Nature Notes



VOLUME 18, NUMBER 1, WINTER 2018 PAJARITO ENVIRONMENTAL EDUCATION CENTER, LOS ALAMOS, NM

## Message from the Director

I'm very pleased to be able to tell you about a new outreach program at PEEC. The strategic plan goal closest to our board's heart is to expand the work we are doing with people in our surrounding communities. Our Education Programs Director Siobhan Niklasson has been working on an exchange—a partnership between two first grade classes from different towns. Read on to hear a story about their first joint field trip. And a huge thank you to you, our members and donors, for making all of our work possible.

-Katherine Bruell

## **Building Bridges between Communities**

By Siobhan Niklasson

In the past year, we at PEEC have started to think about ways to use nature to build community beyond our traditional audience. After all, people with very different backgrounds and priorities can enjoy nature in the same ways and value it for the same reasons.

One nature bridge we've been working to build spans



Children explore nature at Los Luceros. Photo by Thomas Graves Photography

between Los Alamos and the Española Valley. Our communities are bound by longstanding economic, cultural, and educational ties, but our relationship has often been uneasy because of disparities in resources and opportunities. We wondered how we could use environmental education to build bridges between LA and Valley students.

We approached Anna Zobay, a Los Alamos Public Schools first-grade teacher who grew up in Pojoaque and has taught in Los Alamos, Pojoaque, and Española, to see if she would be interested in entering into a partnership with a first-grade class in the Valley. Each class would receive field science lessons at their school, and then we would take the two classes on joint field trips to explore each other's ecosystems and get to know some new friends. It turned out that Anna had been trying to find a way to do just this

> kind of community-focused exchange. She found a teacher, Elsie Casados, at Alcalde Elementary, who was interested in joining the project.

We were lucky enough to have an opportunity to take the students on a joint field trip to the 150-acre, riverfront Los Luceros Ranch thanks to a partnership with New Mexico Historic Sites. This property has breathtaking natural resources, including a cottonwood-dominated riparian area, a horse, and a resident population of donkeys, peacocks, and goats.

The Alcalde students got to Los Luceros first. They met the animals at the ranch and had some time to run around and explore. By the time the Los Alamos students arrived, their new friends were excited to greet them as they got off the bus and to show them around.

During lessons at their schools, the first graders had combed their respective schoolyards, looking for shapes in nature. We repeated the activity with mixed groups of children from Alcalde and Los Alamos in the cottonwood bosque. The kids knew just what to do, and when they returned to the whole group with their objects, they used their findings to compare the ecosystem at Los Luceros to the ecosystems near their schools.

During the day, the kids sang songs together (everyone knew the words to "This Land is Your Land," "Itsy Bitsy Spider, "and "The Wheels on the Bus"), found out who had dressed up in the same costumes for Halloween (lots of Elsas), discussed their favorite animals, and talked about riding bikes.

In addition, family members from both schools who accompanied the children had an opportunity to acquaint themselves with the incredible natural setting at Los Luceros. One father told us that though he was born and raised in Alcalde, he had never before visited the



Beer and wine for sale by Pajarito Brewpub and Grill Details at www.peecnature.org

and the world. The courses follow programs developed by the Northwest Earth Institute (NWEI) and are structured like a book group, with readings followed by discussion. The important difference is action-participants choose actions to take each week to implement the ideas they learn, and report back to the group on their progress. Group members have chosen to change shopping habits, build compost bins, change jobs, help their friends and neighbors live more sustainably, and much, much more.

those of their community

Having the support of others in the group really

ranch. Each class received a shed peacock feather as a momento of their time together.

The day was a great success, and we plan to continue the partnership. All of the first graders will come to the nature center in the spring for another joint field trip. We hope that they can use a common fascination for the outdoors and the language of science to nurture their blossoming friendships. helps participants reach for greater understanding of issues and inspires personal change. Participants in the course called "A Different Way: Living Simply in a Complex World" discussed a huge range of topics over six weeks, from recycling to media use to politics to climate change, and beyond. One group member shared, "I've implemented ten changes in my life, in service to the health of our planet. They've become habit. No more plastic throw-away containers, I

## Let's Talk Sustainability

## By Sue Barns

Most people's love of nature brings with it a desire to preserve and protect the environment. The good news is that there are so many ways to help the world and live more sustainably in it. The difficult part is choosing how best to do that. Put solar panels on the house, or upgrade insulation? Donate to an environmental cause, or buy renewable energy? Start a garden, or run for office? The choices we make every day do matter—but the choices can be overwhelming.

Since spring of 2017, PEEC has hosted a series of discussion courses designed to help participants learn about issues they care about, focus on those that align with their values and, most importantly, take concrete actions that impact their personal lives and



Participants in the "A Different Way" course celebrated the last session with a potluck on the patio of the nature center. Photo by Sue Barns.

joined a food co-op, started buying in bulk, began composting, cut way back on electronics, and am buying only from sustainable sources." The summer course on climate change, "Change Is Our Choice: Creating Climate Solutions," covered a broad range of causes of and solutions to global warming. At the end, participants wanted to keep meeting and take on a project to benefit the whole Los Alamos community. They continued working together for the next six weeks to bring the EcoChallenge (an international action-based sustainability challenge) to residents. The scope and benefits of the work done by course participants has been remarkable!

The next NWEI course is scheduled to begin in January. Over the course of seven weeks, "Choices for Sustainable Living" will cover diverse topics such as ecological principles, food, transportation, consumption, economics, and community. It will give participants an opportunity to explore sustainability more deeply and learn its unique meaning from individual, societal, and global perspectives. As always, the course will focus on actions members can take to promote a healthy, just, and bright future for us all. Won't you join us?

## The Lion in Winter

#### By Marilyn Lisowski

Majestic and sleek, a massive tawny-colored mountain lion with a long, heavy tail gracefully prowls our rocky plateaus and canyons. Even in freezing temperatures, the big cat perches for hours on ledges above game trails waiting to spring onto a passing deer, its favorite prey. Known as a puma throughout South America, this American subspecies is commonly called a "cougar" in the Northwest and a "mountain lion" in the Southwest. Scientifically, it's *Puma concolor*, the last word meaning that the coloration is the same over the body. Only the underparts are lighter.

Mountain lions sport massive canine teeth and long, sharp claws. Adult males weigh 130 to 180 pounds and can measure seven to eight feet from nose to tip of tail. Females are smaller. Should you see one in the forest or in someone's yard, you might think you glimpsed a very, very large housecat. It IS a kind of cat, but it is not a pet.

Solitary, shy, and nocturnal, the mountain lion fears only our black bear, except in winter, when it rises to the top of the food chain. Ecologically, a predator's primary value is to control vegetable eaters, and happily for this predator, rabbits and deer do not hibernate in winter. Do burgeoning herds of deer regularly dine on your landscaping? The mountain lion is ready to help.



This mountain lion is all ears, curious about the bright light that interrupted its evening drink. Photo by Hari Viswanathan.

After a successful, explosive ambush aimed at the neck of the prey, a mountain lion typically does not consume its entire kill. It may cover the kill with snow or dirt to preserve it and return to feed several times, but unselfishly a mountain lion usually leaves about 25 percent for scavengers and turkey vultures.

Mountain lions require huge territories, at least ten square miles per lion, which they mark with scent. So if you see one, be assured it is probably the only big cat around. And they are famously lacking in social skills. They not only avoid humans, they normally stay away from one another except to mate, or, rarely, to share a kill. And they sometimes kill one another.

Mating begins at about two years old. Female



A backyard pond is a great way to attract local wildlife. Photo by Hari Viswanathan.

mountain lions give birth to two to three cubs in a rocky den after three months of pregnancy. Births can be any time of year but peak in June through September, when survival of the tiny, spotted cubs is more likely. Cubs often die if the mother is killed by hunters, but the young can also be killed by passing males. And in New Mexico mothers, and cubs have died from plague contracted from fleas on the rodents they eat.

Most dangerous to the survival of mountain lions are people. Mountain lions were hated by ranchers and farmers who lost livestock to the hungry cats and hunted them nearly to extinction in the east and

Midwest by the beginning of the last century. Bounties placed on these animals made hunting them profitable. Hunters and poachers killed thousands. Human population expansion has caused enormous loss of habitat. Many are hit by cars. With the loss of these predators, deer numbers have ballooned, even in cities.

Seeing a mountain lion is rare. Nevertheless, if you do find yourself face to fur, don't panic and run. Make yourself as large as you can. Lift children onto your shoulders. Hold your jacket up high. Back away slowly, never allowing the back of your neck to face the animal. The spinal cord at the neck



Cataclysmic Collision: Artist's illustration of two merging neutron stars. The rippling spacetime grid represents gravitational waves that travel out from the collision, while the narrow beams show the bursts of gamma rays that are shot out just seconds after the gravitational waves. Swirling clouds of material ejected from the merging stars are also depicted. The clouds glow with visible and other wavelengths of light. Photo and caption courtesy of NSF/LIGO/Sonoma State University/A. Simonnet.

of prey is a favorite strike point. Should you actually be attacked, do not play dead, but fight back. Only 23 fatalities from mountain lion attacks have been recorded in this country since 1890, so your chances of being killed by a mountain lion are quite small. If you do catch a glimpse of these beautiful creatures, moving like silk on the rimrock, vanishing in seconds, consider yourself among the luckiest individuals, as few people are so fortunate.

# Finding Colliding Stars, Propagating Waves, and the Source of Gold

#### By Dr. Galen Gisler

The world's first observation of the merger of a pair of neutron stars was recently detected by the gravitational wave detectors LIGO (Livingstone, Louisiana and Hanford, Washington) and VIRGO (Cascina, Italy). This observation is a major milestone in astrophysics, helping to link and resolve problems in three different realms: gravitational waves, gamma-ray bursts, and the synthesis of elements heavier than iron.

Gravitational waves were first predicted by Einstein's General Theory of Relativity, published in 1916, but it

was 98 years before their existence was confirmed. In this theory, the gravity of a massive object is a geometrical distortion of the fabric of spacetime. Massive objects in orbit around each other, such as binary neutron stars, produce ripples in spacetime that propagate outward in all directions at the speed of light. The radiation of gravitational waves removes orbital energy, with the result that such binaries must inevitably coalesce, given sufficient time. In 1974, Russell Hulse and Joseph Taylor discovered the first known neutron star binary and deduced that its mutual orbit was decaying precisely as predicted by the Einstein

theory, with coalescence of that binary expected in a few hundred million years.

Gamma-ray bursts were first discovered by the VELA satellites designed to detect clandestine nuclear tests in the late 1960s, with the first publication by Los Alamos scientists Ray Klebesadel, Ian Strong, and Roy Olson in 1973. Since then, it has been theorized that at least some gamma-ray bursts, those with durations shorter than about two seconds, might result from the violent merger of a pair of neutron stars.

In a foundational paper in 1957, Margaret Burbidge, Geoffrey Burbidge, Willy Fowler, and Fred Hoyle laid out a general theory for the synthesis of the chemical elements in stars. The fusion of hydrogen into helium, and of helium into carbon, oxygen, and elements all the way up to iron was calculated and found to agree quite well with the relative abundance of elements in the solar system. Synthesis of the elements beyond iron requires an abundance of both energy and neutrons, and at the time the authors had imprecise notions of where these elements could be produced. Some elements could be produced by capture of

single neutrons, followed by radioactive decay, in what is known as the s-process (for slow neutron capture process), thought to occur in the atmospheres of certain very old stars. Other elements, including gold, could only be produced by the rapid capture of many neutrons, called the r-process, but it was unclear whether this process was occurring in supernova explosions, coalescing neutron stars, or both.



Hubble Space Telescope image NGC 4993, the host galaxy of the optical counterpart to GW170817. The inset shows the location of the optical counterpart, nine days after the discovery. Photo and caption courtesy of NASA/STScI/P. Blanchard / E. Berger / CfA.

The possibility of actually observing the merger or coalescence of neutron star binaries was therefore a strong motivation for the development of the LIGO and VIRGO gravitational wave observatories, inspired by these three separate problems in astrophysics.

As the LIGO detectors were undergoing final engineering tests in September 2014, they made their first unambiguous detection of gravitational waves from the merger of two black holes. While the masses of the pre-merger black holes were surprisingly large, this detection proved that the many years of hard work and careful calibration of the detectors had been impressively successful. During the remainder of that first brief observational run and a second run in 2017, four (possibly five) more black-hole merger events were observed. Although the localization of these events is poor, making electromagnetic follow-up efforts difficult, little to no electromagnetic radiation is expected from these black hole mergers anyway. Black holes, after all, are black — no light escapes from them.

Finally, on August 17, 2017, a gravitational wave signal from the merger of neutron stars was observed. Within two seconds of the gravitational wave detection, a short gamma-ray burst was detected by NASA's FERMI satellite and ESA's INTEGRAL satellite. Localization was sufficient to identify a bright optical transient in the elliptical galaxy NGC 4993, and rapid follow-up by many observatories in all accessible wavelengths of the electromagnetic spectrum verified that this transient contained signals of the production of r-process elements, including the rare earths and the precious metals gold and platinum. It is estimated that 16,000 earth masses of heavy elements—

> including two earth masses of gold— were produced in this event, allowing for the possibility that all r-process heavy element production in the universe occurs in neutron star mergers.

This single observation is thus a keystone linking together theories of heavy element production, short gamma-ray bursts, and gravity, and heralds the birth of what is being called multi-messenger astronomy. A new observing run of the

LIGO and VIRGO detectors is scheduled to begin in the fall of 2018, and within a few years these detectors will be joined by new detectors in Japan and India. Gravitational wave detections may soon become routine, and through more neutron-star-merger events we will rapidly gain deeper understanding of gravitational radiation, gamma-ray bursts, and the synthesis of heavy elements. Further black-hole merger observations should also give us deeper insights into the endpoints of stellar evolution.

## The PEEC Penstemon Gardens: Plants from Many Climates Growing in One Place

#### By Larry Deaven

In a previous article, "What Is a Penstemon?" (*Nature Notes*, Winter 2016), Becky Shankland wrote a brief introduction to the genus Penstemon. She also explained the rationale behind my idea of creating a penstemon garden at the nature center. At the time that article was written, we had 18 different kinds of penstemons planted in one area; today, we have approximately 125 different kinds of penstemons scattered all around the PEEC landscape, and it seems time to continue to describe the merits of these versatile plants.

There were at least two reasons for establishing a penstemon garden. One was to add some interest and beauty to the grounds around PEEC. The other



The shorter plants with white flowers in the foreground are Penstemon tubaeflorus from the East and Midwest. The taller plants are P. palmeri (pale pink flowers) and P. clutei (pink flowers) from the Southwest. Photo by Larry Deaven.

was to create a showplace for these beautiful plants where Los Alamos gardeners could see possibilities for incorporating them into their home landscapes. The original garden in our parking lot island has now morphed into five distinct gardens: in the island, in front of the building, behind the building, and in two planting beds on the perimeter of the parking area.

Penstemons are new world plants with the vast majority of them found in North America. There are about 280 different species in the genus. Approximate numbers for the geographic locations of different species are as follows: Southwest US and California,

130; Pacific Northwest, 80; East and Midwest, 20; Mexico and South America, 30; and Canada, 20. In the US, the state with the highest number of different species is Utah with 72; New Mexico has 42. This widespread distribution indicates that penstemon species have evolved to grow in appreciably different environments. Consider levels of moisture. Penstemons thrive in areas of the US where average annual precipitation is 40 inches as well as in areas where the average annual precipitation is 10 inches. Also consider temperature: penstemons thrive in areas that never experience freezing temperatures and in areas where the temperature drops well below zero annually. We have representatives from each of these regions and climatic conditions in our penstemon gardens.

One reason for expanding the gardens was to take advantage of different microclimatic conditions created by the presence of the PEEC building. In the island beds, many plants are in full sun for the entire length of the day. On the northeastern side of the building, as well as on the western side, the plants are in partial shade during the hottest part of the day. Some of the planting beds receive extra water from roof runoff, while others do not, and some of the beds have steep slopes that provide perfect drainage, while others are flat. The walls of the building and the rocks placed in the beds absorb heat during the day and slowly release it at night. Each of these variations in moisture, sun exposure, heat storage, and degree of incline provides opportunities for penstemons from diverse regions to coexist in close proximity on the PEEC grounds.

Currently, we have penstemon species from the Pacific Northwest growing in the beds behind the building where they have a northeast exposure and 4-6 hours of shade each day during the hottest part of the summer. These species include rupicola, cardwellii, serrulatus, ovatus, and euglaucus. On the west side of the building, we have species from the East and Midwest. They too are in part shade, and they receive extra water from roof runoff. These species include digitalis, hirsutus, tubaeflorus, smallii, and multiflorus. On the southwestern side of the building, there is an area that is in a rain shadow. Here we have a few species from southern California and Arizona, including centranthifolius, floridus, clevelandii, and parryi. In the island planting beds and in the beds adjacent to the parking area, we have approximately 80 species from

New Mexico, Utah, Colorado, and adjacent states, and from Mexico. These plants from diverse parts of the country seem to thrive in the environments we provided for them.

In addition to planting species in sites that seemed suited to their native conditions, we deliberately planted some plants from the East and from the Pacific Northwest in the full sun and full exposure to wind and cold of the island beds. Much to our surprise, these



The blue flowers in the foreground are Penstemon ovatus from the Pacific Northwest. The plants in the background are P. cardinalis (red flowers) from the Southwest and P. grandiflorus (lavender and purple flowers) from the Midwest. Photo by Larry Deaven.

plants are also thriving. Apparently, at least some penstemons are quite adaptable to new environmental conditions. So there are examples in the gardens of plants from coastal Washington or Oregon growing side by side with plants native to New Mexico and Utah. Likewise there are plants from Pennsylvania and Minnesota growing next to plants from Colorado. It is too early to know if the plants from other zones will continue to thrive here, either in full exposure to southwest conditions or in the modified conditions close to the building. Nevertheless, it is worthwhile to give any penstemon the opportunity to grow in our gardens. It will be through such attempts that we identify the plants that are especially pleasing and rewarding for our purposes.

So, if you have an opportunity to obtain some penstemon seeds from such far away places as Alaska, Florida, or Mexico, don't reject them because they were grown in a place that seems to be too hot or too cold or too wet as compared to Los Alamos. Plant them and see how they perform in our climate. You may have a pleasant surprise coming your way.

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

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## Inspiring the Next Generation:

"[My daughter] led me on a hike to some of the places you all have been exploring. She was so proud to be able to be the one leading a hike!"

-Forest Explorers parent

#### Nature Center Hours:

Monday 10-4 Tuesday 10-8 Wednesday 10-4 Closed Thursday Friday 10-4 Saturday 10-4 Sunday 1-4

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Coming this summer: take part in local pika citizen science surveys. Photo by Chick Keller.

## INSIDE

- 1 Building Bridges between Communities
- 2 Let's Talk Sustainability
- 3 The Lion in Winter
- **4** Finding Colliding Stars, Propagating Waves, and the Source of Gold
- 6 The PEEC Penstemon Gardens

## FEATURED EVENTS

Choices for Sustainable Living JAN. 10 Backcountry Film Festival JAN. 25 Full Moon Snowshoe Outing JAN. 30 Bats with the Sierra Club FEB. 6 Backpacking the Oregon PCT Talk MAR. 6