

Plant Dispersal Across The Tropical Atlantic By Wind And Sea Currents.

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Goal:

- Evaluation of seed plants dispersed on either side of the tropical Atlantic, specifically South America and Africa, by wind and sea currents.

Introduction:

- Robert Thorne sampled 111 genera of seed plants, restricted to South America, Africa, and Madagascar. (1973)
- His goal was to assess the roles of the Gondwana breakup compared with long-distance dispersal as means of trans-Atlantic disjunction.



Trans-Atlantic disjunction between South America, Africa, and Madagascar.

From Thorne's review...

- Trans-Atlantic disjunctions at the genus level seem more likely to be attributed to long-distance dispersal, while family-level distributions often may date back to the breakup of South America and Africa.
- It was expected to see patterns in time and direction because wind and water systems are not randomly distributed in space and time.
- Many taxa needed to be tested for patterns to emerge, since there is a loose-connection between dispersal and establishment of lineages.
- This article follows Thorne's line of thought and concentrates on genera and species.

Materials and Methods:

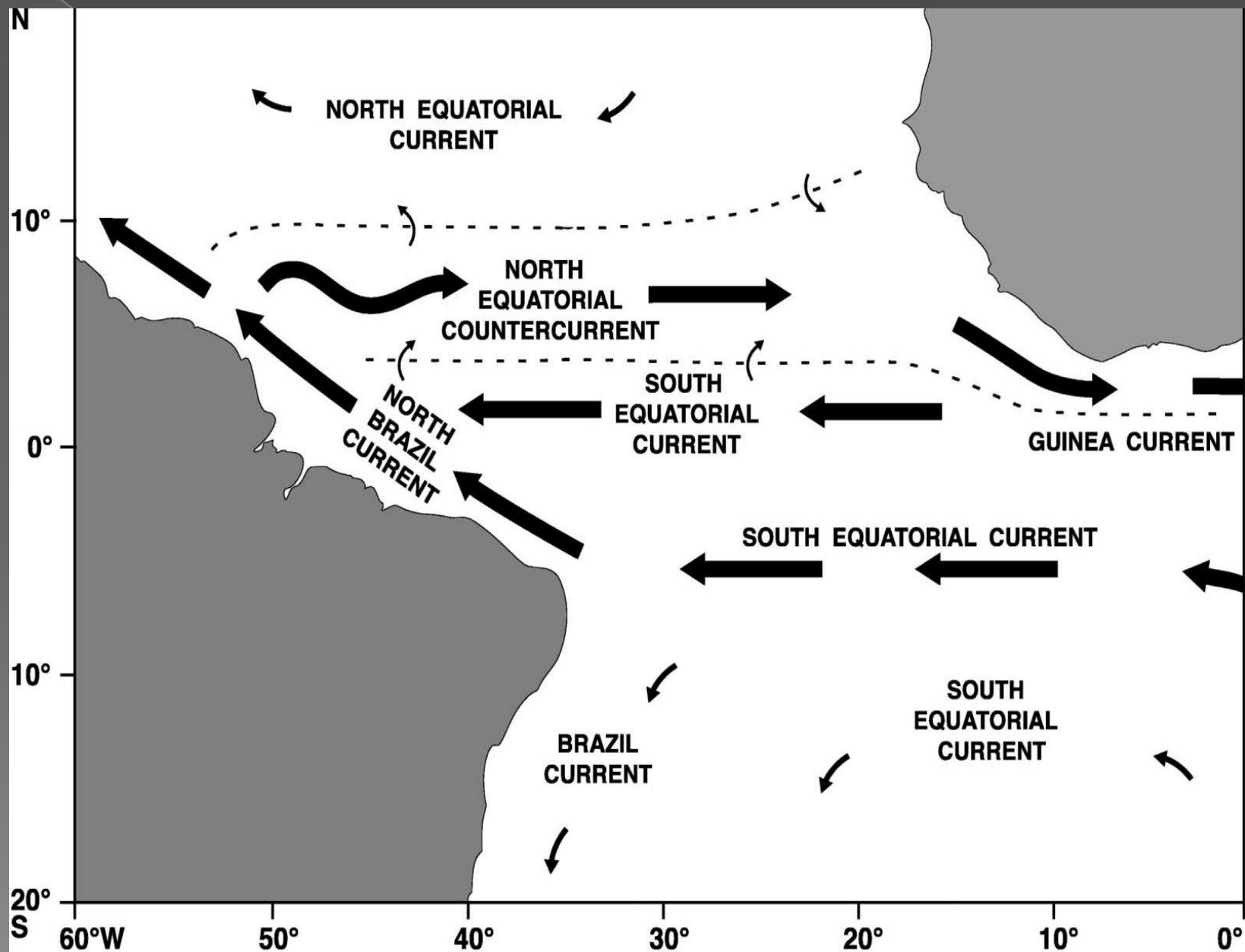
- Starting with Thorne's list of seed plants, lineages with tropical Atlantic distributions were compiled from literature. Thorne's list was updated due to ongoing molecular and systemic work.
- Some 110 angiosperm genera in 53 families contain species on both side of the Atlantic. This is almost identical to Thorne's result, however 16 new genera were added and 14 others were dropped, because they are no longer considered to be monophyletic.

Discussion:

- Knowledge about timing and direction in long-distance dispersals is still very limited. From current data, it appears sea currents have been responsible for dispersals in either direction, while winds seem to play more of a role in transport from South America to Africa.
- This raises the question if oceanographic and climatic data indicate different predominant directions of water versus wind currents, it would explain these apparent differences in their relative roles in conveying biological material from east to west versus west to east.

Ocean Currents:

- ◉ Atlantic Currents vary in strength with seasons, and comprise a westward-flowing North Equatorial Current, an eastward-flowing North Equatorial Countercurrent, and a westward-flowing South Equatorial Current.
 - The North Equatorial Counter Current is the only Current flowing in the opposite direction, and it originates well off the South American coast, and may not be useful for the transportation of plants.



- Fluctuations in the depth of the Atlantic during tertiary times narrowed the distance between continents and provided stepping stone islands, another possible means of transport for both plants and animals. This theory, however, is controversial.
- Rises in ocean ridges may have shortened the distance between continental coasts, making dispersal of plants by water easier.

Floating islands

- Several vertebrate dispersals events are relevant to this discussion. They involved ancestral rodents, monkeys and lizards.
- Fossils from the monkeys and rodents were found in South America and both lineages had close relatives in Africa. Both the rodents and the monkeys had no relatives in North America, Antarctica, or Australia.
- Floating Islands relevant to the postulated migration of monkeys and rodents probably carried shrubs or trees and therefore were helped along by trade winds.
- Though there is no record of such an Island off the coast of Brazil, floating Islands still appears to be the best explanation for the monkeys arrival to South America from Africa.

Wind Currents and birds:

- It is more difficult to account for dispersal events inferred to have been due to winds blowing from South America to Africa.
- Westerly surface winds over the central Atlantic exist, but are subject to significant year-to-year changes.
- Transport on aquatic birds is often thought of as a possibility of dispersal, however there are no bird migratory routes across the Atlantic.
- Land birds have occasionally reached the mid-Atlantic islands and is shown by endemic bird species

Conclusion:

- ◉ Tangled plant-parts are constantly carried out into the tropical Atlantic from deltas of the Congo, Senegal, and the Amazon.
- ◉ Because of their speed, currents can transport larger floating objects with wind exposed surfaces across the Atlantic in less than two weeks.
- ◉ Dispersal by wind and birds appears to be less common.

References

- Renner, Susanne. "Plant dispersal across the tropical Atlantic"
International journal of plant sciences, 2004