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Protecting monarch butterflies' winter home could mean moving hundreds of trees

Researchers are trying to shift Mexico's oyamel firs to higher elevations to help them weather warming temperatures.

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To save dwindling populations of Eastern monarch butterflies, researchers in Mexico are trying something controversial: moving hundreds of fir trees 400 metres up a mountain. Their goal is to help the trees, which serve as winter habitat for the migratory butterflies, keep up with the changing climate.

Forest geneticist Cuauhtémoc Sáenz-Romero at the Michoacan University of Saint Nicholas of Hidalgo (UMSNH) in Morelia, Mexico, has been relocating oyamel firs (*Abies religiosa*) in the Monarch Butterfly Biosphere Reserve, about 100 kilometres northwest of Mexico City, for the past 3 years. A study reporting the results of the experiment is currently under review at a scientific journal.

For nearly two decades, the idea of 'assisted migration' – moving species to new areas to rescue them from rising temperatures – has stirred controversy among ecologists. Opponents worry that species introduced into other regions could spread so much that they threaten organisms already living there¹.

But in the case of the oyamel fir trees, some scientists think the risk is worth it. “This is an example of a good experiment,” says Sally Aitken, a forest ecologist at the University of British Columbia in Vancouver, Canada.

Fall of a monarchy

Over the past 20 years, the number of monarch butterflies (*Danaus plexippus*) in North America has dropped by more than 80%, according to the Center for Biological Diversity, a non-profit group in Tucson, Arizona.

The decline has affected both the Eastern monarch population, which migrates from the northern and central United States and southern Canada to Mexico each autumn, and the smaller, Western monarch population, which migrates across western US states and winters in coastal California. In June, US officials are expected to announce whether these two populations will be protected under the Endangered Species Act.

Rising temperatures and habitat destruction at the butterflies' breeding sites in the United States and Canada are the major drivers of monarch declines, says Karen Oberhauser, a

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Extreme climate events threaten the Eastern monarch butterfly's habitats at their wintering sites in Mexico, Oberhauser says. In 2016, for example, a severe storm damaged thousands of fir trees in the mountains of central Mexico. The loss of habitat, followed by freezing temperatures, killed 31–38%² of the monarchs.

And Sáenz-Romero has estimated that rising temperatures will shrink the habitat suited to oyamel fir trees in Mexico nearly 70% between 2025 and 2035³.

Location, location, location

Efforts to reforest the areas where Eastern monarchs spend the winter are ongoing, but the outcomes have been mixed, Sáenz-Romero says. Trees are often weakened by changing climate conditions, and they become susceptible to drought and infections, he says.

Sáenz-Romero thought that shifting fir seedlings higher up the mountains — where temperatures are cooler — could help to preserve the monarch's winter habitat. A 2017 analysis suggested that his team would have to move seedlings upwards by about 350 metres for the plants to keep up with climate change⁴.

In fact, the researchers were able to shift more than 750 seedlings up a mountainside by up to 400 metres, as long as they planted the young trees under the shade of neighbouring bushes. This protected the seedlings from sunlight and extreme temperatures, says Arnulfo Blanco-García, a forest ecologist at UMSNH, and a study co-author.

The results are encouraging, says Juan Pablo Jaramillo-Correa, a forest geneticist at the National Autonomous University of Mexico (UNAM) in Mexico City. But to build a more complete picture of what makes oyamel firs thrive, scientists should take into account other factors that could affect the trees' growth, such as soil composition, he says.

Pablo Jaramillo-López, an agroecologist at UNAM in Morelia, says that it might be more cost-effective to let forests recover from changing climate conditions naturally.

Beefing up oyamel-fir forests should be only one part of the effort to save monarchs, Jaramillo-Correa says. "It's like taking care of your summer residence only." To help the butterflies. "you

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