

## Introduction

The annual migration of the Monarch Butterfly (*Danaus plexippus*) is without a doubt one of nature's most spectacular phenomena. Each Fall, as the days begin to shorten, Monarchs get the cue to migrate by the hundreds of millions to a relatively small area in mountainous Southern Mexico where they will spend the winter. Clustering on tree trunks, and clinging to the needles of the Oyamel Fir Trees (*Abies religiosa*), these butterflies will endure high time freezing temperatures in high elevations, along with rain, wind and intense mid-day sun for over four months. With the spectacle of several billion butterflies in roughly a dozen different overwintering sites comes a demand for tourism by both local Mexicans as well as foreigners. As the phenomenon grows in popularity, tourist infrastructure continues to grow to meet the needs of travelers. At least two of the colony sites are now home to rows of shops and restaurants that are found near the parking lots and park entrances, which are about an hour's walk from the actual Monarch colonies. Other services, such as horse rentals and guided tours, add to the visitor experience and contribute greatly to the local economy.

## Biology and Life History

Monarchs are a tropical American species that only temporarily visits the temperate areas of the U.S. and Canada to take advantage of a spring-summer abundance of 108 species of milkweed plants for their larvae, compared to only half a dozen kinds of milkweed south of the U.S. - Mexico border. Thus, 2-3 generations a year go through a normally rapid metamorphosis cycle of egg (about 1 week), larvae or caterpillar (2-3 weeks), pupa (7-10 days) and adult (up to 30 days). However, the last generation of adults, emerging late summer, lives 9 months and migrates south in the fall to the Mexican overwintering colonies. In mid-March, the following spring, these same adults mate, fly north to the southern U.S. and before dying, they lay their eggs to start the first spring generation of offspring.



## The Colony Sites

A dozen overwintering colony sites for the eastern North America monarch populations persist in the Trans-Volcanic Range of South-Central Mexico, in the states of Mexico and Michoacan. Others that formerly existed, such as on Popocatepetl Volcano southeast of Mexico City or in areas now logged, have disappeared. The typical site lies between 10,000 and 11,000 feet above sea level in Oyamel Fir forests, with an understory of blooming wildflowers even in mid-winter. Nighttime temperatures are usually near freezing; daytime temperatures range from 40-68°, typically during November to March. The cool temperatures allow very low metabolism rates all winter as the adults rest.



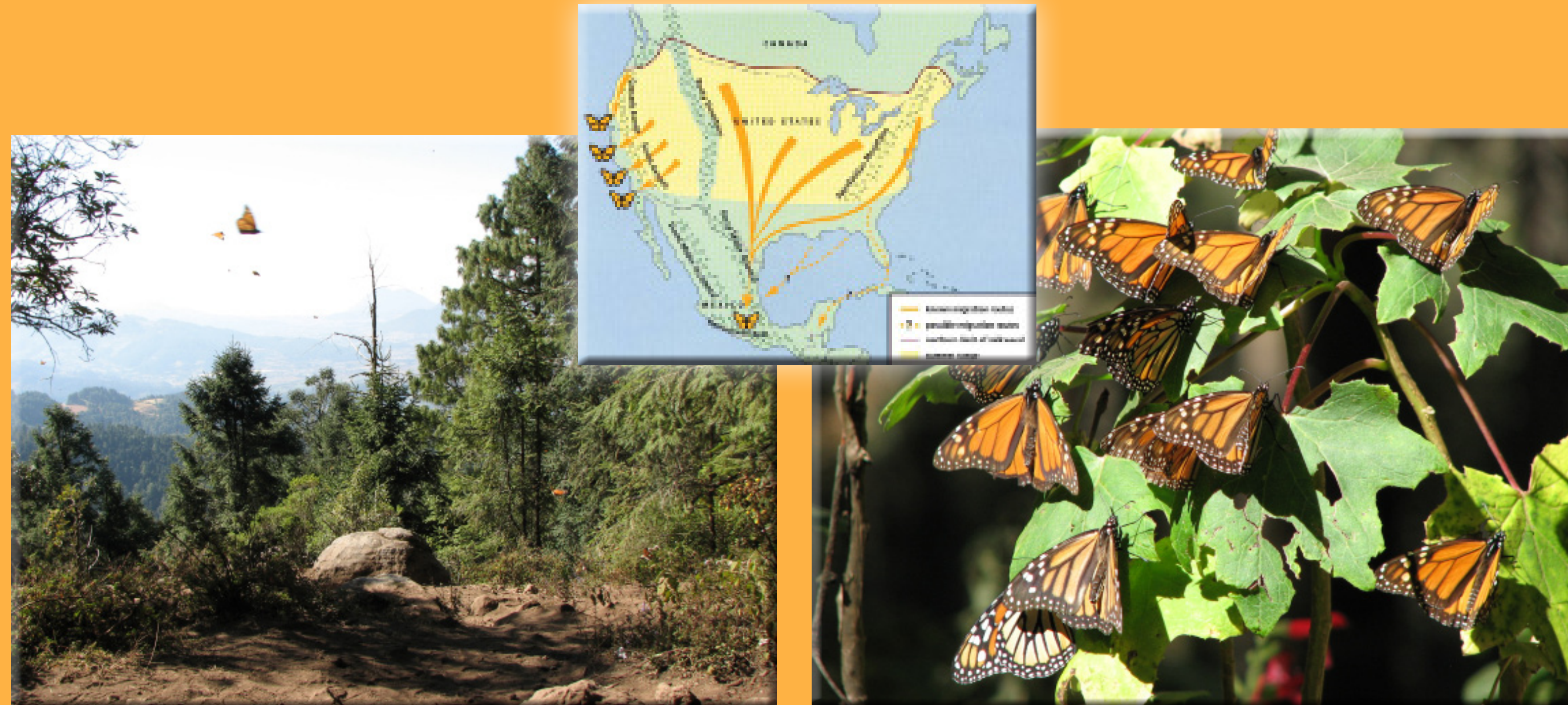
## Environmental Conservation

Because the monarchs and their overwintering sites are the main attractions here, bringing visitors from all over the country and from across the world, the local people understand that monarchs and their habitats are valuable. Without the monarchs, tourism in the area would likely be no more and many people would be without their dependable source of income. Without the forests in which the monarchs overwinter, there would be no monarchs. Without income there would be a serious struggle for the basic necessities, let alone more luxurious things such as vehicles and education. For this reason, the communities that benefit from monarch butterfly tourism exert extra efforts to protect the forest. Men from the local village groups act as vigilantes by patrolling areas that are susceptible to illegal logging trucks, whether it be a commercial operation with large tractors or selective logging by a few men entering the reserves at night with nothing more than a chainsaw and a pick-up or flat-bed truck. Both have devastating effects that locals are well aware of, and want to stop. In the past decade, the government has taken a serious approach to protecting the forests as well. Understanding the positive impact the monarch colonies have on the economy, federal troops are present at key highway junctions from November to March each year to discourage illegal logging, often apprehending dozens of logging operations each year. However, the five month time span that the troops are present leaves seven months of vulnerability. It is during this time that local vigilantes must pick up the slack and defend the environment most vigorously. In an effort to counteract the damage that has already been done by logging in the area, several environmental organizations and individuals have taken it upon themselves to establish Oyamel Fir tree farms for supplying reforestation programs. With support from the local communities, as well as benefactors from Mexico and beyond, these organizations have come together to plant over one million new Oyamel Fir trees, enough to cover an area of 450 acres. Programs like these benefit tremendously by the awareness spread by ecotourism.

# Mexico and the Monarch Butterfly

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## The Migration



The southward migration of the Monarch Butterflies begins around the end of August each year and ends when they reach Southern Mexico, near the intersection of the Sierra Madre Oriental and Sierra Madre Occidental mountain ranges. As the days begin to shorten, and the sun's height above the horizon at noon approaches 55 degrees, monarchs are cued to begin their migration. By utilizing an internal biological clock as well as being able to detect the angle of polarized light coming from the sun, monarch effectively employ a time-compensated sun compass that allows them to navigate. As they near their colony sites, it is suggested that they may orient themselves based on a strong magnetic pull from these volcanic mountains using small fragments of magnetite located in the base of their wings. As a final step, they likely use chemical cues originating from the dead monarch bodies and wings from previous years to return to the very same colony site their ancestors inhabited. Throughout the winter, the butterflies will remain relatively calm, clustered in trees with thousands of other monarchs, leaving for only brief periods to drink water on warmer days. As the days begin to lengthen and temperatures become consistently warmer, the monarchs begin to prepare for their journey back north by mating and perhaps nectaring on wildflowers. Around the second week of March, they will begin to depart from the colonies en masse, continuing to Northern Mexico and Southern U.S., where the gravid females will oviposit on newly sprouted milkweed plants, and then die. Anywhere from two to four generations will continue northward before a final generation (often the great-grandparents of the migratory generation from the previous year) picks up on the environmental cues the following August to begin their migration towards Southern Mexico.

Three Principles of Ecotourism:  
"Responsible travel to natural areas that conserves the environment and improves the well-being of local people." (TIES, 1990)

## Examples in Mexico



## Improving Community Welfare

The region currently receives over 100,000 tourists during the four to five month period each year in which the monarchs are present. The vast majority of people visiting are Mexican citizens (95%), who pay the 30 peso entrance fee (roughly \$3) to gain access to the park. However, money is generated in a number of different ways, with a variety of goods and services now offered at the two most visited reserves, El Rosario and Sierra Chincua. At El Rosario, dozens of restaurants line the trailhead, separated by small gift shops and snack shops. In all, there are at least 100 vendors that are open each day from November 19th until around the second week of March, when the Monarchs begin to make their mass exodus back north to the U.S. and Southern Canada. Being slightly less developed in comparison, Sierra Chincua has a total of roughly 40 restaurants, snack shops and souvenir stands. However, horses are permitted on the trails at Chincua, and are often used by visitors. Horses are typically owned by individual families, with usually no more than two or three horses per family. Consequently, at 150 pesos for a roundtrip ride to the monarch colony, the 60 plus horses ready to be rented each day generate significant income for many families in these rural areas. Apart from the goods and services provided at the reserves, several hotels and restaurants serve tourists in the surrounding towns, which offer further employment to local people.

## Why Mexico?

The Monarch butterfly is a denizen of the American tropics which has never developed a hibernation or estivation life history stage capable of withstanding temperatures lower than 8 degrees below freezing. The north-south migratory phenomenon, like in tropical ducks, warblers, and other waterbirds and songbirds, apparently developed in response to the temporary summertime availability of otherwise-unexploited food resources present in the north. Then the last adult generation of the summer has to return south to overwinter in the tropics.

## Threats

The Monarch faces an array of threats at both the northern and southern ends of its annual migratory journey. The following is a list of the main threats:

- 1) Illegal logging and firewood cutting (Mexico), which opens up the forests to winter storms.
- 2) Use of genetically modified hybrid corn and soybeans that are poisonous to Lepidoptera or resistant to herbicides, allowing pollen drift or intensive spraying and destruction of milkweeds in the rich Mid West agricultural region where most Monarchs have bred in the past (U.S.A).
- 3) Global warming (Mexico) pushing the Monarchs higher on the Michoacan-Mexican mountains to find cooler winter temperatures, until they run out of altitude to continue surviving without burning up all their stored body fat before March comes.
- 4) Direct and collateral damage from impact of uncontrolled tourism (Mexico).



## Solutions for the Future

The threats to the monarch overwintering habitat are numerous and range in severity and scope. While an issue such as global warming may be among the most critical, rapid solutions are not an option. However, other key issues such as deforestation and logging are potentially controllable in the short range and could be eliminated permanently with aggressive and continuous (12 months a year) patrolling of area roads, trails, and monarch reserve boundaries. Additional attention needs to be directed to solutions of possible visitor overload already in ceratin reserves, and concomittent overdevelopment of tourist souvenir stalls, food service establishments, or even horse-riding offerings.



## Responsible Travel

Ecotourism is often called responsible travel and is designed to educate the ecotourist while conserving the environment and improving community welfare. While only 5% of tourists to the Monarch overwintering colonies are foreign, the potential positive impact they may have on the area is far greater. Since the vast majority of Mexican visitors to the colonies are there for only the day, returning to their home that night, foreign tourists, although comparatively small in numbers, are critical to the sustainable tourism industry in these areas. By using local hotels, eating in local restaurants, and employing local guides, foreign tourists infuse the economy with a significant proportion of tourism dollars.

While it is possible to travel to the monarch colonies as an individual traveler, many informed ecotourists prefer to travel with a group to heighten their experience by traveling with other like-minded tourists and not having to worry about the logistics in planning and executing a trip to see these butterflies. An added benefit to some tour groups is the presence of a study leader who has worked professionally and scientifically with Monarchs and can provide in-depth knowledge during the trip.

In the case of U.S. and Canadian tourists, the experience they have in Mexico with the monarchs often leads to more environmental consciousness when they return home, especially in the form of conserving monarch butterflies. Planting a butterfly garden intended to attract and sustain monarchs, joining monarch conservation programs such as Monarch Watch ([www.monarchwatch.org](http://www.monarchwatch.org)), or simply sharing their story with friends and family can be tremendous help in both directly conserving these insects as well as spreading awareness of the migration event and its vulnerability.

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