



Fig. 1. Las Conchas Fire from State Route 4 in Valle Grande, June 27, 2011. Photo by Jacquie Dewar.

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PAJARITO ENVIRONMENTAL EDUCATION CENTER, LOS ALAMOS, NM

Climate Change and Fire Ecology of Valles Caldera – Preparing for the Future

By Bob Parmenter

Human-caused climate warming and 20th-century forest management policies have led to dramatic changes in wildfire frequency and size, which in turn has impacted our forests' ecosystem structure and functioning. Climate change drives wildfire frequency by raising temperatures, lowering relative humidity and increasing vapor pressure deficits, all of which contribute to lower forest fuel moisture, increased combustibility, and subsequent expansion of areas burned. Fire management policies over the last century, including the Forest Service's "10 AM rule" (1935-1978) under which all forest fires were to be put out by 10 o'clock in the morning after ignition, allowed forest fuels to build up beyond historic levels.

Today, these massive fuel loads continue to feed extremely hot and fast-moving fires across large landscapes. Historically, forest fires burned unevenly and at varying intensities, leaving behind a mosaic of trees to supply seeds for natural forest regeneration; whereas, today's fires burn ever-increasing areas with high-severity, stand-replacement outcomes. Recent examples in the Jemez Mountains include the Las Conchas (2011) and Thompson Ridge (2013) fires, both of which started with wind-blown trees hitting power lines on private land, but burned for weeks due to the difficulty in stopping the advancing flame fronts (Fig. 1 above).

Jemez Springs, NM, annual temperature, 1914-2022

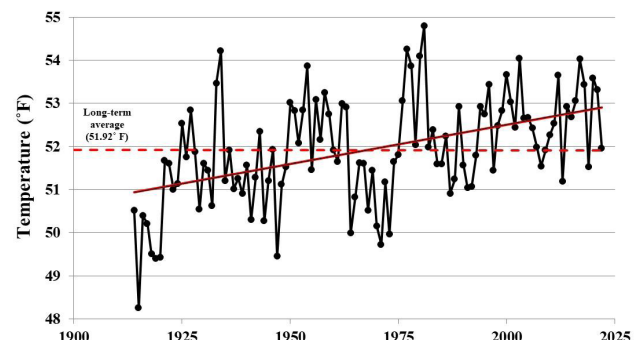


Fig. 2. Average annual temperatures in Jemez Springs, NM, during 1914-2022. Data from National Weather Service and National Park Service

While policies for fire management have shifted away from "full suppression all the time," climate warming continues to exacerbate fire behavior. Evidence for climate warming has been growing world-wide, and even our local weather stations corroborate the warming trend. Temperature data from the Village of Jemez Springs during 1914-2022 provide a nearly-exact match for climate model predictions (Fig. 2). The Intergovernmental Panel on Climate Change (IPCC) predicted an increase of 1.8° F in northern New Mexico during the past 100 years, and our data show an increase of 1.82° F. We can anticipate a continued upward creep through the rest of the 21st century, although the rate of increase is still to be determined, dependent on human action to reduce atmospheric greenhouse gases.

Given the climate warming record observed in Jemez Springs, are we seeing changes in forest fires here in



Fig. 3. Photos of the forest restoration process in Valles Caldera National Preserve. Top left: Feller-buncher machine thins out the trees. Top right: Pine forest after thinning, with slash on the ground. Bottom left: Prescribed fire burns off the slash. Bottom right: Post-thinning and post-fire forest with grass/wildflower understory. Photo Credits: R. Parmenter and (lower right) NPS staff

the Jemez Mountains? Absolutely, yes, and the data tell the story. In the Jemez Mountains from 1909 to 2019 (111-year record), fire data from the US Forest Service and the National Park Service show an average of 68 forest fires per year (7,504 total fires!), of which 46/year were caused by lightning, 17/year were ignited by humans, and 5/year were designated “cause unknown.” During the 20th century (1909-1999), the total area of forest burned each year averaged 1,179 acres (less than two square miles per year). Since that time (2000-2019), the annual burned area has jumped in size to 17,720 acres (over 27 square miles per year), a 15-fold increase in just the last two decades! This has led to landscape-level changes in vegetation patterns, shifting large areas of the eastern flanks of the Jemez Mountains from mixed-conifer forest to a chaparral ecosystem dominated by Gambel oak and New Mexico locust.

So what can be done to preserve and manage our forests under future fire regimes? Valles Caldera National Preserve and the Santa Fe National Forest, the National Park Service and US Forest Service are working in tandem to thin the high-density forests to remove a century of fuel build-up, and reintroduce natural fire regimes to maintain the forest ecosystem (Fig. 3). Historic fire regimes, based on tree-ring and fire scar studies going back centuries, indicate that much of the Jemez Mountains burned every 8 to 15 years, but these fires were low-intensity, slow-moving ground fires in the forest understory. Once the forest conditions are back within manageable limits, natural lightning strikes can ignite low-severity fires which fire managers can safely “let burn” to benefit the ecosystem.

Forest management on the landscape scale is a high priority for virtually all land management agencies (local, state, and federal), as we all recognize the interconnectedness of our landscapes with respect to fire movements and behavior.

In addition to thinning trees and restoring natural fire cycles, our forest restoration work provides additional ecosystem benefits. Following thinning, trees experience reduced competition for soil water and nutrients, making them healthier and more resistant to insect attacks and fungal diseases. Restored forest habitats support healthy wildlife populations (e.g., elk, deer, turkey). Forests developing into old-growth status are an important means of carbon sequestration, extracting greenhouse gases from the atmosphere. Wider spacing of trees allows more snowfall to reach the ground and remain shaded from the sun, thereby reducing sublimation and increasing water availability during spring snowmelt. Finally, restored forest habitats provide beautiful outdoor settings for recreation, hunting, and fishing by both residents and visitors.

If we can restore our forests to improve fire management, increase water availability, and sustain ecosystem functioning, we have a chance to maintain our forest habitats through the coming decades in the face of climate warming. I believe it’s important to remember that an individual ponderosa pine tree can live for 400 years, and assuming that humans can develop the social, political, and economic will to reverse climate warming in the next 50-100 years, the young pines that are alive today may live through this entire warming episode and come out the other side in reasonably good shape. Landscape forest restoration will take time – to borrow a line from the Chinese philosopher Lao Tzu, “Even the longest journey begins with a single step” – and we are taking those first steps today to provide the greatest chance for future forest survival in the Jemez Mountains (Fig. 4). 🌲



Fig. 4. The History Grove, an old-growth forest stand on the north side of the Valle Grande. Photo Credit: D. Usner

How to Help the Blue Crow

By Cathy Wise

It was a picture-perfect Colorado Plateau day... until my mountain bike brakes failed.

Crumpled in an uninjured heap, I can feel my teenage son glowering down as he kindly suggests that I walk the bike back to the car. While I dust off, he offhandedly reports that he heard “those laughing birds,” and I perk up! Before I can probe further, he rolls off at high speed, and I begin my “walk of shame” back to the trailhead. I am now on high alert for a flash of blue or tell-tale vocalizations.

The call of the Pinyon Jay (*Gymnorhinus cyanocephalus*) can be likened to a plaintive laughing “Ha Ha Ha Ha,” but unfortunately, their status is no laughing matter. Long-term drought, climate change, and habitat conversions have resulted in astonishing Pinyon Jay population declines. From 1967–2015, populations fell by an estimated 83.5%, and further losses seem imminent. Considered an obligate resident of Pinyon—Juniper woodlands and adjacent shrub/grasslands throughout the intermountain west, this intelligent and raucous corvid has long captivated humans. Highly colonial, flocks of several hundred birds were impossible to ignore in their foraging flights. Known colloquially as the ‘Blue Crow’, this corvid had little use for farm fields, passing over them in search of piñon.

Piñon nuts are full of fat and protein—nutritious for both birds and mammals—and they are heavy, so the tree relies on animal transport for reseeding. The trees’ second strategy for continued survival is to produce seeds on a schedule that includes “mast years,” in which there is such an overabundance of nuts that even all the hungry birds and animals cannot consume them. Pinyon Jays cache seeds in the ground and those that are not retrieved might become baby trees. People long ago learned that the jays knew the best nut trees and had some insight into the trees’ unwritten production schedule.

Recent decades have seen unprecedented rates of change in climate, rainfall, and land use regimes. Our arid west has become more so while temperatures ramp up. Precious grasslands suffer shrub encroachment due to grazing pressures and invasive plant establishment, and meanwhile, trees

are stressed by drought and pests. Land managers are operating in unprecedented times and need to protect both grasslands and forests, all with an eye to fire safety. In the case of the Pinyon Jay, data are badly needed across the birds’ considerable range, especially in New Mexico, Arizona, Utah, and Nevada. We need to identify stronghold areas for the birds for protection and enhancement and to document historically occupied areas that are now devoid of jays. We need to look for the birds across their range, and we need to do it right now. Please consider helping us! If you can ID a Pinyon Jay—we want you!

The Great Basin Bird Observatory (GBBO) recognized Pinyon Jay declines early and were instrumental in forming the multi-agency Pinyon Jay Working Group. In addition to focused research, GBBO devised an innovative, GIS-based community science program, and Audubon joined the effort last year. Using smartphones, observers can report detailed info on Pinyon Jays in real-time. It’s free, fun, and provides badly needed data. Getting involved is easy – Go to pinyon-jay-community-science-gbbo.hub.arcgis.com, click the ‘Collect Data’ tab at the top of the website in the navigation bar, and create a username with the ending “_ASW” (example: “PeterPinyon_ASW”) so we can identify you as an Audubon SW community scientist. Thank you in advance for getting involved and spreading the word.

Back to the trail: on my embarrassing trek to the car, broken bike in tow, I heard them. Seven calling Pinyon Jays came flying across my trail. They looked like hope. And that’s what you look like to birds. 🦋



Pinyon Jay social organization is complex, with permanent flocks that may include more than 500 individuals. Many birds spend their entire lives with the flock where they hatched. Photo Credit: Warren Berg

Look and Learn at PEEC's Gardens

By Natali Steinberg

Eight years ago, before there was anything but a large concrete slab where PEEC now stands, three women were at work laying out the plans for PEEC's first gardens. Dorothy Hoard, Selvi Viswanathan, and Natali Steinberg, who had gardened at the old PEEC site, were planning on three educational beds: one for a Pollinator Garden, another for a Water Wise Home Garden, and the third for a Native Plant Garden. It was decided to shape the raised beds to resemble the finger mesas of Los Alamos as well as to make them easy for our older gardeners to reach everywhere as they sat on the shelf made by the moss rock walls.



*PEEC's three gardens at the nature center, designed to resemble the finger mesas of Los Alamos.
Photo Credit: PEEC*

Today those three gardens are chock full of the kind of plants that are most desirable to attract bees, butterflies, and birds, as well as those that require less water. The plants are mostly perennials that bloom at various times during the garden season. There are many similar plants in the native beds (farthest from the building) and pollinator beds (closest to the building), as natives are those sought out by pollinators. The middle bed is full of plants that are the kinds home gardeners usually purchase. These are hybrids developed by plant breeders to be hardy and drought-resistant in our climate.

After these beds were planted and the building was up, there were areas around the property that had nothing in these three categories. So Larry Deaven, a penstemon specialist, gradually took over those plots and filled them with more than 280 species of penstemons

from all over the United States. Penstemons are new-world plants, and there are species that do well in every climate in our country. On the Pajarito Plateau, we have ten species that are native. They bloom here during May and June, and gardeners from all over New Mexico come to the nature center to see them.

In addition to the above, many plants from the native bed have been reseeded by mother nature and can be seen growing along the rock stream and the slope by our parking lot. This is an example of how rewarding natives are because their wind-blown seeds grow naturally without additional care or water.

PEEC's plants and shrubs began flowering in April, so be sure to come over to look and learn. 🌱

The Mourning Cloak, Metamorphosis, and the Magic of Nature

By Selvi Viswanathan

The magic of nature is all around us. Metamorphosis is an example of that magic. It is the process of transformation from an immature form to an adult form in two or more distinct stages. It seems like magic when we see a caterpillar form a chrysalis and emerge as an adult butterfly.

I had a chance to observe this miraculous change a couple of years ago. I saw six Mourning Cloak butterfly caterpillars crawling on the side of my house on the south-facing wall above the garage. I was delighted since it reminded me of my mentor Dorothy Hoard, who introduced me to these marvelous insects. We at Pajarito Environmental Education Center started a butterfly group, and Dorothy wanted me to take pictures of the butterflies in our yard. I had a Lumix camera and tried to take photos of the Mourning Cloak, which came to my pussy willow tree. But Dorothy felt we needed much better pictures to see the field marks. Now I can take pictures with my more professional camera thanks to my son Hari, who leaves his camera with me.

I always felt this butterfly should have a different name in North America. I learned it refers to its resemblance to a traditional dark-colored cloak worn when someone was in mourning.

The Mourning Cloak is the butterfly of the spring. Unlike

most butterflies, Mourning Cloaks overwinter as adults. They winter tucked under a bit of tree bark, leaf litter, or standing stalks of vegetation.

Like all butterflies, the Mourning Cloak undergoes complete metamorphosis consisting of four stages: an egg laid on a host plant, a hatched caterpillar that feeds on leaves, the pupae that enters a chrysalis, and finally, the emerging adult butterfly.

Here are a few more details:

1. Egg stage 4 to 14 days: In early spring, Mourning Cloak butterflies mate, and the female lays pale yellow eggs in clusters on or around twigs on the host tree. The aspen tree is one of the host plants we have. Because Mourning Cloak eggs are laid in clusters, the caterpillars can be seen feeding together.

2. Caterpillar stage 3 to 4 weeks: It eats the leaves of the host tree.



Spiny elm caterpillars, Nymphalis antiopa, the immatures of the Mourning Cloak butterfly, are relatively large, spiny caterpillars. Photo Credit: Selvi Viswanathan

3. Chrysalis (pupae stage) 7 to 18 days: During this stage, the caterpillar has grown enough and finds a protected spot, molts for the last time, and forms an encasement in which they metamorphose. They form a chrysalis. Inside the pupa the caterpillar's body breaks down into a kind of soup and is reorganized into the adult structures of the butterfly. This stage can take between 10 to 15 days.

4. The adult butterfly emerges from the chrysalis: Its life span is normally only a few days, but some Mourning Cloaks have been known to survive as long as 11 months as an adult, even during the winter.

Here are a few more interesting facts about the

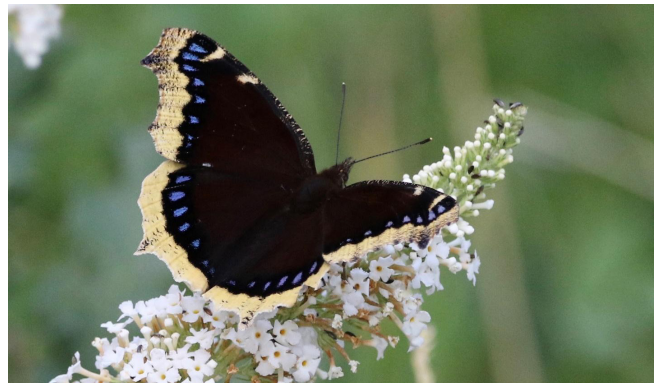


On average, the chrysalis can grow to a length of 0.8 inches (2.0 cm), though the maximum size can be over 1.1 inches (2.8 cm). Photo Credit: Selvi Viswanathan.

Mourning Cloak butterfly:

- It survives winter as an adult butterfly, unlike other butterflies.
- It depends on tree sap for its main source of food, instead of flowers, so we see them even before the snow melts.
- The front pair of their legs are small and hairy, like a brush. This is called brush foot and it makes them look like they have four legs instead of the six legs that insects have.
- The Mourning Cloak has other names. It is called “harbinger of spring” and also “first butterfly of the season.”

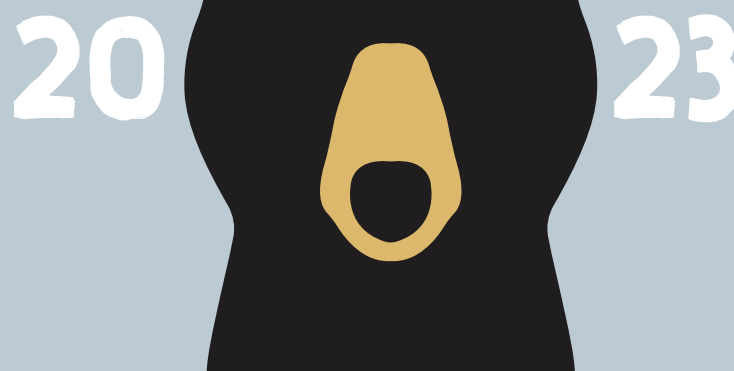
The Mourning Cloak is a stunningly beautiful butterfly. I see them as early as February and am in awe at how this miracle of creation survives, giving me joy and hope. 🦋



The stunning adult Mourning Cloak butterfly. Photo Credit: Selvi Viswanathan



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*Photo credit: Los Alamos
Historical Society Archives*

We want to extend our sincerest gratitude to J. Arthur Freed and his wife Nancy for their incredible bequest of \$250,000 to PEEC.

Art was a supporter of PEEC for many years. When PEEC was fundraising for its capital campaign, he eagerly donated in honor of his beloved wife Nancy. The microscope he funded can be found in the Naturalist Corner, where people can view anything from a minute insect to a pinecone without having to look through a tiny opening. Art also shows up anonymously in an exhibit called "If Rocks Could Talk" as the voice of the rock formation called "Cerro Toledo." To hear Art's voice again, push the Cerro Toledo button!

Legacy gifts like this help ensure a long-term, sustainable future for PEEC. The Freed's generosity will impact PEEC for many years to come.

You can find more information on PEEC's Legacy Society on our website at www.pecnature.org/legacy.

Our Mission: Enriching people's lives by strengthening their connections to our canyons, mesas, mountains, and skies.

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"Great part of the community. Great way to learn about natural Los Alamos."

— Los Alamos Nature Center visitor

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*The cuddliest bear encounter you'll have!
One of our young visitors poses next to
a giant stuffed bear during Bear Festival.
Photo Credit: Stephanie Lusher*

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UPCOMING EVENTS

Poetry Under the Stars **JULY 15**

Mushrooms of NM **AUGUST 4**

Intro to Telescopes **SEPTEMBER 19**

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