

**Title:** WHERE DO THE RAINDROPS FALL

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Environmental Education Team

**Grade Level:** 6-8

<b>Concepts:</b>	<b>Disciplines:</b>
4. Water	1. Social Studies
6. Resources	2. Math

**Objective:**  
Through map interpretation skills, students will complete the study guide correctly, and make conclusions about the importance of rainfall to places and people.

- Directions:**
1. Obtain road/political maps for the Virgin Islands from VI Division of Tourism or the Territorial Government so that each student has one to work with, or at best, share with one other student.
  2. Familiarize students with reading/interpretation of special maps such as the attached rainfall map.
  3. Do a sample place location and rainfall interpretation.
  4. Distribute the rainfall study guide for this activity and have each student complete questions 1 and 2. (20 minutes)
  5. Based on information from DCCA FACT SHEET No.2, discuss with students the rainfall patterns over the Islands; how little of the rainfall is retained and why (evaporation and runoff); and how important rain is to places and people. After this discussion, have students complete question 3.
  6. Go over all study guide items with the class.

**Resources:**  
Climatology and Oceanography of the Virgin Islands, DCCA Environmental Fact Sheet No.2.



WHERE DO THE RAIN DROPS FALL (cont.)

3. For all the Islands, the average yearly rainfall is only about 44 inches. This is not very high.

a) Of the rain that does fall, how does evaporation and runoff diminish the value of each rainfall?

b) Make a list of some problems people have on the Islands because there is not much rain water to use.

DCCA ENVIRONMENTAL FACT SHEET NO.2  
CLIMATOLOGY AND OCEANOGRAPHY  
OF THE VIRGIN ISLANDS

Precipitation and Evaporation

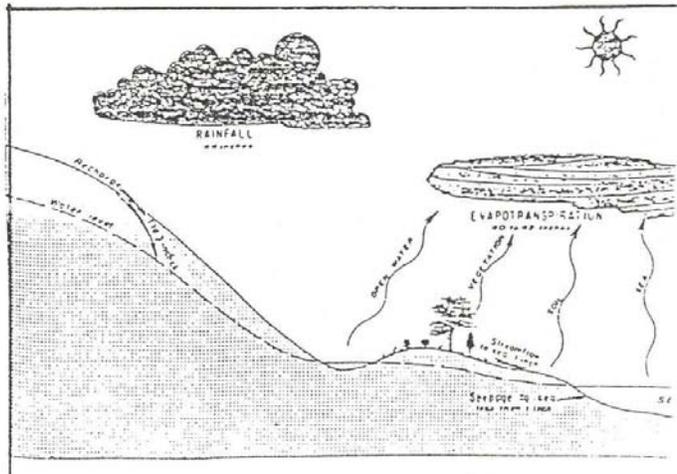
In the Virgin Islands, rainfall varies over the year by island and by areas within a given island. On the average, St. Croix receives 40 inches per year, St. John - 47 inches, and St. Thomas - 42 inches. Heaviest rainfall occurs on the western end of all three islands. The wettest months are August to November; the driest from January to April.

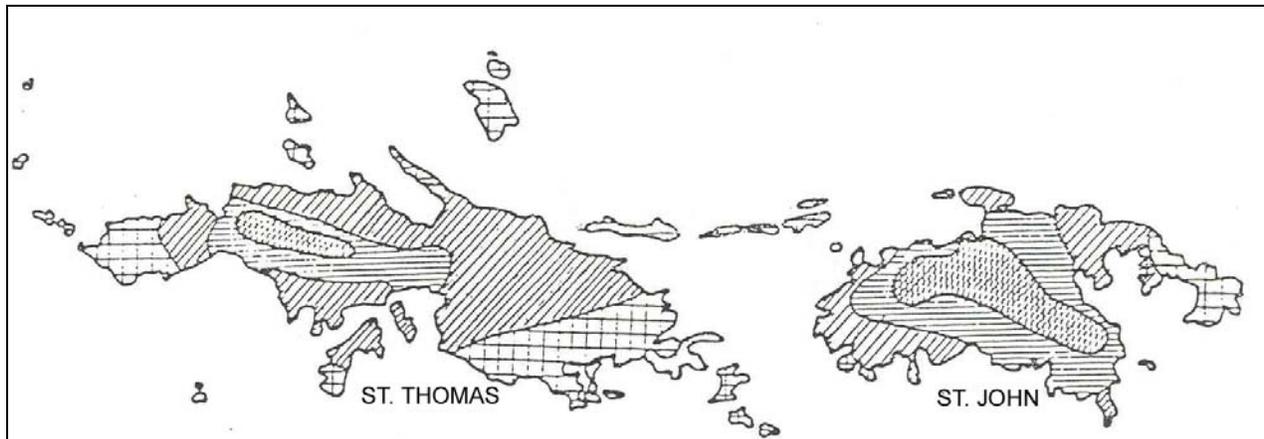
Compared to other places, rainfall in the V. I. is relatively low. Evaporation, however, is high due to constant wind and intense sun. This produces very dry conditions over most of the islands excepting some high mountain forests. Dryness and water loss are heightened by steep slopes which promote runoff and shallow rocky soil which holds little moisture.

Runoff is accelerated by development, which strips the soil of water absorbing vegetation and replaces it with non-absorbing pavement and hard surfaces. Rapid runoff not only robs plants and animals of much-needed water, but also can cause erosion, flooding and water quality problems (due to the soil and organic materials which are carried by the water to the sea).

Table 1.--Monthly and annual average rainfall, U.S. Virgin Islands [Data from National Weather Service]

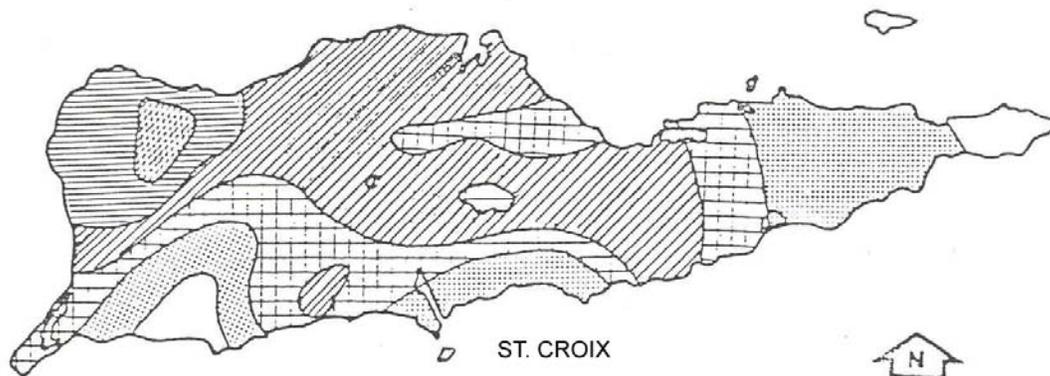
Month	Rainfall, inches
January	2.71
February	1.78
March	1.47
April	2.45
May	4.54
June	3.30
July	3.73
August	4.49
September	6.18
October	5.56
November	4.84
December	3.33
Annual	44.38





The position of St. Croix relative to St. Thomas and St. John has been shifted north and west to fit drawing.

Caribbean Sea



ST. CROIX

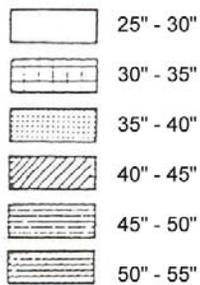


SCALE



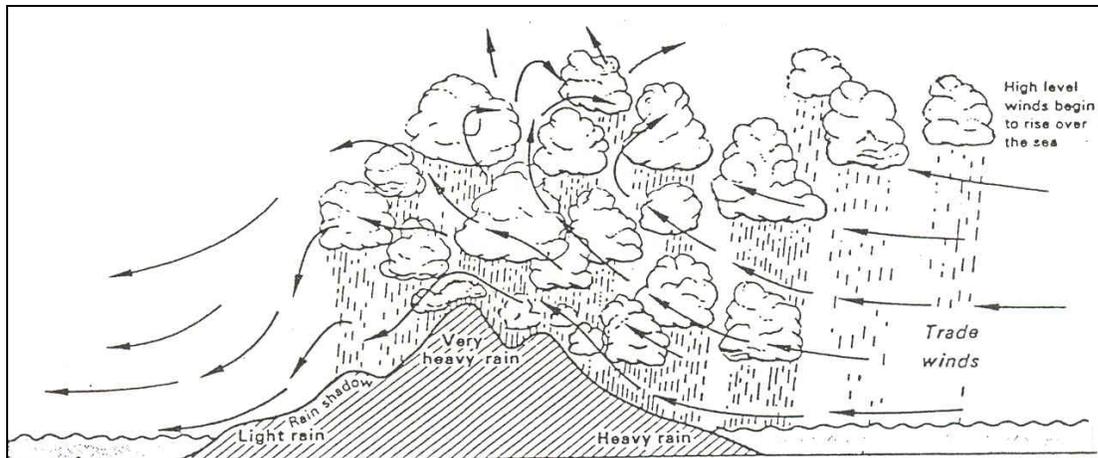
Miles

**LEGEND**



NOTES: 1: Sources: *Water Balance of a Dry Island* by M.J. Bowden (1968) and *Climate Water Balance and Climate Change in the Northwest Virgin Islands* by M.J. Bowden et al. (1970)

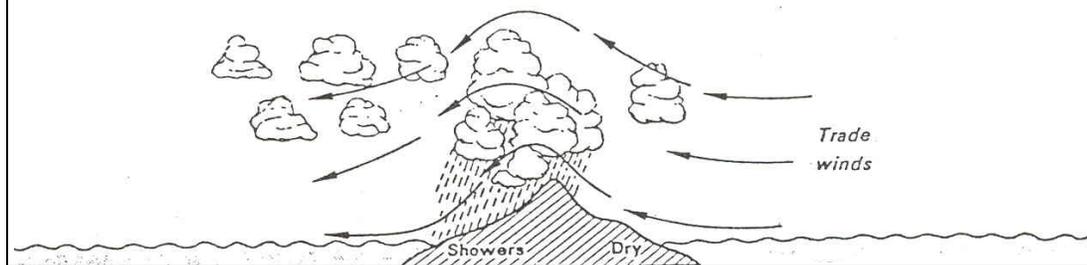
2. For details, see original maps in the source references or reproduction of the information in the publication: *Virgin Islands of the United States Resource Conservatin and Development Project*. V.I. Government (1973).



**Rainfall and relief.**

*Above:* Showers falling over an island large enough and mountainous enough to force high level winds to rise long before they reach it, so that showers fall over the sea and the windward coast as well as on the mountains themselves.

*Below:* Sometimes the showers which fall over a smaller, lower island drift downwind and fall mainly on the leeward slopes. Often lines of cumulus clouds extend for many miles to the leeward of the hill summits where they form.



Water Quality

Water quality can be analyzed in a variety of ways depending on what information is required. Common quality indicators are temperatures, salinity, dissolved oxygen, transparency and bacteria. Additional measurements often required are biochemical oxygen demand (B. O. D.), chemical oxygen demand (C. O. D. ), nitrogen, phosphorous, silicon. The effects of these constituents on water quality are significant to the well-being of individual organisms, whole communities and entire ecosystems. All of these water components may assume pollution roles if changed from normal levels.

Shoreline waters of the Virgin Islands have temperatures of 25.5-28°C between December - April and 27.0 - 29.0°C between June - October. Salinity (the amount of salt in the water) generally averages 35.5 - 36.2 parts per thousand and 34.0 - 35.2 parts per thousand during the same periods. Almost all our waters contain dissolved oxygen near saturation.

Turbidity - - (the amount of suspended particles in the water) is generally very low; indeed, the Caribbean is renowned for the clarity of its waters. In most bays, the sea bottom is easily visible.

Runoff from the land, dredging, sewage, oil pollution and boat traffic are the main causes of water pollution. Fortunately, ocean currents, waves, and swells usually do a good job of flushing most bays. These forces, however, are considerably reduced by the time they reach the heads of deep embayments. As a result, circulation may be very poor in the inner reaches of some of our larger embayments. These conditions are important because pollutants introduced to these calm areas will be very slowly dispersed.

#### Currents

Generally, currents around the islands are driven by the North Equatorial or Canary Current which moves through the Caribbean from east to west and eventually joins the Gulf Stream off the south coast of North America. Local currents in individual bays vary considerably due to exposure, winds, tides, shoreline, and bottom geometry.

#### Tides

There is one high tide and one low tide per day on the north side or Atlantic side of St. Thomas and St. John. There is a second cycle of high and low tides each day on the south or Caribbean side of St. Thomas, St. John, and all coasts of St. Croix. The difference between high and low tide, however, is very small in the Virgin Islands (generally 10- 11", with seasonal high tides at a maximum of two ft.). As a result, the currents caused by tides are not very significant.

#### Waves and Swell

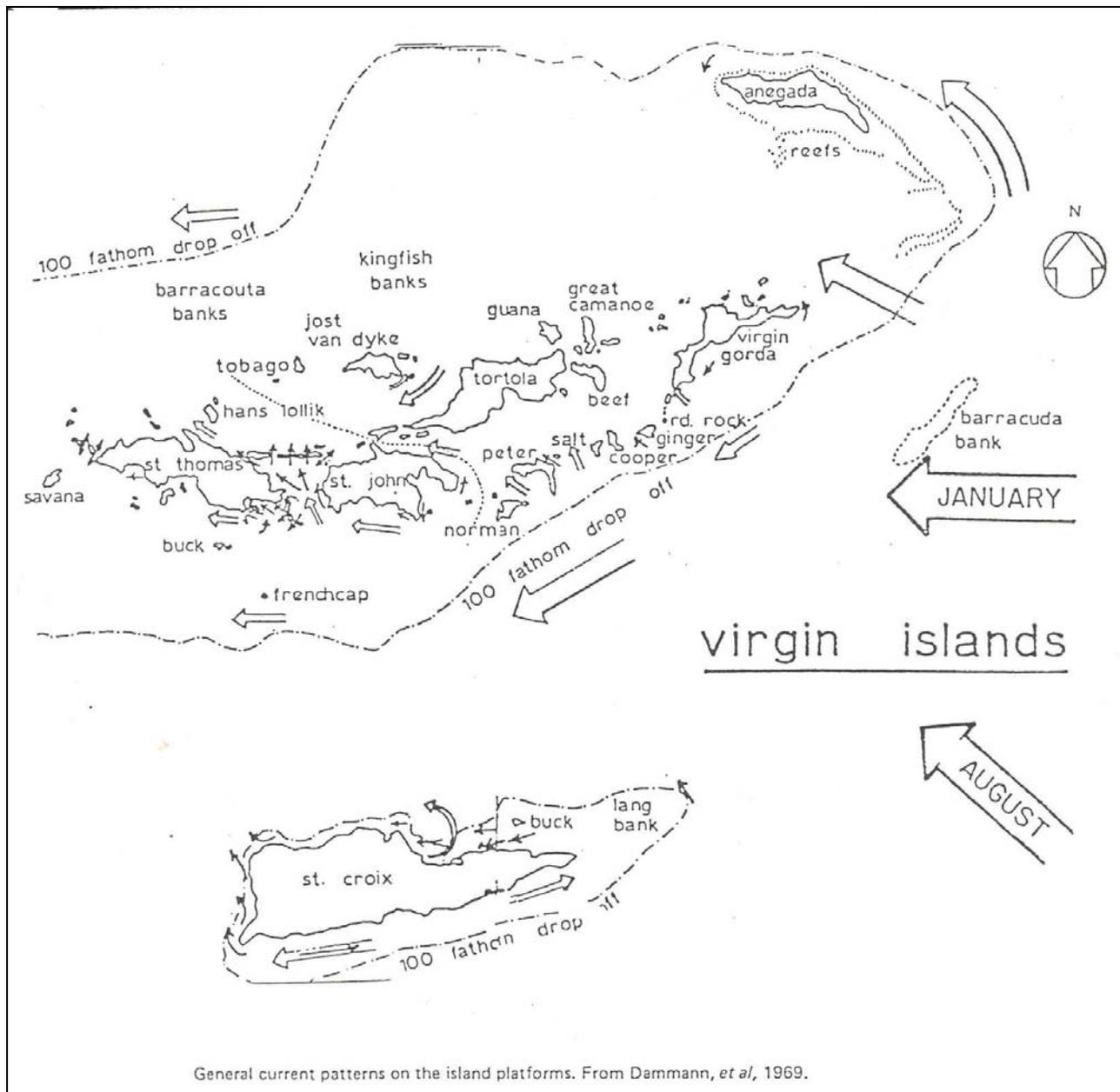
Most waves originate in deep water and are driven by the northeast tradewinds most of the year. This produces an easterly swell on the windward or eastern ends of the islands. The leeward or western ends of the islands are affected by northern swells in the winter, and southeastern ones in the summer.

Wave action affects water circulation and water quality. It also moves sand and other sediment around. This is why the amount and location of beach sand varies seasonally.

#### Storm Waves and Tidal Flooding

Tidal flooding, created by major hurricanes having an average frequency of once in 33 years, raise water levels from five to twelve feet above normal. A six-foot height will flood lower parts of Charlotte Amalie, Christiansted, Frederiksted, Cruz Bay, and other low-lying areas for 800 feet landward from the shoreline. Besides flooding, damage to piers, houses, and other waterfront facilities, and erosion of shores by storm waves can be heavy. Moreover, passing hurricanes may create a minus tide of as much as 1 foot below mean low water that can temporarily affect grounding of vessels in shallow water.

A different, but equally threatening kind of wave is called a tsunami. These are large sea waves of extraordinary length which are associated with submarine seismic disturbances. These waves seem to occur about once every 10 or 15 years in the Caribbean area.



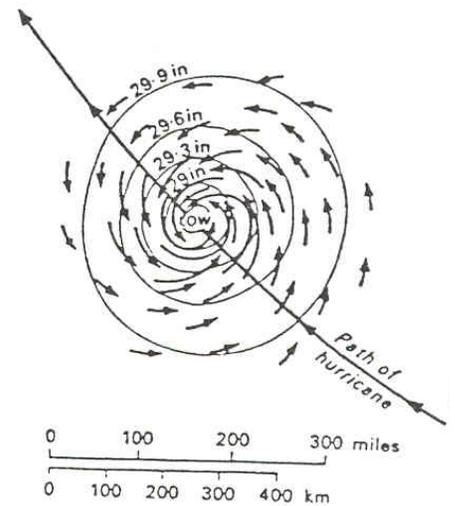
General current patterns on the island platforms. From Dammann, *et al*, 1969.

Hurricanes and Prevailing Winds

Hurricanes constitute a seasonal threat (July to October) of potentially catastrophic proportions. Most of the time, however, the Virgin Islands is blessed by much gentler and more predictable tradewinds. These blow with great constancy from the east and east - northeast. It was the constancy of these tradewinds that brought 17th and 18th century sailing ships to the Virgin Islands and that made it a major trading center between Europe, Africa, and the New World. Thanks to its tradewinds, the Virgin Islands is one of the most popular places in the world for recreational sailboats.



**The birth of a hurricane from an easterly wave**



**A well developed hurricane**

<sup>1</sup>Island Resources Foundation, The Virgin Islands Marine Environment, ( V. L Coastal Zone Management Program Technical Supplement No.1,1976). (Editor: Marsha McLaughlin, Policy and Planning Unit, DCCA. Further info: Environmental Specialist, DCZM)