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Geography of Lake Nicaragua

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The volcano Mombacho dominates the northwest end of Lake Nicaragua. A massive avalanche from its northeast flank formed a peninsula bordered by an archipelago of more than 300 small islands and emergent rocks. Courtesy *Instituto Geográfico Nacional de Nicaragua*.

Geography of Lake Nicaragua

JAIME INCER

INTRODUCTION

Lake Nicaragua, like its smaller neighbor, Lake Managua, occupies the deepest part of a geological depression, or *graben*, which cuts the Central American isthmus from the Gulf of Fonseca in the Pacific Ocean, to the mouth of the Río San Juan, which drains the lake into the Caribbean Sea (Fig. 1).

Both lakes are located between an ancient eroded plateau, which constitutes the central portion of Nicaragua, and a slender belt, the Isthmus of Rivas (20 km wide in its narrowest part), which separates Lake Nicaragua from the Pacific Ocean.

The Isthmus of Rivas, Lake Nicaragua, and the Río San Juan were the topic of much speculation during the past centuries because of the possibility of an interoceanic canal to be made by cutting the isthmus and utilizing the lake and river channel. The project was abandoned in favor of the route through Panamá.

The first Spanish conquistadors arrived on the Isthmus of Rivas in 1522. Captain Gil González Dávila rode to Lake Nicaragua on horseback and took possession of it in the name of the Spanish kings. Because of its great size González believed it to be a sea, whereupon he christened it *Mar Dulce*, or the freshwater sea. Its indigenous name is *Cocibolca*. Soon afterwards the lake was explored, and an exit to the Caribbean Sea was found by the expeditions of Captains Calero, Machuca and DeSoto, the latter better known as the discoverer of the Mississippi River (Quintana, 1968).

During colonial times the Río San Juan, together with Lake Nicaragua, was the most important route by which products from the Central American interior, such as gold, wood, cacao, indigo, etc., reached the commercial fleets that were periodically sent to Spain.

On numerous occasions, English, French and Dutch pirates navigated upstream to raid the city of Granada, located on the extreme northwestern shore of the lake (Fig. 2), as it was a very renowned and rich port in those times (Salvatierra, 1945).

In the mid-1800s the prospect of an interoceanic route once more caused an increased interest in the region. The *Compañía del Tránsito*, an American enterprise, was organized to transport, through the lake, river and isthmus, the numerous adventurers who were headed to California during the Gold Rush (Squier, 1852). Even into the 1900s, the village of Greytown (now San Juan del Norte), located at the mouth of the Río San Juan, was the most important Nicaraguan port. In the following 70 years, however, the commerce and economic activity of the country shifted toward the western side of the lakes, and Greytown is now nearly forgotten. Presently there is a project to dredge the Río San Juan and use Lake Nicaragua to make first

Granada, and later Managua, important lakeports, thus opening up the area, once again, to international commerce (Banco Central de Nicaragua, 1971).

EXTENT, LEVELS AND DEPTH OF THE LAKE

Lake Nicaragua has an area of 8264 km². It has an oval shape, with its major axis (Panaloya-San Carlos) 160 km long and its greatest width 65 km (La Virgen-San Ubaldo). The lake's basin, including that of Lake Managua and of the Río San Juan, covers about 40,000 km². The Río San Juan flows for 190 km to the Caribbean Sea.

The lake's surface is only 31 m above sea level, fluctuating annually about 65 cm between the dry (April) and the rainy (October) seasons (Incer, 1970).

The average depth varies between 5 and 7 fathoms, with the deepest part (20 f) located off the southeast coast of Ometepe Island. On the other extreme, near San Carlos the depth is barely 1.5 f. This may be because sedimentation is favored by the drainage of the lake into the Río San Juan at its southeastern end and because near this point the largest tributaries, both from Costa Rica and Nicaragua, empty into the lake.

According to recent studies by the Fisheries Project of the *Instituto de Fomento Nacional* (INFONAC), most of the lake's bottom is muddy, regardless of its depth. However there are several rocky places southeast of Ometepe Island, near the mouth of the Río Mayales and around the Solentiname Archipelago. Also, sandy bottoms are found southwest of Ometepe, extending to the coast of San Jorge (INFONAC, 1974). This sedimentary sand undoubtedly resulted from recent eruptions of the volcano Concepción, on Ometepe.

Careful examination of the sediments accumulated on the lake bottom shows the presence of grayish mud, waxy clay, and organic silt chiefly formed by coprolites, diatom fragments, tiny crustaceans and gastropods, pollen grains and chitinous arthropod eggs (Swain, 1966).

RELATION TO LAKE MANAGUA

Lake Managua is located northwest of Lake Nicaragua, and is separated from the latter by flat lowlands 25 km wide. It has an area of 1049 km² and its elevation is 9 m greater than that of Lake Nicaragua. In the past, both lakes had a higher level (about 15 m) and were included in one large lake, called "The Great Lake of Nicaragua" by Villa (1968). The level of this great lake dropped until the two separate lakes appeared, Lake Managua draining into Lake Nicaragua by the Río Tipitapa. At the present time this drainage occurs only after prolonged, copious rains (Incer, 1970). Actually, the Río Tipitapa is a slow-moving swamp mostly filled with water hyacinths (*Eichornia azurea*). Near

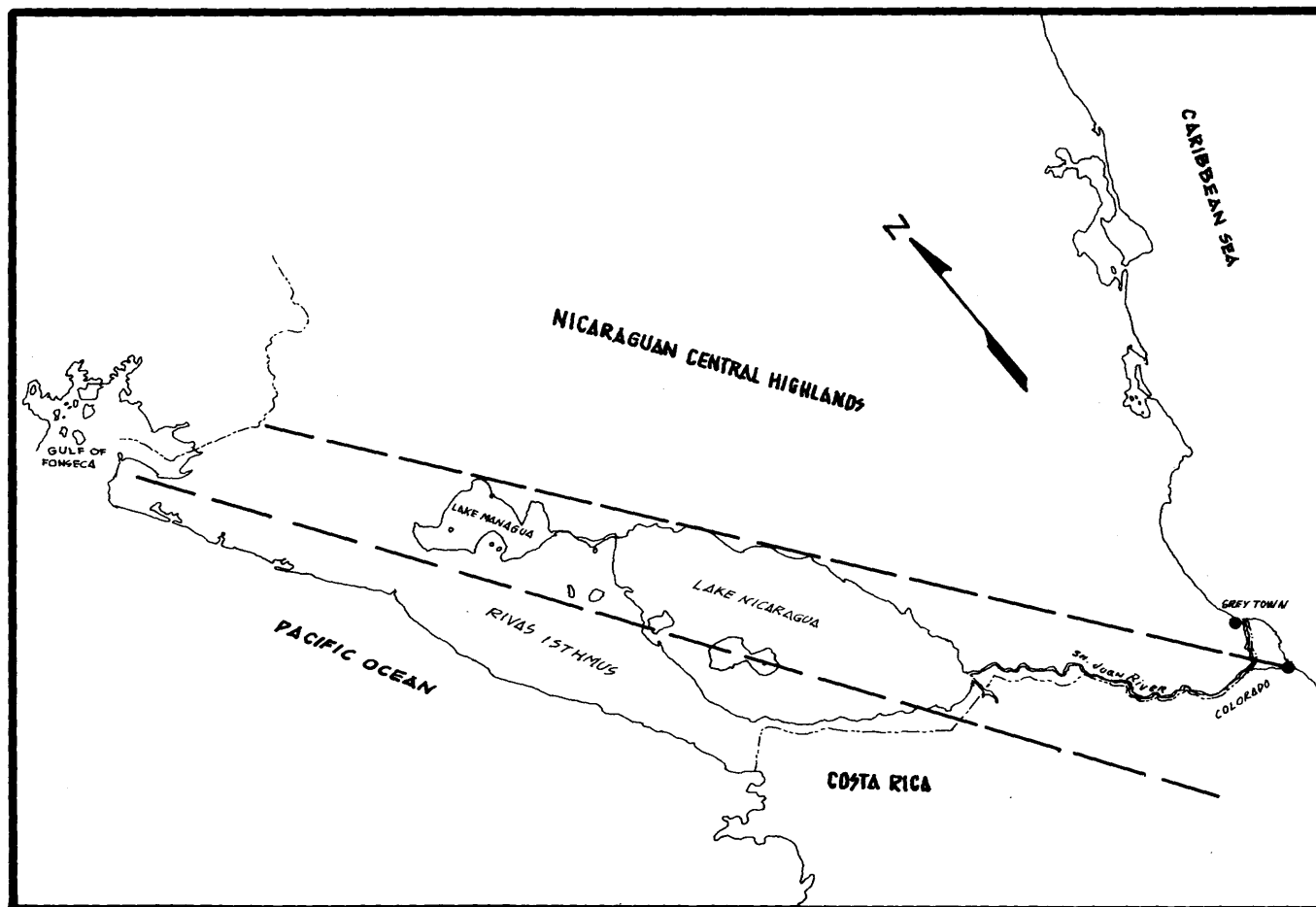


FIG. 1. The Nicaraguan tectonic depression. The major axis of the *graben* is delineated by the broken lines.

the town of Tipitapa and not far from Lake Managua's southeast extremity, the riverbed suddenly drops several meters, producing what nineteenth century travellers described as "waterfalls" during the rainy season (Squier, 1852).

In spite of the former connection between the two lakes, the marine faunal components present in Lake Nicaragua have never been reported in Lake Managua.

CHARACTERISTICS OF THE SHORELINE

The coast of Lake Nicaragua, including its small coves and rocky points, totals some 450 km in length, and its characteristics vary according to the geological history of each locality.

At the extreme northwest, at the Paso de Panaloya, by the entrance of the Río Tipitapa, the coast extends towards Granada as a low, sandy section subject to floods. Here is a long bar that separates the lake's waters from the swamps of Tisma, which were previously part of the lake.

In the area of Granada, the coast becomes irregular and forms an arc-shaped rocky peninsula, surrounded by numerous islets (*Las Isletas*), which are one of Nicaragua's major tourist attractions. These islets are considered to be the result of a massive avalanche torn off from the nearby volcano Mombacho. According to McBirney and Williams

(1956), "the entire chaotic mass appears to be the product of a single avalanche that descended the northeast flank of Mombacho leaving a narrow trough on the upper slopes."

Mombacho's eastern skirt slopes directly to the lake's coast forming rocky ravines. Further south, in Charco Muerto, the coast forms three semicircles, partially submerged remnants of old volcanic craters.

The coast along the Isthmus of Rivas is marshy in parts, forming a coastal lagoon (*Ñocarime*). It continues as a sandy beach, formed by piroclastic material from volcanoes on Ometepe. In the area of La Virgen, Cretaceous marine sedimentary rocks crop out as the oldest in western Nicaragua (Zoppis and Del Giudice, 1958).

The southern coast of Lake Nicaragua, which runs parallel to the Costa Rican border, is low and sinuous. In many parts there are permanent swamps, especially around the mouths of rivers, which originate on the slopes of Costa Rican volcanoes. These lowlands and swamps extend to the mouth of the Río Frio, which is unique in emptying into the lake at a very short distance from where the latter empties into the Río San Juan; thus the water from the Río Frio immediately joins that of the San Juan.

The lake's eastern coast, from Panaloya in the northwest to San Carlos in the southeast, presents a series of small points between which are floodable beaches. The points coincide with the deltas of small rivers flowing into the lake

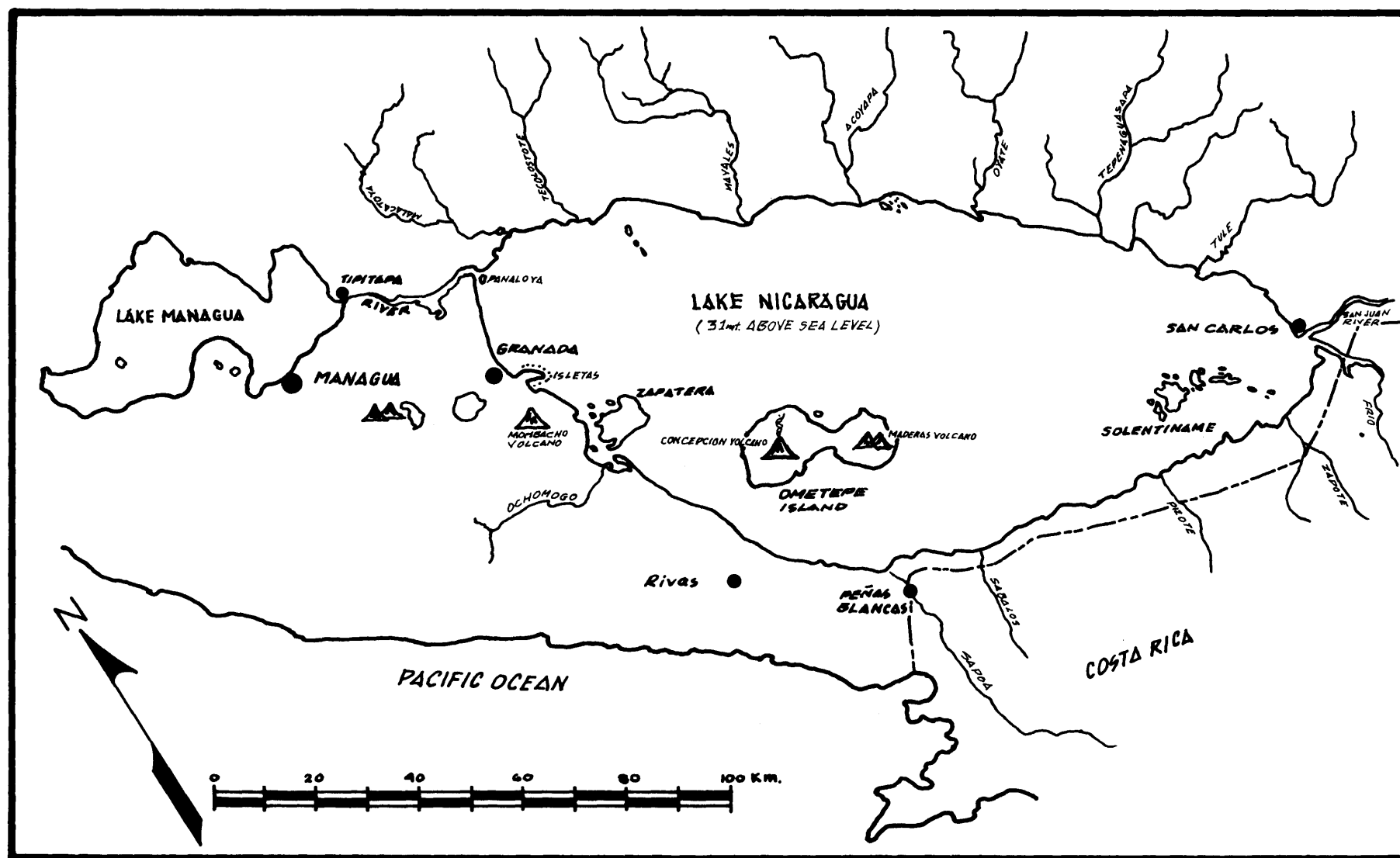


FIG. 2. Map of Lake Nicaragua and vicinity.

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from the central plateau of Nicaragua. The projections of these peninsulas also sometimes continue into the lake as small rocky islands. All of the coast of Chontales is low and marshy and is used for the cultivation of rice (Incer, 1970).

ISLANDS OF THE LAKE

The main island is Ometepe, 275 km² in area, formed by volcanoes Concepción and Maderas, which are connected by a low and frequently-flooded isthmus (Fig. 3).

In its western part, the perfect cone of the volcano Concepción reaches 1616 m above sea level. It discharges vapors continuously, and periodically ejects sand and lava, most recently in December 1973. The plains lying below it have become fertile with its ashes and have great agricultural potential. The eastern part of Ometepe is occupied by the volcano Maderas, an extinct, truncate volcano of 1334 m, covered with dense vegetation. Its slopes abound with coffee groves (Incer, 1970).

Ometepe Island, with a population of 15,000, was a rich archaeological sanctuary in pre-Hispanic times, and ceramic artifacts are still found buried in volcanic ash or hidden by luxuriant vegetation. Moyogalpa and Altagracia are its main towns.

Zapatera Island, somewhat smaller than Ometepe, is the remnant of an ancient and very eroded volcano, with rocky coasts surrounded by semicircular islands, the remains of partially flooded craters. Zapatera was a "mausoleum island" in pre-Spanish times. Much of its statuary is exhibited in important museums through Europe and the United States (Squier, 1852).

Las Isletas are an archipelago of about 300 islets consisting of blocks of basalt and andesite irregularly distributed near the lake's western coast. They are separated by channels of calm water and are covered with various fruit trees that serve as refuge and food for many species of birds. The whole region abounds with beautiful scenery and offers an interesting potential for the development of tourism in this part of Nicaragua, as well as a challenge to those who wish to protect and preserve the environment and natural areas.

The Solentiname Archipelago, facing San Carlos, is composed of several hilly islands of Tertiary volcanic rock, near the extreme southeast end of the lake. They are sparsely inhabited and barely exploited with only subsistence crops.

CLIMATE AND VEGETATION

Lake Nicaragua's basin, running northwesterly to southeasterly, has a steep precipitation gradient for its short extent of 160 km. In its extreme northwest, at Panaloya, the annual rainfall is about 1,200 mm and the vegetation is a tropical savannah with patches of xerophytic forest, growing on black clay (Taylor, 1960).

All of the lake's northeast shores, following the Chontales coast, support *jícara* (*Crescentia*) woodlands, alternating with *roble* (*Tabebuia*) savannah and other secondary herbaceous communities influenced by intense grazing.

South of Río Oyate, to San Carlos, in the extreme southeast, annual precipitation increases to 1,900 mm, ideal for the development of rain forest, but the area has been severely disturbed and reduced to second growth forest (Taylor, 1960).

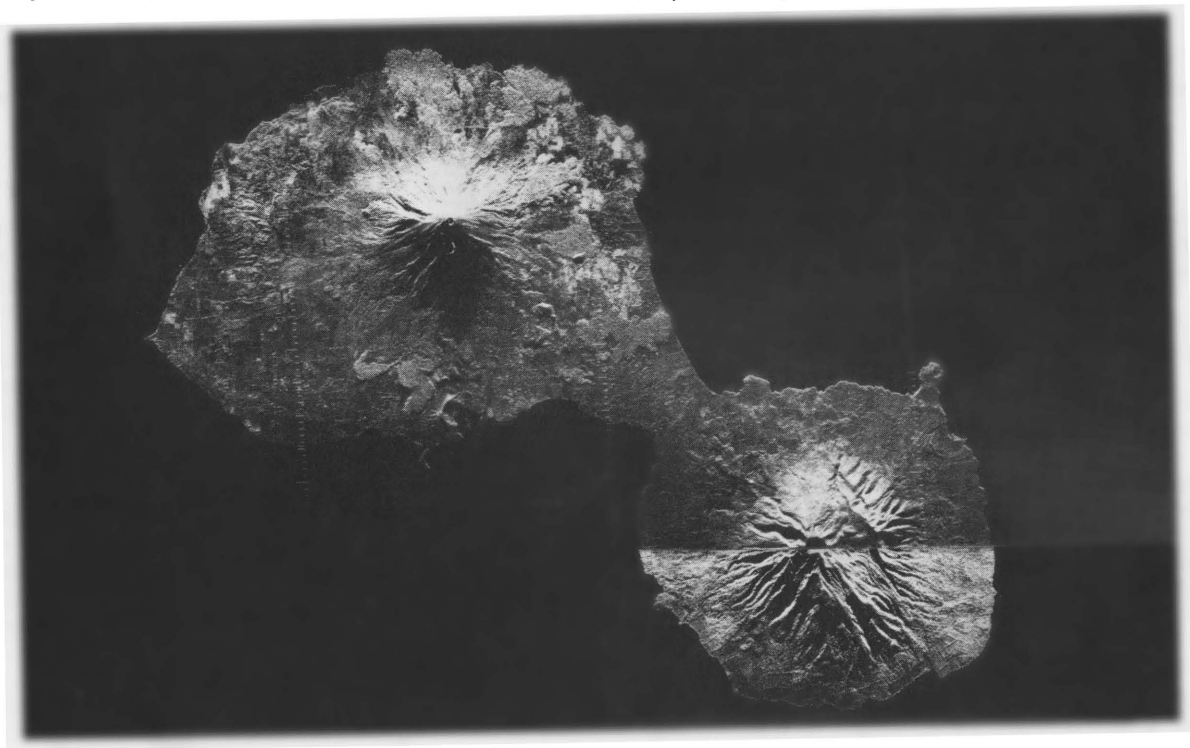


FIG. 3. Photograph of the island of Ometepe, formed by the volcanoes Concepción (left) and Maderas (right). Taken with radar imagery. Courtesy Instituto Geográfico Nacional de Nicaragua.

SUMMARY

The area surrounding Lake Nicaragua is discussed from the standpoints of its history, geological setting, climate and vegetation. A physical description of the lake itself is given, including the nature of its bottom, its shoreline, its islands and volcanoes.

RESUMEN

Se discuten los alrededores del Lago de Nicaragua bajo el punto de vista de su historia, geología, clima y flora. El lago mismo se describe físicamente, incluyendo la naturaleza del fondo, sus islas, y sus volcanes.

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The high precipitation continues throughout the southern shore parallel to the Costa Rican border, to the customs port at Peñas Blancas. Although very close to the Pacific, this area has a clear Caribbean influence in its flora and fauna. South of the lake, beyond the swampy shores and into Costa Rican territory, a hygrophytic forest extends to the slopes of the Guanacaste volcanoes.

The lake's western coast, from Rivas to Granada, has an average annual rainfall of 1,400 mm, as do many parts of western Nicaragua. It is mainly a tropical savannah, much altered by pasturing and cultivation. However, around the extinct volcano Mombacho, rainfall increases gradually upward to its summit, giving rise to a limited but well defined cloud forest, and providing excellent conditions for coffee cultivation. A similar situation occurs on the volcano Maderas (on Ometepe Island), which is also extinct and of about the same altitude as Mombacho.

The winds over Lake Nicaragua vary according to the seasons and the different zones of the lake. Between December and March, northeasterly tradewinds blow at 30 to 40 kph, producing wave action on the coasts of Granada and Rivas, so strong that navigation is difficult and highly uncomfortable. On the other hand, the northeast coast is usually calm, because of the northeastern mountain ranges which cut the wind (Anon., 1973).

Throughout the rest of the year the winds, although variable, are weak and there are frequent calm days, with a smooth lake surface, especially during the rainy season. Carr (1953) states that the Nicaraguan Depression and the valley of the Río San Juan are low enough to permit the passage of the Caribbean winds directly to the Pacific in this part of the isthmus, and thus, the waters of the Pacific are rough in southern Nicaragua and along Costa Rica's northwestern coast.

The winds that prevail from the northeast to the southwest continually cause the movement of vegetation rafts from the coasts of Chontales to those of Rivas. This explains why the flora and fauna of Ometepe Island are more like those of Chontales than of Rivas, even though this island is considerably closer to the shores of the latter.