

BIOLOGICAL INVENTORY OF SINT EUSTATIUS



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SUMMARY

St. Eustatius is one of the islands that form the inner arc of the Lesser Antilles. Together with St. Kitts and Nevis it is situated on a shallow bank, the St. Kitts bank. Like Saba, St. Eustatius is of recently volcanic origin. Its area of 21 km² is somewhat larger. Three landscape types can be distinguished: the northwest hilly area of The Mountains, the flat center called The Kultuurvlakte and the southeast part with the volcano The Quill. The Quill is a 600 meters high cone-shape volcano with a wide round crater. Its beautiful, even form is unique. On the south side of the island two almost vertical limestone slabs, White Wall and the Sugar Loaf, recline against The Quill. The island is almost completely surrounded by a sheer cliff coast. Some locations have beaches. About 1900 people live on St. Eustatius, the majority in Oranjestad on the west side of the Kultuurvlakte. Agriculture is very limited. The lower parts of the island are partly used for keeping cattle. An oil-transshipment company occupies a large part of The Mountains.

According to the system of Köppen the climate of St. Eustatius falls between a savanna- and monsoon-climate, but The Quill arrests the clouds, causing more rainfall on the top than on the plains and The Mountains. These climatological differences lead to a great variety of plants and plant-communities on The Quill.

There are 482 known wild plant-species of St. Eustatius: 448 seed-plants and 34 ferns and related species. Among the plants there is one island-endemic species: the recently rediscovered *Ipomoea sphenophylla*. Five plant-species have a limited geographical distribution including only a few islands, and 3.7% of the species is endemic to the Lesser Antilles and the Virgin Islands.

The moss flora consists of 40 leaf mosses and 20 liverworts.

There is a series of plant communities on The Quill, varying from thorny bushes in the lower parts to **evergreen seasonal forests** in the crater and **elfin forest** on the highest parts of the crater's rim. The evergreen seasonal forest is very similar to rainforest and is rich in species. The elfin forest is an unusual type of forest, which develops only under specific climatological circumstances. The **dry evergreen forest** on the rim of the crater, the **mountain shrubbery** on the east slope and the **semi-evergreen seasonal forest** on the northwest slope are relatively undisturbed. A few of these forest formations only cover a small area, which makes them vulnerable. This is especially true for the elfin forest. Semi-evergreen forest has become rare regionally as a result of human activity. The vegetation of The Mountains has been seriously disturbed in the past by agriculture and cattle breeding, however, at present these activities are very limited here. The vegetation is recovering. Both The Quill and The Mountains have a high scenic value.

As can be expected on a small island, the fauna of St. Eustatius has few species. Among the vertebrates the birds form the largest group, represented by 26 local and nesting species. In addition 28 migrating species are present every year on a temporary basis. In general birds are abundant on St. Eustatius, especially in the relatively undisturbed areas of The Quill and The Mountains. Low hunting pressure and absence of the Mongoose are favorable circumstances responsible for this. With 13 species, amphibians and reptiles are

the next largest group of vertebrates. The only mammals of St. Eustatius are bats. They belong to five different species.

There are no island endemics among the vertebrates. The Red-bellied Racer *Alsophis rufiventris* can only be found on Saba, in addition to St. Eustatius, and is considered an endangered species because of its much-reduced range. Several vertebrates are endemic to the Lesser Antilles and the Virgin Islands, either at the species level or the subspecies level: two bats, ten birds, one amphibian and six reptiles. The ground-lizard *Ameiva erythrocephala*, the tree-lizard *Anolis bimaculatus bimaculatus*, the geckos *Sphaerodactylus sputator* and *S. sabanus*, the subspecies of the bats *Ardops nichollsi montserratensis*, of the Trembler *Cincloerthia ruficauda pavid*a and the tree-lizard *Anolis watti* *schwartzi* have a geographical range which is limited to only a few islands. The Trembler *Cincloerthia ruficauda pavid*a and the Purple-throated Carib *Eulampis jugularis* are birds that are regionally limited almost completely to the habitats of the rain forest and the mountain formations. The possibly endangered Bridled Quail *Dove Geotrygon mystacea*, and the Red-necked Pigeon *Columba squamosa* regionally scarce because of hunting, are found in and around The Quill. One possibly endangered seabird breeds on St. Eustatius: the Red-billed Tropicbird *Phaeton aethereus mesonauta*. The now regionally rare Antillean iguana **Iguana delicatissima**, locally endangered through hunting, is still present with a small population.

About the invertebrates not much more is known than 81 names.

In the past the nature of St. Eustatius was disturbed mainly by activities related to agriculture and cattle-breeding. Nowadays destruction of habitat, by increasing industrial development and unregulated tourism development, pollution and roaming cattle, create the most important threats.

Since the sixties several persons and authorities argued for the establishment of a nature reserve comprising the area of The Quill, White Wall/Sugar Loaf and the area of The Mountains. Concrete plans of Stinapa N.A to that end however, remained unsuccessful. Renewed efforts of the foundation Stenapa, in 1997 led to the proclamation of an island regulation, protecting large parts of the areas mentioned, and also protecting the Stata Morning Glory *Ipomoea sphenophylla*, the orchids and the Antillean Iguana. For effective nature conservation management on St. Eustatius, ongoing vegetation research and floristic surveys are necessary as well as research into the status of the island populations of regionally scarce and of endangered animals.

For the present a few conclusions can be drawn regarding the conservation of the biodiversity. For this conservation it is necessary to protect large contiguous areas. To ensure this objective the following areas are recommended for the conservation and management of nature: the area of **The Quill, White Wall and Sugar Loaf** and what is left of **The Mountains**. The coastal strip at **Concordia Bay** and the **locations where Ipomoea sphenophylla is growing** should be protected on account of their particular value.

INTRODUCTION

PROJECT BACKGROUND

The three Windward Islands of the Netherlands Antilles have a rich, interesting and above all beautiful nature. On all three islands tourism is an important, if not the most important pillar of the economy. Tourism depends largely on what nature has to offer. This is one of the urgent reasons to protect and manage these natural resources. Up until now however, there is no nature policy in these islands and only one nature-park has been established: the Saba Underwater Park. On land practically all nature is still unprotected and unmanaged. Three NGO's: the Saba Conservation Foundation, the St. Eustatius National Parks Foundation and the St. Maarten Natural Heritage Foundation, are presently working to attain responsible nature management. This requires first of all knowledge of the nature in question. Without thorough knowledge it is difficult to select the best conservation areas, and to set conservation priorities and management guidelines.

Flora and fauna have been the subject of various studies in the past. The results of these studies are the building blocks for effective nature management. Carmabi has launched the project "Biological Inventory of the Windward Islands of the Netherlands Antilles (St. Maarten, Saba, St. Eustatius)" to review all existing information in order to support the activities of the island management organizations. This project was subsequently completed in cooperation with the three island foundations mentioned above.

PROJECT OBJECTIVE

Knowledge of the flora and fauna of the Windward Islands of the Netherlands Antilles is scattered and mostly dates back a long time. The purpose of this project is to collect a database of the references concerning the terrestrial natural resources of the islands complemented with field-observations in order to provide up-to-date documentation of the biological diversity and conservation values. At the same time an attempt is made to indicate threats and conservation priorities.

IMPORTANCE FOR ANTILLEAN NATURE

This project provides island and national NGO's with basic information necessary to:

- a. Identify terrestrial conservation and research priorities
- b. Raise funds for nature preservation
- c. Increase environmental awareness of the public

The information compiled will also be integrated in the "Netherlands Antilles Natural Heritage Database" at Carmabi, which is part of an international network of databases of natural resources initiated by the American organization: "The Nature Conservancy".

Working-contacts between the island NGO's and Carmabi were used for this project.

This strengthened the cooperation based on shared interests. Close cooperation between the NGO's of the Netherlands Antilles is of utmost importance to the optimum use of the limited and scattered funds that are available for nature conservation.

METHODS

LITERATURE RESEARCH

Many aspects of nature in the Windward Islands have been studied in the past. For the survey of the biodiversity of these islands the results of these studies, as published in several books, articles and reports, were used. At the end of this report you can find a list of the consulted literature. Oral statements and personal observations complemented the information from literature. The majority of the literature can be found in the library of the Carmabi Institute in Curaçao.

FIELDWORK

In order to obtain up-to-date information on the biodiversity of the islands a working visit was made to each of the three islands in August 1996. Although a one-week stay per island proved to be very short, a considerable amount of additional data was collected. Practically all conservation areas suggested in the past were visited to consider their current situation. In addition an effort was made to determine the occurrence and status of endemic and/or endangered plants and animal species. Plants were identified using several flora and plant books (Stoffers, 1962-1984; Arnoldo, 1971; Howard, 1974-1989; Liogier, 1985-1995; Coomans and Coomans-Eustatia, 1988); birds were identified using two bird books (Voous, 1983; Evans, 1990); and to identify reptiles two works were used (Lazell, 1972; Schwartz and Henderson, 1991).

During each field expedition land snails and butterflies were collected to extend the knowledge of the invertebrates of the islands. All specimens were sent to relevant authorities, the butterflies after tentative identification by Dr. A. Debrot at Carmabi. Many photographs were taken during these work-visits. A selection was made to illustrate the accompanying text. These are in the back of the report.

INVENTORY OF THE FLORA

For the inventory of the flora lists of plant species were made. It was decided to make lists per island, in order to facilitate island use. The lists enumerate ferns and related plants (Pteridophyta) and seed plants (Spermatophyta) (Appendix I). The grasses (Gramineae) and sedges (Cyperaceae) are listed separately (Appendix II). The records are based primarily on species mentioned in the "Flora of the Netherlands Antilles" by Dr. A. L. Stoffers (ed.). This Flora however, does not include all families. For the absent families the "Flora of the Lesser Antilles" by Richard A. Howard was used.

Cultivated species have not been included, only when clearly established after running wild. The Flora by Howard includes all families and with certain families (all Pteridophyta and the families Gramineae, Cyperaceae and Rubiaceae) a comparison was made between both Floras. This made it apparent that the two authors in many cases use different names for the same species. These cases are indicated in the lists. Various old names, which Stoffers uses in his publication of 1956, are also listed after the more recent name.

The authors also did not always list the same species for each of the different islands. With respect to the families mentioned above, species that are mentioned in the Flora by Howard but not in the Flora by Stoffers were added to the lists. The records are undoubtedly incomplete, since there are other families from which Howard mentions species that Stoffers doesn't. At the time of my visit on the islands I also found several species which neither author mentions. During further fieldwork the records undoubtedly will become longer. In addition to the scientific names of the species the popular names as far as known, are also listed in the records as well as the geographic range of distribution. With respect to the moss flora (Bryophytes) of St. Eustatius, the names can be found in the report of Augustinus *et al.* (1985).

INVENTORY OF THE FAUNA

Species of the fauna were also listed per island (Appendix III). It concerns mainly vertebrates, because this group is the best known. Of the invertebrates only names and a few collecting sites are known. However, literature references about this have been included in the list of references. An exception was made for the diurnal butterflies, because it concerns unpublished data that were made available by L.D. Miller and J.Y. Miller. These data can be found in Annex IV.

In the lists of vertebrates, as with the plants, in addition to the scientific names, the common names, and where different from the common name, the island common name is listed. Also the geographic area of distribution is listed. With several animal groups the islands are inhabited by subspecies (=geographical varieties). These are also mentioned in the records with their geographical area of distribution.

Furthermore for each species the habitat is indicated, and in the last column information is given about places of occurrence and the conservation status. In the case of rare and/or endangered species in each case it is indicated whether these animals were found in August 1996.

REPORTING

This report presents an overview of what is known of the flora, fauna and vegetation of St. Eustatius up until now. The information collected during the one-week working visit in August 1996, was incorporated in this. On the basis of the most recent data an attempt is made to indicate the status of the different nature elements, while the most important threats are also discussed. In addition a short review is given of the efforts in the area of nature conservation management. In several areas the data are still incomplete. Wherever additional research is desirable for the benefit of nature conservation management, this is indicated. Finally a number of areas are indicated whose conservation is considered important to the conservation of biodiversity.

GENERAL INFORMATION

LOCATION OF THE ISLAND



Photo 1. St. Eustatius seen from Saba.

St. Eustatius is located at 17.30° N and 73° W (De Palm, 1985). The island, like Saba and St. Maarten is part of the island arc of the Lesser Antilles, extending from the Virgin Islands to Venezuela (Westermann, 1957). In fact there are two arcs to distinguish: an inner-arc and an outer-arc. St. Eustatius and Saba are the most northerly islands of the inner-arc (fig.1). Grenada borders the inner-arc in the south. St. Maarten is part of the outer-arc, which consists of the islands Sombrero up to and including Marie Galante. The islands of the inner-arc are geologically younger than the islands of the outer-arc and have geologically young volcanoes lacking on the islands of the outer-arc. Because of this the geological structure of the islands of the inner and outer-arc are different. The islands are located within seeing distance of each other (photo 1). The distance from St. Eustatius to St. Maarten is 63.0 km. (in a straight line), St. Eustatius and Saba are 33.6 km from each other (Land Register, 1997).

CLIMATE

The climate determines to a major extent which plants and animals are able to live in a certain part on earth. The climate of St. Eustatius is tropical (the average temperature in the coldest month lies above 18° C) and according to the system of Köppen falls between a savanna- and monsoon-climate (Stoffers, 1956). The average rainfall is 1072.7 mm per year (1881-1980, Oranjestad) (De Palm, 1985), but the deviation of yearly rainfall is large. The monthly rainfall is very irregular too. No clear wet or dry season can be distinguished. The average values over a large number of years do indicate however, that in February, March and April the least rain falls while in the most rain falls in August, September, October and November. In those wet months the average rainfall is twice as much as in the dry months. Lazell (1972) calls St. Eustatius and Saba “Snag-islands. This type of island has one high peak (more than 600 m high) that arrests (snags) a few clouds and is able to hold on to them mainly because of evaporation from the island itself. The lowlands of these islands are very dry. Indeed the low-lying rain-stations (at 25 and 40 m) in St. Eustatius collect on average a little less rain than a higher-lying station (at 300 m) (Braak, 1935 in Augustinus *et al*, 1985). According to Veenenbos (1955) The Quill (above 400 m) has an average rainfall of 1500-2000 mm, however, there are no rain-stations above 400 m, so numbers cannot confirm this.

The average yearly temperature is 25.7° C (1959-1980; De Palm, 1985). The change in temperature all through the year is small. January is on an average the coldest month with 25.2° C and August is on an average the hottest month with 28.0° C. The temperature drops however, with increasing height. It is to be expected that on average on top of The Quill the temperature is a little lower.

The dominant wind direction is east. All three Windward Islands are situated in the Atlantic hurricane zone. On average one tropical storm or hurricane passes at a distance of less than 200 km each year. Once every 4 or 5 years hurricane conditions occur (De Palm, 1985).

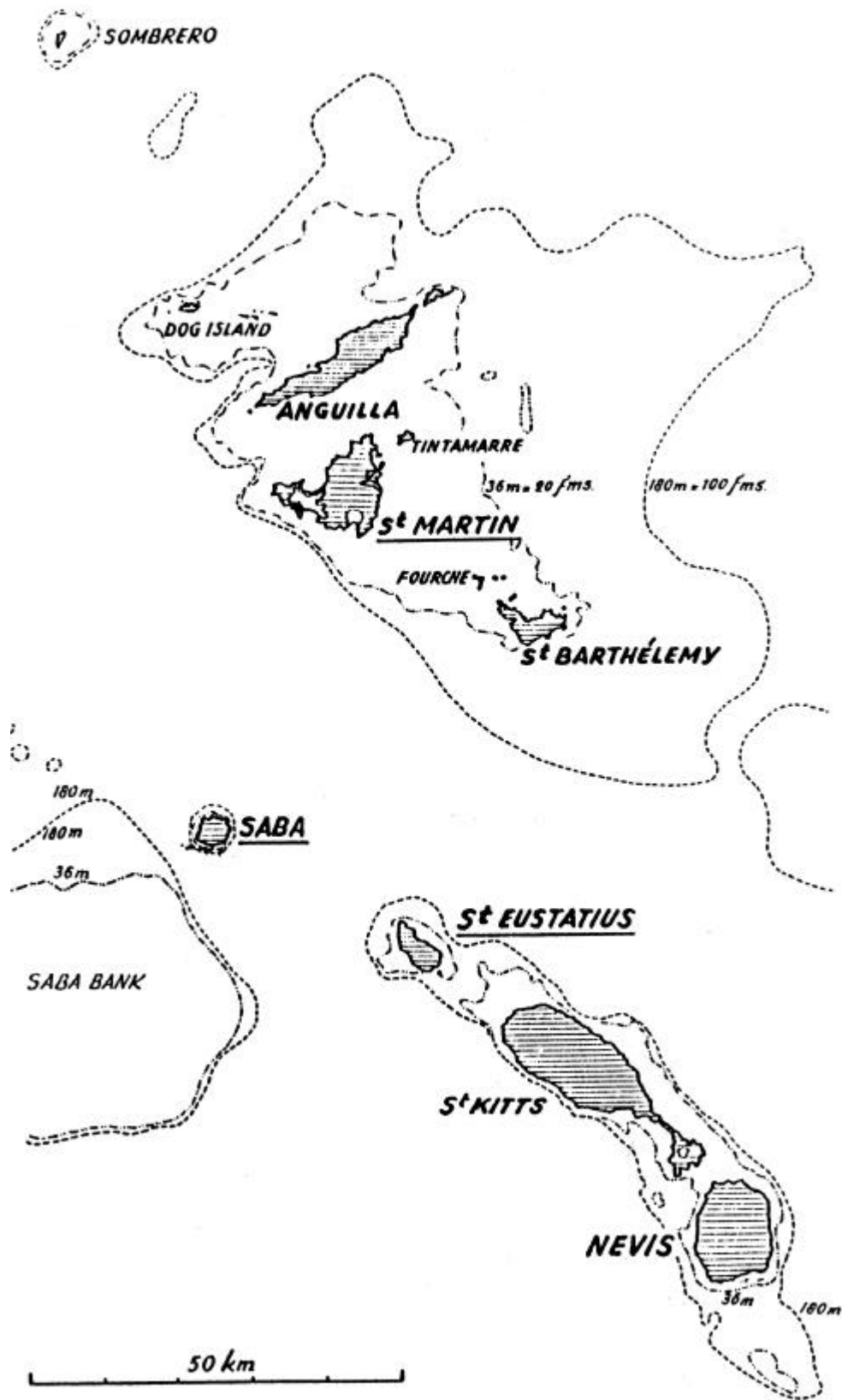


Figure 1. Location of the Windward islands of the Netherlands Antilles (after Wagenaar Hummelinck, 1953).

TOPOGRAPHY

The island of St. Eustatius has an area of roughly 21 km² (Westermann and Kiel, 1961). It is more or less egg-shaped with the broadest part in the southeast (fig.2). The northwest and the southeastern part are hilly and the area in between is almost flat (photo 2.). The hills in the northwestern part are called The Mountains or The Little Mountains. They are rather low, but they have steep slopes. The highest top is “Boven” (294 m). “Ber-



Photo 2. The Mountains seen from Boven, with the Quill in the background

gje”, also called Little Mountain, is 223 m high and Signal Hill reaches up to 134 m. There are two well developed valley systems in The Mountains (Westermann and Kiel, 1961), that run into Venus Bay at the east side and Tumble Down Dick Bay at the west side. Along the west coast of The Mountains there is a very steep cliff. The east-side coast is irregular. At Jenkins Bay and Tumble Down Dick Bay there are cobbled beaches. The beach at Venus Bay is covered with cobbles and sand.

The southeastern part of the island only consists of one hill, a sleeping volcano with a wide and deep crater, The Quill. This name is a corruption of the old Dutch name “De Kuil”. Westermann and Kiel (1961) call this volcano perhaps the most beautiful example of this type in the Antilles. The edge of the crater is highest at the eastern side (601 m) and lowest at the Westside (378 m). The bottom of the crater lies at 273 m. above sea level. The craters shape is almost round. The slopes on the inside are extremely steep. The outer slopes are more gradual, however several steep ravines cut into them. The northwestern slope of The Quill changes into an almost flat area that extends to The Mountains.

This low-lying, slightly sloping plain between both hill areas is called “De Kultuurvlakte”. In the center of this plain a small round hill can be distinguished, known as the Round Hill. All along the southeastern and center part of the island the coast consists of a sheer cliff, on average about 30 meters high (Westermann, 1957), except at Billy Gut and Concordia Bay where you can find sand beaches. At the base of the cliff on the west side of The Kultuurvlakte below Oranjestad there is also a sandy beach.

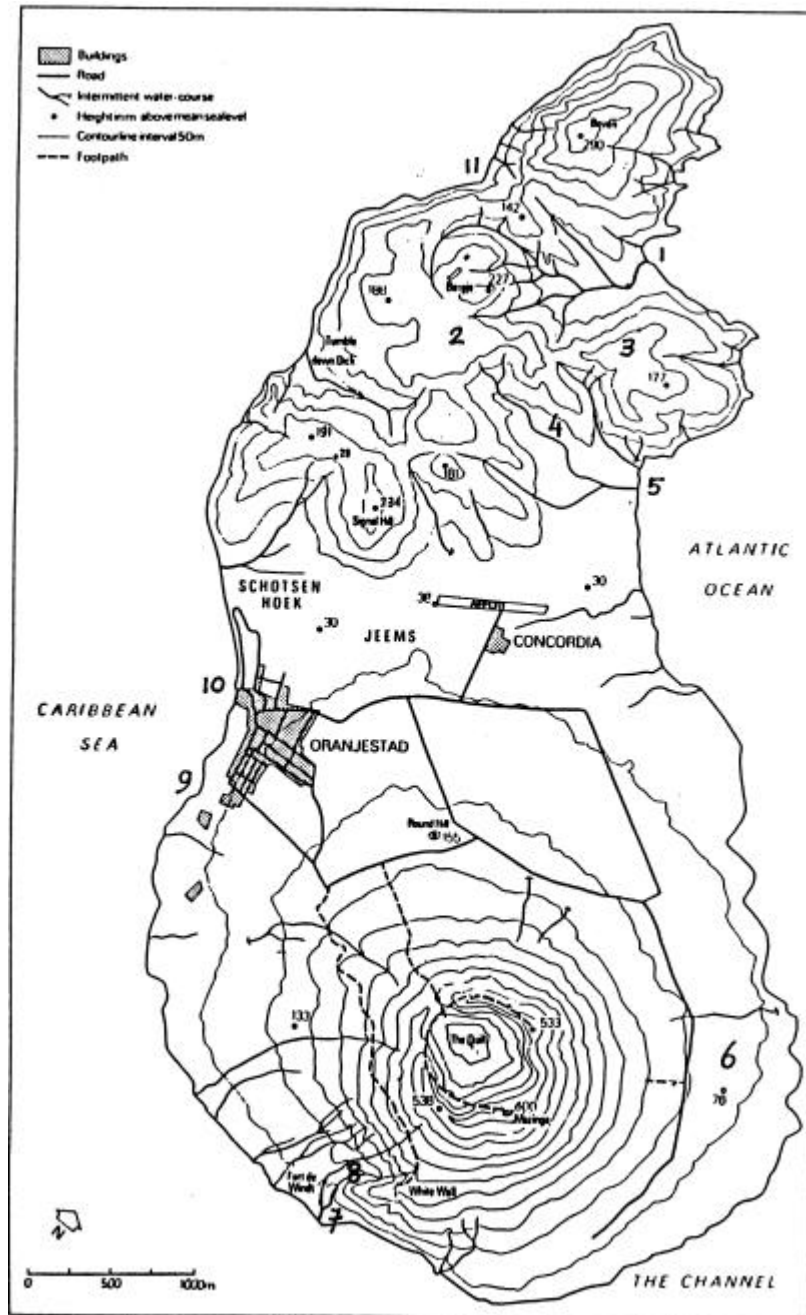


Figure 2. Topographical map of Sint Eustatius.

- | | |
|------------------------|--------------------|
| 1. Venus Bay | 7. Sugar Loaf |
| 2. The Mountains | 8. Big gut |
| 3. Gilboa Hill | 9. Gallows Bay |
| 4. Zeelandia | 10. Oranjestad Bay |
| 5. Concordia Bay | 11. Jenkins Bay |
| 6. Behind the Mountain | |

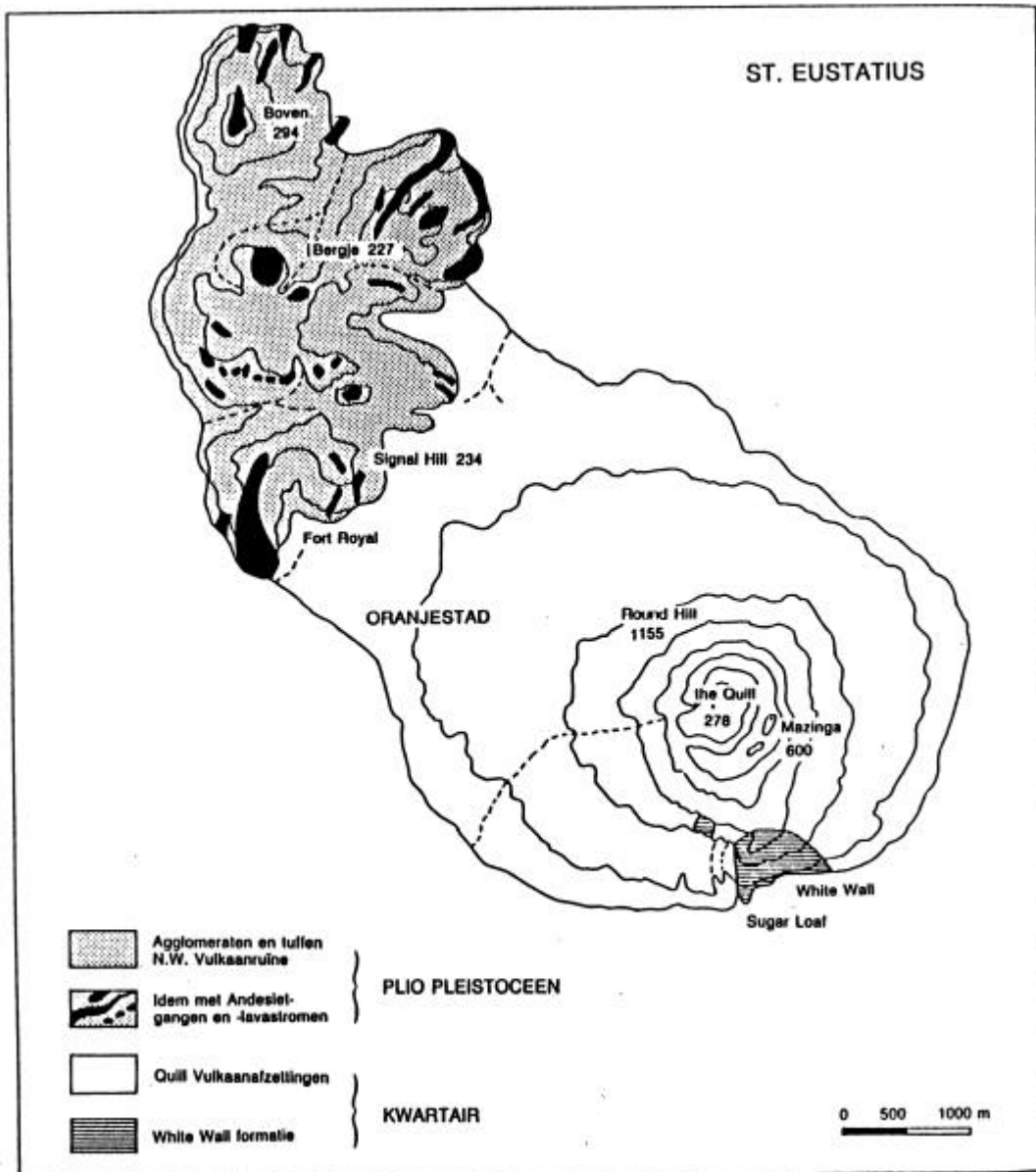


Figure 3. Geological map of Sint Eustatius (after de Palm, 1985).

GEOLOGICAL HISTORY

Besides climate, the geographic relief and the soil conditions of the island determine its natural vegetation. Relief and soil condition are a reflection of its geological history.

St. Eustatius is a young volcanic island. It's composed of two volcanic complexes (Westermann, 1957). The eldest complex takes up the northwestern part of the island (fig. 3). It is irregular in shape. The first eruptions of the volcano that lay in this part of the island go back probably to the late Pliocene (Westermann and Kiel, 1961) (Pliocene: 16 million – 1 million years ago). It is assumed that the volcanic activity stopped in the early Pleistocene era. Bergje or Little Mountain is the remnant from the central crater of the old volcano (Westermann and Kiel, 1961). Boven and Gilboa Hill are made of petrified streams of lava. The horseshoe ridge Panga, between Fort Royale and Signal Hill is what remains of the base of the volcano. Several parts of the complex are made of ejecta, other parts from agglomerates, tuffs and lava. The original volcano could have been more than 600 meters high. Erosion leveled out the whole complex.

The whole southeastern part of the island is taken up by one big volcano, The Quill that is unique because of its even form. The Quill is also a beautiful example of an ash-volcano (Westermann, 1957). This one originates from the Holocene (Holocene: 10.000 years – present day). The unique form took shape in the last phase, when there was no lava-flow anymore, but magma was exploding and blown away as a spray by gas pressure. Especially the last eruptions must have been violent, since only loose material was thrown out. The entire top, crater, slopes and the base of the volcano are covered with loose material. The largest blocks are lying on the edge and on the bottom of the crater. Lower on the slopes the material gets finer and The Kultuurvlakte is covered for the greater part by volcanic ashes. The finer material was blown in western direction by the trade wind. Thus the base of the volcano lies on the remains of the old volcano. The various strata of ejected material can still clearly be seen in the coastal cliff. The Round Hill probably is a small adventitious crater, which afterwards was covered with ashes. In historical times there were no further eruptions. The cone of the volcano however, shows little erosion, which indicates a relatively recent sleeping phase (Westermann, 1957).

On the south side of The Quill we find a totally different rock of sedimentary origin. These are two slabs reclining against the slope of the volcano: The White Wall (270 m) and The Sugar Loaf (73 m) (photo 3). They consist of limestone originating from corals and shells, alternated with some volcanic material. Their age is determined to be roughly 70.000 to 21.000 years old (Westermann and Kiel,



Photo 3. White Wal and Sugar Loaf seen from Big Gut.

1961). The limestone was originally formed at the bottom of a shallow sea near the then still small Quill-volcano. The horizontally constructed slabs were forced upwards during the active phase of the volcano and were turned over by a plug of lava (now hardened) (Westermann, 1969).

Together with St. Kitts and Nevis, St. Eustatius lies on a sub-marine bank with a maximum depth of 180 m (fig.1). According to Westermann (1957) the island could be descending. Among other things, the fact that the sea now washes several ruins from the old town center dating back to the 18th century would indicate that.

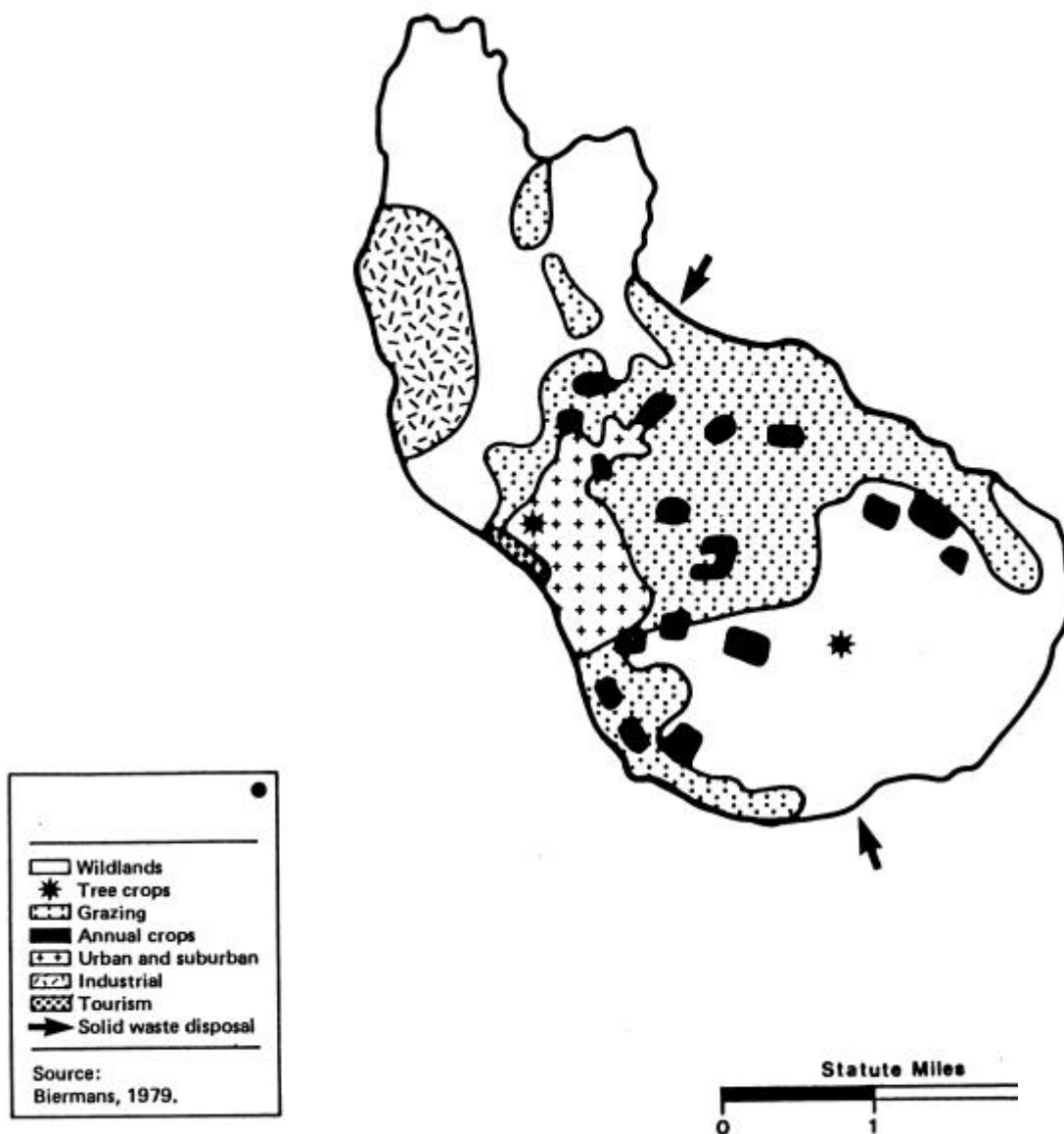


Figure 4. Land use on Sint Eustatius (after ECNAMP, 1980).

ECONOMICAL DEVELOPMENT AND LAND USE

The present biodiversity is not only the result from natural factors. It was affected highly by human activity. The main impact started with the European colonization of the island.

In the 17th century St. Eustatius was an island of plantations, which mainly supplied sugarcane (De Palm, 1985). Later on the island developed into a staple-place and a slave trade center. In the early 19th century there were 40 plantations and practically



Photo 4. Aerial photograph of the Oil Terminal and Tumble Down Dick Bay.

all available agricultural area was used. Sugarcane was cultivated till high up the slopes. In the last century plantation agriculture declined. Efforts were made for the revival, even right up to the beginning of this century with the cultivation of sisal which remained an important export-product till 1928 (Stoffers, 1960), but finally plantation agriculture in St. Eustatius was finished. An effort to cultivate fruit trees in the crater of The Quill failed too. After the establishment of the oil-industries on Curaçao and Aruba many men moved away (De Palm, 1985). In 1910 there were still 1325 people on St. Eustatius, but this number dropped down to 970. Subsequent agricultural projects, like the Concordia project in 1940 in which the government made small inexpensive agricultural lots available and the initiative of a group of Dutch farmers to set up several large mixed industries, failed. Yet, at the end of the 70's there was a revival in agriculture and cattle breeding. At that time the farmers were united in an agricultural cooperation and received assistance from the government garden. One of the problems in agricultural development was large landownership. In 1983 about 50% of the land was owned by a very small number of families.

From 1965 onward a number of governmental projects such as the airport in 1971, were implemented to improve infrastructure. The runway came to lie straight across The Kultuurvlakte. The Sint Eustatius Historical Foundation made an effort to restore historical buildings and improve the townscape. The island became more attractive to tourists and American pensioners. The number of hotels increased and a separate district with luxury houses was developed. In 1983 Stinapa in cooperation with Sint Eustatius Historical Foundation constructed some 12 nature trails for tourists.

The oil transshipment company Statia Terminals N.V. is a new economical pillar that became operational in 1982. This company is located in the western part of The Mountains (photo 4). On the coast a large deep-water pier and a floating mooring point were constructed. The population of the island increased again through tourism and industrial activity. In 1995 roughly 1900 people were living in Statia (CBS, 1996).

Summarizing, it can be said that most of the area of St. Eustatius was formerly used for agriculture, cattle breeding and charcoal-production. At present there is hardly any agriculture (fig. 4). The Kultuurvlakte and the lower slopes of The Quill are still used for grazing, especially for cattle (fig. 4 and personal observation, 1996) (photo 5). There are still groups of free-foraging goats ranging about, even on top of The Quill. Stoffers (1960) men-



Photo 5. The Kultuurvlakte.

tions charcoal burning on the lower slopes of The Quill. The majority of the people live in Oranjestad, built on The Kultuurvlakte on the western coast. New districts were developed between Oranjestad and the airport. Luxury houses were built on the northern slope of The Quill. The oil-transshipment company occupies more and more of the western part of The Mountains. Oil-transshipment takes place at Tumble Down Dick Bay.

BIOLOGICAL SURVEY

THE FLORA



Photo 6. Island endemic *Ipomoea sphenophylla*, *Statia Morning Glory*.

According to the data of Stoffers (1962,1963, 1966, 1973,1979, 1980,1982 and 1984) and based on personal field observations (1966) the Flora of St. Eustatius consists of 482 wild plants: 34 ferns and related species (Pteridophyta) and 448 seed-plants (Spermatophyta) of which 85 are monocotyledons and 362 are dicotyledons (Appendix I and II). Of the 85 monocotyledons 44 belong to the Cyperaceae and Gramineae (Appendix II).

One island-endemic of St. Eustatius is known, a creeper of the family Convolvulaceae: *Ipomoea sphenophylla*, *Statia Morning Glory* (photo 6). This plant has in the past been gathered only a few times, for the first time in 1884 by Suringar (Howard, 1995) and later on by Boldingh. Of the scarce collected material Howard could only retrieve a sterile specimen. In 1989 Powell and Staples searched for this plant at the known sites in vain. Only in 1994 two Statians (Edwin Gawlik and Jan Faber) found flowering specimens on the Statia Terminal grounds. These and all subsequent locations lie in a small area to the south of Little Mountain (Faber, pers. com. and

Roger, personal observation, 1996) Howard proposes to consider the material gathered later by Jan Faber as neotype.

Stoffers mentions another island-endemic *Mapourea eustatiana* in his publication of 1956. This probably referred to another species because in part III of the "Flora of the Netherlands Antilles" of 1984, in which the genus *Mapourea* is described, Stoffers does not mention the species, nor as a synonym. Howard also does not mention the species in his "Flora of the Lesser Antilles".

Of the remaining 481 wild plant species of St. Eustatius, 85 species have a geographical distribution limited to the West Indies (in certain cases including Southern Florida). Of these, 18 can be found only in the Lesser Antilles (including the Virgin Islands) (3.7%) and of those 18 species, 5 are limited to only a few islands.

The next species have a small geographical distribution in the Lesser Antilles.

★ *Agave van grolae* is limited to the islands of the St. Kitts Bank. Howard (1979) mentions no locations.

- ★ *Eupatorium macranthum* can also be found on Saba in addition to the islands of the St. Kitts Bank. Howard (1989) mentions no locations.
- ★ *Begonia retusa*, Mountain Manna, can also be found on Saba, St. Kitts, St. Barths and Montserrat aside from St. Eustatius. This plant is only known from St. Eustatius through Boldingh and v. Groll-Meyer (Stoffers, 1966). Boldingh visited St. Eustatius in 1906 and v.Groll-Meyer from 1904 till 1906 (Stoffers, 1956). According to Stoffers the habitat of this plant is the mountain forest. Boldingh indicates the top of The Quill as location.
- ★ *Myrcia citrifolia* var. *imrayana*, Redwood, or Birds Cherry, can be found in Netherlands Antillean Windward Islands as well as in Guadeloupe and Martinique. Stoffers (1982) mentions several locations, all on the outer slopes of The Quill and at White Wall. The most recent collection of this plan dates from 1953.
- ★ *Aristida suringari* is limited to St. Eustatius, St. Maarten, Aruba, Bonaire, St. Croix and St. Thomas. Boldingh found this grass between Oranjestad and Fort de Windt and Suringar on White Wall and Sugar Loaf (Stoffers, 1963). Suringar collected plants on St. Eustatius in 1885 (Stoffers, 1956).

The variety of mosses and liverworts of St. Eustatius is known from the study of Wiersma (Wiersma, 1984; Augustinus et. al, 1985). The moss flora of the island consists of 40 species and the liverwort flora of 20 species. The moss flora of St. Eustatius is characterized by a high percentage of neo-tropical species and an extreme low rate of endemism. There are no island-endemic species among the mosses. Wiersma only rates one species, *Splachnobryum obtusum*, as a Caribbean species (West Indies and the bordering coasts of Central and South America). The remainder of the species has a wider distribution, over the American continent, or over the world. Wiersma (1984) observes that species with a small geographical distribution (southern neo-tropical and Caribbean) are limited to the higher areas (above 600 m).



Photo 7. Mushrooms from the Northwest slope of The Quill.

In August 1996 an extremely large number of fungi and mushroom species were found in the humid forests of The Quill (photo 7), but no information about these could be found in the literature.

Based on the available data it is difficult to say which species should be considered locally rare. Of many species no locations are known or the information is very old. However, it can be noted that a number of species is limited to humid forest-like habitats that can only be found on the highest parts of The Quill. This applies for instance to the Araceae (photo 8) and most of the ferns, orchids, Piperaceae and mosses. The only family recently reported on is the orchid family, thanks to the research of Jan Faber. Of the 141 species known in the Lesser Antilles, 16 can be found in St. Eustatius (Howard, 1974; Faber, pers. com., 1996). These all grow in the higher parts of the island; 9 species only on The Quill, 1 species only in The Mountains and 5 species both on The Quill and in The Mountains (Faber, pers. com., 1996) (photo 9). For one species mentioned by Howard, no locations are known.



Photo 8. Aracaeid in the semi-evergreen seasonal forest on the Northwestern slope of The Quill.



*Photo 9. Flowering orchid on a hill at Zeelandia (*Oncidium urophyllum*)*

THE VEGETATION

The present-day vegetation of St. Eustatius is determined first by the prevalent climate and second by anthropogenic factors. Based on the climate, a vegetation adapted to endure dry periods is expected. This applies to the major part of the island. However, on the higher parts of The Quill there is more rainfall than elsewhere (section climate), and thus a richer vegetation can be found caused by the more humid circumstances.

Stoffers distinguishes the following vegetation-types in St. Eustatius (fig.5):

Climatic communities

- ❑ Optimal formation
 - ⊙ Pioneer forest
- ❑ Montane formations
 - ⊙ Montane thickets (1)
 - ⊙ Elfin woodlands (2)
- ❑ Seasonal formations
 - ⊙ Evergreen seasonal forest (3)
 - ⊙ Semi-evergreen seasonal forest (4)
 - ⊙ Deciduous seasonal forest (5 + 6)
 - ⊙ Thorny woodlands (7)
 - ⊙ Leucaena thickets
 - ⊙ Croton tickets (8)
- ❑ Dry evergreen formations
 - ⊙ Dry evergreen forest (9)
 - ⊙ Evergreen bushland (10)
 - ⊙ Thorny woodland
 - ⊙ Croton thickets
 - ⊙ Littoral woodland (12)
 - ⊙ Vegetation of the rock pavement (13)
 - ⊙ Vegetation of the rocky slopes
- ❑ Edaphic communities
 - ⊙ Strand scrub community (14)
 - ⊙ Hippomane woodland (15)

The Quill

The vegetation pattern on The Quill is complicated. This is caused on the one hand by differences in altitude and related differences in climatological circumstances, on the other hand by anthropogenic influence that did not have the same impact everywhere. According to Stoffers (1956) there are no less than eight different types of vegetation. Below is a short characterization of each type.

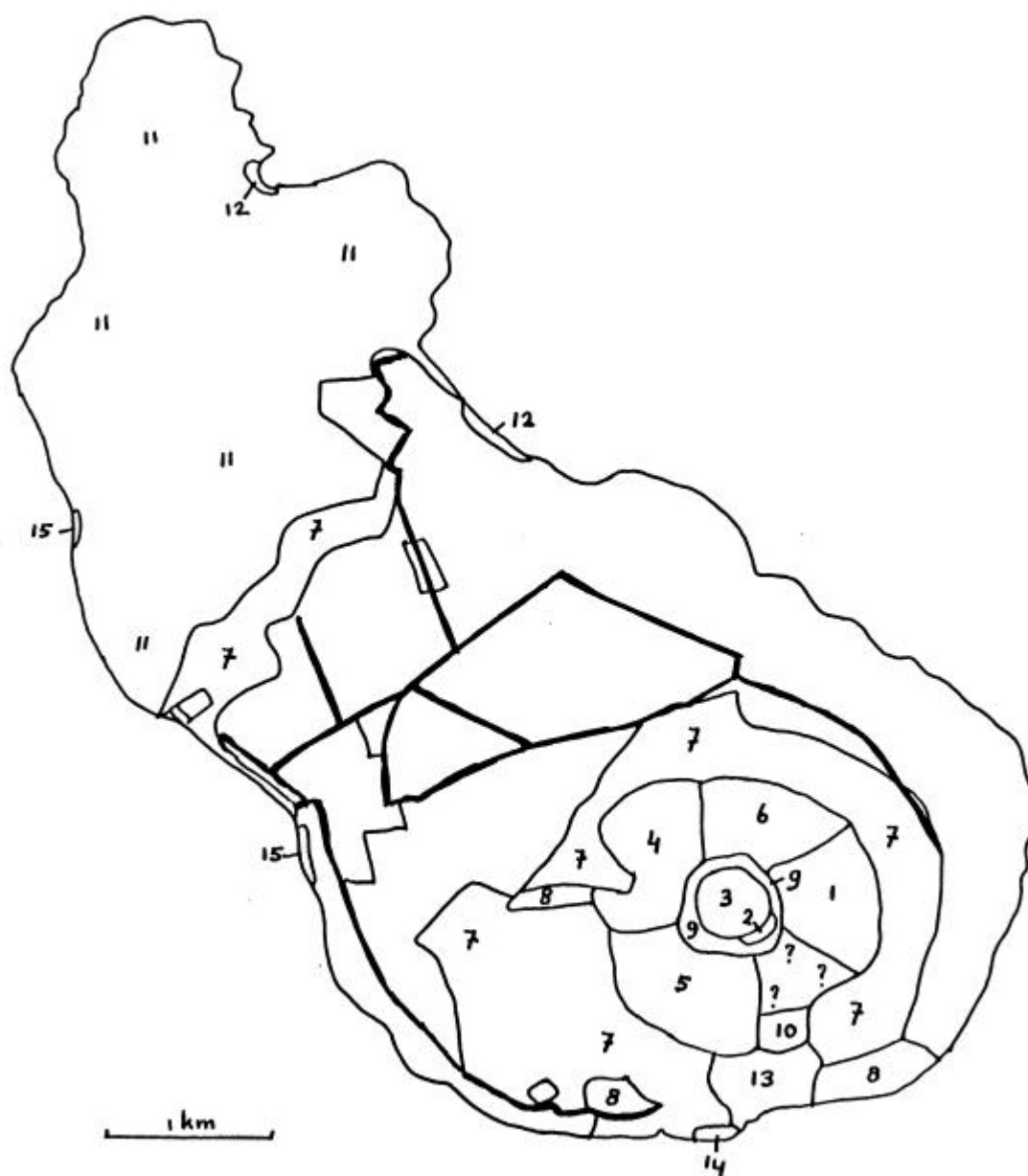


Figure 5. Vegetation map of Sint Eustatius (after Stoffers, 1956).
 The numbers of the vegetation types are explained in the text.

Evergreen seasonal forest

Inside the crater of The Quill, from 273 meters above sea level up to the rim evergreen seasonal forest is found (photo 10). This rich forest type is closest to the rainforest. Three layers of trees can be distinguished plus a bush layer and a herb layer

Lianas and creepers are numerous, but epiphytes are rather rare. The top layer of trees rises up to 30 to 40 meters. This layer consists of only few species, among which are the Cotton Tree (*Ceiba pentandra*) with its buttress roots (photo 11), the Yellow Plum (*Spondias mombin*) and *Phoebe elongata*. Among the shrubs Piperaceae are prominent and in the herb layer ferns are prominent. A relatively rich moss flora exists, however liverworts are scarce (Augustinus et al, 1985).

Among this vegetation human influence is apparent because several crop plants can be found running wild, such as coffee (*Coffea arabica*), cocoa (*Theobroma cacao*) and Mamaya (*Mammea americana*). These are the remnants of the cultivation at the beginning of this century (Stoffers, 1960). Part of the crater is sometimes used for the cultivation of bananas (Augustinus et al, 1985). Several paths and open places cut in the forest at the bottom of the crater were observed in August 1996, probably for the benefit of visitors.



Photo 10. Evergreen seasonal forest in the crater of The Quill.



Photo 11. Tree with buttress roots (probably *Ceiba pentandra*) in The Quill crater.

Pioneer forest

In some places in the crater pioneer forest can be found. Pioneer forest develops in open places, caused by falling trees. Stoffers (1956) considers this type of vegetation amongst the optimum formations because it usually occurs in rainforests. Typical pioneer species are Wild Banana (*Heliconia bihai*) and the Trumpet Tree (*Cecropia schreberiana*).

Elfin forest

Elfin forest only covers a small area (not more than 4 or 5 hectare) on the highest part of The Quill's crater rim (600 m.) situated at the southeast part of the crater. This type of forest can also be found in Saba and elsewhere in the Caribbean, however only at the tops and the upper slopes of the highest peaks and mountain ridges (Stoffers, 1956). The elfin forest in St. Eustatius is different from the elfin forest in Saba. In St. Eustatius wild balsam (*Clusia major*) dominates this forest. There are few other tree species, among which the most striking is *Ternstroemia peduncularis*. The trees in the forest are very crooked and knotty, do not grow higher than 5 meters and have usually formed knee-like buttress roots. They are burdened with epiphytic mosses. However, mainly leaf-mosses as distinct from the Saban elfin forest where liverworts dominate. One liverwort does contribute much to this vegetation's appearance, i.e. the *Frullania* hanging down from the branches (Augustinus et al , 1985). The herb layer is well developed with for instance Begonias and Piperaceae. The elfin forest in St. Eustatius has to be considered very vulnerable because of its extremely small area. The Augustinus report *et al* (1985) mentions a fire that happened a few years earlier (in 1980-1981, the time the research took place?) that seriously damaged the elfin forest. The recovered vegetation is said not to be typical for the area.

Dry evergreen forest

On the outer rim of the crater, higher than 350 meters, evergreen forest is found (photo 12). It is clearly different from the vegetation lower on the slopes. Many evergreen trees grow here, among others from the genus *Maytenus*, *Guapira* and *Capparis*. In the herb layer Myrtaceae dominate. Especially Birds Cherry (*Myrcia citrifolia*) is abundant. Epiphytic Araceae (*Anthurium*, *Philodendron*), orchids (*Epidendrum*) and Bromelia (*Tillandsia*) are relatively abundant, particularly in the southeast direction. Where the forest is less dense there is a wealth of herbs: Begonias, Orchids, *Anthurium* and ferns (Stoffers, 1960). According to Augustinus a new analysis of this type of vegetation is necessary because of the large number of herbs.

The climatological circumstances at the craters rim are more favorable to mosses than lower on the slopes: there is a high humidity and also a high intensity of light (Augustinus et al, 1985). This is reflected in the richest moss flora of the island (both the dry evergreen forest and the elfin forest), both with respect to leaf mosses as well as liverworts. According to Augustinus et al, (1985) the rim of the crater is the only location



Photo 12. Dry evergreen forest on the rim of the crater, with bromeliads and *Clusia major*.

where liverworts growing on leaves were found. However, no mosses were collected on the northern and eastern slopes of The Quill, and according to Stoffers (1956) this type of liverwort should also occur in the montane thickets on the outer eastern slope.

Montane thickets

From a height of 250-350 m the vegetation on the leeward and that on the windward side of the volcano differ. On the leeward side seasonal formations are found, while on the windward side a montane formation is found, i.e. a form of montane thicket. This vegetation typically only has one tree layer. The species of this tree layer are evergreens with thin boles and small crowns. The bush layer here has been replaced by a rich herb layer with *Anthurium cordatum*, Mountain Manna (*Begonia Retusa*) and Mountain Grass (*Scleria lithosperma*). This vegetation type is also rich in mosses (Stoffers, 1956). During the work of Augustinus *et al.* no mosses were collected here, but Stoffers (1956) mentions that the tree leaves are usually covered with liverworts.

Semi-evergreen seasonal forest



Photo 13. Semi-evergreen forest.

Stillmore or less original semi-evergreen seasonal forest covers the northwestern slope (photo 13). Stoffers (1956) calls this forest the best example of semi-evergreen seasonal forest of the windward islands of the Netherlands Antilles. Two tree layers can be distinguished, a shrub layer and a sparse bottom vegetation. Most adult trees have low branches and umbrella-shaped crowns. Lianas are abundant, but epiphytes are relatively scarce. Some of the larger trees have buttress roots, e.g. the Cotton Tree (*Ceiba pentandra*). Other dominant trees are: white Cedar (*Tabebuia heterophylla*), Locust tree (*Hymenea courbaril*), Yellow plum (*Spondias mombin*) and the Gum tree (*Bursera simaruba*). The moss flora is relatively rich, the liverwort flora somewhat less so (Augustinus *et al.*, 1985). This forest type has largely been destroyed on the Caribbean islands by the impact of human activities (Janzen, 1998). It has often been degraded to brushwood after repeated cutting of trees. In St. Eustatius too people have impacted this forest type: Stoffers (1956) saw

recently cut trees, to be used for charcoal production.

Nowadays these activities are probably much less common. The forest now seems in good condition and recovering from past disturbance. During the fieldwork in the area in August 1996, a fair number of fallen trees were seen, to be sure, but none of them had been cut down. They were mostly the result of hurricane Luis.

Deciduous seasonal forest

At the same altitude on the southern and southwestern slopes a vegetation type is found that Stoffers (1956) classified as probably deciduous seasonal forest. More deciduous species are found in deciduous seasonal forest than in semi-evergreen seasonal forest. Mappo (*Pisonia subcordata*) dominates the tree layer, making up more than 50 % of the vegetation. The brush layer is very dense and quite variable in composition. In more open areas Bromeliads and cacti cover the bottom. In several places Mimosa (*Leucaena leucocephala*) dominates, indicating past use for agriculture.

According to Augustinus *et al.* (1985) this vegetation type needs reinterpretation based on a larger number of surveys. Both the number of true mosses and number of liverworts here is lower than in the semi-evergreen seasonal forest (Augustinus *et al.*, 1985).

The upper parts of the northern slope are covered with secondary vegetation derived from seasonal forest.

Thorny woodland

Below 250 m altitude only thorny woodland is found, derived from seasonal formations (photo 14). The vegetation here has felt the greatest impact from human activities, and climatological conditions are less favorable as well. In thorny woodland, Casha (species of the genus *Acacia*) forms 20-80 % of the vegetation. On the western side of The Quill, Mimosa (*Leucaena leucocephala*) takes second place. Other important species are West Indian Cherry (*Malpighia emarginata*) and Black Cherry (*Randia aculeata*). Cacti also occur in this vegetation type. On the eastern side, species from arid vegetation types accompany the *Acacia* shrubs, such as species of the genus *Capparis*. Few mosses occur in thorny woodland (Augustinus *et al.*, 1985).



Photo 14. Thorny woodland with *Pilocereus royeri* and *Leucaena leucocephala*.

The most important vegetation types of The Quill are the elfin forest, montane thicket, evergreen and semi-evergreen seasonal forest, and the dry evergreen forest. Their importance comes from their relative rareness, and relatively slight degree of disturbance, their high degree of phytodiversity and their high perceptual value. Because of the high diversity in vegetation types, the over-all plant diversity of the volcano is very high. Since dry tropical forests have been seriously impacted by human activities worldwide, and have for instance

all but disappeared in Central America and certain areas of South America (Janzen, 1988; Ceballos, 1995), conservation of these forest formations is important.

The vegetation of the hard to reach southeastern slope of The Quill was not classified by Stoffers (1956), nor was it visited in August 1996)

Grazing lands

In the areas used for grazing of cattle, such as the Kultuurvlakte, Zeelandia and Behind the Mountain, grassland alternates with brushwood (photo 15), in which the Snakeberry tree (*Rauvolfia viridis*), West Indian Cherry (*Malpighia emarginata*) and Persian lilac (*Clerodendron aculeatum*) (photo 16) are common (per. obs., 1996). In rainy periods many herbs grow and flower here.



Photo 15. Grazing land in the area Behind the Mountain.



Photo 16. Persian Lilac (*Clerodendrum aculeatum*).

The Mountains

Looking at Stoffers' 1956 map of the vegetation of St. Eustatius, we see that the area of The Mountains in the northwestern part of the island is almost completely covered with a vegetation type classified by Stoffers as secondary woodland derived from a forest type somewhere between seasonal forest and dry evergreen forest (11). On the side of the Kultuurvlakte this changes to

thorny woodland vegetation, a seasonal formation. The whole area was used for agriculture and animal husbandry in the past and still clearly showing its influence. The present vegetation varies from place to place, both in structure and composition (Augustinus *et al.*, 1985). In the valley at Gilboa Hill the remains of past plantation culture are visible as sisal plants growing wild. The dominating vegetation type is abundant in acacias. In some valleys where water collects after rain showers, trees grow that prefer a moister habitat. These are the remains of past forest (Stoffers, 1960). They are mixed however, with trees from elsewhere, such as the sugar apple (*Annona squamosa*) and the Kinnup tree (*Melli-*

cocca bijuga). The ground under the trees is usually covered with prickly pears of the genus *Opuntia*. Vines such as the Passionflower (*Passiflora sp.*) and the Cockspur (*Pisonia aculeate*) are abundant. The steep slopes are generally covered with bushes, dominated by Wild sage (*Lantana spec.*). The moss flora in The Mountains is poor, both in true mosses and in liverworts.

Although the vegetation in the area of The Mountains has had a strong anthropogenic influence and cannot be considered rare, the areas outside the property of the Oil Terminal are today relatively undisturbed. The area also has great scenic value.

White Wall and Sugar Loaf

Evergreen bush land

The White Wall and the Sugar Loaf both consist almost completely of limestone while the rest of St. Eustatius is volcanic in origin. The vegetation too is different from the rest of the island. On top of the White Wall it is xerophytic in character. Stoffers (1956) classified it as evergreen bush land, belonging to the dry evergreen formations. This vegetation type is common in the Antillean islands, but only on limestone substrates. A layer of bush-like trees of about 4 m height can be distinguished, with a few higher emergent trees. Several species of this vegetation type are also found in littoral woodland. Many species with compound leaves are microphyllous. The leaves are scaly-rough, glossy or fleshy.

Vegetation of the rock pavement

On the steep walls of White Wall and Sugar loaf, only few plants can grow. This rock pavement vegetation (photo 17), belonging to the evergreen formations, is composed of only few species among which are *Strumfia maritiima*, Sea Grape (*Coccoloba uvifera*) and Bitter Pod (*Urechites lutea*).

Although the vegetation on White Wall and Sugar Loaf cannot be considered regionally rare, it is rare at the island level as well as for the Dutch Windward Islands.



Photo 17. White Wall

Coasts

Littoral woodland

Along the coast a few different vegetation types are found. Littoral woodland, considered by Stoffers (1956) to be part of the dry evergreen formations, is only found at Concordia Bay and Venus Bay. In a strip behind the beach at Concordia Bay, this vegetation is very dense and about 3 m high. Sea Grape (*Coccoloba uvifera*) dominates. In addition a few specimens of Waru (*Hibiscus tiliaceus*) and *Thespesia populnea* are present.

At Venus Bay this vegetation type has a different composition. It is poor in species and consists almost completely of low, wind-flattened bushes of Button Wood (*Conocarpus erecta*).

Beach vegetation and Hippomane woodland

Edaphic communities are also uncommon on St. Eustatius. Stoffers (1956) distinguishes two types: Beach scrub community and Hippomane woodland. The first is found on the pebble beach at Fort de Windt, where Big Gut runs into the sea. White Lavender (*Argusia gnaphalodes*) and *Euphorbia mesembrianthemifolia* are important species here.

According to Stoffers (1956), hippomane woodland was found between Oranjestad and Gallows Bay, and at Tumble Down Dick Bay. This last location has now been severely disturbed by the activities of the Oil Terminal.

All these coastal communities are rare for the island and scenically valuable

THE FAUNA

Mammals

As in St. Maarten and Saba, bats are the only mammals not imported by humans. It is curious that Husson (1960) does not list any species for St. Eustatius. He does mention that in the literature consulted by him only once reference was made to bats in St. Eustatius, i.e. by van Kol (1904, in Husson 1960): “ On the plain still stood the building of the former sugar factory ‘Fair Play’ ... and which now serves as housing for bats”. Knox Jones and Phillips (1970) list five species for St. Eustatius (Appendix III), one omnivorous, two fruit eating and two insectivores. None of these species is endemic to the island. However, two of them do have a limited geographic distribution as species and two as subspecies:

- ★ *Ardops nicholisi montserratensis*, the Tree Bat is a small fruit eater (Peterson *et al.*, 1996). As a species this bat is endemic for the Lesser Antilles, and the subspecies is only found on St. Eustatius and Montserrat.
- ★ *Brachyphylla cavernarum*, the St. Vincent Fruit-eating Bat is a fairly large omnivorous bat (Peterson *et al.*, 1996). Its geographic range extends from the Lesser Antilles to Puerto Rico and St. Croix.
- ★ *Tadarida brasiliensis antillarum*, the Free-tailed Bat, a small insectivore, can be found in hollow trees, caves, and clefts in the rocks, as well as under the roofs of buildings. The subspecies is limited to the West-Indies (Knox Jones en Phillips, 1970).
- ★ *Molossus molossus debilis*, the Mastiff Bat is also a small insectivore and often lives in buildings. This bat is very similar to the preceding one. The subspecies is limited to the northern islands of the Lesser Antilles (Knox Jones and Phillips, 1970).

The fifth species, *Artibeus jamaicensis*, the Jamaica Fruit-eating Bat, is a widely distributed species (Knox Jones and Phillips, 1970). It is a fairly large fruit-eater.

No information was found in the literature about locations of diurnal roosts or foraging areas of St. Eustatian bats. There are no caves on the island. This limits settlement of large groups of bats that live in colonies, such as the St. Vincent Fruit-eating Bat, a few hundred of which live in a small cave on St. Maarten (see report on St. Maarten). During my stay on St. Eustatius in August 1996 I have seen bats in Down Town, but it was not possible to determine which species they were. Nor did any of the several informants know of any diurnal roosts. Additional literature research and field study is needed. In particular it is important to know the population size of the Tree Bat, in view of the small distribution range of this species/subspecies. Apparently it is not common in the rest of its range either (Peterson *et al.*, 1996). Possible roosts of St. Eustatian bats are hollow trees, empty buildings, under the roofs of occupied buildings, and accessible water reservoirs.

The fruit-eating bats play an important role in the forest ecosystems for the distribution of seeds. Insectivores help to control insect populations. In this last case they are useful to agriculture and horticulture.

Birds

Compared to St. Maarten, St. Eustatius has less diversity in habitats, particularly in coastal habitats. In addition the island has a smaller surface area. These characteristics limit the number of birds found on the island. The species diversity is indeed smaller than on St. Maarten. On the other hand, St. Eustatius has a smaller human population density, resulting in less pollution, and less hunting pressure. Moreover the island has remained free of the Mongoose (*Herpestes auropunctatus auropunctatus*), which is known not to restrict itself to the rats for whose extermination it was imported to many islands, but to also eat indigenous mammals, birds, reptiles and amphibians (Husson, 1960; Nellis and Everard, 1983). The island still has fairly large more or less undisturbed nature areas, with richer vegetation that has more to offer for birds, e.g. the evergreen seasonal forest in The Quill crater. The crater can also serve as a refuge for birds during hurricanes. Based on this a higher bird density can be expected. According to Voous (1955) birds were fairly abundant during his visit to the island in 1952, especially in the less disturbed forests of The Quill and The Mountains. In August 1996 too, the observation results conformed to expectations.

In total the avifauna of St. Eustatius consists of 54 species (Voous, 1983). Of these, 26 are local or nesting birds, 28 are migratory birds and non-nesting visitors. There are 12 species of sea birds, 3 are nesting and 9 are non-nesting (Annex III). There are no island endemics among the birds of St. Eustatius. There are however, species with a limited geographical range. Thus 5 birds are endemic for the Lesser Antilles and Virgin Islands at the species level and another 5 at the subspecies level (Annex III).

The following species are endemic for the Lesser Antilles and Virgin Islands at the species level:

- ★ *Eulampis jugularis*, the Purple-throated Carib
- ★ *Sericotes holosericeus holosericeus*, the Green-throated Carib
- ★ *Margarops fuscus*, the Scaly-breasted Thrasher
- ★ *Cinclocerthis ruficauda pavidus*, the Trembler
- ★ *Loxigilla noctis coryi*, the Lesser Antillean Bullfinch

And at the subspecies level:

- ★ *Zenaida aurita aurita*, the Zenaida Dove
- ★ *Columbigalla passerina nigrirostris*, the Common Ground Dove
- ★ *Orthorhynchus cristatus exilios*, the Antillean Crested Hummingbird
- ★ *Elaenia martinica riisii*, the Caribbean Elaenia
- ★ *Dendroica petechia bartholemica*, the Yellow Warbler

Terrestrial species

Caribs and Hummingbirds



*Photo 18. The crater of The Quill with its steep inner slopes: habitat of the Purple-throated Carib (*Eulampis jugularis*).*

The Green-throated Carib and Antillean Crested Hummingbird are common birds on St. Eustatius that also visit flowers in gardens. The Purple-throated Carib however, just like on other islands, is restricted to moister habitats such as found on the higher parts of The Quill (Photo 18).

Thrasher

The Scaly-breasted Thrasher is a shy bird with a preference for the dense foliage of woodland or high bushland,

though it does go down to the ground to feed on fallen fruit (Evans, 1990). It is relatively common on most islands within its range, but the last observations on St. Eustatius date back to 1927, when several individuals were seen (Voous, 1983). Whether the bird still occurs on St. Eustatius then, is uncertain. It may have been overlooked by observers, because of its hidden lifestyle.

Trembler

The trembler too can be easily missed. It is generally very quiet and inconspicuous. This bird is found only in rainforest or similar vegetations and nowhere in its range is it very common (Evans, 1991). The subspecies found in St. Eustatius ranges from Saba to Montserrat. The only evidence for its occurrence on St. Eustatius consists of one specimen collected in 1880, and the sound of its song in The Quill crater in 1952 (Voous, 1983). Only in and around the crater of The Quill does suitable habitat for this bird exist.

Other species/subspecies with limited geographical range

The lesser Antillean Bullfinch, the Zenaida Dove, the Common Ground Dove, the Caribbean Elaenia, and the Yellow Warbler are all species that can live in the dryer and secondary habitats. They are all common within their range, as they are on St. Eustatius. The subspecies of the Lesser Antillean Bullfinch only inhabits the northern islands of its range, southward to Montserrat. On St. Maarten a different subspecies is found. The subspecies of the Yellow Warbler is limited to the northern islands of the Lesser Antilles.

Larger dove species

One species, *Geotrychon mystacea*, the Bridled Quail Dove, also has a limited range, but it extends outside of the Lesser Antilles. This large species of dove is found in Puerto Rico, the Virgin Islands and the Lesser Antilles (Evans, 1990; Chipley, 1991). The bird is most abundant on the larger of the Virgin Islands, where its numbers have increased since the beginning of the 20th century. Elsewhere however, the species has declined and according to Evans (1990) should be considered highly endangered. In Dominica and Barbuda it is supposed to be extinct already. In the three main zones of occurrence in Puerto Rico, except for a few locations Bridled Quail Doves were so scarce, as to make it practically impossible to study their relative abundance (Rivera-Milán, 1992). The Bridled Quail Dove is the only species on St. Eustatius that is listed in the ICBP/IUCN Red Data Book of 1992. It is listed as a near threatened species. ON St. Eustatius this bird is only known from the forest and woodland around the top and in the crater of The Quill, where it was observed only as recent as August 1996. The Bridled Quail Dove of the island of Guana (one of the Virgin Islands) too is only found in wooded habitats (dry evergreen forest) and avoids vegetations of cacti and thorny bushes (Chipley, 1991). They are animals of the lower layer. They forage on the forest floor.. They have never been seen flying above the tops of the trees. This marks the importance of the forest on the slopes and in the crater of The Quill, for the survival of this bird on St. Eustatius.

Another large species of dove, the Red-necked Pigeon (*Columba squamosa*) is another bird that prefers dense woods and is found on St. Eustatius mostly in the high trees around The Quill crater (Voous, 1983), though it was also observed close to the sea (at Fort de Windt) in August 1996 (Rojer, pers. obs.). This bird is much hunted on the Caribbean island, which has probably caused its scarcity in many parts of its range (Evans, 1991), such as on St. Maarten. It is also found on the Leeward Islands of the Netherlands Antilles, but is extinct on Aruba. It appears that not much bird hunting is going on nowadays on St. Eustatius. This works out favorably for these and other elsewhere much persecuted birds.

Birds of prey

The Red-tailed Hawk (*Buteo jamaicensis jamaicensis*) deserves special mention. Evans (1990) calls it a common species in the northern Caribbean region. On St. Eustatius however, this bird can be considered at least rare, and on St. Maarten it is extinct. There are several reports for St. Eustatius (Voous, 1983), especially from the Little Mountains and around The Quill, nevertheless this bird was not observed in August 1996, nor could informants affirm its presence. It would seem likely then that this bird is a winter visitor from more northern reaches, as is indicated by Evans (1991). It was also observed flying over sea between Saba and St. Eustatius (Voous, 1983). Voous feels that a study of its way of life on the islands is very much needed.

The American Kestrel (*Falco sparverius caribaeum*) is a widespread small bird of prey, that is listed on appendix II of CITES. On St. Eustatius the species is markedly numerous in areas with human activities. Everywhere in its range this bird has a preference for open parkland (Voous, 1955). It was observed in several locations in August 1996.

Other terrestrial breeding birds

The other 9 terrestrial breeding birds (Annex III) of St. Eustatius make use of dryer and more open habitats, or can utilize different habitats, with the exception of two breeding species of night heron, the Yellow-crowned Night Heron (*Nyctanassa violacea bancrofti*) and the Green Heron (*Butorides striatus virescens*) that live in coastal habitats. According to Voous (1983) the Yellow-crowned Night Heron is hunted. These 9 species are all widely distributed, and almost all are common.

Seabirds

A lot less seabirds breed on St. Eustatius than on St. Maarten. This correlates with the lesser degree of variation in coastal habitat. The island has no inland bays or salinas, nor mangrove stands. It also lacks small desert islands off its coast. Thus, van Halewyn and Norton (1984) do not classify it as an important breeding area for seabirds. Nevertheless, some seabirds do nest there that according to the authors mentioned, should receive special attention due to their threatened (*Puffinus lherminieri lherminieri*, Audubon's Shearwater) or possibly threatened (*Phaeton aetherius mesonauta*, Red-billed Tropicbird) status.

Shearwater

Most seabirds breeding in the Caribbean, also breed elsewhere. However, the breeding grounds of Audubon's Shearwater are almost exclusively restricted to the Caribbean region (van Halewyn and Norton, 1984). The islands of the Southern Lesser Antilles and Tobago probably harbor the largest part of the breeding population. The nesting habitat is quite varied. The birds nest in holes on the ground high in the hills, but also in natural hollows under cliffs, rocks and limestone, sometimes only just above sea level. On some islands, as on St. Eustatius (Voous, 1983) the birds are, or were killed and/or their eggs collected for consumption. Several observations from St. Eustatius are known but there is no proof of breeding. It is suspected that the birds at least used to breed at Tumble Down Dick Bay and Gallows Bay. They are mostly active at night at nesting sites, so nests can easily escape attention (van Halewyn and Norton, 1984). The first location mentioned however, is much disturbed nowadays by the activities of the Oil Terminal.

Tropicbirds

Two species of tropicbirds nest on St. Eustatius. The Red-billed Tropicbird (*Phaeton aetherius mesonauta*) is possibly threatened according to van Halewyn and Norton (1984). Its status should therefore be monitored. The Red-billed Tropicbird also nests elsewhere, but its main breeding grounds are in the Caribbean. According to van Halewyn and Norton (1984) this species is most numerous on the Virgin Islands and Tobago. According to recent counts on nearby Saba however, this small islands harbors the largest breeding population of Red-billed Tropicbirds (Walsh-McGehee, pers. comm. 1997). On St. Eustatius many nesting sites of this bird are known in the cliffs almost

completely surrounding the whole island, and on the steep slope of White Wall. The breeding season is in winter and spring (Voous, 1983). The birds have also been filmed on White Wall in 1982 by Peter Creutzberg. Voous (1983) estimated their number at a little over 20 pairs and van Halewyn and Norton (1984) give a number of 33 pairs. These numbers may be too low. A rough estimate of the number of pairs of Red-billed Tropic Birds on Saba by Walsh-McGehee and Lee in April 1997, based on counts (Walsh-McGehee, 1997) results in much higher numbers than Voous' estimate for Saba (1983).

According to van Halewyn and Norton (1984), eggs of the Red-billed Tropicbird are occasionally collected and birds sometimes killed, but these activities are limited because the nesting sites (holes in the sea cliff walls) are usually inaccessible. In several places lack of sufficient nesting habitat may be a limiting factor for population size. That is why the Caribbean populations are small, but relatively stable according to van Halewyn and Norton, (1984). Walsh-McGehee (1997) however, warns that coastal development, so common on West Indian islands, is causing enormous habitat losses. In August 1997, no birds were seen at the known nesting sites of White Wall and Concordia Bay, but informants assured that they had recently been seen at those sites (Faber, pers. comm. 1996) and had also been seen from sea at Jenkins Bay (van 't Hof, pers. comm. 1996).

The White-tailed or Yellow-billed Tropicbird (*Phaeton lepturus catesbyi*), which also nests on St. Eustatius, is in the minority compared to the Red-billed Tropicbird. According to van Halewyn and Norton, (1984) the latter is dominant over the first whenever there is competition for nesting sites. Their breeding season only partly overlaps, however. The Yellow-billed Tropicbird breeds in spring and summer. Voous (1983) only reports one nesting site on St. Eustatius. According to van Halewyn and Norton, (1984) the conservation status of this species is not really worrying, but recent data suggest that the Caribbean breeding populations have decreased by half since the 1980s (Walsh-McGehee, pers. comm. 1997). Coastal development and loss of nesting sites are supposed to be the main cause for their decline. The species was not observed in August 1996.

A number of seabirds with an endangered status can be seen regularly on the coasts of St. Eustatius, but they breed elsewhere, e.g. the Brown Pelican and the Magnificent Frigatebird.

Migrants and Visitors

St. Eustatius, like the other Antillean islands, is important for migratory birds from the northern part of the continent, but only few waders and other migratory wetland birds are to be found, because of the lack of suitable habitat. Eight species of songbirds and two species of bird of prey have been sighted passing through the island or spending the winter months (Annex III).

Amphibians and Reptiles

The literature reports only one amphibian for St. Eustatius (Piping Frog, locally known as Mountain Frog, *Eleutherodactylus johnstonei*), the same as found on St. Maarten and

Saba (Annex III). One of the informants however, distinguished the Mountain Frog, supposedly living in the hills, from a different 'Frog' living in residential gardens. However, this could not be verified by personal observations. The Mountain Frog is a species found on the Lesser Antilles. On most islands it is abundant in disturbed habitats and in secondary forests (Kaiser and Henderson, 1994). On some of the Lesser Antilles' islands it was imported, possibly also on Saba (Schwartz, 1967). It adapts easily and is supposedly able to out-compete other, indigenous, species of the same genus (Kaiser and Henderson, 1994). It is only a small animal that produces an impressive sound however. The song of this amphibian can be heard as soon as darkness falls and also during the day after a rain shower.

Reptiles are represented by 12 species, 8 lizards, one snake, and three species of sea turtle (Annex III). St. Eustatius has no island endemics among reptiles, but does have species and subspecies with a small geographic range. Of the 12 species, 7 are restricted to the Lesser Antilles. Although there is no proof, it is possible that the islands of St. Eustatius, St. Kitts and Nevis, like the islands of the Anguilla Bank, were joined during the ice ages. IN present times they lie together on a shallow submarine plateau, the St. Kitts Bank (see chapter on geology). The geographic range of the St. Kitts Bank reptiles would indicate this; of the 7 Lesser Antilles' species three are restricted to the islands of the St. Kitts Bank, one as a species and two as subspecies. One species is only found on St. Eustatius and Saba, while being extinct on St. Kitts and Nevis. One species, besides occurring on the islands of the St. Kitts Bank, is also found on Saba, and one occurring on the islands of the St. Kitts Bank, is in addition found on the islands of the Anguilla Bank. All these species merit special attention because of their limited range.

The Red-bellied Racer

The snake *Alsophis rufiventris* (photo 22) has a very limited geographic range. IN addition to St. Eustatius, it is only found on Saba. The animal used to live on St. Kitts and Nevis, but has not been seen there since the 19th century (Daltry *et al.*, 1997).



Photo 22. The red-bellied racer (*Alsophis rufiventris*).

That was when the mongoose was introduced to those islands. Because of the dramatic decline of its range (from 302 km² to 33 km²),

the Red-bellied Racer is now listed as endangered on the IUCN's "Red List of Threatened Animals" of 1996. On St. Eustatius it is still present in high densities, especially in the southern, forested areas (Daltry *et al.*, 1997). The animal is often seen during field trips (Faber, pers. comm., 1996). In August 1996 too, this snake was observed. This was

in the vegetation on the rim of the crater. The absence of the mongoose on St. Eustatius clearly has a positive effect on the occurrence of this snake. However, 55 % of the snakes had incomplete tails, which suggests that they are nevertheless seriously predated (Daltry *et al.*, 1997). The natural enemy of this snake is the American kestrel, *Falco sparverius*, but also cats and even chickens have snake on their menus. Rats eat snake eggs and on other islands are known to also attack the snake itself. Moreover people on St. Eustatius persecute snakes believing them to be poisonous. Daltry *et al.*, 1997 point out the danger of accidental introduction of the mongoose from other islands. The Red-bellied racer preys on *Eleutherodactylus* and lizards (Schwartz and Henderson, 1975). These prey are present in abundance, especially in the wooded habitats.

The ground lizard



Photo 19. *Ameiva erythrocephala* in the area Behind the Mountain.

belongs to a different species. *Ameiva erythrocephala* is common on St. Eustatius and in August 1996 was seen in different habitats, from the lowest parts of the island along the coast to close to the crater rim.

The ground lizard of St. Eustatius (*Ameiva erythrocephala*) is only found on the islands of the St. Kitts Bank. There are a total of 19 different species of the genus *Ameiva* known from the West-Indian region, and 9 of those are limited to the Lesser Antilles and Virgin Islands (Schwartz and Henderson, 1991). Of those 9 however, two species are already extinct. The ground lizard of St. Maarten be-

Tree lizards

Anolis bimaculatus bimaculatus (photo 20) is only found on the islands of the St. Kitts Bank, Barbuda and Antigua, while the subspecies only occurs on the islands of the St. Kitts Bank. The latter is also true for *Anolis wattsi schwartzi* (photo 21). Both species live practically separated because of their different habitat preference (Lazell, 1972). *Anolis wattsi*



Photo 20. *Anolis bimaculatus bimaculatus*.



Photo 21. *Anolis watsi schwartzi*.

schwartzii prefers humid forest habitats, while *Anolis bimaculatus bimaculatus* prefers dry open habitats. Lazell (1972) suspects that the latter species was able to increase its range because of the reduction in forest after the increase of agriculture, and thus can now be found sympatrically with the first species. Observations in August 1996 support this view. On the slopes and on the rim of the crater of The Quill only *Anolis watsii*

schwartzii was seen. It is abundant there. In The Mountains too, as well as in the lowlands, even close to sea, this lizard was found, but always in shady spots under trees and not in such densities as on the higher parts of The Quill. Wherever the two species come into contact with each other they react strongly (Lazell, 1972).

Adolph and Roughgarden (1983) found that none of the bird species of St. Eustatius was a bigger food competitor than the two tree lizards and the ground lizard are to each other. Predation by the Pearly-eyed Thrasher and the American Kestrel had little effect on the niche relations between the two tree lizards.

Gecko's

The gecko *Sphaerodactylus sabanus* is found on the islands of the St. Kitts Bank as well as on Saba. Another gecko, *Sphaerodactylus sputator* occurs on both the islands of the St. Kitts Bank and those of the Anguilla Bank. Of these two gecko species no more can be said than that they both have a preference for mesophilic habitats and their lives are cryptic. Nothing is known about their status. *Hemidactylus mabouia* and *Thecadactylus rapicauda* are widespread species often found in buildings. They have likely been introduced by humans.

Caribbean Iguana

Although the Caribbean Iguana (*Iguana delicatissima*) (photo 23) looks very much like the Green Iguana, it is a different species that is found only on the Lesser Antilles. Like the Green Iguana it is listed on Appendix II of CITES. In 1973 Lazell still speaks of a healthy and viable population, but in 1992 their number was estimated to be less than 500 (Carmabi/Stinapa year reports, 1992). The situation is not much better on other islands. Based on the observations by different people the status of the species in 1992 looks to be as follows: endangered on 7 islands, vulnerable on one island, possibly extinct on two islands, and definitely extinct on 4 islands (including St. Maarten and St. Kitts) (Carmabi/Stinapa year reports, 1992) (translator's note: In 1998 a small population of Carib-

bean Iguana's was found inhabiting the Flamingo Pond area in St. Maarten, when it was being filled in for extension of the airport. The animals were rescued by the Nature Foundation and released on Paradise Peak). The main causes for this are habitat destruction and intensive hunting by people for consumption purposes.



Photo 23. The Antillean Iguana (*Iguana delicatissima*).

is a very favorable condition for the preservation of the population. This iguana lives in a wide variety of habitats, from xerophytic cactus vegetations to rainforest. In 1992 the Caribbean iguana was found both in The Mountains and on the lower slopes of The Quill (Leysner, pers. comm. 1996). Recently specimens were seen on Little Mountain (Faber, pers. comm., 1996).

Sea turtles

Two species of sea turtle are common in the sea around the island: the Green Turtle (*Chelonia midas*) and the Hawksbill Turtle (*Eretmochelys imbricata*). The Leatherback (*Dermochelys coriacea*) is less common. All three species are listed on Appendix I of CITES as endangered species. Green Turtle and Leatherback have in the past used the beach of Concordia Bay to lay eggs (ECNAMP, 1980; Sybesma and Eckert, 1992). Although this beach, situated on the windward side of the island, seems quite suitable for nesting, it appears not to be used intensively by the sea turtles. Reports about this are scarce. It was gratifying that in June of 1997, for the first time in years, a nest with sea turtle eggs was found again (Beurs and Nieuwsberichten, 1997). It concerned a Leatherback. According to people from the island, disturbance by lights from a newly built hotel has caused the decline in number of nesting sea turtles (Lloyd Courtar, pers. comm. in van Buurt, 1984). Other negative impacts are illegal sand mining (Begemans in Beurs and Nieuwsberichten, 1997), pollution of the beach by marine debris and the accessibility of the beach to automobiles. In August 1996 visitors were observed driving up and down the beach in a heavy car, all the way up to the water line. According to informants the Statians do not hunt sea turtles, but fishermen from other islands do come to the island to hunt them.

On St. Eustatius too the Caribbean iguana is hunted, although the meat is not especially appreciated by the Statians themselves. According to informants people from off-island, working on St. Eustatius for the Oil terminal, are doing most of the hunting. In times of unemployment Statians will also hunt the iguanas to sell them. The absence of Mongoose introduced in other islands (e.g. in St. Maarten)

Other animals

Little is known about invertebrates of St. Eustatius, other than some names and collecting sites (photo 24). Nothing can be said about the status of these animals. In the crater of The Quill land crabs are found (Faber, pers. comm., 1996). This would probably be the Mountain Crab, *Gecarcinus ruricola*, a species intensively hunted on Saba. This animal is of ecological significance as a detritivore in Caribbean terrestrial ecosystems. In addition to this species it is likely that other land crabs occur, as well as the hermit crab *Coenobitus clypeatus*.



Photo 24. Spider in the crater of The Quill.

From the literature and from personal communications furthermore, the following animals are known from St. Eustatius: 13 species of terrestrial snails (Vernhout, 1914; Haas, 1960 and 1962), one species of scorpion (De Armas, 1983), one mite (Kohls, 1969) and 66 species of insect (Weber, 1948; v.d.Kuyp, 1953 and 1954; Cobben, 1960; Drake en Cobben, 1960; Marcuzzi, 1962; Forrest Gilmour, 1963; De Kort-Gommers en Nieser, 1969; v.Doesburg, 1970, Wygodzinsky, 1975; Stuzák en Cobben, 1975; Marcuzzi, 1977; Simonthomas, 1984), including 22 species of diurnal butterflies (Smith et al., 1994; Miller and Miller, pers. comm., 1996) (Appendix IV).

In August 1996 a total of 9 species of terrestrial snails and 11 species of butterflies were collected in St. Eustatius. The terrestrial snails were sent to specialist Dr. A. Hovestadt for identification, and the butterflies were sent to butterfly specialist Lee D. Miller for final identification.

THREATS

In the preceding text several threats to the biodiversity have already come forward. With the exception of hurricanes, humans are the source of all threats. Below are the most important ones:

- ★ **Sacrifice of valuable nature areas** to industrial or tourism development. The Oil Terminal already occupies a large area in The Mountains and on the coast at Tumble Down Dick Bay (photo 4). Particularly on a small island such as St. Eustatius this has a large impact on nature. The impact goes beyond just the immediate area concerned because of e.g. the visual disturbance of the landscape. The Tumble Down Dick Bay

has been lost as nesting area for regionally endangered and vulnerable sea birds. The endemic plant *Ipomoea sphenophylla* probably grew on the spot where storage tanks are now standing. The only known places of occurrence of this species are all situated on the property of the Oil Terminal close to the impacted area. Construction of hotels and other tourism facilities in valuable nature areas also causes a quantitative as well as a qualitative decline of nature values there.

- ★ **Uncontrolled use** of valuable nature areas as tourism attraction, causing pollution (as in the crater of The Quill), fire hazard (e.g. elfin forest), erosion and disturbance because of widening of trails, breaking of new trails where they are undesirable, and the disappearance of rare native species because of visitors with a passion for collecting.
- ★ **Free-roaming cattle**, particularly goats, cause a lot of degradation of the vegetation and leads to erosion. The latter in particular is a problem in St. Eustatius because the soil of the Kultuurvlakte is extremely prone to erosion. On the steep slopes of The Quill too are areas that easily start to slide. During my visit to the crater and the Big Gut at White Wall in August 1996, I witnessed several rock falls, which in at least one case was directly caused by goats. Goats were seen all the way to the top of The Quill.
- ★ **Pollution of the bottom, the coast and the sea** by the use of ravines (guts) as landfill and by the activities of the Oil Terminal.
- ★ **Hunting and trade in plants and animals.** The danger of hunting obtains especially to the Caribbean Iguana. With regard to other animals one has to stay alert to this danger, because they can suddenly acquire market value. Some plant species, e.g. orchid and ferns are potentially subject to trade. The same goes for animals that can be kept as pets. Providing information and nature education can help in preventing this.
- ★ **Introduced predators** such as dogs, cats and rats that pose a threat to herpeto- and avifauna. There is also a danger of accidental introduction of the Mongoose from other islands.
- ★ **Introduction of invertebrates** that cause disease in native species. This has not been reported for St. Eustatius yet, but it did happen on Saba, so it is a real danger.
- ★ **Hurricanes.** An example of the enormous damage hurricanes can cause to nature, can be seen in St. Maarten. Island populations of birds that were reduced by other causes are extremely sensitive to hurricanes (Evans, 1990). St. Eustatius too was repeatedly hit by hurricanes in the past. Stoffers (1960) recounts for example that several trees in the crater of The Quill fell over during a hurricane in 1928.

NATURE CONSERVATION AND MANAGEMENT

PREVIOUS HISTORY AND PRESENT SITUATION

Preservation of the natural heritage of St. Eustatius has long received attention. In 1957 planner Thijssse studied the possibilities to raise the level of prosperity of the population, and concluded even then that preservation of certain nature areas is required if tourism potential is to be activated.

In 1968 Stinapa N.A. foundation made definite proposals to establish reserves and the management of some of them by the foundation (Westermann, 1969). Several expert authors such as Westermann (1969), Mörzer Bruyns (1969), Kristensen (1978) and Voous (1979) supported this initiative. Among the areas that according to Stinapa were in need of protected status was The Quill. Westermann (1969) calls The Quill: “probably the most beautiful volcano of the Antilles with its fine cone shape and wide, deep and forest-covered crater”. To lend strength to his plea he quotes the lyrical outpourings of Molengraaff (1886) from the previous century, who calls the rim of the crater “certainly the most alluring place to stay awhile”, and talks about “the treasures of the tropical vegetation” and “the surprising glimpses through openings in the greenery”. Westermann is of the opinion that the Stinapa proposal to establish and manage The Quill as a nature reserve deserves active and speedy realization by the government, specifically because of scientific, tourism, geological and hydrological reasons. He points out the threats of axe and fires and of soil erosion enhanced by deforestation. Mörzer Bruyns (1969) states that there is no doubt of the importance of Stinapa’s proposal to designate this area as National Park. He proposes not to allow any development above the 200-meter line and set the limits of the park there, at least on the side of the Kultuurvlakte, elsewhere preferably run all the way to the sea. Voous (1979) call The Quill: “ a geological formation determining the aspect of the island”. He deems the volcano simultaneously of great scientific and of esthetic value. The Quill must be preserved untouched and intact for future generations. Voous pleads for conservation of the integrity of landscape, nature and history. He warns against expansion of the road system and in particular against a coastal road around The Quill. He also notes that on most of the Lesser Antilles the humid slope forests with the accompanying animal life are highly endangered by tree cutting and subsequent erosion, and thus the forest on the slopes and inside the crater is of more than local importance.

In addition to The Quill, Stinapa also proposed to obtain the legal rights of use of the area of White Wall and Sugar Loaf, in order to preserve and manage it as a nature reserve (Westermann, 1969). Westermann supports this proposal arguing that such rock plates tilted by volcanic forces are rare. Although found in St. Kitts they are less monumental there. “It is a wonder of nature that knows no equal”. He also points out the importance of White Wall as nesting area for Red-billed Tropicbirds. Mörzer Bruyns too (1969) is of the opinion that both formations, forming a geographical whole with The Quill, should be part of the National Park as proposed by Stinapa.

About the area of The Mountains Mörzer Bruyns supposes that further study will reveal it to be of scientific and in particularly of biological interest, and that careful and specific management will increase the biological diversity of the area. He also points out that St. Eustatius harbors a lot of special birds that, however, only occur in small populations. Establishment of one or two national parks or reserves, would increase the chances of these populations. Voous (1979) feels that nature and landscape in the area of Little Mountains should be preserved for the benefit of a romantic tourism island. Kristensen (1978) shares this opinion. He argues that the hills in the northwest merit complete protection.

The St. Eustatius Historical Foundation, established in 1974 (De Palm, 1985) from the start engaged itself in nature conservation. This was apparent among other things from the establishment of the first underwater park of the Netherlands Antilles at Jenkin's Bay (Kristensen, 1978) Due to lack of tourist interest and legal basis for the park, not much was left of this initiative over the following years. Only in 1993, as part of the Netherlands Antilles Tourism Development Program, Carmabi, based on a study of the natural and cultural resources, prepared a zoning plan, which was presented to the island government (Carmabi/Stinapa year reports, 1993).

In 1982 Stinapa N.A. drafted a plan to make The Quill into a National Park (Carmabi/Stinapa year reports, 1982). Although the island government, the Bureau of Culture and Education and STICUSA supported this plan it was never realized. In 1983 however, some ten nature trails were constructed as a first step towards establishment of a park. The cooperation between the Historical Foundation and Stinapa was also apparent from the filming of a nature documentary on St. Eustatius by Peter Creutzberg during that same period. The initiatives to establish The Quill as a nature park did not always receive the desired support however, as may be demonstrated by the opinion of G. Sleeswijk, Lieutenant Governor of St. Eustatius in 1986. According to this Lieutenant Governor, legislation to make The Quill a protected area was unnecessary, because there were no real threats such as construction of houses or cutting of trees (Walstra, 1987). Nevertheless the attempts to safeguard the natural heritage of the island continued. In 1993 the St. Eustatius Historical Foundation passed over into the St. Eustatius National Parks Foundation (STENAPA Foundation), which focused more than before on nature conservation and management. At the time of this writing STENAPA is trying to raise funding for the underwater park and two nature parks on land: one in the area of The Mountains and one in the area of The Quill. In addition a Botanical Garden is being worked on in the area Behind the Mountain. STENAPA also made efforts to establish a legal framework. In 1997 the "Island Ordinance for the Protection of Fauna and Flora" came into force. *Ipomoea sphenophylla*, 15 species of orchids and the Caribbean Iguana are among the protected flora and fauna listed in this ordinance. The ordinance also aims at protection and conservation of unique or characteristic landscapes. This includes the area of The Quill above 250 m altitude, the cliff wall in the Lower Town area, and the areas designated as Boven, Venus, Gilboa Hill and Bergje.

RESEARCH FOR CONSERVATION MANAGEMENT

In the past several studies have been completed that are useful for the actual nature conservation management, e.g. the study of the moss flora and vegetation (Wiersma, 1984) and the study of biotic and abiotic components of the landscape (Augustinus *et al.*, 1985). In 1997 a study of the endangered Red-bellied Racer started. This study is part of the "Red-bellied Racer Conservation Project", an initiative of Fauna & Flora International. Continuation and research in other areas is indispensable. In the report of Augustinus *et al.* (1985) among other things the need to reevaluate the various vegetation types is pointed out. Also indicated is an analysis of the vegetation of the southeastern slope of The Quill, which was not studied by Stoffers in 1956. The steep, inaccessible inner walls of the crater form another important object of study, while too little is as yet known about the development of the vegetation in the area of The Mountains. With respect to the small

area of elfin forest, its recovery after the fire must be looked into. In addition a floristic survey of the proposed conservation areas is needed. In addition to the Red-bellied Racer St. Eustatius possesses several other regionally rare or endangered animal species. In order to ensure their continued survival it is necessary to study these island populations further. Voous (1983) for example, as long as ten years ago indicated the need to study the habits of the Red-tailed Hawk. Halewyn and Norton (1984) urge the study and the monitoring of endangered and possibly endangered seabirds in the Caribbean. About the status of invertebrates nothing much can be said at the moment. Here too is a wide unexplored field for study.

CONCLUSIONS

On the basis of data from the literature, conversations with relevant people and observations *in situ*, the following areas are considered to possess great nature values and are recommended for conservation and management in order to preserve biodiversity.

- ★ **The Area of The Quill**, encompassing the whole volcano down to the coast, except on the side of the Kultuurvlakte where the 200-meter altitude line can form the border. The richer and less disturbed vegetation types are situated above this line. The Quill is characterized by a large diversity of forest formations, leading to a great diversity of plant life. Some of these forest formations are vulnerable because of the small surface area they occupy, in particular the elfin forest found only on the eastern rim of the crater. Because of its restriction to very specific climatological circumstances elfin forest is an unusual forest type. The crater is the only location in the Netherlands Antilles where evergreen seasonal forest is found. This type of forest is very close to rainforest, and although probably impoverished by centuries of anthropogenic influence, it is still very rich in species. It contains a number of very large and ancient trees. The dry evergreen forest on the crater rim and the montane thickets on the eastern slope are relatively undisturbed. The semi-evergreen forest on the northwestern slope appears in good condition and recovering. At a regional level this type of forest has been seriously disturbed by human activities and in many places has been reduced to bushland. The forests of The Quill form the habitat for several birds and reptiles that are rare in the region and/or endangered. A few species do not occur outside of this area of the island. The lower parts of The Quill are important for the conservation of the rare and endangered Caribbean Iguana. Preservation of the vegetation on the steep slopes of The Quill is also important to prevent erosion. Geologically the volcano may be the most perfect example of an ash volcano of the region and unique because of its symmetrical cone shape and round crater. No less important a reason for the protection of this area is its great scenic value, which together with its abundance of plant and animal species makes this a very attractive area for visitors.
- ★ **The White Wall and Sugar Loaf** with the adjacent **Big Gut** and cobble beach, on the one hand because the White Wall and Sugar Loaf form a rare and scientifically interesting geological phenomenon, on the other hand because it is the only place on the island with limestone. Consequently the characteristic limestone vegetation is only to be found here. In addition the nearby cobble beach is the only place on the island where a strand scrub community can be found. Visitors will undoubtedly appreciate the wild beauty of the whole area, with the deep Big Gut and the steep walls of the limestone plates. The proximity of the historical monument of Fort de Windt adds even more of interest of the area.
- ★ What is left of **The Mountains** including Venus Bay, because of its present relatively undisturbed character and scenic value. Internationally the conservation of large continuous nature areas is advocated instead of small fragmented areas. Since the area of The Mountains is no longer used for agricultural purposes it is especially suited as a nature park. Although the vegetation is impoverished compared to the original vege-

tation, it is nevertheless recovering. Here too prevention of erosion is an important argument for the conservation of the vegetation. Furthermore dry tropical forests have regionally much been reduced. Also for the survival of obviously small island populations of birds and the Caribbean Iguana the area is of the utmost importance. On the coast the possibly endangered Tropicbirds nest.

- ★ **The beach, the cliff wall and the coastal vegetation at Concordia Bay.** The beach is important as potential nesting beach for internationally endangered sea turtles. In the cliffs along the beach tropicbirds nest. The coastal vegetation is unique for the island and protects the erosion prone soil there.
- ★ **The locations where *Ipomoea sphenophylla* is growing.** The only known sites of occurrence of this endemic species are all located on the property of the Oil Terminal. Thus the danger that this plant could be lost due to expansion of the company is very great. Protection of these localities is highly desirable and urgent.

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Photo 25. The guides Jacques van der Horden and Hans Duizendstra.

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APPENDIX I

PLANTS OF ST.EUSTATIUS

abbreviations:

SA= Saba

SE= St.Eustatius

SM= St.Martin

LA= Lesser Antilles

WI= West Indies

AM= America (American Continent + West Indies)

WO= world (America + other parts of the world)

sources:

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abbreviations:

(ST)= source is the Flora of Stoffers

(ST 56)= source is: The Vegetation of the Netherlands Antilles by Stoffers

(H)= source is the Flora of Howard

(list H)= source is a list of plants recorded from St. Martin, compiled by Richard A.Howard in March 1991

*= illustration in the "Flora of the Lesser Antilles" of Richard A.Howard

(L)= local name from Saba, reported by J.Johnson

scientific name	common name	area of distribution
<u>PTERIDOPHYTA</u>		
<u>Cyatheaceae</u> (ST)		
<i>Cyathea arborea</i> *		SE, SA--AM
<u>Hymenophyllaceae</u> (ST)		
<i>Trichomanes angustifrons</i>		SE--AM
<i>Trichomanes punctatum</i>		SE--WI (AM in H)
<u>Lycopodiaceae</u> (ST)		
<i>Lycopodium dichotomum</i>		SE--AM
<u>Polypodiaceae</u> (ST)		
<i>Nephrolepis rivularis</i>		SA, SE--AM
<i>Nephrolepis biserrata</i> *		SE, SM--possibly WO
<i>Cheilanthes microphylla</i>		SA (H), SE--AM
<i>Pitogramma calomelanos</i> *		SA, SE, SM--WO
<i>Adiantum tenerum</i>		SA, SE, SM--AM
<i>Vittaria lineata</i> *		SE--AM
<i>Paltonium lanceolatum</i> (<i>Neurodium lanceolatum</i> * in H)		SE, SM (H) --AM
<i>Polypodium pectinatum</i>		SE--AM
<i>Polypodium polypodioides</i>		SA, SE, SM--AM
<i>Polypodium aureum</i> (var. <i>aureum</i> in H)		SA, SE, SM--AM
<i>Polypodium triseriale</i>		SA, SE, SM--AM
<i>Polypodium phyllitidis</i>		SA, SE, SM--AM
<i>Polypodium heterophyllum</i>		SA, SE, SM--AM
<i>Polypodium lycopodioides</i>		SA, SE, SM--WO
<i>Thelipteris tetragona</i> var. <i>tetragona</i>		SA, SE, SM--AM
<i>Thelipteris dentata</i>		SA, SE--WO
<i>Thelipteris opposita</i>		SA, SE--AM
<i>Thelipteris nephrodioides</i>		SA, SE--AM
<i>Ctenitis meridionalis</i>		SE--LA
<i>Tectaria incisa</i>		SA (not in H), SE--AM
<i>Tectaria trifoliata</i> *		SA, SE--AM
<i>Bolbitis cladorrhizans</i> (= <i>C. portoricensis</i> in H)		SE--AM
<i>Lomariopsis sorbifolia</i> *		SA?, SE--WI
<i>Elaphoglossum martinicense</i>		SA, SE--WI
<i>Elaphoglossum dussii</i> (= <i>E. petiolatum</i> in H)		SE (not in H)--WI (AM in H)
<i>Asplenium cristatum</i>		SA, SE, SM--AM
<i>Asplenium auritum</i> (var. <i>rigidum</i> in H)		SA, SE--AM
<i>Asplenium abscissum</i> *		SE--AM

<i>Asplenium serratum</i>		SA, SE--AM
<i>Blechnum occidentale</i>		SA, SE, SM--AM (introduced in Hawaiï)
<u>SPERMATOPHYTA</u>		
<u>MONOCOTYLEDONEAE</u>		
<u>Agavaceae (H)</u>		
<i>Agave van grolae</i>		SE--LA: St.Kitts, Nevis
<i>Furcraea tuberosa*</i>		SA, SE--LA
<u>Amaryllidaceae (H)</u>		
<i>Hippeastrum puniceum*</i>	easter lily	SA, SE, SM--AM
<i>Hymenocallis caribaea</i>	spider, white lily	SA, SE, SM--WI
<i>Zephyranthes grandiflora</i>		SA, SE--AM
<i>Zephyranthes puertoricensis</i>	crocus, white snowdrop	SA, SE, SM--AM
<i>Zephyranthes rosea</i>		SE, SM--AM
<u>Araceae (H)</u>		
<i>Anthurium cordatum</i>		SA, SE (not in H, but ST mentions the species in his publication of 1956)--WI
<i>Anthurium grandifolium*</i>	monkeytail (list H)	SA, SE, SM--WI
<i>Philodendron giganteum*</i>	chinny leafs (L) elephant ears	SA, SE--WI
<i>Philodendron lingulatum</i>		SA, SE--WI
<u>Bromeliaceae (H)</u>		
<i>Bromelia pinguin*</i>		SA, SE, SM--AM
<i>Catopsis floribunda</i>		SA, SE, SM--AM
<i>Pitcairnia angustifolia</i>	clapper (L)	SA, SE--WI
<i>Tillandsia recurvata*</i>	ballmoss	SA, SE, SM--AM
<i>Tillandsia usnoides</i>	spanish moss	SA, SE, SM--AM
<i>Tillandsia utriculata</i>		SA, SE, SM--AM
<i>Vriesea ringens</i>		SA, SE--AM
<u>Commelinaceae (H)</u>		
<i>Callisia repens</i>	waterweed (L)	SA, SE, SM--AM
<i>Commelina elegans</i>	watergrass, waterweed (L)	SA, SE, SM--AM
<i>Tradescantia pallida*</i>	purple heart?	SA, SE, SM--AM
<u>Heliconiaceae (H)</u>		
<i>Heliconia bihai</i>	wild banana	SA, SE--WI
<u>Iridaceae (H)</u>		
<i>Eleutherine bulbosa*</i>		SE--AM
<u>Orchidaceae (H)</u>		
<i>Prescottia stachyodes*</i>		SE--AM
<i>Spiranthes elata*</i>		SE, SM--AM
<i>Spiranthes lanceolata*</i>		SE--AM
<i>Erythrodes hirtella</i>		SE--WI

<i>Erythroides plantaginea</i>		SA, SE--WI
<i>Jacquinella globosa</i> *		SA, SE--AM
<i>Epidendrum ciliare</i> *		SA, SE, SM--AM
<i>Epidendrum difforme</i> *		SE--AM
<i>Epidendrum kraenzlinii</i>		SA, SE (Faber), SM--WI
<i>Epidendrum secundum</i> *		SA, SE, SM--AM
<i>Tetramicra canaliculata</i>		SE--AM
<i>Brassavola cucullata</i> *		SA, SE, SM--AM
<i>Polystachya concreta</i>		SE--WO
<i>Oncidium leiboldii</i>		SA, SE, SM--AM
<i>Oncidium urophyllum</i>		SE--LA
<i>Liparis nervosa</i>		SE (Faber)--WO
<u>Smilacaceae</u> (H)		
<i>Smilax coriacea</i>	white withe	SA, SE, SM--WI
<i>Smilax guianensis</i> *		SA, SE--LA
DICOTYLEDONEAE		
<u>Acantaceae</u> (H)		
<i>Blechum pyramidatum</i> *		SE, SM--WO, native to AM
<i>Justicia eustachiana</i> *		SA, SE, SM (list H)--LA
<i>Justicia sessilis</i>	prickly balsum	SA, SE, SM--AM
<i>Ruellia tuberosa</i> *	fever root	SA, SE, SM--AM
<u>Aizoaceae</u> (ST)		
<i>Mollugo verticillata</i>		SE--AM
<i>Sesuvium portulacastrum</i>		SA, SE, SM--WO
<i>Trianthema portulacastrum</i> *		SE, SM--WO
<u>Amaranthaceae</u> (ST)		
<i>Celosia argentea</i>		SE--WO
<i>Amaranthus polygonoides</i> ssp. <i>polygonoides</i>	white polly	SA, SE, SM--AM
<i>Amaranthus dubius</i>		SA, SE, SM--AM (introduced in Europe)
<i>Amaranthus spinosus</i> *		SA, SE, SM--WO (probably native to AM)
<i>Amaranthus crassipes</i>		SE (Rojer), SM--AM
<i>Amaranthus viridus</i>		SA, SE, SM--WO
<i>Achyranthes indica</i> (= <i>Achyranthes aspera</i> * var. <i>aspera</i> in H)	man better man, worry vine (list H)	SA, SE, SM--WO
<i>Alternanthera caracasana</i>		SA, SE, SM--WO
<i>Lithophila muscoides</i> *		SA, SE, SM--WI
<i>Iresine angustifolia</i>	white snow plant	SE, SM--AM
<i>Iresine diffusa</i> *		SA, SE, SM--AM

<u>Anacardiaceae</u> (ST)		
<i>Comocladia dodonaea</i> *	red man, centepee plant, money bush	SA, SE, SM--WI
<i>Spondias mombin</i>	yellow plum	SA, SE--WO
<i>Spondias purpurea</i> *	Jamaica plum, red plum	SA, SE--AM
<u>Annonaceae</u> (ST)		
<i>Annona muricata</i> *	soursop	SA, SE, SM--AM, probably native to WI
<i>Annona montana</i>		SA, SE, SM--AM
<i>Annona reticulata</i>	custard apple	SA, SE--AM, probably native to WI
<u>Apocynaceae</u> (ST)		
<i>Rauvolfia viridis</i>	snakeberry tree, Antigua balsam	SA, SE, SM--AM
<i>Plumeria alba</i> *	white frangepane, pigeon wood	SA, SE, SM--WI
<i>Catharanthus rosea</i> *	churchyard blossom, old maids olleander (list H)	SA, SE, SM--WO, na- tive to Madagascar,
<i>Tabernaemontana citrifolia</i> *	milky tree, milky wood billyache (list H)	SA, SE, SM--WI
<i>Urechites lutea</i> *	bitter pod, bay withe (L)	SA, SE, SM--WI
<u>Asclepiadaceae</u> (ST)		
<i>Calotropis procera</i> *		SA, SE--WO, native to the Old World
<i>Asclepias curassavica</i> *	ipecacuanha hippety- iguana (L)	SA, SE, SM--WO, na- tive to AM,
<i>f.curassavica</i>		SA, SE--WI: Cuba, Trinidad and Tobago
<i>Asclepias nivea</i>	ipecacuanha	SA, SE, SM--WI
<i>Mateleia maritima</i> *		SA, SE, SM--AM
<u>Begoniaceae</u> (ST)		
<i>Begonia retusa</i>	mountain manna,	SA, SE--LA: St.Barts, St.Kitts, Montserrat
<u>Bignoniaceae</u> (H)		
<i>Crescentia cujete</i> *	calabash	SA, SE, SM--WO, na- tive of AM
<i>Macfaydena unguis-cati</i> *	cat claw	SA, SE, SM--AM
<i>Tabebuia heterophylla</i> *(= <i>T.pallida</i>)	white cedar	SA (Rojer), SE, SM-- WI
<i>Tecoma stans</i> *	yellow blossom	SA, SE, SM--AM
<u>Bombacaceae</u> (ST)		
<i>Quararibea turbinata</i> *	millar wood	SE--AM
<i>Ceiba pentandra</i> *	silkcottontree	SE, SM--WO, native of AM, probably culti-

		vated and escaped in Africa and Asia
<u>Boraginaceae</u> (H)		
<i>Argusia gnaphalodes</i> *	white lavender	SA, SE, SM--WI
<i>Bouyeria succulenta</i> *	white chank	SA, SE, SM--AM
<i>Cordia nesophila</i>		SA, SE--LA
<i>Cordia sulcata</i>	manjack, sticking berry, Jack tree (L)	SA, SE--WI
<i>Heliotropium angiospermum</i>		SA, SE, SM--AM
<i>Rochefortia acanthophora</i>		SE, SM--WI
<i>Tournefortia filiflora</i>		SA, SE, SM--WI
<i>Tournefortia microphylla</i>		SE, SM--WI
<i>Tournefortia volubilis</i>		SA, SE, SM--AM
<u>Brassicaceae</u> (ST)		
<i>Brassica integrifolia</i>	mustard, mustard salad	SA, SE--WO, native to Asia
<i>Lepidium virginicum</i> *		SA, SE, SM--AM, introduced in Europe
<u>Burseraceae</u> (ST)		
<i>Bursera simaruba</i> *	gum tree, balsam tree, lime tree, turpentine tree (L)	SA, SE, SM--AM
<u>Cactaceae</u> (H)		
<i>Opuntia triacantha</i> *	spanish lady (ST), suckers (list H + L)	SA, SE, SM--WI
<i>Opuntia rubescens</i> (= <i>O. spinosissima</i>)	sour prickly, sweet prickly (ST)	SE, SM--WI
<i>Opuntia dillenii</i>	sour prickly (ST), prickly (list H)	SA, SE, SM--AM
<i>Hylocereus trigonus</i>	strawberry (ST), prickly (list H)	SA, SE, SM--WI
<i>Melocactus intortus</i>	popehead (list H), tothead (L)	SA, SE, SM--WI
<i>Pilocereus royeri</i> (= <i>Cephalocereus royeri</i>)	dildo (list H)	SA, SE, SM--WI
<i>Selenicium grandiflorum</i> *		SA, SE, SM--WI: Jamaica, cultivated and escaped
<u>Caesalpiniaceae</u> (ST) (in H: <u>Caesalpinioideae</u>)		
<i>Hymenaea courbaril</i> *	locust	SA, SE, SM--AM
<i>Tamarindus indica</i>	tamarind	SA, SE, SM--WO, probably native to Africa,
<i>Cassia bicapsularis</i> * (= <i>Senna bi-</i>	blydog	SA, SE, SM--AM, in-

<i>capsularis</i> in H)		roduced in the Old World
<i>Cassia alata</i>		SE, SM--AM, introduced in the Old World
<i>Cassia occidentalis</i>	bitter root	SA, SE, SM--WO, probably native to AM
<i>Cassia glandulosa</i>	wild peas	SA, SE, SM--AM
<i>Parkinsonia aculeata</i> *	wondertree, Jeruzalem thorn	SE, SM--WO, native to AM
<i>Haematoxylon campechianum</i> *	logwood	SE--AM, probably relict of cultivation
<i>Caesalpinia coriaria</i>	dividivi	SA, SE, SM--AM, introduced in India
<i>Caesalpinia bonduc</i> *		SA, SE, SM--WO, native to Asia
<u>Capparaceae</u> (ST)		
<i>Capparis cynophallophora</i>		SA, SE, SM--AM
<i>Capparis indica</i> *	black willow	SA, SE, SM--AM
<i>Capparis frondosa</i> (= <i>C.baducca</i>)	church blossom, wild cocoa (list H)	SA, SE, SM--AM
<i>Capparis flexuosa</i>	mustard tree, man of war bush, nightwood (L)	SA, SE, SM--AM
<i>Morisonia americana</i> *	wild misple, rat misple (list H)	SA, SE, SM--AM
<i>Cleome viscosa</i>	wild massamby	SA, SE, SM--WO, native to the Old World
<i>Cleome gynandra</i>	massamby	SA, SE, SM--WO, native to Asia and Africa
<u>Celastraceae</u> (ST)		
<i>Crossopetalum rhacoma</i> *		SA, SE, SM--AM
<i>Maytenus elliptica</i>		SE, SM--WI
<i>Gyminda latifolia</i> *	boxwood (list H)	SE, SM--AM
<i>Schaefferia frutescens</i> *		SA, SE, SM--AM
<u>Chenopodiaceae</u> (ST)		
<i>Chenopodium ambrosioides</i>	wormbush	SA, SE, SM--WO, native to AM
<i>Chenopodium murale</i> *	sprainbush	SE, SM--WO, native to the Old World
<u>Chrysobalanaceae</u> (ST)		
<i>Chrysobalanus icaco</i> *	cocoa plum, fatpork,	SA, SE, SM--AM
<i>Hirtella triandra</i> *	hairy plum	SA, SE--AM
<u>Clusiaceae</u> (ST)		
<i>Mammea americana</i> *	mamaya	SA, SE--AM, cultivated in the Old World
<i>Clusia major</i> (= <i>C.alba</i>)	wild mammy, wild bal-	SA, SE--LA

	sam, balsam (L)	
<u>Combretaceae</u> (ST)		
<i>Conocarpus erecta</i> * var. <i>erecta</i>	button wood	SM, SE--WO
<u>Compositae</u> (H)		
<i>Acmella uliginosa</i> *		SE--WO
<i>Ageratum conyzoides</i> *	white cap	SA, SE, SM--WO, native to AM
<i>Ambrosia hispida</i> *		SA, SE, SM--WI
<i>Bidens pilosa</i>		SA, SE, SM--AM
<i>Borrchia arborescens</i> *		SA, SE, SM--AM
<i>Chaptalia nutans</i> *		SA, SE, SM--AM
<i>Conyza canadensis</i>		SA, SE, SM--WO
<i>Cosmos caudatus</i>	foxtail	SE--AM
<i>Emilia sonchifolia</i>		SA, SE, SM--WO, native to the Old World
<i>Erechtites hieracifolia</i>		SA, SE, SM--AM, introduced in the Old World
<i>Eupatorium macranthum</i>		SA, SE--LA: St.Kitts, Nevis
<i>Eupatorium odoratum</i>		SA, SE, SM--AM
<i>Eupatorium sinuatum</i>		SE--WI
<i>Neurolaena lobata</i> *		SA, SE--AM
<i>Parthenium hysterophorus</i> *		SA, SE, SM--AM, introduced in Asia
<i>Pectis humifusa</i>		SA, SE, SM--WI
<i>Porophyllum ruderale</i> *		SA, SE, SM--AM
<i>Pseudelephantopus spicatus</i> *		SA, SE, SM--AM
<i>Sonchus oleraceus</i>	wild salad	SA, SE, SM--WO
<i>Synedrella nodiflora</i> *		SA, SE, SM--AM, introduced in the Old World
<i>Tridax procumbens</i> *		SM, SE ? (Rojer)--WO
<i>Vernonia albicaulis</i>	wild tobacco	SA, SE, SM--WI
<i>Vernonia cinerea</i>		SA, SE, SM--WO
<i>Wedelia calycina</i>	yellow sage, cup tree (L)	SA, SE--AM
<u>Convolvulaceae</u> (H)		
<i>Cuscuta americana</i>	love vine	SA, SE, SM--AM
<i>Evolvulus sericeus</i>	blue dots	SE, SM--AM
<i>Ipomoea carnea</i> ssp. <i>fitulosa</i>		SE, SM--AM, Hawaiï
<i>Ipomoea nil</i>		SA, SE, SM--WO
<i>Ipomoea pes-caprae</i>	seaside potato, sea vine	SE, SM--WO
<i>Ipomoea quamoclit</i>		SA, SE, SM--WO
<i>Ipomoea sphenophylla</i>	morning glory?	SE--LA, endemic to SE
<i>Ipomoea tiliacea</i>		SE, SM--WO

<i>Ipomoea triloba</i>		SE--WO, native to AM
<i>Ipomoea turbinata</i>	lilac bell	SE--WO
<i>Ipomoea violacea</i>		SA, SE--WO
<i>Jacquemontia penthantha</i>		SA, SE, SM--WO
<i>Merremia dissecta</i>		SA, SE, SM--WO, native to AM
<i>Stictocardia tiliifolia</i>		SE--WO, native to Asia
<u>Crassulaceae</u> (ST)		
<i>Bryophyllum pinnatum</i> *	leaf of life	SA, SE--WO, native to Africa
<u>Cucurbitaceae</u> (ST)		
<i>Melothria guadelupensis</i>		SA, SE--AM
<i>Cucumis anguria</i>	pumpkin	SA, SE--AM
<i>Momordica charantia</i> *	snake apple bush (L), maidenapple (list H)	SA, SE, SM--WO, native of the Old World
<u>Erythroxylaceae</u> (ST)		
<i>Erythroxylum havanense</i>	bracelet	SA, SE, SM--AM?
<u>Euphorbiaceae</u> (ST)		
<i>Phyllanthus amarus</i>		SA, SE, SA--WO, native to AM
<i>Croton lobatus</i>	lilac bush	SA, SE, SM,--WO
<i>Croton astroites</i>	wild marrow, marron (L)	SE, SM--WI
<i>Croton flavens</i>	yellow balsam, marrow, wormbush (list H)	SA, SE, SM--AM (WI + Yucatan)
<i>Bernardia corensis</i>		SE, SM--AM
<i>Acalypha chamaedrifolia</i>	bastard nettle	SA, SE, SM--WI + S.Florida
<i>Tragia volubilis</i> *	stinging nettle (SM)	SA, SE, SM--WO
<i>Dalechampia scandens</i> *		SE, SM--WO
<i>Jatropha gossypifolia</i> *	physic nut, oil nut tree (L)	SA, SE, SM--WO
<i>Jatropha curcas</i> *	grave physic nut	SA, SE, SM--WO
<i>Hippomane mancinella</i> *	manchineel tree	SA, SE, SM--AM
<i>Hura crepitans</i> *	sandboxtree	SE, SM--WO
<i>Euphorbia articulata</i>		SA, SE, SM--WI
<i>Euphorbia hirta</i>		SA, SE, SM--WO
<i>Euphorbia hypericifolia</i>		SA, SE, SM--AM
<i>Euphorbia hyssopifolia</i>		SE, SM--WO
<i>Euphorbia mesembrianthemifolia</i>		SE, SM--AM
<i>Euphorbia prostrata</i>		SA, SE, SM--WO, native to AM
<i>Pedilanthus tithymaloides</i> *		SE, SM--LA and St.Croix
<i>ssp.padiifolius</i>		
<u>Fabaceae</u> (ST) (=Faboideae in H)		

<i>Crotolaria retusa</i>	big yellow popbush	SE (Rojer), SM--WO
<i>Crotolaria verrucosa</i>	purple popbush	SA, SE, SM--WO
<i>Crotolaria incana</i>	small yellow popbush	SA, SE, SM--WO
<i>Gliricidium sepium</i> *	cough bush	SE, AM
<i>Piscidia carthagenensis</i> * (<i>P.piscipula</i>)	stinkwood	SE, SM--AM
<i>Lonchocarpus benthamianus</i> (= <i>L.violaceus</i> * in H)		SE--LA
<i>Andira inermis</i>		SA, SE--WO
<i>Tephrosia cineria</i>		SE, SM--AM
<i>Tephrosia cathartica</i> (= <i>T.senna</i> * in H)		SA, SE--AM
<i>Cracca caribaea</i> *		SE, SM--AM
<i>Indigofera suffruticosa</i> *	wild indigo	SA, SE, SM--AM, cultivated in Asia and Africa
<i>Cajanus cajan</i> *	pigeon pea	SA, SE--WO?, cultivated and naturalised
<i>Rhynchosia minima</i>		SA, SE, SM--WO
<i>Rhynchosia reticulata</i> *	pea withe	SA, SE, SM--AM
<i>Galactia dubia</i>		SE, SM--WI (LA in H)
<i>Galactia rubra</i> *		SA, SE, SM--LA
<i>Galactia longifolia</i>		SE, SM (H)--LA: Antigua, Guadeloupe (LA in H)
<i>Clitoria ternatea</i> *		SE--WO, native to the Old World
<i>Centrosema virginianum</i> *	blue bell	SA, SE, SM--WO
<i>Abrus precatorius</i> *	jumby beans, liquorise plant	SA (Rojer), SE, SM--WO
<i>Stylosanthes hamata</i> *	wild clover	SA, SE, SM--AM
<i>Alysicarpus vaginalis</i> *	sistern pea nut	SA, SE, SM--WO, native to Asia
<i>Desmodium triflorum</i>		SE, SM--WO
<i>Desmodium canum</i> * (= <i>D.incanum</i> in H)	wild pea (list H), horelaces? (L)	SA, SE, SM--WO
<i>Desmodium scorpiurus</i>		SA, SE--WO, native to AM
<i>Desmodium tortuosum</i>		SA, SE, SM--WO, native to AM
<u>Flacourtiaceae</u> (ST)		
<i>Casearia decandra</i>	crack open	SA, SE, SM--AM
<i>Samyda dodecandra</i> *	banso, wild guave	SE, SM--WI
<i>Xylosma buxifolia</i> *	cockspur	SE--WI
<u>Gentianaceae</u> (ST)		

<i>Voyria aphylla</i> *		SA, SE--AM
<u>Gesneriaceae</u> (H)		
<i>Gesneria ventricosa</i> *	dare meat (L)	SA, SE--LA and St.Croix
<u>Hydrophyllaceae</u> (H)		
<i>Nama jamaicensis</i> *		SE--AM
<u>Krameriaceae</u> (ST)		
<i>Krameria ixina</i>	wild senna	SE--AM
<u>Labiatae</u> (H) (= Lamiaceae)		
<i>Hyptis pectinata</i>	holly stalk (list)	SA, SE, SM--WO
<i>Leonotis nepetifolia</i> *	adonis abbot (list H), lion's tail (L)	SA, SE (Rojer)--WO, native to Africa
<i>Ocimum campechianum</i>		SE--AM
<i>Salvia serotina</i>		SE--AM
<u>Lauraceae</u> (ST)		
<i>Phoebe elongata</i> (= <i>Cinnamomum elongatum</i> in H)		SE--WI
<i>Nectandra coriacea</i> (= <i>Ocotea coriacea</i> in H)	sweet wood	SA, SE, SM--AM
<i>Nectandra krugii</i> (= <i>Ocotea krugii</i> in H)	black sweet wood	SA (H), SE--WI
<u>Loranthaceae</u> (ST)		
<i>Phoradendron trinervium</i>		SA, SE, SM--WI (AM in H)
<u>Malpighiaceae</u> (ST)		
<i>Malpighia emarginata</i>	cherry, West Indian cherry	SA, SE, SM--WI, cultivated in AM
<i>Byrsonima crassifolia</i>		SE--AM
<i>Byrsonima spicata</i>	hilly hock mahogany tree (SA)	SA, SE--AM
<i>Heteropteris purpurea</i> *		SE--AM
<i>Stigmaphyllon</i>	goat bush	SE, SM--WI
<i>periplocifolium</i> (= <i>S.emarginatum</i> * in H)		
<i>Bunchosia glandulosa</i>		SE, SM--AM
<u>Malvaceae</u> (ST)		
<i>Abutilon indicum</i>		SA, SE, SM--AM
<i>Herissantia crispa</i> *		SE--WO, native to AM
<i>Malvastrum americanum</i>		SA, SE, SM--WO, native to AM
<i>Malvastrum coromandelianum</i>		SA, SE, SM--WO, probably native to AM
<i>Sida ciliaris</i> var. <i>ciliaris</i>		SE, SM--AM
<i>Sida glomeratus</i>		SE--AM
<i>Sida glabra</i>		SE, SM--AM

<i>Sida procumbens</i> (= <i>S.abutifolia</i> in H)		SE, SM--AM
<i>Sida spinosa</i>		SE, SM--AM
<i>Sida acuta ssp.carpinifolia</i> (no subspecies in H)	soap bush (list H)	SA, SE, SM--WO
<i>Sida cordifolia</i>	mash mellow (list H)	SA, SE, SM--WO
<i>var.cordifolia</i> (no variety in H)	broombush (L)	
<i>var.althaeifolia</i>		SA, SE, SM--WO
<i>Bastardia viscosa</i> *		SE, SM--AM
<i>Pavonia spinifex</i>	ginger bush	SA, SE--SM--AM
<i>Hibiscus tiliaceus</i>	waru	SE, SM--WO
<i>Hibiscus brasiliensis</i>		SE--AM
<i>Thespesia populnea</i> *		SA, SE, SM--WO
<u>Melastomaceae</u> (ST)		
<i>Miconia impetolaris</i>		SE--AM
<i>Miconia laevigata</i>	sweet butchberry? (L)	SA, SE, SM--AM
<u>Menispermaceae</u> (ST)		
<i>Hyperbaena domingensis</i> *		SA, SE--AM
<i>Cissampelos pareira</i> *		SA, SE, SM--WO
<u>Mimosaceae</u> (ST) (= Mimosoideae in H)		
<i>Inga laurina</i> *	red wood	SA, SE, SM--AM
<i>Pithecellobium unguis-cati</i> *	crab wood, moneybush	SA, SE, SM--AM
<i>Albizia lebbek</i> *	woman's tongue	SA, SE, SM--WO, native to the Old World
<i>Acacia tortuosa</i>		dutch casha
SE, SM--AM		
<i>Acacia farnesiana</i>	cashia	SA, SE, SM--WO, probably native to AM
<i>Acacia macracantha</i>	french casha, creole casha, spanish casha, casha (list H)	SE, SM--AM
<i>Leucaena leucocephala</i> *	mimosa, tantan	SA, SE, SM--WO, probably native to AM
<i>Mimosa pudica</i>	shame lady shame, sensitive plant	SE, SM--WO, native to AM
<i>Desmanthus virgatus</i> *	wild tantan	SA, SE, SM--WO
<u>Moraceae</u> (ST)		
<i>Ficus citrifolia</i>	rubber tree list H)	SA, SE, SM--AM
<i>Ficus nymphaefolia</i>		SA, SE, SM--AM
<i>Ficus americana</i> *		SA, SE--AM
<i>Cecropia schreberiana</i>	downgolog (L) trumpet tree (H)	SA, SE--WI
<u>Moringaceae</u> (ST)		
<i>Moringa oleifera</i> *	moringo, orselli	SA, SE, SM--WO, na-

		tive to Asia
<u>Myrsinaceae</u> (ST)		
<i>Ardisia obovata</i> *	bastard cinnamon	SA, SE, SM--WI
<u>Myrtaceae</u> (ST)		
<i>Psidium guayava</i> *	guava, guave tree	SA, SE--WO, probably native to AM
<i>Pimenta racemosa</i> *	cinnamon tree, bayberry, bayrom tree (H+ L)	SA, SE, SM--WO, native to WI
<i>Myrcia splendens</i>	Surinam cherry?	SA, SE, SM--AM
<i>Myrcia citrifolia</i> var. <i>imrayana</i>	(list H)	SA, SE, SM--LA: Guadeloupe and Martinique
<i>Myrciaria floribunda</i> *	guave berry	SE, SM--AM
<i>Syzygium jambos</i> *	plum rose	SE, SM--AM, native to Asia
<i>Eugenia uniflora</i>	honey berry, Surinam cherry	SA, SE--AM, cultivated in Tropics and Sub-Tropics
<i>Eugenia ligustrina</i>	black berry,	SE, SM--AM
black cherry		
<i>Eugenia axillaris</i>	choaky berry,	SA, SE, SM--AM,
<i>Eugenia rhombea</i>	pigeon berry	SA, SE, SM--AM
<i>Eugenia cordata</i> * var. <i>sintenisii</i>		SE--WI
<i>Eugenia procera</i>		SA, SE, SM--AM
<u>Nyctaginaceae</u> (ST)		
<i>Guapira fragrans</i>	black loblolly, loblolly (list H)	SE, SM--AM
<i>Pisonia subcordata</i>	mappo, mampoo, bloody (L), black loblolly, bladdy tree (list H)	SA, SE, SM--WI
<i>Pisonia aculeata</i> *	cockspur	SA, SE, SM--WO
<i>Mirabilis jalapa</i> *	four' o clock	SA, SE--WO, native to AM
<i>Boerhavia erecta</i>	hogmeat (list H)	SA, SE--WO
<i>Boerhavia diffusa</i>		SA, SE, SM--WO
<i>Boerhavia coccinea</i> *	hog meat bush (L)	SA, SE, SM--WO
<u>Nymphaceae</u> (ST)		
<i>Nymphaea ampla</i> *		SE--AM
<u>Olacaceae</u> (ST)		
<i>Schoepfia schreberi</i> *		SA, SE--AM
<u>Oleaceae</u> (ST)		
<i>Chionanthus compactus</i> *	bridgo tree, bachoa? (L)	SA, SE, SM--AM
<i>Jasminum fluminense</i> *		SE, SM--WO, native to Africa
<u>Oxalidaceae</u> (ST)		

<i>Oxalis corniculata</i>		SA, SE, SM--WO, native to Europe
<u>Papavaraceae</u> (ST)		
<i>Argemone mexicana</i> *	thistle	SA, SE, SM--WO, native to AM
<u>Passifloraceae</u> (ST)		
<i>Passiflora suberosa</i>		SA, SE, SM--WO, native to AM
<i>Passiflora laurifolia</i>	bell apple	SA, SE, SM--WO, native to AM
<i>Passiflora rubra</i>	snakeberry vine	SA, SE, SM--AM
<u>Phytolaccaceae</u> (ST)		
<i>Rivina humilis</i> *	jumbi pepper	SA, SE, SM--AM
<i>Trichostigma octandrum</i> *	white hoop	SA, SE, SM--AM
<i>Petiveria alliacea</i> *		SA, SE, SM--AM
<i>Microtea debilis</i> *		SA, SE, SM--AM
<u>Piperaceae</u> (ST)		
<i>Piper medium</i>		SE--AM
<i>Piper reticulatum</i>	joint wood tree? (L)	SA, SE--AM
<i>Piper dilatatum</i>		SA, SE, SM--AM
<i>Peperomia pellucida</i>		SA, SE--WO
<i>Peperomia blanda</i>		SE, SM--AM
<i>Peperomia glabella</i> var. <i>glabella</i>		SA, SE, SM--AM
<i>Peperomia glabella</i> var. <i>nervulosa</i>		SE--AM
<i>Peperomia nigropunctata</i>		SA, SE, SM--WI
<i>Peperomia guadeloupensis</i> (= <i>P.boldinghii</i> in ST 1956, = <i>P.myrtifolia</i> in H)		SA, SE, SM--WI (LA + St.Croix in H)
<i>Peperomia alata</i>		SA, SE, SM--AM
<i>Peperomia serpens</i>		SA, SE--AM
<i>Peperomia magnoliifolia</i>		SA, SE, SM--AM
<u>Plumbaginaceae</u> (ST)		
<i>Plumbago scandens</i> *	blister bush, bright eyes (L), eyebright (list H)	SA, SE, SM--AM
<u>Polygonaceae</u> (ST)		
<i>Antigonon leptopus</i> *	coralito (list H)	SA, SE, SM--WO?
<i>Coccoloba swartii</i>	red mangle, redwood	SA, SE--AM
<i>Coccoloba uvifera</i>	sea grape	SA, SE, SM--AM
<i>Coccoloba venosa</i>	hoag apple, sugary grape	SA, SE, SM--AM
<u>Portulacaceae</u> (ST)		
<i>Portulaca grandiflora</i> (H)		SE--WO, native to AM
<i>Portulaca oleracea</i>	purslane	SA, SE, SM--WO
<i>Portulaca quadrifida</i>		SE, SM--WO, native to Asia
<i>Portulaca halimoides</i>	silk cotton purslane	SA, SE, SM--AM

<i>Talinum triangulare</i> (= <i>T.fruticosum</i> * in H)		SA, SE, SM--AM
<u>Punicaceae</u> (ST)		
<i>Punica granatum</i> *	pome granate tree	SA, SE, SM--WO, probably native to Asia
<u>Rhamnaceae</u> (ST)		
<i>Krugiodendron ferreum</i> *	iron wood, iron berry	SE, SM--AM
<i>Gouania lupuloides</i> *	white root	SA, SE, SM--AM
<i>Colubrina arborescens</i>		SA, SE--AM, culti- vated in Africa
<u>Rosaceae</u> (ST)		
<i>Prunus myrtifolia</i>		SE--AM
<u>Rubiaceae</u> (ST)		
<i>Exostema caribaeum</i> (H)		SA (H), SE (H), SM-- AM
<i>Hillia parasitica</i> *	white bell, morning star (L)	SA, SE, SM (H)--AM
<i>Gonzalagunia spicata</i> (= <i>G.hirsuta</i> in H)		SA, SE--AM
<i>Randia aculeata</i>	black cherry (list H)	SA, SE, SM--AM
<i>Hamelia axillaris</i>		SA, SE--AM
<i>Faramea occidentalis</i> *		SA, SE--AM
<i>Antirhea acutata</i>		
SE (Rojer), SM--WI		
<i>Guettarda scabra</i> *	candle wood, wild guave	SA, SE, SM--WI + S.Florida
<i>Guettarda parviflora</i> (= <i>G.odorata</i> in H)	wild cherry	SA, SE, SM--AM
<i>Erithalis fruticosa</i> *	flambeau (list H)	SE, SM--AM
<i>Chiococca alba</i> *	buckroot amadesiac (L)	SA, SE, SM--AM
<i>Chiococca parvifolia</i>		SA, SE--AM
<i>Strumpfia maritima</i> *		SE, SM--AM
<i>Coffea arabica</i>	coffee	SA, SE--WO, native to the Old World
<i>Psychotria nervosa</i>	bastard canckerberry	SA, SE, SM--AM
<i>Psychotria microdon</i>		SA, SE, SM--AM
<i>Palicourea domingensis</i>		SA, SE--WI
<i>Ernodea littoralis</i> *		SA, SE, SM--AM
<i>Diodia apiculata</i>		SE--AM
<i>Spermacoce confusa</i>		SA, SE, SM--AM
<i>Borreria laevis</i>		SA, SE--AM
<i>Borreria verticillata</i>		SE--AM
<u>Rutaceae</u> (ST)		
<i>Zanthoxylum punctatum</i> *		SE, SM--WI

<i>Zanthoxylum martinicensis</i>	yellow prickle	SA, SE, SM--AM
<i>Triphasia trifolia</i> *	sweet lemon, myrtle lemon	SE, SM--WO, native to Asia
<u>Sapindaceae (ST)</u>		
<i>Cardiospermum halicacabum</i>	sprainbush vine (list H)	SA, SE, SM--WO
<i>var.microcarpa</i> (= <i>C.microcarpum</i>)		
<i>Dodanea elaeagnoides</i>		SE--WI + Florida
<i>Allophylus racemosus</i> *		SA, SE, SM--AM
<i>Exothea paniculata</i>		SE--AM
<u>Sapotaceae (ST)</u>		
<i>Bumelia obovata var.obovata</i> (= <i>Sideroxylon obovata</i> in H)	nickerberry (L)	SA, SE, SM--WI + N.Venezuela
<i>Dipholis salicifolia</i> (= <i>Sideroxylon salicifolium</i> * in H)		SE--AM
<i>Chrysophyllum argenteum</i> *		SA, SE, SM--WI
<i>Manilkara zapota</i>	mispale, sapodille	SA, SE--AM, often cultivated
<u>Scrophulariaceae (H)</u>		
<i>Scoparia dulcis</i> *		SA, SE--WO
<u>Simaroubaceae (ST)</u>		
<i>Suriana maritima</i> * (family Surianaceae in H)		SE, SM--WO
<i>Picrasma antillana</i> (= <i>P.excelsa</i> * in H)	bitter ash, wild coffee, bastard bough (list H)	SA, SE, SM--LA + Virgin Islands
<u>Solanaceae (H)</u>		
<i>Brunfelsia americana</i> *	lady of the night	SE--WI, cultivated elsewhere
<i>Cestrum laurifolium</i>		SA, SE--WI
<i>Physalis angulata</i> *		SE (Rojer)--WO
<i>Physalis pubescens</i>		SA, SE (Rojer)--AM
<i>Solanum racemosum</i> *	cancer berry	SA, SE, SM-- LA+Virgin Islands
<u>Sterculiaceae (ST)</u>		
<i>Waltheria indica</i> *	mash mellow	SA, SE, SM--WO
<i>Melochia pyramidata</i> <i>var.pyramidata</i>		SE, SM--AM
<i>Melochia tomentosa var.frutescens</i>	black toarch (list H)	SE, SM--AM
<u>Symplocaceae (ST)</u>		
<i>Symplococcus martinicensis</i> *	blue berry	SA, SE--WI
<u>Theaceae (ST)</u>		
<i>Ternstroemia peduncularis</i>		SE, SM--WI
<u>Theophrastaceae (ST)</u>		
<i>Jacquinia barbasco</i> (= <i>J.arborea</i> = <i>J.armillaris</i> * in H)	picrous bark	SA, SE, SM--WI

<u>Thymelaeaceae (ST)</u>		
<i>Daphnopsis americana*</i> <i>ssp. caribaea</i>	maho, mahow (L)	SA, SE, SM--AM
<u>Tiliaceae (ST)</u>		
<i>Corchorus hirsutus</i>		SE, SM--WO
<i>Triumfetta rhomboidea</i>	wild maho	SA, SE?--WO
<i>Triumfetta lappula</i>	wild maho	SA, SE, SM--WO
<i>Triumfetta semitrilobata*</i>	wild maho	SA, SE, SM--WO
<u>Turneraceae (ST)</u>		
<i>Turnera ulmifolia var. ulmifolia</i>		SA, SE, SM--AM
<i>Piriqueta cistoides*</i>		SE--AM
<u>Ulmaceae (ST)</u>		
<i>Celtis iguanaea</i>	snaky	SA, SE, SM--AM
<i>Trema micrantha</i>		SA, SE--AM
<u>Urticaceae (ST)</u>		
<i>Urera caracasana</i>		SE--AM
<i>Pilea semidentata</i>		SA, SE--WI
<i>Pilea microphylla</i>	creeping charly	SA, SE, SM--AM
<i>Boehmeria ramiflora*</i>		SA, SE--AM
<i>Laportea aestuans*</i>	stinging nettle	SA, SE, SM--AM
<u>Verbenaceae (H)</u>		
<i>Aegiphila martinicensis</i>		SE--AM
<i>Bouchea prismatica</i>		SA, SE--AM
<i>Citharexylum spinosum*</i>	savannah berry, Susanna berry (list), fiddlewood (L)	SA, SE, SM--AM
<i>Clerodendrum aculeatum*</i>	Persian lilac, haguebush (list)	SA, SE, SM--WI
<i>Clerodendrum speciosissimum</i>		SE--WO, native to Asia
<i>Lantana camara</i>	sage, scrubby cup, scrubby tree (L)	SA, SE, SM--WO, native to WI
<i>Lantana involucrata*</i>	sage	SA, SE, SM--AM
<i>Lantana urticifolia</i>		SA, SE, SM--AM
<i>Stachytarpheta jamaicensis*</i>	purple worm bush, shower bell (L)	SA, SE (Rojer), SM--WO?
<u>Vitaceae (ST)</u>		
<i>Cissus sicyoides (= C. verticillata*</i> in H)	pudding withe	SA, SE, SM--AM
<u>Zygophyllaceae (ST)</u>		
<i>Kallstroemia pubescens</i>		SA, SE, SM--WO, native to AM
<i>Kallstroemia maxima*</i>		SA, SE--AM

APPENDIX II

CYPERACEAE AND GRAMINEAE OF ST.EUSTATIUS

abbreviations:

SA= Saba

SE= St.Eustatius

SM= St.Martin

LA= Lesser Antilles

WI= West-Indies

AM= America (American Continent + West-Indies)

WO= world (America + other parts of the world)

ST= information from : Stoffers, A.L. 1963, Flora of the Netherlands Antilles, Vol. I: 85-203, Spermatophyta, Monocotyledoneae, edition of "Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen", no.36, Utrecht

H= information from: Howard R.A. 1979, Flora of the Lesser Antilles, Vol.3, Monocotyledoneae, Arnold Arboretum, Harvard University, Massachusetts

Scientific name	Common name	Area of distribution
<u>Cyperaceae (ST)</u>		
<i>Cyperus distans</i>		SE (not in H)--WO
<i>Cyperus rotundus</i>	nutgrass	SA, SE, SM--WO
<i>Cyperus confertus</i> s(<i>Mariscus confertus</i> in H)		SA (not in H), SE (not in H)--AM
<i>Cyperus planifolius</i> (= <i>Mariscus planifolius</i> in H)	bullgrass	SA, SE (not in H), SM (not in H)--WI
<i>Cyperus ferax</i> (= <i>Torulium odoratum</i> in H)		SA (not in H), SE (not in H)--WO
<i>Scleria lithosperma</i>	mountain grass	SE (not in H)--WO
<u>Gramineae (ST)</u>		
<i>Eragrostis ciliaris</i> var. <i>ciliaris</i>		SA, SE, SM--WO
<i>Pappophorum pappiferum</i>	crabgrass	SA, SE, SM--AM
<i>Sporobolus virginicus</i>		SA, SE, SM--WO
<i>Sporobolus pyramidatus</i>		SE, SM (not in H)--AM
<i>Aristida adscencionis</i>	mule grass	SA, SE (not in H)--WO
<i>Aristida swartziana</i>		SE (not in H)--WI
<i>Aristida suringari</i>		SE, SM--WI: St.Croix en St.Thomas
<i>Antheophora hermaphrodita</i>		SA, SE, SM--AM
<i>Tragus berteronianus</i>		SA, SE, SM--AM
<i>Leptochloa domingensis</i>		SA, SE--AM
<i>Eleusine indica</i>	dutch grass	SA, SE, SM--WO
<i>Dactyloctenium aegyptium</i>		SA, SE, SM--WO

<i>Cynodon dactylon</i>	bahama grass	SA, SE, SM--WO
<i>Chloris inflata</i>		SA, SE, SM--AM
<i>Bouteloua heterostega</i> (= <i>B.repens</i> in H)		SE (not in H), SM (H: only record in the LA)--WI (H: AM)
<i>Bouteloua americana</i> (H)		SA, SE, SM--AM
<i>Pharus glaber</i>		SA, SE, SM--AM
<i>Digitaria insularis</i>	long grass	SA, SE, SM--AM
<i>Digitaria horizontalis</i>	hay grass	SA (not in H), SE (not in H), SM--WO
<i>Brachiaria purpurascens</i>	para grass	SA, SE, SM--WO
<i>Brachiaria fasciculata</i> (H)		SA, SE, SM--AM
<i>Paspalum fimbriatum</i>		SA, SE, SM--AM
<i>Paspalum caespitosum</i>		SE--AM
<i>Paspalum laxum</i>		SA (not in H), SE (not in H), SM (not in H)--WI
<i>Panicum maximum</i>	guinea grass	SA, SE, SM--WO
<i>Panicum adpersum</i> (= <i>Brachiaria adpersum</i> in H)		SA, SE, SM--AM
<i>Panicum diffusum</i> (H)		SE, SM--AM
<i>Lasiacis harrisii</i> (= <i>L.divaricata</i> in H)	cane grass, wild cane	SA, SE, SM--AM
<i>Oplismenus setarius</i> (= <i>O.hirtellus</i> ssp. <i>setarius</i> in H)	running mountain grass	SA, SE, SM--AM
<i>Setaria geniculata</i>		SA, SE, SM (H)--AM
<i>Setaria setosa</i> (var. <i>setosa</i> in H)		SA, SE, SM--AM
<i>Setaria utowanaea</i>		SE, SM (H)--AM
<i>Setaria glauca</i> (H)		SA, SE--WO
<i>Setaria rariflora</i> (H)		SE, SM--AM
<i>Pennisetum setosum</i>		SE, SM (H)--AM
<i>Cenchrus echinatus</i>	burrgrass	SA, SE (not in H), SM (not in H)--AM
<i>Heteropogon contortus</i>		SE--WO
<i>Vulpia myuros</i> (H)		SE (H: only recorded by Boldingh)—WO

APPENDIX III THE ANIMALS OF SINT EUSTATIUS

abbreviations:

SA= Saba

SE= St.Eustatius

SM= St.Martin

LA= Lesser Antilles

WI= West Indies

AM= America (American Continent and West Indies)

WO= world (America + other parts of the world)

Mammals

Sources:

Emmons, L.H. (1990) Neotropical Rainforest Mammals. The University of Chicago Press.

Husson, A.M. (1960) Zoogdieren van de Nederlandse Antillen. Natuurwetensch.Werkgr.Ned.Ant.

Knox Jones Jr., J. and C.J.Phillips (1970) Comments on the Systematics and Zoography of Bats in the Lesser Antilles. In: Stud. Fauna Cur. and other Carib. Isl. no.121.

Corbet, G.B and J.E.Hill (1991) A World List of Mammalian Species. Oxford University Press.

scientific name, common name and local name	area of distribution	habitat	status and particular details
<i>Brachyphylla cavernarum</i> <i>cavernarum</i> St.Vincent fruit-eating bat	WI (species and subspecies)		locations of day-roosts on SE are unknown

<i>Artibeus jamaicensis jamaicensis</i> Jamaica fruit-eating bat	AM (species and subspecies)	mature and secondary rainforests and deciduous forest	this bat can be found in hollow trees, under palm leaves, in caves or occasionally in buildings; widespread and common in its range; locations of day-roosts in SE are unknown
<i>Ardops nichollsi montseratensis</i> Tree Bat	LA for the species SE and MO for the subspecies	?	?
<i>Tadarida brasiliensis antillarum</i> Free-tailed bat	AM for the species WI for the subspecies	dry or montane habitats on the fringes of the entire rainforest region	locally common and widespread in its range; roosts in tree holes, caves, rock crevices and under the roof of houses; locations of day-roosts in SE unknown
<i>Molossus molossus debilis</i> Mastiff bat	AM for the species northern LA for the subspecies	rainforest and many types of drier habitats, and in towns and cities	common to uncommon in its range; roosts in tree holes, rotting trees, rock piles, and buildings; often found in large colonies of hundreds in narrow, closed spaces under the roofs of houses in towns; locations of day roosts in SE are unknown

Birds

Sources:

Voous, Prof.Dr.K.H. (1983) Birds of the Netherlands Antilles. De Walburg Pers.

Evans, P. (1990) Birds of the Eastern Caribbean. MacMillan Education Ltd.

Halewyn, R. van and R.L.Norton (1984) The Status and Conservation of Seabirds in the Caribbean. ICBP Technical Publication No.2.

ECNAMP (1980) Preliminary Data Atlas, St.Eustatius.

Walsh-McGehee, M. (1997) Summary of the presentation at the Society of Caribbean Ornithology in Aruba in August 1997.

scientific name, common name and local name	area of distribution	habitat	status and particular details
Resident- and breeding birds			
<i>Buteo jamaicensis jamaicensis</i> Red-tailed Hawk Chicken Hawk (local)	AM for the species WI for the subspecies	wide range of habitats, particularly mountaneous ones	considered a chicken thief, but probably unbased; breeding bird (Voous) or winter visitor (Evans) on SE; records from around the Quill and the Little Mountains; not observed in August 1996
<i>Falco sparverius caribaeorum</i> American Kestrel Killy-killy (local)	AM for the species WI for the subspecies	dry woodlands, not too dense	though fairly common in its range it appears on the list of Appendix II of CITES; numerous in SE; sight records from different locations in August 1996

<i>Columba squamosa</i> Red-necked Pigeon Pigeon, Blue Pigeon (local)	WI (including Aruba, Bonaire, Curaçao, Los Testigos and Los Frailes)	rainforest, but also drier lowland woodland	commonly hunted in all islands and probably has become rare in the main part of its range for that reason; in SE most regularly seen in high trees surrounding the crater wall of the Quill; suspected of making interinsular flights and therefore of periodic occurrence; nests found near the steep crater wall; here observed in August 1996 and also near Fort de Windt
<i>Zenaida aurita aurita</i> Zenaida Dove Dove, Mountain Dove (local)	WI for the species LA for the subspecies	lowland dry woodland and adjacent open country, sometimes rainforest or along busy streets among buildings	common in SE in lowlands and low hills, most numerous in arid scrub; frequently observed in August 1996
<i>Columbigallina passerina nigrirostris</i> Common Ground Dove Ground Dove (local)	AM for the species LA for the subspecies	lowland open country and woodland particularly xerophytic vegetation, roadsides and gardens	common and widespread in SE; frequently seen in August 1996
<i>Geotrygon mystacea</i> Bridled Quail Dove Partridge (local)	LA, Puerto Rico and Virgin Islands	lowland dry scrub woodland (Evans) or mountain zones with dense luxuriant vegetation (Voous)	rare or irregular in some parts of its range; must probably be considered seriously endangered; rare in SE, where only known from forest and scrub around the top and in the crater of the Quill; in August 1996 observed at the N/W slope of the Quill and in the vegetation of the rim

<i>Crotophaga ani</i> Smooth-billed Ani	AM	open country and plantations up into mountainous rainforest	observed and collected in SE for the first time in 1962; numbers vary areas considerable; mostly seen around grazing cattle in open grassland with scrub near the airport
<i>Eulampis jugularis</i> Purple-throated Carib Docter bird (local)	LA and Virgin Islands	humid forest and adjacent plantations, but also lowland dry forest sometimes	only species of endemic genus of LA; scarce, if not decidedly rare in SE, occurring in and around the crater of the Quill, occasionally in the lowlands; not seen in August 1996
<i>Sericotes holosericeus</i> Green-throated Carib Docter bird (local)	LA and Virgin Islands for the species LA for the subspecies	lowland dry woodland, gardens; cultivated areas, sometimes open areas in mountain regions	only species of endemic genus of LA and Virgin Islands; common in SE in gardens, along roadsides and all types of vegetation, but probably less numerous than Crested Hummingbird; not observed in August 1996
<i>Orthorhyncus cristatus exilius</i> Antillean Crested Hummingbird Docter bird (local)	LA, Virgin Islands and Tobago for the species LA and Virgin Islands for the subspecies	all habitats from sea level to the tops of the highest mountains	only species of endemic genus of LA, Virgin Islands and Tobago; one of the commonest birds of the E. Caribbean; common in gardens, along roadsides and in the crater of the Quill; in August 1996 observed in the crater and at the rim; seen visiting Bromelia flowers
<i>Elaenia martinica riisii</i> Caribbean Eleania Whistler, Cheery-cheer (local)	WI for the species SM, SE, Aruba, Bonaire and Curaçao for the subspecies	all habitats, except dense rainforest	commonest of flycatchers in the region; common in SE, but more often heard than seen

<i>Tyrannus dominicensis</i> <i>dominicensis</i> Grey Kingbird Woodpecker (local)	WI (species and subspecies)	open land	conspicuous, migrating; numbers vary in SE, probably by the temporary presence of migrants from other parts of its range; in August 1996 observed at the rim of the Quill
<i>Progne dominicensis</i> Caribbean Martin Gale Bird (local)	WI	towns, open country and along sea-cliffs	mainly summer visitor; it spends the winter in S.America; some remain through the year; rather common; in August 1996 seen over the path to the top of the Quill and in Lower Town
<i>Margarops fuscatus fuscatus</i> Pearly-eyed Thrasher Thrush (local)	WI for the species range of the subspecies is not available	rainforest, but also secondary wooded vegetation and adjacent tree plantations	genus endemic to WI; leads a hidden life in all kinds of vegetation in SE; in August 1996 seen in Zeelandia and at the rim of the crater of the Quill
<i>Margarops fuscus</i> Scaly-breasted Thrasher Thrush, Black-billed Thrush (local)	LA	mainly lowland dry woodland, but also rainforest	relatively common, but shy species in its range; latest record from SE of 1927; not seen in August 1996
<i>Cinclocerthia ruficauda pavid</i> Trembler	LA for the species SA, SE, St.Kitts, Nevis and Montserrat for the subspecies	mainly mountain rainforest	only species of endemic genus of LA; not very common and locally endangered or already extinct in its range, but mostly silent and easily overlooked; only evidence of its occurrence in SE is a specimen collected prior to 1880; in 1952 calls heard in the crater of the Quill; not observed in August 1996

<i>Vireo antiloquus barbadensis</i> Black-whiskered Vireo	WI for the species range of the subspecies is not available	most wooded habitats from sea level to mountain rain-forest, but dry scrub woodland is preferred	widespread in the Eastern Caribbean, but uncommon in the Virgin Islands, SA and SM; birds of the northern part of its range are migratory and seem to winter in S.America; not uncommon in SE; in August 1996 observed in the area Behind the Mountain
<i>Dendroica petechia bartholemica</i> Yellow Warbler Goldfinch, Canary, Banana bird (local)	AM for the species N.LA for the subspecies	lowland dry scrub woodland and coastal mangrove swamp	common species in its range; rather common in SE in low scrub
<i>Coereba flaveola bartholemica</i> Banaquit; Yellowbreast (local)	AM for the species N.LA for the subspecies	all kinds of habitat	one of the commonest and widely distributed birds in the Caribbean; abundant in secondary vegetation gardens and plantations; often very tame; in August 1996 observed at different locations, also inside the hotel
<i>Loxigilla noctis coryi</i> Lesser Antillean Bullfinch Robin, Sparrow, Cheechee bird (local)	LA and Virgin islands for the species LA and Virgin Islands south to Montserrat for the subspecies	all habitats from sea level to mountain top; secondary vegetation, gardens along the forest edge and scrubbery are preferred	one of the commonest birds of the LA; in SE common in low bushes, scrubbery and gardens; in August 1996 seen at the hotel and on the N/W slope of the Quill
<i>Tiaris bicolor omissa</i> Black-faced Grassquit Sparrow (local)	AM (species and subspecies)	open grassland, ticket, scrub and gardens, also waste ground along roadsides or field margins	abundant and widely distributed in its range; common in SE; in August 1996 observed at the rim of the crater of the Quill and near Fort de Windt

<p><i>Puffinus lherminieri lherminieri</i> Audubon's Shearwater Wedrego (local) several records from</p>	<p>WO for the species WI for the subspecies</p>	<p>tropical seas; breeding habitat mainly small off-shore islets and sea cliffs</p>	<p>not easily seen from ashore, mostly far out at sea and visiting coastal waters and breeding places at night only; birds and eggs are exploited by man; its conservation status is of special concern; SE; formerly is breeding suspected at Gallows Bay and Tumble Down Dick Bay, but the last mentioned location is disturbed now by the Oil Terminal; in 1972 birds were killed at Gallows Bay</p>
<p><i>Phaeton aethereus mesonauta</i> Red-billed Tropicbird white tropic (local)</p>	<p>WO (species and subspecies)</p>	<p>tropical seas, sea-cliffs for breeding</p>	<p>Caribbean populations are small, but probably stable; its conservation status needs to be monitored; breeding almost Tropic, confined to the Eastern Caribbean; different breeding places known in SE: Concordia Bay, White Wall, Yenkin's Bay, Gallows Bay, Cay Bay, Venus Bay and Tumble Down Dick Bay (?); breeding season winter-spring; records of 33 pairs; not observed in August 1996, but undoubtedly still present</p>

<p><i>Phaeton lepturus catesbyi</i> White-tailed or Yellow-billed Tropicbird; Tropic (local)</p>	<p>WO for the species WI for the subspecies</p>	<p>tropical seas; seacliffs for breeding</p>	<p>most numerous in the Caribbean where its range does not overlap that of <i>P.aetherius</i>; breeding season spring-summer; Caribbean breeding population is now 1/2 of what was estimated in the eighties (Walsh-McGehee, pers.comm. 1997), mainly due to coastal development and loss of nesting sites; breeding recorded in SE from Cupe Coy Bay; numbers estimated at a few pairs only; not seen in August 1996</p>
<p><i>Nyctanassa violacea bancrofti</i> Yellow-crowned Night Heron Crabeater (local)</p>	<p>AM (species and subspecies)</p>	<p>mangrove swamp and along coast</p>	<p>most seen at around dusk; most common where there are extensive areas of mangrove swamp; not uncommon in SE; nests with eggs found in seagrass growth near Zeelandia Bay; not observed in August 1996</p>
<p><i>Butorides striatus virescens</i> Green, Striated Heron or Green-backed Heron Gaulin, Little Gaulin, Pond Bird (local)</p>	<p>WO for the species AM for the subspecies</p>	<p>wide range of habitats, particularly swamps and along lakes, ponds and streams</p>	<p>one of the commonest herons in the E.Caribbean; scarce in SE; nests not found, but most certainly breeding; also seen far from water, once on the slope of the Quill</p>

Migrants and non-breeding Seabirds			
<i>Falco columbarius</i> Merlin, Pigeon Hawk	WO	during migration any habitat from sea level to mountain top	regular passage migrant and winter visitor in most months of the year in the Virgin Islands and N.LA; further south only a casual visitor; only one record from SE
<i>Pandion haliaetus</i> Osprey Fish Hawk (local)	WO	all kinds of sea coasts, lagoons and inland bays	numbers have declined owing to biocidal poisoning, but still a rare though regular winter visitor; species of Appendix II list of CITES and SA
<i>Sula leucogaster</i> Brown Booby Booby (local)	WO	tropical seas; flat rocky islands and atolls, steep outlying rocks and cays as breeding places	commonest booby in the WI, but breeding colonies have declined considerably; regular, though scarce visitor along all coasts of SM, SE and SA; numerous records from coast of SE
<i>Pelecanus occidentalis</i> Brown Pelican	AM for breeding	coastal seas; mangrove swamp	uncommon visitor to most of the LA; needs protection of breeding sites; in August 1996 observed at Concordia Bay and Venus Bay
<i>Fregata magnificens</i> Magnificent Frigatebird Weather bird (local)	WO	along tropical coasts and bays; mangrove swamp for breeding and steep rocks for roosting	common appearance throughout the WI, but few known breeding sites; breeding colonies should be fully protected; in August 1996 3 birds observed at Concordia Bay in SE

<i>Bubulcus ibis</i> Cattle egret Cowbird (local)	WO	around grazing animals, roosting and mangrove swamp and coastal islets for breeding	invaders from Africa as recently as 1930; now the commonest heron in many Caribbean islands; roost and nest colonially; very irregular in numbers; in SE sleeping gatherings may exceed 100 birds
<i>Egretta caerulea</i> Little Blue Heron Water Gaulin (local)	AM	almost any habitat from damp pasture at sea level to montane swamp or stream; fresh or brackish water is preferred	commonly observed in the Eastern Caribbean; once collected in SE
<i>Egretta thula</i> Snowy Egret Egret (local)	AM	shallow water; mangrove swamp or shrubland for breeding	for the most LA a rare, but regular migrant or winter visitor; one record from SE only
<i>Charadrius vociferus</i> Killdeer Soldier bird, Pond bird (local)	AM	warm and tropical coastal and inland arid habitats	besides SM, rare transient migrant in the E.Caribbean; few records from SE
<i>Pluvialis dominica</i> Lesser Golden Plover	WO	tundras; mud flats and shores with fresh water, brackish lagoons, flat flooded country	regular passage migrant throughout the E.Caribbean; once recorded from SE
<i>Calidris alba</i> Sanderling	WO	arid tundras; sand beaches, saline mud flats	passage migrant and winter visitor in SE
<i>Calidris pusilla</i> Semipalmated Sandpiper Pond bird (local)	AM	tundras, muddy shores of lagoons, flooded plains and rain pools	non-breeding visitor from N.America; once recorded from SE
<i>Actitis macularia</i> Spotted Sandpiper Tip-up, Dipper, Weather bird (local)	AM	all kinds of fresh water habitats	abundant transient and winter visitor in the WI; recorded in SE

<i>Arenaria interpres</i> Ruddy Turnstone Pond bird (local)	WO	all kinds of rocky coasts	usually seen in autumn or spring, migrating in the E.Caribbean; only one record from SE
<i>Larus atricilla</i> Laughing Gull Laughing bird, Davy (local)	AM	temperate and warm coasts	breeds throughout the E.Caribbean in small colonies; summer visitor; few records off the coast of SE
<i>Sterna maxima</i> Royal Tern Sea gull (local)	WO	warm and tropical coasts	may be seen at any time of the year throughout the E.Caribbean, however breeding colonies are few and small here; its status needs to be monitored; numerous records from SE
<i>Sterna sandwicensis</i> Sandwich Tern	WO	coasts and bays	some breeding sites in the Caribbean were abandoned in this century; needs protection; only one record from SE
<i>Sterna fuscata</i> Sooty Tern Egg bird (local)	WO	oceans; seacliffs and remote islets for breeding	most numerous breeding seabird species in the Caribbean, but threatened by egg collecting; one record off the N.coast of SE
<i>Sterna albifrons</i> Least Tern Spratt gull (local)	WO	temperate and tropical sea coasts, wide rivers and arid often alkaline plains	widespread and local as a breeder in the Caribbean
<i>Coccyzus americanus</i> Yellow-billed Cuckoo	AM	lowland dry scrub woodland	relatively uncommon passage migrant or winter visitor in most of the LA; breeds in St.Kitts; only one record from SE
<i>Ceryle alcyon</i> Belted Kingfisher	AM WO	bays and seashores, lowland rivers, lakes and lagoons	passage migrant and winter visitor in the Caribbean; not uncommon in SE

<i>Hirundo rustica</i> Barn Swallow Christmas bird (local)		lowland open country, road-sides	common passage migrant and winter visitor in the E.Caribbean, also in SE
<i>Mniotilta varia</i> Black-and-white Warbler	AM	deciduous and coniferous woodlands	regular passage migrant and winter visitor in the E.Caribbean; scarce in SE, numbers varying each year
<i>Parula americana</i> Northern Parula Warbler	AM	swampy woodlands	regular and fairly common passage migrant and winter visitor in the E.Caribbean; not uncommon in SE, but numbers varying each year
<i>Dendroica discolor</i> Prairie Warbler	AM	bush and scrub	uncommon winter visitor, probably not present each year in SE
<i>Dendroica tigrina</i> Cape May Warbler	AM	spruce forests	winter visitor ; one record from SE
<i>Setophaga ruticeila</i> American Redstart	AM	open, mainly deciduous forests	regular passage migrant and winter visitor in the E.Caribbean; observed in all kinds of vegetation, rather numerous in some years, almost absent in others
<i>Piranga olivacea</i> Scarlet Tanager	AM	woodlands	accidental in the E.Caribbean; few records from SE

Amphibians and Reptiles

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scientific name, common name and local name	area of distribution	habitat	status and particular details
Amphibians			
<i>Eleutherodactylus johnstonei</i> Piping Frog Mountain Frog (local)	LA, introduced in Jamaica	mesic forests, including rain-forest, also cut-over fields, yards, gardens and adjacent to sugarcane fields	very common in its range; occurs from sea level to elevations of at least 854 m; can be encountered in almost any terrestrial situation which offers concealment and some moisture; makes a weak 2-note call, which was heard in August 1996 in the crater and on the slopes of the Quill in response to rain showers

Reptiles			
<i>Ameiva erythrocephala</i> Ground Lizard	SE, St.Kitts and Nevis	mesophilic	frequently observed in August 1996 among others in the area Behind the Mountain, on the W.slope of the Quill, in Big Gut near White Wall and in gut near Great Bay
<i>Anolis wattsi schwartzi</i> Tree Lizard	LA for the species SE, St.Kitts and Nevis for the subspecies	xeric scrub, wooded ravines, mesic forest including rain-forest, plantations, beaches, stone walls, buildings, moist and shady pockets in arid lowland	frequently observed in SE in August 1996 among others: in Zeelandia, on the N/W slope of the Quill, on the rim and in the crater of the Quill, near White Wall, on the S.slope of Boven, under trees in Lower Town and near Venus Bay; is very abundant in more forested areas
<i>Anolis bimaculatus bimaculatus</i> Tree Lizard	SE, St Kitts, Nevis, Barbuda and Antigua for the species (introduced in Bermuda and SM) SE, St.Kitts and Nevis for the subspecies	xeric scrub, bushes, gardens, plantations, rockwalls formerly separated from <i>A..w. schwartzi</i> in SE by habitat	inhabits the more arid lowlands; absent at high elevations; may be preference; <i>A..b.bimaculatus</i> probably have extended its range when people cut the forest; observed in August 1996 in the hotel garden and in a gut near Bay; seemed to be less abundant as <i>A.w.schwartzi</i> in its habitat

<i>Iguana delicatissima</i> Antillean Iguana	LA in its range;	variety of habitats from xeric forests, arid cactus and rock areas, to wetland forest	may be infradispersed (generally in wet areas) or clumped (usually in drier parts) hunted for food by humans and that is the main reason of its critical state in different islands and of its extinction in the remaining ones; in 1992 observed in SE near Fort Royal, in the area of Little Mountain and Signal Hill, near Venus Bay, in gut near Zeelandia Bay, at Key Bay and on the lower slopes of the Quill; considered endangered by its small population size (<500); recent observations from Little Mountain (Faber, pers.comm.): not observed in August 1996
<i>Hemidactylus mabouia</i> Common Gecko, Mabouya	WO	buildings, open rocky areas	active at night; introduced from Africa; frequently encountered in houses
<i>Sphaerodactylus sputator</i>	SE, SM, Anguilla, St.Barts, St.Kitts and Nevis	mesophilic	there is no specific information available from SE; not observed in August 1996
<i>Sphaerodactylus sabanus</i>	SA, SE, St.Kitts, Nevis	mesophilic	same
<i>Thecadactylus rapicauda</i> Woodslave, Houseslave	AM	mesophilic; rainforest, mesic highlands, plantations, buildings	nocturnal; in August 1996 observed on hotel building

<i>Alsophis rufiventris</i> Red-bellied Racer Snake	SA, SE, formerly also St.Kitts and Nevis	mesophilic; rainforest, along forest edge, rock-strewn areas at forest edge or in forest, gardens, heavily disturbed areas	diurnal; preys on <i>Eleutherodactylus</i> , <i>Anolis</i> and <i>Ameiva</i> ; in view of the dramatic decrease of its range assessed to be 'Endangered' in the 1996 IUCN Red list of Threatened Animals; abundant, especially in the forested areas in the south, but less abundant than in Saba; in August 1996 seen at the rim of the crater of the Quill
<i>Chelonia midas</i> Green Turtle	WO	oceans; shallow water with sea grass beds; large open beaches for nesting	endangered; numbers have declined very much worldwide, because of exploitation by humans; appears on Appendix I of CITES; occasional nesting recorded in SE in the past at Concord Bay; commonly encountered in the sea around the island
<i>Eretmochylys imbricata</i> Hawksbill	WO	tropical oceans, coral reefs and rocky coasts; small quiet beaches for nesting	highly endangered; meat is edible, but favoured especially due to their shells; numbers have declined worldwide; appears on Appendix I of CITES; more common than Green Turtle in the sea around SE
<i>Dermochelys coriacea</i> Leatherback	WO	tropical, temperate and sub-arctic seas and oceans, nests in tropical areas only	lives in open sea; also endangered due to human exploitation; appears on Appendix I of CITES; nesting reported at Concordia Bay on rare occasions; a nest was found there in June 1997; this was the first since years

APPENDIX IV BUTTERFLIES OF ST. EUSTATIUS

Abbreviations:

SA= Saba

SE= St.Eustatius

SM= St.Martin

LA= Lesser Antilles

WI= West Indies

AM= America (American Continent and West Indies)

WO= World (America + other parts of the world)

Source: pers. comm. J. Y. Miller and L.D.Miller, 1996.

Common names from:

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Scientific name	Common name	Area of distribution
Nymphalidae		
<i>Biblis hyperia</i>	Red Rim	SA, SE--AM
<i>Junonia genoveva</i>	Smokey Buckeye	
Heliconiidae		
<i>Agraulis vanillae</i>	Gulf Fritillary	SA, SE, SM--AM
<i>Heliconius charitonia</i>	Zebra Long Wing	SA, SE--AM
Lycaenidae		
<i>Cyclargus thomasi</i>		SE, SM--WI (+ Florida)
<i>Hemiargus hanno</i>		SA, SE, SM--AM
<i>Leptotes cassius</i>	Tropical Striped Blue	SA, SE, SM--AM
<i>Strymon acis</i>	Antillean Hairstreak	SA, SE, SM--WI (+ Florida)
<i>Strymon columella</i>	Dotted Hairstreak	SE, SM--AM
<i>Strymon bubastus</i>		SA, SE, SM--AM
Pieridae		
<i>Ascia monuste</i>	Great Southern White	SA, SE, SM--AM
<i>Eurema elathea</i>		SE, SM--AM
<i>Eurema lisa</i>	Small Sulfur	SA, SE, SM--AM
<i>Phoebis sennae</i>	Cloudless Sulfur	SA, SE, SM--AM
Hesperiidae		
<i>Ephriades arcas</i>		SA, SE, SM--WI
<i>Hylephila phyleus</i>	Fiery Skipper	SE, SM--AM
<i>Panoquina sylvicola</i>	Sugarcane Skipper	SA, SE, SM--AM
<i>Polvegonus manuelyi</i>		SE, SM--AM
<i>Pyrgus oilaus</i>	Tropical Checkered Skipper	
<i>Urbanus obscurus</i>		SA, SE, SM--LA
<i>Urbanus proteus</i>	Long Tailed Skipper	SA, SE, SM--AM
<i>Wallengrenia ophites</i>		SA, SE, SM--LA