Eastern monarch butterflies (both pages) fly en masse each year to their overwintering grounds in the mountains of Central Mexico.

PATRICIO ROBLES GIL / SIERRA MADRE / MINDEN PICTURES / GETTY IMAGES; (BUTTERFLIES OPPOSITE) DON FARRALL / GETTY IMAGES

Fragile Beauty

Scientists and communities work together to help preserve butterflies and their habitats

By Leslie Forsberg

SETTLING INTO MY KAYAK, I paddle through cool, blue sea alongside an ivory ribbon of warm sand. Breathing in the tangy salt air of Northwest Florida's Emerald Coast, I relax and gaze upward. Monarch butterflies flicker and flash like tangerine snowflakes against the powder-blue sky. Their vivid colors in this pastel landscape are breathtaking, all the more so when the sun limns their gossamer wings.

I have tremendous respect—and a sense of awe—for these winged wonders that migrate great distances each year. When fall brings cooler days, millions of eastern monarchs set out from points across Southern Canada and the Northern United States to fly as far as 3,000 miles to their winter home in mountainside *oyamel* fir forests west of Mexico City. When spring arrives, the butterflies add sparks of color to temperate landscapes on their return journey north. A lesser-known western monarch population migrates from the desert basins of Oregon and Washington to overwinter in the pine, cypress and eucalyptus trees tucked into arroyos on the Central California coast. Pacific Grove, California, in the heart of monarch country, has even dubbed itself Butterfly Town, USA.

Seeing the flurries of monarchs migrating to California or Mexico every fall, it's hard to imagine that their populations are under pressure. Yet, as with many butterfly species these days, the monarchs face the challenges of decreasing habitat and climate change.

Of some 800 butterfly species commonly found in the United States and Canada, 140 species—17 percent—are at risk, according to NatureServe, a nonprofit that collects scientific data about endangered species. While only 22 butterfly species are listed as endangered or threatened under the federal Endangered Species Act, many experts agree that the list has not kept up with what's happening in the field. That reality includes a decline in host plants—due to urbanization, large-scale agriculture and invasive plant species—as well as climate change, which threatens the habitats of high-elevation butterflies.

When the Xerces Society, an invertebrate-conservation organization named after the now-extinct Xerces blue butterfly, recently sent a questionnaire to U.S. and Canadian Lepidoptera experts, many of them expressed the same concern.

"We're seeing a decline in the rare endemics," says Xerces Society Executive Director Scott Black. "They live in one place, so as human encroachment eliminates habitat, they decline. But what is truly alarming is that scientists across the country are now seeing declines with many of our more-common species. This should really get us to think about what's wrong and how we can address these issues."

Aside from the sheer aesthetic beauty butterflies add to our world, they are integral parts of the ecosystem. They pollinate flowering plants and, thus, support overall biodiversity. Butterflies also provide food for birds and other animals, so they're interconnected in the food web. Most important, they're an indicator species: If butterflies are declining, it means something is awry systemically.

The stakes are high: As butterflies decline, other species will decline and drop out of that ecosystem as well, Black warns. Saving butterflies is an effort that involves safeguarding other species in the same habitats—for example, the plants that butterflies need for food are also needed by farm-crop pollinators such as bees.

"Each [butterfly] species is an individual with its own idiosyncrasies, and they're all challenging to bring back to healthy populations. But I do think it's doable," says Black.

IN THE OYAMEL GROVES OF MEXICO, the size of the monarch population is determined by how many acres the

overwintering insects inhabit. Traditionally they have taken up 18 acres of forest, with highs of up to 52 acres. Yet in the December 2009 count, they inhabited only 4.7 acres, the lowest level ever. The situation in California is similar: "Western monarch numbers have declined by about 90 percent," says Black. "In 1997 the average count per grove was 12,000; in 2009 the average was less than 1,000."

The reasons are varied: Reduction of the monarchs' overwintering habitat due to urbanization (in the case of the western monarchs) and illegal logging (in Mexico); weather extremes; and the disappearance of milkweed, the sole host plant for monarch larvae, from farmlands and roadsides across the United States and Canada. In many areas, milkweed is considered just that—a weed—and is mowed or treated with herbicides. The milkweed/monarch relationship is illustrative, as most butterflies are closely linked to just one or two flowering plants.

There is some hope for a monarch rebound, however. Last December nearly 10 acres in Central Mexico were host to overwintering colonies, doubling the acreage of the previous year. And the 2008 U.S. Farm Bill offers incentives for farmers to plant native pollinator plants, including milkweed, along fencerows. Yet both western and eastern monarch populations still face challenges.

The monarch is a charismatic poster child—it's the butterfly that's recognizable to most, and it's the only one that flies so far on such tiny wings. Certainly there's something we can learn from them about perseverance.

ALAN CHIN LEE

The female Miami blue butterfly (right) is primarily dark gray, with a dusting of blue at the wing bases.

Indeed, persevering is a good description for butterflies and conservationists alike. Across the nation, dedicated research biologists, zoologists, government officials, citizens and even entire cities are coming together—such as in the Monarch Joint Venture, which is working to protect monarch populations—to find unique approaches that will help boost the odds for these fragile beauties.

THE SAGA OF A DIMINUTIVE blue butterfly with orange spots is a reminder of the complexity of the problems facing imperiled butterfly colonies—and of the challenges involved in getting the wheels of bureaucracy moving in support of the conservation process.

"It's impossible to imagine a species more endangered than the Miami blue," says Jeffrey Glassberg, director and president of the North American Butterfly Association, "yet it's not federally protected." The Miami blue was once abundant and widespread in Southern Florida's coastal habitat. Throughout the 1980s, however, development continued down the mainland and far into the Florida Keys, pushing the Miami blues into ever-smaller habitats among the subtropical hardwoods on which it was reliant. Invasive species—including fire ants—and the use of pesticides may have further endangered the Miami blue.

Only one known colony of Miami blues remained in 1992, on Key Biscayne, when the worst happened: Hurricane Andrew barreled through, destroying the colony. As years went by with no sightings, the Miami blue was presumed extinct. Then, in 1999, NABA member Jane Ruffin found a population of Miami blues at

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The Monarch's Amazing Cycle of Life

<< The monarchs that migrate great distances to spend the winter clustered on fir branches in Mexico are several generations removed from those that journeyed north the previous year. In the spring, the wintering monarchs fly north into the southern United States and lay eggs. The spring generation, which lives several weeks, continues the journey north—as do one or two more short-lived summer generations. The "super-generation" born in the fall completes the cycle by migrating to Mexico.

Bahia Honda State Park in the Florida Keys.

NABA swiftly petitioned the U.S. Fish and Wildlife Service to list the Miami blue as a federally endangered species, on an emergency basis. When the listing was denied, NABA turned in desperation to the state of Florida in 2002. Within less than a month the state took a bold and remarkable step—the first time Florida had ever taken an independent stand for an endangered species—declaring the Miami blue worthy of attention. But bad weather and human bungling, such as mowing the blues' host flower in state parks, conspired to limit actual protection, and despite the efforts at a captive-breeding program, the colony on Bahia Honda disappeared in January 2010.

"No one knows exactly why, but there were various culprits, from an increasing iguana population that ate the butterflies' food source to failure to implement protection measures in time," says Glassberg.

RYAN HAWK / WOODLAND PARK ZOO

However, it's not the end of the story for the plucky little blue. Yet another wild population of Miami blues had been discovered in 2006 in Key West National Wildlife Refuge, and today, various government and private organizations are working together on behalf of the butterfly. Florida even has a license plate with the Miami blue on it, with proceeds going to support conservation efforts. But the little butterfly that could isn't out of the woods yet. With only a few hundred left, time is of the essence.

"This butterfly occurs in Florida and nowhere else," says Jaret Daniels, assistant director of research at the University of Florida's McGuire Center for Lepidoptera and Biodiversity. "If we lose it, it's gone forever, and if it can happen to one species, it could happen to another. Imagine waking up 25 years from now and not having monarch butterflies in your backyard."

While population numbers are an important measure of success in butterfly conservation, they're not the whole picture. According to Daniels, "Success stories should also include successes in understanding more about the organisms. Research and recovery go hand in hand."

ERIN SULLIVAN / WOODLAND PARK ZOO

The Oregon silverspot butterfly (above) inhabits four sites along the Central Oregon coast. At Cascade Head Preserve, ecologist Debbie Pickering (left) introduces captive-reared pupae into a netlike cage, where they will complete their metamorphoses before being released, while entomologist Erin Sullivan records where each pupa is being placed.

ON A ROBIN'S EGG–BLUE August day, Debbie Pickering—an ecologist with The Nature Conservancy—and a group of volunteers stride across a lush meadow atop a bluff at Oregon's spectacular Cascade Head Preserve, overlooking the Pacific Ocean, on their way to inspect release cages that contain Oregon silverspot butterfly pupae. Before they arrive at the first netlike cage, they can see the results of thousands of hours of research and hard work: Several Oregon silverspots, brilliant flashes of orange, have emerged from their chrysalises.

As Pickering gently lifts the netting, the freed butterflies flutter over the meadow, their orange wings with black bars adding contrast to the green grasses. One lands

Butterfly Spotting

<< Start learning about butterflies by getting a field guide and visiting a natural area near your home. Most butterflies live in warm, dry climates, so you're more likely to spot them east of the Cascade Range or in southern regions, and most commonly from May through October.

- For an extensive **list of free-flying-butterfly exhibits and gardens** throughout North America, visit the Butterfly Conservation Initiative website at www.butterflyrecovery.org.
- The **Audubon Butterflies app** is a mobile field guide to more than 600 butterflies of North America ($4.99; available at iTunes and Android Market; www.audubonguides.com).

The endangered Palos Verdes blue's coastal habitat is near Los Angeles.

JANE HENDRON / USFWS

How to Help

>> Join an organization that supports imperiled species, such as the **Xerces Society** (www.xerces.org) or the **North American Butterfly Association** (www.naba.org). The Xerces Society offers the latest information about butterfly conservation, and NABA suggests ways to get involved—from planting butterfly-attracting plants in your yard to participating in an annual butterfly count.

on an early blue violet and, closing its wings, reveals a brick-red underside spotted with mirrorlike silver dots.

Once abundant on coastal grasslands from Southern Washington to Northern California, the Oregon silverspot butterfly was listed as a threatened species in 1980; by 1998, its population at Cascade Head hovered at just 57 individuals. Since then, the silverspot has benefited from extensive research and it is one of the few success stories—with increased knowledge yielding an increased population of 610 butterflies at the preserve in 2010.

Cascade Head Preserve, which is managed by The Nature Conservancy, is one of the primary habitats for Oregon silverspots. The Nature Conservancy and a range of partners are working hard to ensure that this scenic locale remains the home of these beautiful insects.

"We're maintaining the prairie habitat, and the butterfly is a good indicator of how well the prairie itself is functioning," says Pickering.

In the case of the Oregon silverspot, scientists have employed a time-honored ecological approach to aid the insect. Native American tribes traditionally burned prairies, yet this practice fell out of favor once settlers arrived. With fire suppression, the silvery insect's habitat shrank due to encroachment from trees, shrubs and non-native plants that competed for space with the butterfly's larval plant, the early blue violet.

"We did quite a bit of research into the results of reintroducing fire," says Pickering. "We found that when we burned an area, the early blue violet's seed was stimulated, and the next year we got a big flush of violet seedlings."

The butterflies' odds were further boosted by a captive-rearing and population-supplementation program that began in 1999. The U.S. Fish and Wildlife Service and The Nature Conservancy collect female butterflies and transfer them to insect "nurseries" at the Oregon Zoo (Portland) and Woodland Park Zoo (Seattle). Biologists at the nurseries feed the butterflies and collect their eggs, hatch the larvae and keep them in cold storage over the winter, and then feed the larvae and monitor pupation (the chrysalis stage).

"When I think back to the early days of research, I realize how far we've come," says Woodland Park Zoo biologist Erin Sullivan. "Our survival rates are through the roof. We had only 35 larvae hatch in the early 2000s, and we released about 1,300 pupae into the field last year. This year we have 1,600."

The adage "it takes a village to raise a child" is true for imperiled butterflies, too. The Oregon silverspot owes its existence to extraordinarily close working relationships between the aforementioned groups, as well as the U.S. Forest Service, Portland-based Lewis & Clark College, and the Xerces Society. "We've been very fortunate to have great partnerships," says Pickering.

"When we go out into the field and see the butterflies flying in their natural habitat, that's the most miraculous part of the experience," notes Sullivan.

A CONSORTIUM of organizations, including some rather unlikely partners, is also helping to restore the habitat of the Palos Verdes blue, a tiny periwinkle butterfly with dark-gray wing edges that once inhabited coastal sage scrub throughout the Palos Verdes Peninsula, about 25 miles southwest of Los Angeles. The species—classified as endangered since 1980—was presumed extinct in 1983.

A decade later, a previously undiscovered population was found at the Defense Fuel Support Point in San Pedro, California. The Department of Defense swung into action, funding a captive-rearing program at the fuel base and later partnering with The Urban Wildlands Group, an L.A.-based nonprofit organization.

When a second captive-breeding site opened at Southern California's Moorpark College under the direction of biologist Jana Johnson, the species' odds of survival increased. Johnson was able to go from rearing 200 pupae one year to 750 the next, to thousands the following year.

"They engaged students [at Moorpark's Teaching Zoo] who are used to caring for animals, so our ability to produce went up exponentially," says Travis Longcore, butterfly conservationist with The Urban Wildlands Group.

Starting with the Department of Defense's first release of butterflies at the base in 2000, support for the Palos Verdes blue has burgeoned, and the region's habitat is being restored, with fields of deerweed and locoweed planted to provide the food source the butterflies need. The Palos Verdes Peninsula Land Conservancy is a major player in restoring local habitats. And the city of Rancho Palos Verdes is also working on a conservation plan—a massive 1,500-acre preserve to benefit numerous species, including the blue butterfly.

"It will be a huge opportunity for us to release the butterflies there," says U.S. Fish and Wildlife Service biologist Eric Porter. "Then we'll be more comfortable knowing we can sustain the species."

While the odds are looking up for imperiled species such as the Oregon silverspot, many more species are struggling, even with an expanding knowledge base and the best of conservation practices. The situation of the Palos Verdes blue remains fragile, with a 2010 estimated population of only 35 butterflies. Yet, for those involved in saving butterfly species, when everything lines up right, the rewards are great.

"To be able to participate in helping butterflies continue to exist is a thrilling part of my life's work," says Pickering. "I think the world would be a poorer place without Oregon silverspot butterflies on the coastal headlands."

The same could be said for any imperiled butterflies—flashes of brilliance in a world that would be just a bit grayer without them.

Leslie Forsberg writes from Seattle.