

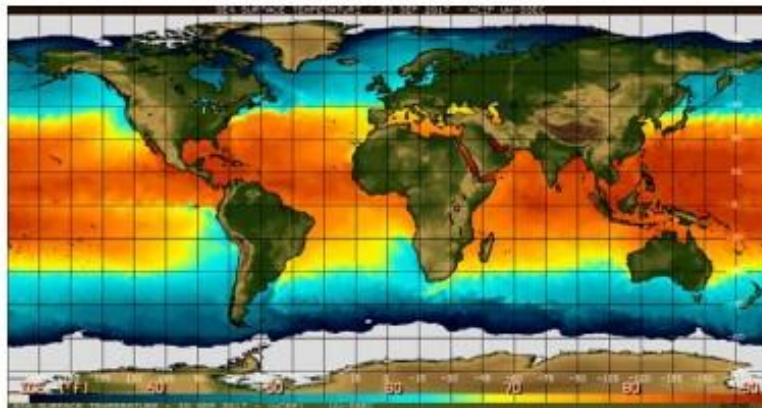
Where Orchids Grow

By Jeff Baylis

While orchids exist on all continents save Antarctica, the areas where species densities are high are limited to certain places. Of the six Floristic Kingdoms recognized by biogeographers, the Neotropical region has by far the highest total orchid species count even though it is smaller in area than the Paletropical regions. Within the neotropics, although the Amazon basin is vast and its tree diversity is very high, its orchid diversity is relatively small compared to parts of the adjacent Andes. The public perception is that lowland tropical rainforests harbor a huge number of fabulous plants, especially orchids, but in reality orchids are relatively scarce in the rainforest of the Amazon, with fewer species than the countries of the Andes.

Diversity of species occurs with diversity of Environment

Climatology defines the tropics as that area of the Earth situated between the Tropic of Cancer (23 degrees N Lat.) and the Tropic of Capricorn (23 degrees S Lat.). This region is home to the highest sea surface temperatures on earth. This region also is home to the trade winds of tropics which flow east to west within this zone. Similarly, due to tidal effects the warm equatorial currents of the world's oceans flow east to west. But the main thing is that



Sea Surface Temperatures

the currents all go from east to west due to the rotation of the earth so all that warm water winds-up jammed against the east side of the continents. Evaporation over thousands of miles of ocean produces a lot of moisture in the air. The prevailing wind patterns result in moist ocean air being swept inland when it strikes land, where it rises because of a warmer land mass and elevation. As it rises, it produces clouds and rain due to adiabatic cooling, and this in turn provides the moisture fueling the Amazon rainforest.

The Andes are a unique mountain range

The Pacific tectonic plates spread from deep under the ocean; on their eastern border, they collide with and move under the continental plates of South

America and Central America. Along the entire coast of South and Central America is a subduction zone -- meaning the Pacific plates are being shoved under the continental plates. This process has resulted in a geologically active, continuous mountain range bordering the west coast, acting as a barrier against the warm moist winds blowing along the equator from the east and between the Tropic of Cancer and the Tropic of Capricorn.

As a result of his observations made during his expedition to South America from 1799 to 1804, Alexander von Humboldt became the first scientist to propose and document the pattern of Life Zones on mountains that varied with elevation, and hence temperature. He noted the same vegetation changes in the Andes that he had observed in the Alps, although the plant species involved were quite different. It is now well known in plant ecology that as you go up in elevation the temperature gets colder and the characteristic plants at that altitude change to match.

When the warm moist air coming from the Atlantic coast crosses the lowlands of Brazil and strikes the Andes, the warm moist air flows upwards into higher elevation along the walls of the mountain range. It also accelerates

COUNTRIES WITH THE MOST ORCHID SPECIES			
Country	Orchids	Area/sq mile	Density sq species/mi
Ecuador	3787	109K	035.
Columbia	2723	440K	006.
New Guinea*	2717	303K	.009 *
Brazil	2590	3287K	0008.
*Paleotropical			

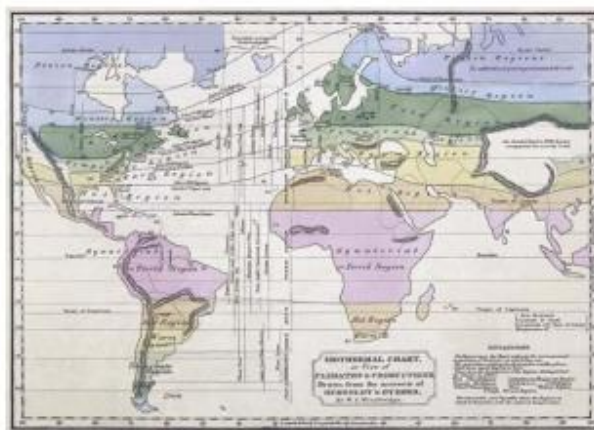
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as it goes up to, similar to wind over the curved wing of an airplane. As the air expands it cools. This is **adiabatic cooling** and the thin, cold air can hold less moisture. As a result clouds and rain form so you create an atmosphere of higher rainfall. As the wind continues over the top of the mountains there is an area of turbulence. This wind is drier and as it continues down the western side of the mountain it becomes drier still due to adiabatic heating as the thin air compresses, forming some of the driest deserts in the world along the Pacific coast of South America.

The Andes are much higher in elevation than the Alps, with a mean elevation of 13,000 feet, and is 4,300 miles long, the longest mountain range in the world. The Andes run north to south in an uninterrupted line from Columbia to Argentina, and straddle almost the entire New World tropics. This means that if you are at 8000 feet in the Andes in Argentina and travel north at 8000 feet to northern Ecuador you are basically in the same climate the entire time. There is a stacked series of continuous corridors of constant climates, but these are stacked vertically in the Andes in addition to arrayed latitudinally.

By contrast, the lowland Amazon rainforest of Brazil is remarkably uniform. One can stand in the Zocolo in Iquitos, Peru in the upper reaches of the Amazon and you are at an elevation of 300 feet. You can draw a straight line due east from there to the Atlantic coast of Brazil, a linear distance of about 1000 miles, and there is no point on that line that is higher than where you are standing.

Orchids, like all plants, need light, water and air to engage in photosynthesis and grow. Situated on or near the equator, the sun is directly overhead for at least part of the year, and sunlight has its shortest path to the earth's surface and is at its most intense. In addition, it is richer in the blue end of the spectrum than the sunlight at higher latitudes. At higher elevations, these qualities of sunlight are enhanced even further. Water in the equatorial Andes is in abundance at higher elevations on the eastern slopes, often in the very air itself in cloud forests. Air in the mountains is in constant motion, bringing carbon dioxide for photo-



synthesis.

In Ecuador, all of these factors come together, where the equatorial trade winds slam into the wall of the Andes. Lowland tropical rainforest yields to montane tropical rainforest which transitions to cloud forest and then páramo and at the top, glaciers. The diversity of habitats and climates over a very short distance is stunning. Alexander von Humboldt observed this array of habitats while exploring the Cordilleras along the border between Ecuador and Columbia. He wrote of this region:

"This portion of the surface of the globe affords in the smallest space the greatest possible variety of impressions from the contemplation of nature.... There, the different climates are ranged the one above the other, stage by stage, like the vegetable zones, whose succession they limit; and there the observer may readily trace the laws that regulate the diminution of heat, as they stand indelibly inscribed on the rocky walls and abrupt declivities of the Cordilleras."

---Alexander von Humboldt

In recent attempts to identify the earth's biodiversity hotspots, this section of the Andes von Humboldt was describing rises to the top most every list. Orchids grow here because of global patterns of air and water circulation, sunlight, and plate tectonics.

