Panama butterfly migrations linked to El Nino, climate change

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Bob Srygley (driving) and field assistants track sulphur butterflies as they migrate across the Panama Canal. Peak migrations correspond to El Niño, a global climate pattern. Credit: Christian Ziegler

A high-speed chase across the Panama Canal in a Boston Whaler may sound like the beginning of another James Bond film—but the protagonist of this story brandishes a butterfly net and studies the effects of climate change on insect migrations at the Smithsonian Tropical Research Institute.

"Our long-term study shows that El Niño, a global climate pattern, drives Sulfur butterfly migrations," said Robert Srygley, former Smithsonian post doctoral fellow who is now a research ecologist at the US Agricultural Research Service, the chief scientific research agency of the U.S. Department of Agriculture.

Climate change has been linked to changes in the migration of butterflies in North America and Europe but this is one of the first long-term studies of environmental factors driving long-distance migration of tropical butterflies.

For 16 years, Srygley and colleagues tracked the progress of lemony yellow Sulfur butterflies, *Aphrissa statira*, a species found from Mexico to Brazil, as they migrate across central Panama from Atlantic coastal rainforests to the drier forests of the Pacific coast.

"The El Niño Southern Oscillation—a global climate cycle—turns out to be the primary cause for increases in the plants that the larvae of these butterflies eat. El Niño results in dry, sunny days in Panama, which favor plant growth. When the plants prosper, we see a big jump in the number of Statira Sulfur butterflies."

Peak Sulfur butterfly migrations take place a month after the rainy season begins in Panama. Because butterfly development—from egg to larva to pupa to adult—takes about 22 days in the laboratory, Srygley thinks that these butterflies lay their eggs on new leaves produced by vines only four or five days after the rains begin. His team tracked the production of new leaves by two of the butterflies' host plants for 8 years. Drier years resulted in more new leaves.

The number of migratory butterflies was greatest in El Niño years, with one exception. The El Niño Southern Oscillation is a global-scale climate phenomenon characterized by changes in sea surface temperatures. In Panama, El Niño years have less rainfall during the dry season and higher plant productivity, with the one exception being an unusually wet El Niño year.

El Niño is global in its impact. In deserts and tropical seasonally-dry forests world-wide, a warm tropical Pacific Ocean surface is associated with increased rainfall resulting in seed germination and plant growth. The effects of increased primary productivity cascade upward into higher trophic levels resulting in periodic outbreaks of herbivorous species and migratory activity.

Neotropical wet forests are different because El Niño years are drier, but moderate drought results in increased primary productivity similar to that in desert and tropical dry forests. Thus the lowland forests of Panama fall into a set of habitats encircling the globe in which insect migrations are larger during El Niño years. However the Panamanian wet forest is in a class of forests that have the greatest abundance and diversity of herbivorous insects in the world, "It is like we had seen the tip of the iceberg and suddenly we realize its true size", Srygley suggested. The authors predict widespread insect migrations during El Nino years.

According to Srygley, "Understanding how global climate cycles and local weather influence tropical insect migrations should ultimately improve our ability to predict insect movements and effects such as crop damage."

This research is presented in the journal *Global Change Biology*.

Source: Smithsonian Tropical Research Institute