrub
22	*Cakile lanceolata*	*Brassicaceae*		herb
23	*Canavalia rosea*	*Fabaceae*	bay bean	vine
24	*Capparis cynophallophora*	*Capparaceae*	Jamaica caper	tree
25	*Capparis flexuosa*	*Capparaceae*	limber caper	shrub
26	*Capparis indica*	*Capparaceae*	linguam, wh caper	tree
27	*Celosia nitida*	*Amaranthaceae*		shrub
28	*Celtis iquanaea*	*Ulmaceae*		liana
29	*Cenchrus echinatus*	*Poaceae*	sandbur	herb
30	*Centrosema virginianum*	*Fabaceae*		liana
31	*Chamaecrista glandulosa v. swartzii*	*Fabaceae*		shrub
32	*Chamaesyce mesembrianthemifolia*	*Euphorbiaceae*		subshrub
33	*Chloris barbata*	*Poaceae*	fingergrass	herb
34	*Chromolaena sinuata*	*Asteraceae*		shrub
35	*Cissus trifoliata*	*Vitaceae*	sorel vine	vine
36	*Cissus verticillata*	*Vitaceae*	pudding vine	vine
37	*Citharexylum fruticosum*	*Verbenaceae*	fiddlewood	tree
38	*Cleome viscosa*	*Capparaceae*		herb
39	*Clerodendrum aculeatum*	*Verbenaceae*	chuc chuc, haggarbush	shrub
40	*Coccoloba microstachya*	*Polygonaceae*	uvilla	tree
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42	*Coccoloba uvifera*	*Polygonaceae*	seagrape	tree
43	*Coccoloba uvifera x krugii*	*Polygonaceae*	hybrid seagrape	tree
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45	*Commelina erecta*	*Commelinaceae*	day-flower	herb
46	*Comocladia dodonaea*	*Anacardiaceae*	christmas-bush	shrub
47	*Conocarpus erectus*	*Combretaceae*	button-wood	tree
48	*Convolvulus nodiflorus*	*Convolvulaceae*		vine
49	*Corchorus hirsutus*	*Tiliaceae*	jack switch	shrub

Appendix A. List of plant species recorded on Buck Island during this vegetation inventory.

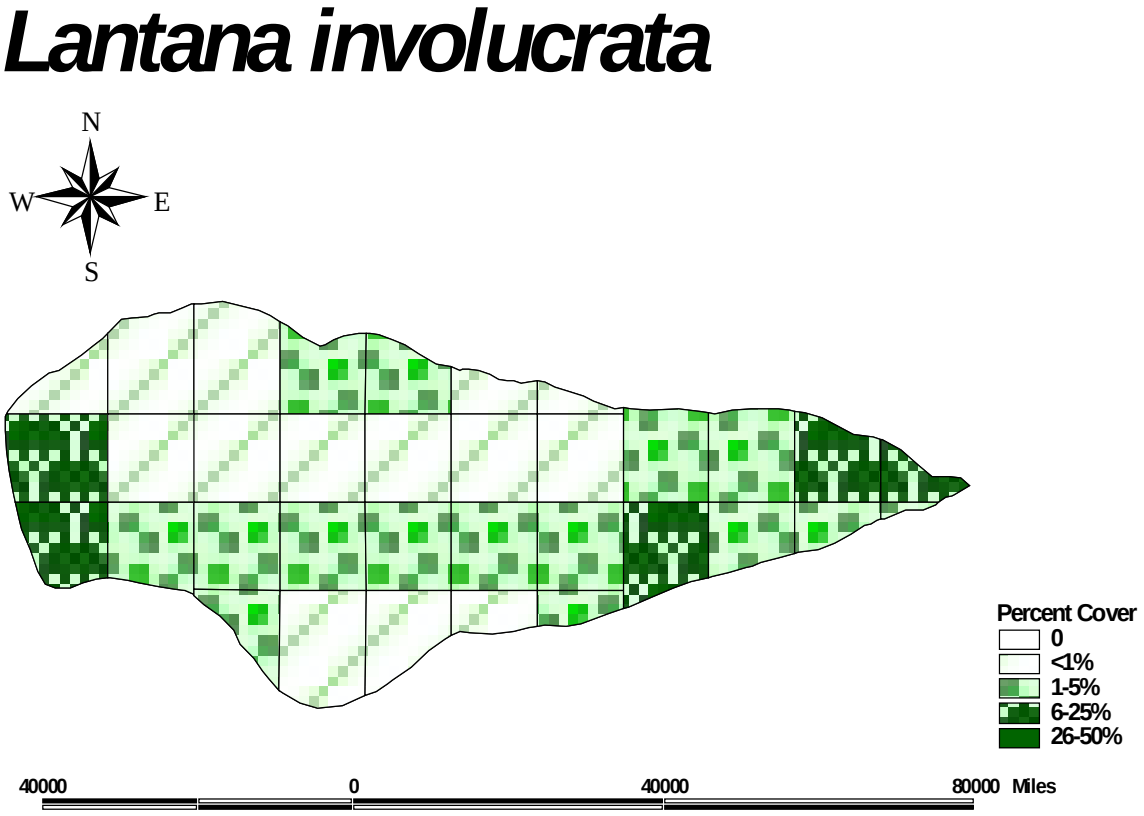
No.	Scientific name	*Family*	Common name	Form
50	*Cordia dentata*	*Boraginaceae*	toothed manjack	tree
51	*Cordia ricksecker*i	*Boraginaceae*	orange manjack	tree
52	*Cordia stenophylla*	*Boraginaceae*		shrub
53	*Crossopetalum rhacoma*	*Celastraceae*	Florida crossopetalum	shrub
54	*Croton astroites*	*Euphorbiaceae*	white maran	shrub
55	*Croton betulinus*	*Euphorbiaceae*	broom bush	shrub
56	*Croton discolor*	*Euphorbiaceae*		shrub
57	*Croton flavens var. rigidus*	*Euphorbiaceae*	yellow maran	shrub
58	*Cyperus ligularis*	*Cyperaceae*	sedge	herb
59	*Cyperus planifolius*	*Cyperaceae*	sedge	herb
60	*Dactyloctenium aegyptium*	*Poaceae*		shrub
61	*Dalbergia ecastaphyllum*	*Fabaceae*		shrub
62	*Dendropemon caribaeus*	*Loranthaceae*	mistletoe	herb
63	*Desmanthus virgatus*	*Fabaceae*		shrub
64	*Digitaria insularis*	*Poaceae*	Sourgrass	herb
65	*Distictis lactiflora*	*Bignoniaceae*		liana
66	*Duranta erecta*	*Verbenaceae*		shrub
67	*Erithalis fruticosa*	*Rubiaceae*	black torch	shrub
68	*Ernodea littoralis*	*Rubiaceae*		shrub
69	*Erythroxylum brevipes*	*Erythroxylaceae*	brisslet	tree
70	*Eugenia axillaris*	*Myrtaceae*	white stopper	tree
71	*Eugenia cordata*	*Myrtaceae*	heart-leaved eugenia	shrub
72	*Eugenia procera*	*Myrtaceae*		shrub
73	*Eugenia rhombea*	*Myrtaceae*	spiceberry eugenia	tree
74	*Exostema caribaeum*	*Rubiaceae*	princewood	tree
75	*Ficus citrifolia*	*Moraceae*	shortleaf fig	tree
76	*Flueggia acidoton*	*Euphorbiaceae*		shrub
77	*Galactia dubia*	*Fabaceae*	iron weed	vine
78	*Galactia striata*	*Fabaceae*		vine
79	*Guaiacum officinale*	*Zygophyllaceae*	lignumvitae	tree
80	*Guapira fragrans*	*Nyctaginaceae*	black mampoo	tree
81	*Gymnanthes lucida*	*Euphorbiaceae*	oysterwood	tree
82	*Helicteres jamaicensis*	*Sterculiaceae*	cow bush, cat's balls	shrub
83	*Heliotropium angiospermum*	*Boraginaceae*	eyebright	herb
84	*Heliotropium ternatum*	*Boraginaceae*		shrub
85	*Heteropteris purpurea*	*Malpighiaceae*		liana
86	*Hippomane mancinella*	*Euphorbiaceae*	manchineel	tree
87	*Hymenocallis caribaea*	*Amaryllidaceae*	spider-lily	herb
88	*Ipomoea eggersii*	*Convolvulaceae*	Eggers' morning glory	vine
89	*Ipomoea pes caprae*	*Convolvulaceae*	Beach morning glory	vine
90	*Iresine angustifolia*	*Amaranthaceae*		shrub
91	*Jacquinia arborea*	*Theophrastaceae*	barbasco	shrub
92	*Jatropha gossypifolia*	*Euphorbiaceae*	belly ache bush	shrub
93	*Krugiodendron ferreum*	*Rhamnaceae*	ironwood	tree
94	*Laguncularia racemosa*	*Combretaceae*	white mangrove	tree
95	*Lantana involucrata*	*Verbenaceae*	sage	shrub
96	*Lantana urticifolia*	*Verbenaceae*		shrub
97	*Launeae intybacea*	*Asteraceae*	wild lettuce	herb
98	*Leptochloa filiformis*	*Poaceae*	sprangletop	herb

Appendix A. List of plant species recorded on Buck Island during this vegetation inventory.

No.	Scientific name	*Family*	Common name	Form
99	*Leucaena leucocephala*	*Fabaceae*	tan tan, wild tamarind	tree
100	*Macfadyena unguis-cati*	*Bignoniaceae*	cat-claw, doxantha	liana
101	*Malpighia infestissima*	*Malpighiaceae*	stingingbush	tree
102	*Mammilaria nivosa*	*Cactaceae*	wooly-nipple cactus	herb
103	*Melicoccus bijugatus*	*Sapindaceae*	kenip	tree
104	*Melocactus intortus*	*Cactaceae*	turk's cap cactus	shrub
105	*Melochia tomentosa*	*Sterculiaceae*	broom weed	shrub
106	*Metastelma grisebachianum*	*Asclepiadaceae*		vine
107	*Mollugo nudicaulis*	*Molluginaceae*		herb
108	*Morinda citrifolia*	*Rubiaceae*	noni, painkiller	
109	*Oplonia spinosa*	*Acanthaceae*	espinosa	liana
110	*Opuntia dillenii*	*Cactaceae*	prickly pear	shrub
111	*Opuntia repens*	*Cactaceae*	jumping cactus	shrub
112	*Opuntia rubescens*	*Cactaceae*	tuna	tree
113	*Opuntia triacantha*	*Cactaceae*		shrub
114	*Panicum chapmani*	*Poaceae*		herb
115	*Paspalum laxum*	*Poaceae*		herb
116	*Pectis linifolia*	*Asteraceae*		herb
117	*Petiveria alliacea*	*Phytolaccaceae*		shrub
118	*Pilosocereus royenii*	*Cactaceae*	pipe-organ cactus	tree
119	*Piscidia carthagenensis*	*Fabaceae*	fish poison tree	tree
120	*Pisonia subcordata*	*Nyctaginaceae*	loblolly	tree
121	*Pithecellobium unguis-cati*	*Fabaceae*	bread-and-cheese	shrub
122	*Plumbago scandens*	*Plumbaginaceae*		shrub
123	*Plumeria alba*	*Apocynaceae*	frangipani, milktree	tree
124	*Portulaca oleracea*	*Portulacaceae*	purslane	herb
125	*Psychilus macconnelliae*	*Orchidaceae*		herb
126	*Rauvolfia viridus*	*Apocynaceae*	bitter bush	shrub
127	*Rhynchosia minima*	*Fabaceae*		vine
128	*Rivina humilis*	*Phytolaccaceae*		shrub
129	*Rochfortia acanthophora*	*Boraginaceae*		shrub
130	*Samyda dodecandra*	*Flacourtiaceae*	guayabilla	shrub
131	*Scaevola plumieri*	*Goodeniaceae*		shrub
132	*Schaefferia frutescens*	*Celastraceae*	Florida boxwood	tree
133	*Serjania polyphylla*	*Sapindaceae*	basket wiss	liana
134	*Sesuvium portulacastrum*	*Aizoaceae*	sea purslane	herb
135	*Setaria setosa*	*Poaceae*		herb
136	*Sidastrum multiflorum*	*Malvaceae*		shrub
137	*Sida repens*	*Malvaceae*		herb
138	*Sideroxylon obovatum*	*Sapotaceae*	mastic, arana gato	tree
139	*Siphonoglossa sessilis*	*Acanthaceae*		herb
140	*Solanum racemosum*	*Solanaceae*	cankerberry	shrub
141	*Spartina patens*	*Poaceae*		herb
142	*Sporobolus virginicus*	*Poaceae*	seashore dropseed	herb
143	*Stigmaphyllon emarginatum*	*Malpighiaceae*		liana
144	*Stylosanthes hamata*	*Fabaceae*		herb
145	*Suriana maritima*	*Simaroubaceae*	baycedar	shrub
146	*Tabebuia heterophylla*	*Bignoniaceae*	pink cedar	tree
147	*Talinum paniculatum*	*Portulacaceae*		shrub

Appendix A. List of plant species recorded on Buck Island during this vegetation inventory.

No.	Scientific name	*Family*	Common name	Form
148	*Tamarindus indica*	*Fabaceae*	tamarind	tree
149	*Tecoma stans*	*Bignoniaceae*	ginger thomas	shrub
150	*Tephrosia cinerea*	*Fabaceae*		vine
151	*Teramnus labialis*	*Fabaceae*	blue wiss	vine
152	*Thespesia populnea*	*Malvaceae*	Haiti-haiti, otaheita	tree
153	*Tillandsia recurvata*	*Bromeliaceae*	Old man hand	herb
154	*Tillandsia utriculata*	*Bromeliaceae*		herb
155	*Tournefortia microphylla*	*Boraginaceae*		vine
156	*Tragia volubilis*	*Euphorbiaceae*	bran nettle, 7-minute itch	vine
157	*Tragus berteronianus*	*Poaceae*	burgrass	herb
158	*Turnera diffusa*	*Turneraceae*	old woman broom	shrub
159	*Turnera ulmifolia*	*Turneraceae*	elm-leaved turnera	shrub
160	*Urochloa maximum*	*Poaceae*	guinea-grass	herb
161	*Wedelia fruticosa*	*Asteraceae*		shrub
162	*Zanthoxylum spinifex*	*Rutaceae*		shrub
	TOTALS			

total specimens collected = 262
total species collected = 158
Species encountered, not collected = 6 (Mammillaria nivosa, Cocos nucifera, Guapira fragrans, Agave missionum, Ipomoea triloba, Jacquemontia pentanthos)
Number of taxa documented 164

Appendix B. Distribution map of *Lantana involucrata*, showing relative coverage values among 34 mapping units on Buck Island, St. Croix in 2002.