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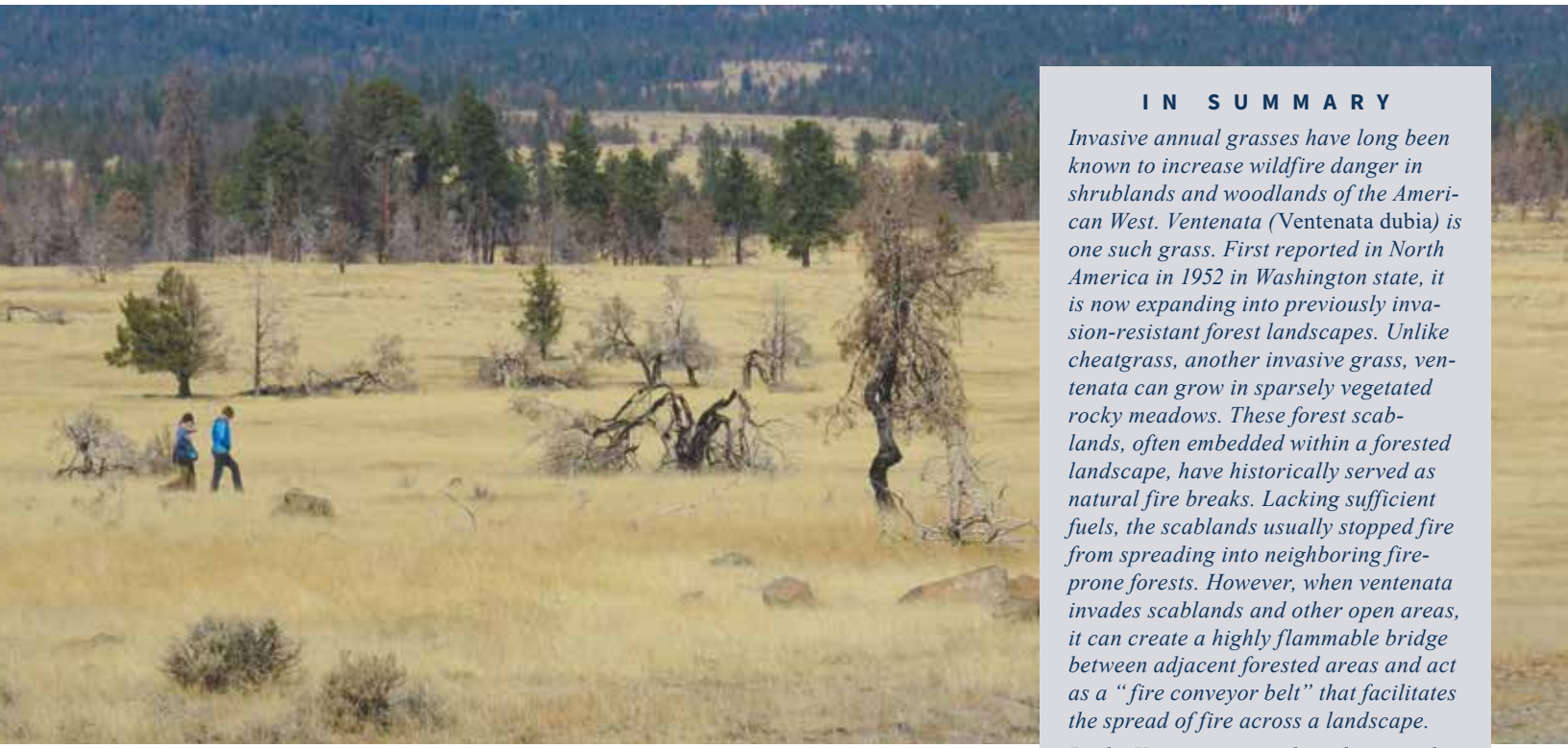
Science FINDINGS

INSIDE

"Science affects the way we think together."
Lewis Thomas

Not Just Another Cheatgrass: The Ventenata Invasion in the Interior Northwest



A rocky, high-elevation meadow, or scabland, in the Ochoco National Forest, Oregon. Highly flammable ventenata grass has invaded the scabland, which previously served as a natural fire break between forested areas. Photo by Claire Tortorelli.

IN SUMMARY

*Invasive annual grasses have long been known to increase wildfire danger in shrublands and woodlands of the American West. Ventenata (*Ventenata dubia*) is one such grass. First reported in North America in 1952 in Washington state, it is now expanding into previously invasion-resistant forest landscapes. Unlike cheatgrass, another invasive grass, ventenata can grow in sparsely vegetated rocky meadows. These forest scablands, often embedded within a forested landscape, have historically served as natural fire breaks. Lacking sufficient fuels, the scablands usually stopped fire from spreading into neighboring fire-prone forests. However, when ventenata invades scablands and other open areas, it can create a highly flammable bridge between adjacent forested areas and act as a "fire conveyor belt" that facilitates the spread of fire across a landscape.*

Becky Kerns, a research ecologist with the USDA Forest Service Pacific Northwest Research Station, calls the ventenata invasion a "perfect storm" that is threatening forest resilience in the Blue Mountains Ecoregion. Not only is it contributing to wildfires, but those very fires may exacerbate the ventenata invasion.

Forest managers in eastern Oregon are using maps, study findings, and other information developed by Kerns' research team and incorporating this information into proposed activities and other planning efforts to aid restoration and fuel reduction efforts while minimizing further invasion.

"Knowing trees, I understand the meaning of patience. Knowing grass, I can appreciate persistence."

—Hal Borland

Wildfires in the Blue Mountains Ecoregion of eastern Oregon burned nearly 319,000 acres in 2014 and 2015. Wildfire is common in the much of the Western United States, but these fires in eastern Oregon were unusual: They ignited in areas that previously hadn't burned because of their scrubby, largely vegetation-free conditions.

As it turns out, ventenata (*Ventenata dubia),* a relatively recently introduced invasive annual grass, was thriving in those areas, adding fuel to historically fuel-deprived areas.

Invasive plants are a growing challenge for land managers, especially when the plants alter fire behavior. Cheatgrass—another invasive species—has long been recognized as a contributor to wildfire in the American West,

particularly in the Great Basin. It germinates in the fall, dies off in early summer, and becomes a dry, crackling tinder as fire season begins. After a fire, many native species may be dead, but cheatgrass quickly moves in and establishes itself in burned areas, crowding out the recovery of other species. The grass-fire cycle then begins anew: invasion, fire, and expanded invasion.

Ventenata behaves similarly, but in different places, as evidenced by the 2014–2015 fires. Unlike cheatgrass, ventenata can flourish at higher elevations in low-density forests and scablands—sparsely vegetated rocky meadows embedded within the larger forested landscape. Ventenata also invades without a catalyzing disturbance. Once established, it can form dense populations and contribute to high loads of flammable fine fuels, with the potential to initiate the same grass-fire cycle as cheatgrass in the Great Basin.

Many forest managers are concerned about the spread of ventenata. In response to calls from the field, Becky Kerns, a research ecologist with the USDA Forest Service Pacific Northwest Research Station, launched a series of studies to develop basic information about the ventenata invasion and its potential impacts in the 27,400 square mile Blue Mountains Ecoregion. Located mostly in northeastern Oregon, this ecoregion also includes the border areas of Washington and Idaho. To understand the current and future ecological and wildfire impacts that ventenata may have on this ecoregion, Kerns and her colleagues focused on documenting the state of the invasion, how it has changed through time, environmental and disturbance factors that exacerbate invasion, and determining the potential shifts in fuels and fire regimes.

Ventenata and Wildfire Danger

Ventenata was first documented in the United States in 1952 around Spokane, Washington. Native to southern Europe and northern Africa, it's not clear how the grass arrived in the Pacific Northwest. Nonnative invasive species are often introduced accidently through international trade. The nonnative species may hitch a ride on cargo ships, rail cars, or air transportation, possibly as a contaminant in hay, and then establishes a foothold in its new country. On the other hand, many problematic invasive species were originally purposefully introduced but then became problematic as they spread.

KEY FINDINGS

- Ventenata has rapidly spread across the inland Pacific Northwest, where it threatens to replace native plants and alter fire behavior. The annual grass is invading many open areas and those with low tree cover at higher elevation (above 4,000 feet) within forests that in the recent past were resistant to invasion by other invasive grasses, including cheatgrass.
- About 8 percent of the Blue Mountains Ecoregion in eastern Oregon is likely invaded (greater than 20 percent cover) by ventenata. From 2006 to 2017, the invaded area increased more than 40 percent throughout the region.
- Ventenata can thrive in a variety of habitats. It does not require a catalyzing disturbance, such as wildfire, prescribed fire, or cattle grazing. However, fire may enhance the spread of the grass and increase its impact on native plant communities, especially in historically fire-resistant rocky meadows that, prior to invasion, had low vegetative cover and acted as natural fire breaks.
- Ventenata invasion can increase fine fuels and alter fire behavior. Fire simulations demonstrate that invasion can lead to larger and potentially more severe fires across the landscape by facilitating fire spread between forests and invaded open areas. This behavior has also been observed by firefighters.

Ventenata has since spread to 10 states nationwide and four Canadian provinces. Kerns and colleagues from Oregon State University found that ventenata is now widespread across the inland Northwest in a variety of habitats with low or no tree cover.

Based on remote-sensing measurements, ground data, and novel image fusion methods using Google Earth Engine™, the team determined that ventenata had likely invaded about 8 percent of the Blue Mountains Ecoregion by 2017, primarily invading areas above 4,000 feet elevation with low tree cover. The area of invasion increased more than 40 percent since 2006, and Kerns says there is still suitable habitat for the grass to gain more ground.

"Ventenata came on my radar in about 2008," Kerns says. "Some folks didn't know it was there, thinking it was cheatgrass. There is an overlap in the niches of ventenata and cheatgrass, but ventenata has a different sweet spot. It is invasive at higher elevations and can handle cold soils, so the areas we once thought were resistant to annual grass invasion actually were not."

Ventenata, an invasive grass, was first discovered in the Pacific Northwest in the 1950s. It has since been found in a variety of habitats, including areas previously untouched by other invasive grasses. Photo by Michelle Day.

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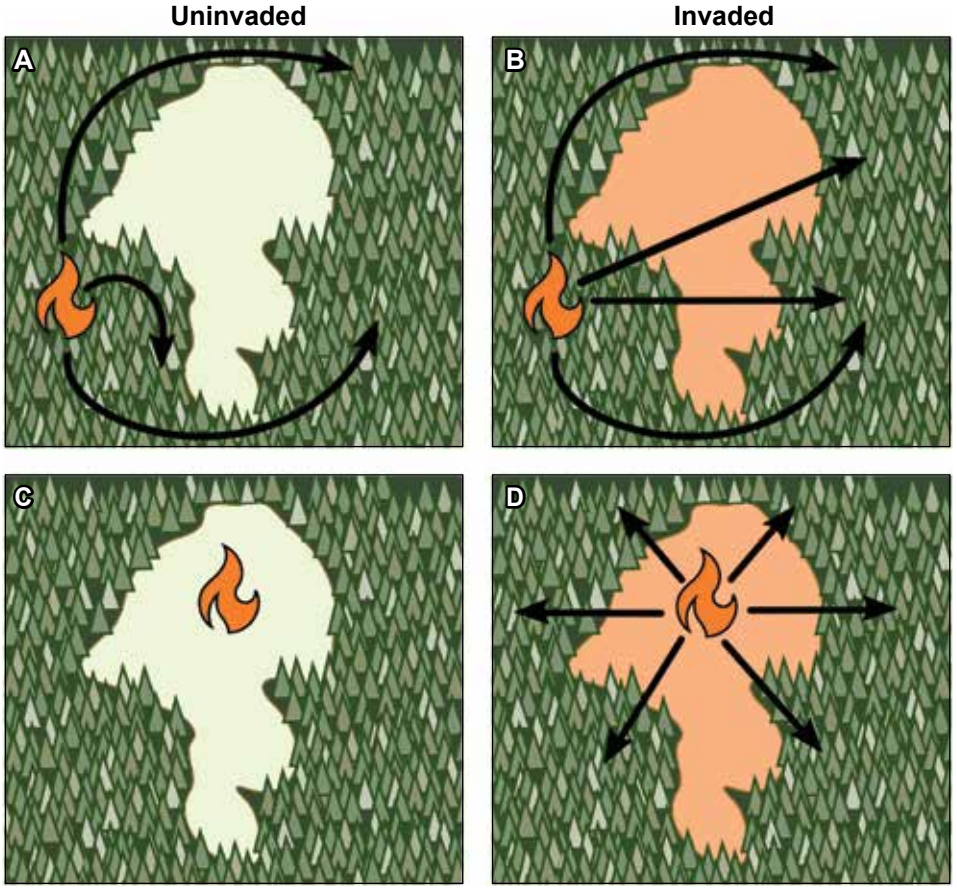
Forest Service

Scabland in the Umatilla National Forest that has not been invaded by ventenata. It supports sparse native vegetation that rarely burns. Photo by Becky Kerns.



Potential differences in fire spread when a fire ignites in the forest and travels either around an uninvaded open area or across an invaded open area. Adapted from Tortorelli et al. 2023.

The team that Kerns put together also set out to identify more detailed information about the habitat associated with the species' invasion of the Northwest and determine how it affects—and is affected by—wildfire.

The scientists sampled invaded areas within the footprint of recent past wildfires in the Blue Mountains Ecoregion. Crews gathered data on a variety of characteristics, including soil depth and composition, other vegetation, elevation, slope, and the presence or absence of grazing animals to compare the environmental characteristics associated with ventenata to those associated with other nonnative grasses.

Several invasive grasses were commonly found in burned dry forests, forest scablands, woodlands, and shrublands. However, ventenata was the only species that regularly invaded forest scablands and woodlands both with and without fire.

Prior to ventenata invasion, the harsh growing conditions of these forest scablands made them relatively resistant to invasive vegetation despite being exposed to nonnative grasses for decades.

These sparsely vegetated ecosystems form a natural fire break: If fire sweeps through nearby forests, scablands interrupt the spread because they have insufficient fuel to carry fire. Ventenata has changed that dynamic. It heavily invades scablands and produces extensive beds of highly combustible fuel. As a result, fire can more easily move through scablands and into adjacent forests, exacerbating landscape-scale fire risk. Results from the team's wildfire simulation modeling demonstrated that an invasion can increase fire size, burn probability, fireline intensity, and fire transmission across forest landscapes, despite primarily invading nonforested areas.

Once fire burns through a scabland, it creates space for ventenata to reinhabit and expand, squeezing out other plant species and contributing to a shift from shrub-dominated communities to nonnative annual grasslands.

A Perfect Storm?

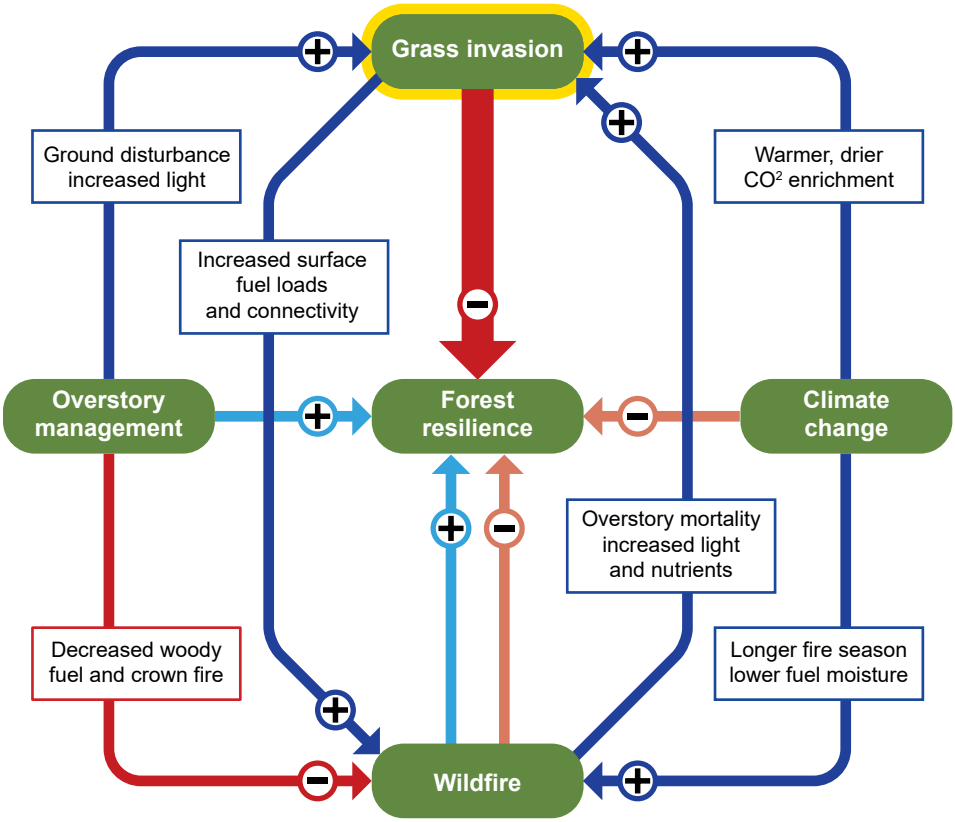
Worldwide, grasses are some of the most problematic invasive species because they can alter disturbance regimes. Add climate change to this scenario and the outlook becomes even more concerning. Many Pacific Northwest forests are becoming drier and thus more susceptible to increasingly intense, frequent wildfires and longer fire seasons.

Wildfire, in turn, can kill forest overstories, which increases light availability and nutrients to the soil and helps invasive grasses thrive.

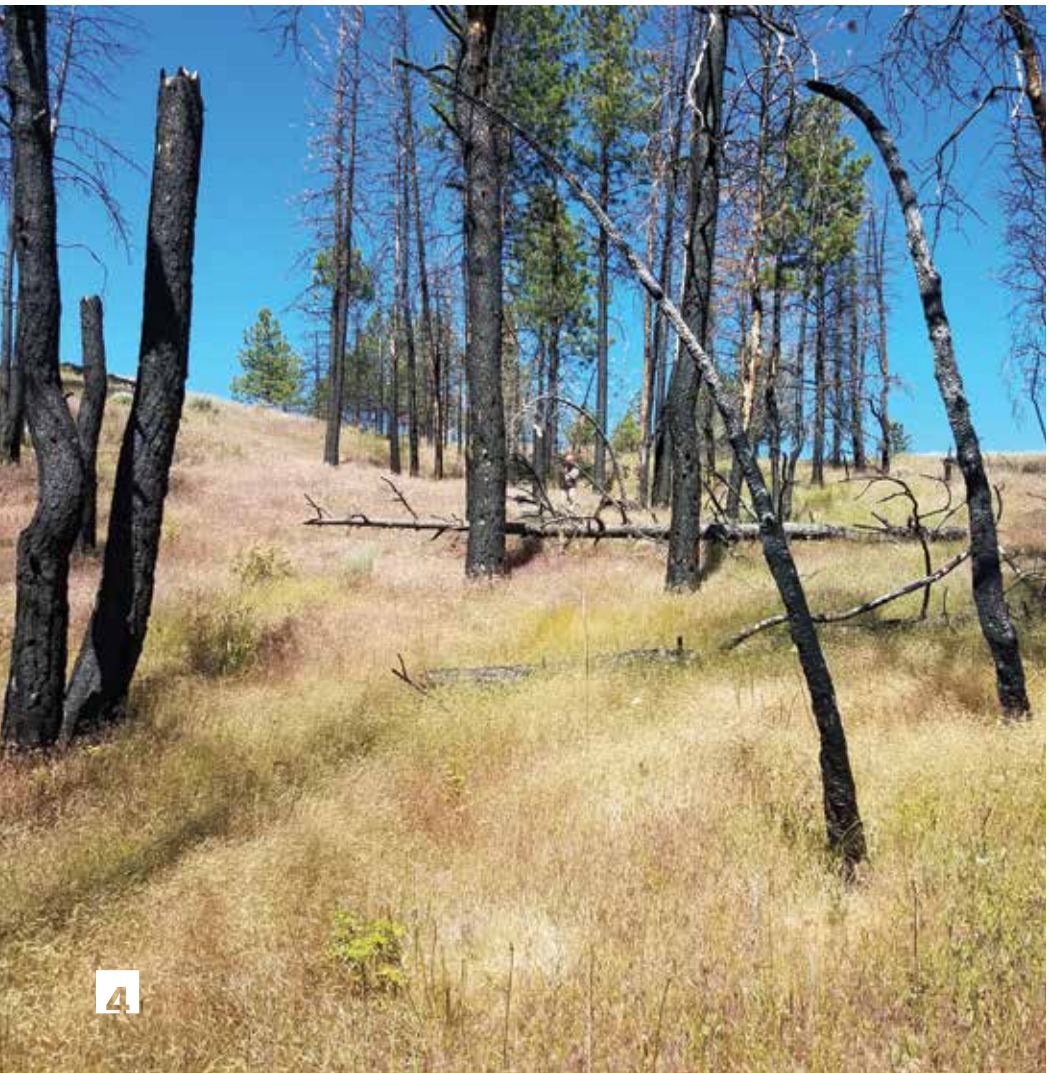
Kerns and her colleagues delved into the underrecognized intersection of several key processes in forests and how they can affect forest resilience: grass invasion, climate change, wildfire, and overstory management. They identified how these process can converge into a worse-case scenario in their article "Invasive Grasses: A New Perfect Storm for Forested Ecosystems?" that was published in *Forest Ecology and Management* in 2020.

The invasion of ventenata and other invasive grasses are complicating traditional methods for managing forest fuels. Forest managers have historically used overstory management methods, such as thinning, prescribed fire, and other fuel-reduction measures to make forests less susceptible to catastrophic fire.

Overstory management by itself decreases wildfire danger because it removes woody fuel and the potential for crown fires, thus helping to mitigate fire danger. But at the same time, it can create ground disturbances and increase sunlight, which promotes grass invasion. Grass invasion increases the chances



A flowchart illustrating how grass invasions may combine with climate change, wildfire, and overstory management to create a "perfect storm" that threatens forest resilience. Adapted from Kerns et al. 2020.



A burned ponderosa pine forest in the Ochoco National Forest that has been heavily invaded by ventenata. Photo by Claire Tortorelli.

of wildfire ignition and spread because it adds continuous surface fuels and creates connectivity between areas prone to fire.

"Lack of understanding regarding the ecological consequences and importance of managing invasive grasses as a fuel may lead to unintended consequences and outcomes as we enter an age of novel and rapid ecological changes," Kerns says.

Taken together with climate change, this multifaceted feedback loop could be bad news for forest resilience. While thinning, prescribed fire, and, to some extent, wildfire itself can have positive effects on forest resilience, in certain situations, they could be outweighed by the negative effects of grass invasion.

"These grasses can alter fundamental ecosystem processes such as disturbance regimes through the development of a grass-fire cycle, which can initiate a cascade of related changes and ecological, social, and economic impacts that may be irreversible," Kerns says.

Controlling the Invasion

Kerns and her colleagues have developed maps that show where ventenata has likely invaded across the entire ecoregion.

"This information is vital for the effective development and deployment of treatment options in a diverse, forested matrix of land ownerships and plant communities," she says.

Broadening our understanding about invasive grasses in general, and ventenata in particular, is essential to its control, Kerns explains. She and her colleagues are spreading the word through various means. In 2022, they led a webinar on the subject through the Northwest Fire Science Consortium. They also have connected directly with managers from national forests, the USDI Bureau of Land Management, and Oregon State University Extension to discuss these findings and their use when planning activities in the field.

Jessi Brunson, a botanist and invasive plants specialist with the Malheur National Forest, says Kerns' research is an excellent resource for locating areas that are susceptible to ventenata grass invasion, such as forest scablands. It identifies areas that can be monitored and possibly treated in the future.

The Forest Service has been conducting small-scale ventenata eradication treatments

LAND MANAGEMENT IMPLICATIONS

- New maps and information about vulnerable habitats and the factors that drive the spread of invasive grasses can be used for early detection and rapid response measures.
- Some management techniques that are effective against other types of invasive grasses may need to be adapted to address ventenata's unique niche (higher elevation and low-productivity environments) and relationship to disturbance. Early efforts are typically more successful than eradication-and-control attempts in the later stages of invasion.
- Although ventenata primarily invades nonforested or low tree-cover patches within forests, it influences fire behavior in forests by facilitating fire spread. This has implications for fire and fuel management both tactically and strategically across forest-mosaic landscapes.

with an herbicide called indaziflam,[1] which kills off seeds when they begin to germinate. Brunson says the herbicide program will be expanded into larger areas in summer 2023.

She says the goal is to use herbicides in an area once ventenata has been detected. The intended effect would be to keep ventenata out while promoting the growth of sagebrush and other native species. This approach would maintain scablands as patchy fire breaks and promote landscape fire resistance.

Brunson says this targeted method is far preferable than attempting a wholesale eradication program.

"I think the idea that we are going to eradicate it is just wrong," she says. "There are thousands of acres of invasive grasses, and if you tried to eradicate all of it, you'd be left with a lot of bare ground."

Another option is to re-seed burn areas with native plant species to promote native plant growth that can out-compete invasive grasses.

[1] This publication reports research involving herbicides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of herbicides must be registered by appropriate state or federal agencies, or both, before they can be recommended.

CAUTION: Herbicides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus herbicide and herbicide containers.

The Malheur National Forest has been seeding postfire areas for about a decade, and in the past 2 years has been specifically targeting areas prone to grass invasion. As with the herbicide program, the forest expects to expand the seeding program in the future to fight invasives.

"It's not too late to try to do something," Brunson says.

Shawna Bautista, an invasive plant manager with the Forest Service, said that ventenata is a particularly challenging foe. It grows and spreads quickly, taps into soil moisture faster than native grasses, and has a very high silica content, which makes it unpalatable to grazing animals.

"The only good thing about it is the seeds don't live a long time in the soil compared to other grasses—maybe 2 or 3 years," she says. "So that is one weakness we are starting to capitalize on with this new herbicide."

Bautista has been involved in other challenging plant invasions during her 34-year career. One of the most virulent occurred in California in the 1990s with *Arundo donax*, a tall bamboo-like plant that forms impenetrable thickets in riparian zones. She and her team used a combination of mechanical removal and herbicides in a targeted way to remove the invasive plants, "and the native vegetation came back like gangbusters," she says.

That gives her hope that ventenata may be controllable. "You're not going to eradicate it, but on a site-by-site basis you can make an amazing difference," she says.

Writer's Profile

John Kirkland has been writing about science, higher education, and business for more than 20 years. He lives in Portland, Oregon.

For Further Reading

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Scabland invaded by ventenata after a fire in the Ochoco National Forest. Photo by Claire Tortorelli.

Science
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Scientist Profile

BECKY KERNS is a research ecologist with the Pacific Northwest Research Station. She earned her Ph.D. in forest ecosystem science at Northern Arizona University. Her work sits at the intersection of plant ecology and fire, fuel, and climate science. Her current projects are focused on plant invasion in forests, current and future wildfire risk and novel fuels in Western forests, understory vegetation patterns and dynamics, and modeling how climate change will affect vegetation and invasive species. Her goals are to understand vegetation changes and what drives those changes and use that information to improve the management of landscapes.

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