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ENVIRONMENT

The curious case of a rare plant's destruction raises further questions about the extinction crisis, climate change and the role of humans

By Daniel Rothberg

January 10th, 2021 - 2:00am

No one can say for sure when the first Tiehm's buckwheat plants were destroyed last summer.

But what is clear is that by September, multiple surveys had reported large-scale destruction to about half of Earth's only known population of the sensitive species, *Eriogonum tiehmii,* a rare Great Basin wildflower caught in the crosshairs of a heated political fight over permitting a mine.

When the destruction was disclosed in September 2020, it lit off a powder keg, and the question quickly turned to who was responsible for the widespread damage: Was it humans or rodents?

State and federal agencies — in addition to environmentalists — began investigating the case.

What struck biologists was not only the scale of the damage but the seemingly targeted nature of the attack and the pace at which it occurred, a time range amounting to a geologic blink. What caused the damage, and why target this particular species?

Ben Grady, a botanist at Ripon College and the president of the Eriogonum Society (eriogonum is the scientific name for buckwheat family), described the scale of the destruction as stunning.

“We've taken something and basically cut the population in half,” Grady said.

The Tiehm’s buckwheat is distributed across roughly 10 acres of land at the base of the Silver Peak Range near Tonopah. Its habitat is extreme, even for the Great Basin, and a passerby could not be blamed for writing it off as inhospitable. But through the long process of evolution, the plant has eked out an isolated existence on patchy outcrops of washed-out clay.

So what had changed to cause such widespread destruction to the species all at once?

Several pieces of evidence point to herbivory by rodents as a cause — perhaps the main cause — of Tiehm’s buckwheat damage. But no one was there, and no one can say for sure how it all happened. It’s likely that a degree of uncertainty about the cause will linger over the incident.

People want a clear narrative, but this is not a story of definitive scientific conclusions. Multiple scientists, in interviews, said the technical work of understanding the Tiehm’s buckwheat and why the destruction occurred is only starting. Meanwhile, the rare plant is at even greater risk.

The curious case of Tiehm’s buckwheat raises questions about the extinction crisis, the role of humans and even climate change. Dig deeper, and there is an unfolding scientific mystery that is closely tied to the climate politics of permitting a mine for lithium, a much-needed mineral to support the electric vehicles and massive batteries required for a decarbonized economy.

“When everything initially came out in September, there was a lot of controversy in terms of what happened and how it happened,” Grady recalled. “But the more jarring thing to me, after the dust settled, was we lost a lot of plants here, and this thing is in a heck of a lot of trouble.”

The initial suspect

The Earth is in the middle of its sixth mass extinction, and there is one primary culprit: humans. In the case of the Tiehm’s buckwheat damage, human activity became an immediate suspect.

As rare desert flora goes, the Tiehm's buckwheat was already a well-known species by the time its population crashed. In the months prior, the diminutive yet charismatic plant had caught the attention of botanists, environmental activists, land managers and miners across the West.

Even before the large-scale destruction was first reported last August, the Tiehm's buckwheat faced emerging threats from human activity. Environmentalists said mining exploration and the development of a proposed lithium mine posed an existential threat to the buckwheat species.

The area around the buckwheat, known as Rhyolite Ridge, had seen a sharp increase in human activity, with an Australian-based lithium company, ioneer, seeking to permit the lithium mine.

In late 2019, the Center for Biological Diversity petitioned state and federal regulators to protect the plant from extinction. The mining company pushed back, arguing that a mitigation proposal for Tiehm's buckwheat would maintain the species and emphasizing the need for more lithium in supply chains for batteries and electric vehicles. The rhetoric escalated over the following year.

After the damage was uncovered, an early field survey by the Center for Biological Diversity, the group leading the charge to protect the plant as endangered, found evidence of footprints and new trails leading to the buckwheat. Their fieldwork suggested damage consistent with humans. The implication was that the mining company could somehow be responsible for the damage.

"The buckwheats appear to have been dug up by small shovels or spades," the group reported.

Naomi Fraga, a well-known botanist and the director of conservation at the California Botanic Garden, helped author the report with the group's state director, Patrick Donnelly. When Fraga observed the damage, she said her immediate thought was that humans dug up the plant. The destruction varied from plant to plant, and it affected plants far away from one another.

"That is one of the largest puzzles that is hard to reconcile with a natural event: the targeted nature, how specific it was and that it occurred across a whole range of the species," she said.

Not all biologists were in agreement, and the investigation took a turn to scat.

If the genes fit

As the investigation proceeded, agency officials and the mining company pushed back on the theory of human-caused damage. Several surveys showed lines of evidence pointing to rodent activity. Perhaps a dry summer forced critters to consume food that they would not normally eat.

In fact, when the damage was reported to the state by a UNR graduate student in September, the student noted evidence of rodent damage and wrote in a report that “we did not notice any human or large animal tracks” in the immediate area. On follow-up surveys, biologists for state and federal agencies documented bite marks, burrows and another valuable clue: rodent scat.

Like law enforcement arriving at a crime scene, investigators collected samples and sent them to a lab. In animal droppings, soil tailings and damaged buckwheat roots were strands of DNA, traces of unique genetic material. If rodents were gnawing at Tiehm’s buckwheat, traces of the plant’s DNA should show up in samples, including the scat. Simply put, you are what you eat.

When the U.S. Fish and Wildlife Service reported the results of the DNA analysis in December, it supported that rodents — white-tailed antelope ground squirrels, to be specific — had caused the damage to the buckwheat. The study was another piece of evidence to figure out whodunit.

But these conclusions did not linger in the realm of science for very long. Within hours, the new report was injected with political weight. First, ioneer called a press conference with reporters.

James Calaway, an executive for ioneer, reported that the DNA evidence “conclusively shows that the destruction of Tiehm’s buckwheat at Rhyolite Ridge discovered in mid-September was exclusively animal caused.” The report, Calaway said, “categorically refutes the irresponsible assertion by the Center for Biological Diversity that this was an intentional human attack.”

That same day, Fraga, working with the Center for Biological Diversity, questioned how much information could be taken from study. Did it really leave humans off the hook for the damage?

Fraga said she “would be cautious about interpreting the result of this study as definitive proof that rodents caused the extensive damage observed at the

Tiehm’s buckwheat population.” She noted that the area had been significantly changed from when the damage was first discovered.

As with most things, the reality was not fully satisfying to those who wanted a neat, conclusive answer. *The Nevada Independent* talked to the scientist who actually authored the DNA study.

“What people should take away from this study is it is just one piece of evidence in this story,” said Jacqualine Grant, who conducted the DNA analysis and works as an associate professor of biology at the Southern Utah University in Cedar City. “It’s not the nail in the coffin, as it’s being portrayed on one side. And it’s not loosey goosey as it’s being portrayed on the other side.”

Grant, whose background is in conservation biology, said the report “is strong evidence, but it’s not perfect evidence.” Yet she said that when the DNA analysis is taken in consideration of other evidence, such as roots with bite marks, the findings do “lend credence to this idea that somehow rodents were involved.”

From a scientific perspective, the idea that rodents could be responsible for so much damage is unusual, and it would represent a significant scientific finding.

"I couldn't find anything of this scale to a rare plant, and especially a buckwheat, that has been documented,” Fraga said. “There's nothing in scientific literature to suggest this would happen."

Fraga said she still believes human activity could have played a role, and she does not believe that the agencies fully investigated it, opting instead to focus on data that supported the rodent theory.

“I just don’t think it’s a case-closed,” she said.

In the weeks after the damage was reported, the agency investigation was coalescing around a hypothesis of what motivated the rodent behavior. Perhaps swings in weather, even driven by human-caused climate warming, were causing unexpected species interactions.

“We have to assume that the buckwheat population has been there for thousands of years, if not longer, and so have the rodents,” Grant said. “What

was different about this year that made the rodents go after the buckwheat in a way that they had not done in previous years?”

Staggering damage

There is one thing nearly everyone agrees on. The scale of the Tiehm’s buckwheat destruction was massive and unexpected. Tiehm’s buckwheat persists on eight rocky outcrops at Rhyolite Ridge, and each area represents a discrete subpopulation. These patches are natural but they look as though someone smashed and left several clay pots to dry in the middle of the desert.

Analysis of the damage, conducted by the mining company and a state official, found that all Tiehm’s buckwheat had been killed in two subpopulations with extensive damage in the other areas. According to data collected by the mining company’s consultant, EM Strategies, only about 38 percent of the population was intact after the plants were damaged last summer.

On Oct. 7, Jim Morefield, a supervisory biologist with the Nevada Division of Natural Heritage, filed a report on the destruction, summarizing the damage and hypothesizing what caused it.

He wrote that to the extent survey data “can be extrapolated over the entire Tiehm’s buckwheat population of about 44,000 individuals, one could estimate that 16,000 plants were killed and another 11,000 damaged, leaving about 17,000 plants undamaged as of September 17.”

What stood out to everyone was the scope and rate of damage to Tiehm’s buckwheat. In one email that was shared with *The Nevada Independent*, Kris Kuyper, biology manager for ioneer’s consultant EM Strategies, wrote that “the amount of plants damaged or dead is staggering.”

The email was obtained as part of a public records request the Center for Biological Diversity filed with state officials. The environmental group shared the records with several media outlets.

The emails showed that the investigation was being closely watched, not only by the scientific community but also by political leaders. One email, from Cathy Erskine, senior policy advisor for the Nevada Department of

Conservation and Natural Resources, informed agency leadership that “the governor’s office is aware of and has taken interest in TB,” or Tiehm’s buckwheat.

Gov. Steve Sisolak’s spokesperson, Meghin Delaney, said in an emailed statement last month that “the governor’s office receives regular updates on a range of activities from state agencies” and that “it has received updates over the previous months on the progress of this issue.”

Although Morefield, who surveyed the Tiehm’s buckwheat in 2010, had encountered herbivory in Great Basin plants before, he said he couldn’t say he’d “ever seen anything this extensive.”

Herbivory on this scale is fairly rare, and it might be surprising under normal conditions, he said. But climate conditions at the site have been less than normal. He hypothesized that significant climate swings in recent years might have affected rodent populations and changed their diets.

After a dry summer, biologists like Morefield have seen an uptick in herbivory to native species.

Morefield is confident that rodents played a role in damaging the buckwheat. He said “the hypothesis best supported by the evidence to date is that one or more small mammal species caused damage to the Tiehm’s buckwheat populations over the period of a couple of months.”

When Morefield views the totality of the evidence, it points to herbivory by small mammals. If humans were involved, it was minimal. But when asked, he could not rule out the possibility of human-caused activity.

“I can’t, for sure, rule out that some human might have gone out on the site and vandalized some plants for nefarious reasons,” Morefield said. “I have seen no evidence to support that.”

Unexpected behavior

From a botanist’s perspective, the findings were even more jarring, said Grady, who studies the buckwheat, a beloved species in the Western U.S. Grady knows a lot about the plant. He *is*, after all, the president of the Eriogonum Society, a group dedicated to buckwheat enthusiasts.

“I study buckwheat, and normally there is not a lot of herbivory on buckwheat,” said Grady, who has supported the Center for Biological Diversity’s efforts to protect the Tiehm’s buckwheat.

In general, Grady said rodents tend to avoid going out of their way to consume buckwheat.

Insect attacks on buckwheat are also rare. Buckwheats, Grady said, are presumed to produce a secondary chemical, as some plants do, that prevent them from attacks. Still, there is a lot that scientists do not understand about buckwheat in general and Tiehm’s buckwheat in particular.

“They are an interesting group of plants,” he said. “They are charismatic. A lot of these things are rare. But they are not a model species. We don't know a lot about a lot of these species.”

“There are a lifetime of questions,” he added.

For similar reasons, Fraga remains skeptical that rodents were solely responsible for the attack on the buckwheat. If they were, she said the findings should be published in a scientific journal.

“It would be extraordinary,” she said.

From a wildlife perspective, the scale of the rodent destruction was also surprising, although not entirely implausible. Before the DNA analysis identified white-tailed antelope ground squirrels as a possible culprit, the Nevada Department of Wildlife conducted a survey of the plant damage.

The report found evidence of foraging consistent with another species: pocket gophers.

“This damage is consistent with pocket gopher foraging activities and patterns,” Tony Wasley, the department’s director, said in a cover letter for a report on the agency’s survey findings.

“However,” Wasley wrote in October, “the scale over which the disturbance occurred by far exceeds known home range size for an individual pocket gopher. If the disturbance occurred within a short time frame and was the sole result of pocket gopher foraging, it would require that multiple individual gophers simultaneously switched to Tiehm’s buckwheat as a preferred forage item over a relatively short period of time. The likelihood of a synchronized

event of selective herbivory for Tiehm’s buckwheat by pocket gophers although plausible, remains unknown.”

The report also identified white-tailed antelope ground squirrels as a possible suspect. Michael West, a state wildlife biologist who compiled the report, said in an email that the rodent species has several life history characteristics that could lead it to cause significant damage to plants.

These rodents have high reproductive potential, meaning that their populations can boom under certain circumstances. Their home ranges can extend as far as 15 acres, overlapping with one another. They are social, and they are aggressive in stocking up on food for winter, West said.

“Combined, these [characteristics] can lead to high levels of activity within a relatively small area and short period of time,” West wrote in an email last month, after the DNA study was released.

In that context, it might not be terribly surprising to see explosive population growth followed by a warm summer push rodents to eat plant parts they might not normally eat. Still, the situation is rare enough that many scientists have described it as anomalous and deserving more research.

For one, many rodents would be needed to consume the plants. Morefield’s report estimates that if 27,000 buckwheat plants were damaged or killed, 900 individual rodents would have had to have consumed one plant per day for the course of a month. If the rodents were hungrier and ate two plants per day in the course of a month, then it would have taken 450 individual rodents.

Of course, no one can say for sure that it happened — or didn’t happen.

“Many biologists wrote into the Fish and Wildlife Service with their opinions that this could not possibly have been caused by rodents because they’ve never seen it before,” said Grant, the DNA study author. “But just because we haven't seen it before doesn’t mean it cannot happen.”

Is it changing climate?

What many of the reports and surveys speculate is a scenario that unfolded with shifts in the climate. Morefield writes in his field report that temperatures in western Nevada last summer were about four degrees higher than the 30-year mean, and coupled with little precipitation.

It mirrored what was seen across the Great Basin last year. According to the National Centers for Environmental Information, 2020 marked the driest year on record for Nevada and Utah.

What's significant is that this period of heat and extreme drought came after a winter period in late 2018 and early 2019 that saw above average precipitation that fueled vegetation growth.

Morefield and others, including West, the state wildlife biologist, said they could envision a potential scenario where rodents proliferated after rain and snow soaked the region only to face a stressful 2020 that forced ground squirrels to forage for food that they normally wouldn't touch.

"After three previous relatively wet years, including the extreme water year of 2019, summer of 2020 was exceptionally hot and dry in this region (setting historic records at regional weather recording sites), and this could have led to sudden and increasing resource scarcity for local rodent populations," Morefield wrote in his field investigation, which was filed last October.

West offered a similar potential timeline, but he said his speculation was observational.

"I do not possess and have not analyzed any quantitative data of vegetation, animal density or body size, or weather conditions related to the Tiehm's buckwheat herbivory issue," he wrote.

The hypothesis is bolstered by the fact that Morefield, Grant and other observers, including Las Vegas ecologist Jim Boone, have observed unusual herbivory across the Southwest this year.

Grant can't say for sure what happened, and she said it might be impossible to ever know without many more years of studying the Tiehm's buckwheat and its interactions.

But Grant, who studies ecology in the Intermountain West, said what is known is that climate change will have an affect on plants across the region. The problem is it's still challenging to forecast.

"We don't know a lot about how rodents are going to respond," Grant observed. "These biotic interactions are going to be affected by climate change, and it's somewhat difficult to predict."

If the culprit is extreme heat and drought, driven by climate change, the blame falls back on humans. And the twist is that the extraction activity that threatens the Tiehm's buckwheat — a lithium mine — is needed to address climate change and move to a decarbonized economy.

Ioneer, the company looking to develop the mine, has made this very point in materials it has submitted to the state about its proposed mitigation plan for the plant. In August, the company wrote that "working collaboratively to address difficult issues such as global climate change and species diversity is essential to balancing in ensuring Nevada's economic and biologic integrity."

Peter Raven, the president emeritus of the Missouri Botanical Garden and an author of a textbook on botany, is concerned about the interplay between both extinction and climate change.

"All of this is taking place in a much older biological framework," Raven said.

To make it to what humans refer to as 2021, the Tiehm's buckwheat and plants like it have had to evolve to the conditions of place, and they've survived in areas where their habitats remain. Both disruption to habitats and climate change can pose a threat to plants like the buckwheat, threatening species with extinction in a speed that is no match for the evolutionary process.

"No matter what happens, there is no guarantee that the buckwheat will be able to survive in that place in 20 years where it is now," Raven said. "The climate's changing very rapidly."

And still, Raven, who has signed onto letters supporting efforts to protect the plant under state and federal endangered species law, said that it is essential to try to keep ecosystems intact.

One of his colleagues, Raven said, often says "if you don't save it now, you can't save it later.

At greater risk

Today there are cameras set up in the Tiehm's buckwheat habitat. The plant is being closely monitored by everyone: regulatory agencies, scientists hired

by the mining company and the environmental activists seeking to protect it under the federal Endangered Species Act.

Will rodents return next spring, or was the herbivory a one-time occurrence?

Everyone wants to see what happens next. Morefield noted that some damaged buckwheat are beginning to resprout, signaling that at least some Tiehm's buckwheat plants could recover from the incident. But there still remain many unanswered questions, including the definitive cause.

The problem with rare plants is that, by being rare, they tend to be isolated and understudied. What botanists are looking for is how the Tiehm's buckwheat responds. Morefield and others are still asking whether the Tiehm's buckwheat has faced similar rodent attacks in the past.

But Morefield said it's pretty clear the plant is at greater risk since the damage occurred.

"The smaller the population a rare species becomes, the more challenges it has to survive long-term," he said, noting that the damage could affect reproductivity and genetic diversity.

Grant, the DNA author, said the damage signified the need to protect the plant. In addition to the evidence of the rodent attack, she pointed to the threats from mining and climate change.

"All of those things together say we really need to have a concerted effort to protect this plant," she said. "And in the United States, our main mechanism for doing that is the Endangered Species Act."

Calaway, an executive for the mining company, said at a press conference in December, that a listing under the Endangered Species Act was not the best course of action. He noted that the company has funded numerous studies and efforts to protect the plant voluntarily.

"What is a better approach is to have us working with responsible federal agencies committing contractually over many, many decades to that protection and preservation," Calaway said.

Since the destruction, the Center for Biological Diversity has filed an emergency petition to list the plant under the Endangered Species Act. The

environmental group has asked a federal judge to weigh in on the issue and require the U.S. Fish and Wildlife Service to take action. The case is pending.

On Monday, 101 scientists and 15 environmental groups plan to send a letter, organized by the center, to the incoming Biden administration, asking them “to take urgent and decisive action.”

Fraga said she has rarely worked with a plant in as precarious a situation. Before the damage, the Tiehm’s buckwheat faced a threat from the proposed mine. Today it is at even greater risk.

“In the beginning of this story in the journey of trying to protect it, it’s been significantly impacted,” she said. “Now the threshold or baseline has been shifted. It’s a tragedy.”