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Stuck in the Weeds: The Invasive Plant That Thrives on Bureaucracy

The fight to eradicate Arundo donax has morphed into another one of America's forever wars.

FLETCHER REVELEY

A railroad trestle runs over the Ventura River estuary, with stands of Arundo along the banks. **Kitra Cahana/Undark**

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In the spring of 2024, when Cy Tongate visited Shelby Park on the eastern bank of the Rio Grande in Eagle Pass, Texas, the area looked more like a warzone than a riverside park in need of weed control. Humvees and pickup trucks crowded the newly cut access roads; patrol boats planed across the river; large beige tents rose from the soccer fields, shielding National Guard troops from the searing Texas sun. Checkpoints blocked the park's entrances, and along the riverbank an ad hoc wall of shipping containers and razor wire marked the boundary of the United States. Standing on top of the fortification, lookouts peered into Mexico over tufts of Tongate's ultimate target: *Arundo donax*, a tall, bamboo-like invasive plant that sprouted at the water's edge.

The military buildup was part of Texas Gov. Greg Abbott's "Operation Lone Star," a multi-pronged deployment of the state's National Guard and Department of Public Safety personnel that had begun in 2021 and ramped up in subsequent years, eventually overtaking Shelby Park in January of 2024. Abbott, displeased with then-president Joe Biden's border policies and determined to stem what, in his telling, had become an "invasion" of migrants, banned federal Border Patrol officers from entering the park, considering them too lenient. The move sparked tensions between state and federal authorities, and Shelby Park—named for a pro-slavery activist and Confederate general—became a flashpoint in the national immigration debate.

Into this tangle slipped Tongate, a young, mid-level bureaucrat with the Rio Grande Vegetative Management Program, a project run by an obscure state agency called the Texas State Soil and Water Conservation Board. He had visited the park sporadically since 2022, pursuing his own inconspicuous piece of the governor's wider border vision: the reduction of *Arundo donax*, known locally as giant reed or carrizo cane, which had aggressively colonized not only Shelby Park but nearly everywhere else in the Rio Grande Basin as well. The plant grew so expansively that it was impeding border operations—migrants could hide in the dense thickets—and authorities wanted it gone.

Cy Tongate of the Rio Grande Vegetative Management Program, by a thicket of Arundo donax at Shelby Park last October. The plant has colonized the Rio Grande Basin, impeding border operations. **Fletcher Reveley/Undark**

Working in the park, however, proved challenging. Tongate was frequently ensnared in the bureaucracy of the military command structure, with flummoxed National Guard troops calling up and down the chain of command to verify his clearance. The confusion, he said, sometimes led to troops mistaking his team's herbicide-spraying drones for drug-smuggling tools. Once,

he recalled, a particularly paranoid National Guardsman accused him of spraying Agent Orange. Most consequentially, however, the jurisdictional turf war produced such a flurry of activity, with new roads and fences going up everywhere, that it activated the underground network of Arundo stems, causing the plant to grow more vigorously. It took Tongate five re-treatments to beat back the plant, and though most of it is gone now, upriver Arundo stands threaten to re-infest the area. "That's any government work," said Tongate. "There's a lot of futility."

The futility Tongate sometimes feels is perhaps commensurate with the enormity of the task before him. For thousands of years, *Arundo donax* has spread across the globe, wreaking havoc on the riparian ecosystems it invades. The plant's kaleidoscopic utility—it has been used by humans for everything from construction materials to musical instruments—ensured its rapid territorial expansion as it followed human migrations, and infestations can now be found on every continent in the world except Antarctica.

Likely arriving in North America alongside Spanish colonizers in the 17th and 18th centuries, Arundo now bedevils waterways in at least 25 states, vigorously spreading through a form of asexual reproduction that results in vast thickets of genetic clones. In the areas it overtakes, Arundo often outcompetes nearly every native species, forming robust monocultures that destroy habitat, consume huge amounts of water, and pose increased risk of fires and floods. In California, where the plant was first rigorously studied in the 1990s, one scientist labeled it the "greatest threat" to that state's riverside ecosystems. And in Texas, along the Rio Grande, the plant now covers tens of thousands of acres.

In embarking on his multi-year battle with Arundo, Tongate joined a long line of scientists, land managers, environmentalists, government officials, nonprofit workers, and others who have gone up against Arundo—and mostly lost. At first, the failures had to do with the plant's remarkable tenacity and a poor understanding of how to kill it; efforts to mow, uproot, or burn it, for example, rarely worked. After scientists eventually developed an effective technique for eliminating Arundo in the early 1990s, however, attempts to control it continued to fail, not because of the plant's vigor or biological cunning, but rather because of humankind's myriad foibles.

Tangles of bureaucracy, ineffective coordination, underfunding, divisive science, two separate corruption scandals, and at least one ambush by semi-automatic gunfire have stymied attempts to address North America's Arundo infestations, leading to a sort of forever war. Borders—between landholdings, counties, states, and nations—often prove catastrophic for Arundo removal efforts, as jurisdictional squabbling, territorialism, and bureaucratic inertia foreclose on the possibility of keeping apace with a plant that pays no mind to lines on a map. A large-scale biological control program in Texas, which released similarly heedless predatory insects to attack the plant, may have surmounted some of those issues, but it has generated its own problems, as doubts have emerged over its efficacy and the quality of its science.

Despite the difficulties, Tongate maintains faith that those fighting against Arundo's spread will emerge victorious—someday. "I might be dead," he said, adding: "On a long enough timeline, what is it? Give me a long enough lever and I can move the world."

In the here and now, however, Tongate is humbled by the forces arrayed against him: "Federal agencies. State agencies. Multiple different federal and state agencies, all fighting with each other. And our own internal corruption issue," he said. "The crooked timber of humanity."

For a long time, Arundo's obdurate spread was thought to have begun in the Mediterranean Basin. Carl Linnaeus, known as the father of modern taxonomy, first described the plant from samples collected in Spain and France, naming it in his landmark "Species Plantarum" in 1753. Modern genetics, however, has traced Arundo's provenance to the Indus Valley, which stretches across modern-day Afghanistan, Pakistan, and India, and to the southern edge of the Caspian Sea, in Iran. One group of scientists wrote that the species "may represent one of the oldest and most persistent biological invasions." Sometime in antiquity, then, Arundo invaded the Mediterranean region, just as it later would the Americas.

The plant's success can partially be explained by its biology. A remarkably high capacity for photosynthesis allows Arundo to grow up to four inches a day and reach heights of more than 25 feet in a single year. Its height blocks sunlight from reaching other plants, and it reproduces through thick mats of underground stems, called rhizomes, that crowd out other species in the soil. The rhizomes, which look like webs of interconnected ginger, can sprout new shoots at each junction in the web, or node, leading to stands of Arundo so dense that visibility within them is reduced to mere feet. Moreover, if the rhizomes break apart, many of the separate pieces have the ability to form a new colony.

Arundo withstands droughts, relishes floods, and flourishes without regard to soil type or groundwater salinity. Its underground rhizomic labyrinth easily survives both frost and fire, and it is often the first plant to resprout following a blaze. Since its aboveground biomass fuels "firestorms," according to one scientist, this creates a feedback loop, further entrenching the plant's dominance. "We've done a bunch of competition studies, where we manipulate light, water, nutrients, and it's always the winner," said Tom Dudley, a University of California, Santa Barbara ecologist who has studied Arundo for more than 30 years. "No matter what the mechanism of competition is, Arundo, it just outcompetes basically anything else."

Beyond its own impressive suite of abilities, however, Arundo long ago found an accomplice in its global spread—human beings. Throughout history, people have used the reed to make weapons and fishing poles, furniture and toys, primitive pipe organs and flutes, baskets and mats. It has been employed as material for roofing, fencing, insulation, and adobe construction. Various medicinal traditions have claimed its efficacy as an anti-inflammatory, a diuretic, a blood-clotting agent, and a treatment for herpes. As far back as 5,000 years, the Marsh Arabs of ancient Mesopotamia built elaborate ceremonial buildings, called mudhif, from Arundo. Egyptian mummies have been found wrapped in Arundo leaves, while more recently, psychonauts have investigated Arundo as a source of the powerful psychoactive molecule *dimethyltryptamine*, or DMT. (The plant contains a small amount, but not at concentrations high enough to make it a worthwhile source.) And the natural reeds in instruments like saxophones and bassoons, as well as in clarinets like the one Dudley has played since childhood, are made exclusively from Arundo. Where humans have gone, so too has Arundo, ingratiating itself with its protean utility.

The plant likely arrived in the Americas alongside Spanish colonizers, and by the early 1800s it was being cultivated intentionally around Los Angeles for use as a building material and to stabilize ditches. From there, it quickly spread. By 1852, it had been observed in Texas watersheds, and by 1890, according to the US Geological Survey, it had reached as far east as New Jersey. The US Department of Agriculture's (USDA) Soil Conservation Service, a precursor to the modern-day Natural Resources Conservation Service, likely planted Arundo as an erosion control measure, oblivious to the damage it would cause. Valerie Vartanian, a former project manager with The Nature Conservancy in California who managed efforts to eradicate Arundo in the 1990s, said that their blunder allowed the plant to spread rapidly. "It had the opportunity then to really just take over," said Vartanian. "And that's what it seemed to do."

A stand of Arundo donax in the bed of the Santa Clara River, near Santa Paula, California. By the late 20th century, Arundo had proliferated dramatically, choking

waterways from coast to coast. **Kitra Cahana/Undark**

By the late 20th century, it had proliferated dramatically, choking waterways from the East Coast to the West Coast. Rivers in Southern California like the Santa Clara, the Santa Ana, the Santa Margarita, the Salinas, and many others fell victim to particularly egregious infestations. Scientists in that state began to take notice, observing the plant's excessive water use, the increased fire risk it posed, and the havoc it wreaked on habitat used by endangered species like the least Bell's vireo and the Arroyo Toad. "There's something for everyone to hate about *Arundo donax*," wrote one ecologist.

In an effort to unite the burgeoning research, a scientist with The Nature Conservancy named Gary Bell co-founded an initiative dubbed "Team Arundo" in the early 1990s. Team Arundo began connecting scientists and stakeholders, and organizing conferences to discuss the threat of Arundo invasion. With increased scrutiny, the severity of the problem began to crystallize. "By far the greatest threat to the dwindling riparian resources of coastal Southern California," Bell wrote in a 1997 paper, "is the alien grass species known as *Arundo donax*."

But a problem soon emerged: Nobody knew how to kill it.

In California in January of 1993, following days of intense rainfall, an engorged Santa Margarita River breached a levee on the sprawling Camp Pendleton Marine base, sending a wall of water crashing through the airfield. The flood nearly killed a marine, who had to be rescued, unconscious, by his comrades, and damaged some 70 aircraft and other pieces of equipment. General Walter E. Boomer, touring the base in the wake of the deluge, told a reporter that "we probably have more damage here as a result of the flood than we did during Desert Storm." Bridges, roads, and a historic chapel were wiped out by the torrent, and damages were estimated to top $100 million.

According to Jason Giessow, an environmental consultant who worked extensively on the base in the aftermath of the flood, the models used to design the levee contained a crucial omission: They did not account for the presence of *Arundo donax*. "It's not acting like vegetation, where water's passing through it," said Giessow. "It's acting like it's poured concrete, so you have to raise the bed form like 6 feet, 9 feet."

The devastation was not contained to the military base. Bridges and roads in other watersheds were damaged too, often by massive clumps of Arundo becoming ensnared in bridge piers, causing water to back up and eventually overcome the structures. For those who had been paying attention to Arundo—and to many who hadn't—the 1993 flooding was a wake-up call. The Department of Defense, which was responsible for Camp Pendleton, committed significant resources to Arundo removal on the Santa Margarita, as did other agencies and organizations.

By the time Valerie Vartanian inherited the reins of Team Arundo, just before the flood, a sort of panicked mythology had taken hold around the plant. It couldn't be mowed; it couldn't be pulled up; areas cleared of Arundo were immediately re-infested. It was even rumored that the plant could be run through a chipper and each chip could resprout. Collaborating with other scientists, including Tom Dudley, who had co-founded a northern chapter of the initiative called Team Arundo del Norte, Vartanian set about investigating these rumors. Soon, a more evidence-based understanding of the plant emerged.

Each chip could not sprout, the scientists found. Only the underground rhizome junctions, or nodes, could sprout year round, while aboveground leaf nodes could also sprout, but only in the springtime when they often develop a rooting hormone. The plant could be treated with herbicides like glyphosate, especially during the fall when it would enter a period of dormancy. Although mowing didn't work on its own, the researchers found that the chemical could greatly facilitate access to the innermost portions of dense stands, and freshly cut Arundo was especially vulnerable to herbicide if applied within a two-minute window. What emerged from these experiments was a different picture of the plant—one that showed that, at least with strict protocol, Arundo was not invincible. "We dispelled a lot of myths," said Vartanian.

Tom Dudley, an ecologist at UC Santa Barbara who has studied Arundo donax for more than 30 years, stands by a thicket of Arundo at the Santa Clara River Preserve near Saticoy, California. **Kitra Cahana/Undark**

Biologically speaking, in fact, the problem wasn't particularly complicated. To eradicate Arundo, teams simply had to start at the very top of the watershed and work their way down systematically. By doing this, they removed the possibility of re-infestation by vegetative fragments floating down from upriver. The Arundo had to be cut back enough to allow adequate

coverage with the herbicide, and it usually required several treatments. Treatments worked better in the fall, and treating after flood and fire events greatly improved efficiency and reduced cost. Using this method, in the late 1990s and early 2000s, Arundo was mostly cleared in the Santa Margarita watershed, which includes Camp Pendleton, and in several other small to medium-sized watersheds in southern California.

In other watersheds, however, a troubling reality emerged. While Arundo treatment was simple enough in theory, in practice it proved dizzyingly complex. A thicket of bureaucratic and legal hurdles, often as dense and impenetrable as the plant itself, confounded Vartanian's efforts. In the Santa Ana watershed, for example, there were dozens of legal entities that had to unite behind the effort: landowners, regulatory agencies, water districts, land managers, businesses, non-governmental organizations, resource conservation districts, public works agencies. There were federal, state, county, municipal, and individual interests, each with their own mission and funding picture. A successful eradication program would need near-universal buy-in —any holdouts would threaten the success of everything downstream. "It was so complicated," Vartanian said. "There were so many entities."

At first, regulatory agencies like the US Fish and Wildlife Service and the Army Corps of Engineers felt that removal of Arundo would trigger costly mitigation requirements such as habitat restoration, a perspective Vartanian fought hard to shift, arguing that Arundo removal was, in fact, itself a form of habitat restoration. She succeeded in bringing those agencies around to her viewpoint, but the permitting process for individual landowners remained daunting. Some landowners even felt they were being asked to act against their own interests. In removing Arundo, for example, they could be inviting the return of endangered species, which in turn would impose stricter regulations on their land use through the Endangered Species Act.

Other hurdles involved siloed interests: the mosquito control district that liked Arundo because it used up so much water it kept the mosquito population in check; the musical instrument reed industry that wanted to cultivate the plant; the Fish and Wildlife Service concerns over treating Arundo in the fall because the work might interfere with the breeding habits of the spadefoot toad. Alone, each of these hurdles could be overcome, but together they amounted to a herculean feat of bureaucratic juggling. The work had to be carefully coordinated and executed—mapping the infestations, securing funds, obtaining landowner permission, advancing through the permitting process, conducting the work—and if any element faltered it would threaten the entire endeavor.

Vartanian and her partners responded to these challenges by developing creative solutions. Beyond the regulatory agencies coming to accept Arundo removal as a form of environmental mitigation, programs were also established to incentivize landowners: an Arundo exchange initiative, where landowners could swap their Arundo for free willows; or a mitigation bank, where development projects could simply pay for mitigation work that had taken place elsewhere in lieu of having to do it themselves. Still, poor watershed-wide coordination and incessant funding woes stymied the work.

To help overcome this, Vartanian considered the possibility of establishing a watershed-wide endowment that Arundo removal projects could draw upon to sustain their work. This too, however, proved complicated. Such an endowment would require donors, a board, a financial adviser, and an administrative body—it too would require money and coordination. The idea never moved forward.

Vartanian left her position at The Nature Conservancy in 1998, moving out of California for 11 years. When she returned to the state in 2009, she was dismayed by the lack of progress. In 2011, Giessow co-authored a report that surveyed 23 watersheds with Arundo infestations. Of those 23, only two had achieved an initial reduction of 90 percent or above. Six watersheds had achieved initial reductions of between 30 and 70 percent. The rest had not managed to reduce their infestations more than 30 percent, and several, including the Santa Clara River, had not been able to reduce Arundo at all. "We just don't learn," said Vartanian, adding: "It's just hard for us to work together these days. And it's getting harder."

Ensconced in a protective legal and bureaucratic web, *Arundo donax* proved a far more formidable foe than its biology would have suggested. Discouragingly, too, the infestations that led to such consternation and disillusionment in California were, relatively speaking, quite small—most contained fewer than 1,000 acres of infestation. *Arundo donax* in the Rio Grande Basin, by comparison, covered tens of thousands of acres. And there, the watershed flowed through not just counties but entire states, and formed an international border with Mexico. The scale of the problem was staggering.

For some scientists, biological control—the use of natural enemies such as predators, parasites, and pathogens to reduce the population of an unwanted species—seemed to offer a solution. These agents paid no mind to borders, jurisdictions, or land ownership. Perhaps, some thought, they could simply fly above the crooked timber of humanity.

The history of using one species to control another dates back at least 4,000 years, with some major success stories as well as some catastrophic failures. (The cane toad, released in Australia to control a beetle pest, continues to wreak havoc on that country's ecosystem.) Today, though, most countries, including the US, require rigorous processes to ensure the mistakes of the past aren't repeated. For a control agent to be deemed suitable, it must be shown to be host-specific—capable of surviving on only the target species.

"Host specificity testing has become really, really important," said Mark Hoddle, a biological control specialist who directs University of California, Riverside's Center for Invasive Species Research. "You want a natural enemy that's going to be really focused on the target." So when USDA scientists moved forward with a biological control program for *Arundo donax* in the early 2000s, the first step was to try to identify such a host-specific natural enemy.

The search was far ranging, taking teams of scientists to Spain, Cyprus, Greece, India, and Nepal in search of suitable insects or pathogens. Eventually, consensus began to build around two species in particular: *Tetramesa romana*, a type of non-stinging wasp native to the Mediterranean region, and *Rhizaspidiotus donacis*, a scale insect. The wasp damages Arundo by laying eggs inside its stems, which causes the plant to develop abnormal growths, or galls, that can stunt and perhaps kill the shoots; the scale, meanwhile, feeds on the vascular tissue at the base of the shoots and the underground rhizomes, causing damage and weakening the plant over time.

In evaluating these organisms, the USDA team was concerned with two central questions. First, were they host specific (meaning, they would not affect other plants)? In both cases, it was clear that they were. Second, would they do enough damage to Arundo to be effective biological control agents? Here, the answers were less clear. "What is that impact going to be under, you know, released conditions?" said Tim Widmer, a scientist with the USDA's Agricultural Research Service who was involved in the early biological control effort. "Sometimes it's hard to judge, but we were pretty confident."

Around that time, in 2005, a USDA-ARS entomologist and biological control researcher named John Goolsby returned to his native Texas after a six-year overseas assignment in Australia. He had heard about the Arundo program through colleagues, and felt that the Rio Grande Valley would be an ideal location to implement the research. His superiors agreed, and Goolsby began to lead the Texas initiative.

The program that Goolsby inherited, however, was still small, hobbled by inadequate funding and insufficient personnel. The researchers before him had made headway in identifying suitable agents, but deploying those agents over such a large area would be a technically challenging and costly endeavor. Local stakeholders—mostly agricultural interests concerned about Arundo's water usage—supported the program but could contribute little to it. Fortunately for Goolsby, however, another interested party, one with deep pockets, had also taken an interest in the work. "As I started to work on this project," said Goolsby, "about a year later, you know, the national security angle popped up."

By the mid-2000s, increasing border militarization policies and the strategy of "prevention through deterrence," which sought to funnel migrants away from urban crossing points and into more remote and dangerous areas, using the desert's lethality as a deterrent, had largely succeeded in their aims. Border Patrol personnel now pursued migrants along vast lengths of the Rio Grande, where the agents were frequently hampered by impervious tangles of Arundo. In a 2007 statement, the Department of Homeland Security, of which Border Patrol is a component, said that Arundo was "overrunning border access roads, reducing visibility, and hiding illegal activities." Eager for a solution, DHS decided to pour roughly a million dollars a year, according to Goolsby, into the biological control program. That was, he said, "the tipping point."

Within the biological control community, the ethics of such a funding source remains a point of debate. Goolsby, for his part, was proud of the collaboration with DHS, and said that "any kind of initial controversy just sort of melted away." Others like Hoddle, the UC Riverside biological control expert, viewed the funding as a shrewd way to accomplish noble goals, a sort of trojan horse for the benefit of the ecosystem. Scientists like Dudley, however, were critical of DHS's motives. "I honestly do think it's patently racist," he said, adding: "DHS doesn't like brown people. Sorry to put it that bluntly." Despite the differing viewpoints on DHS's intentions, however, the agency's involvement was seen by some in the field as perhaps a case where the interests of Border Patrol and those of ecologists happened to overlap.

The program accelerated rapidly. A 2009 analysis by Goolsby and other researchers predicted that biological control would produce a 67 percent reduction in Arundo within two years, which, because of the plant's excessive water consumption, would lead to a return of $4.4 in savings for crop irrigation water for every $1 of public investment. In Washington, DC, the effort found a champion in Congressman Henry Cuellar from Texas's 28th district, who raised awareness of the issue and spearheaded fundraising. Goolsby, for his part, began taking measurements of Arundo biomass every 50 miles or so along 558 miles of the Rio Grande, from Del Rio to Brownsville, to establish a baseline. In a lab at the Moore Air Base, a deactivated Air Force facility in Edinburg, Texas, the scientists began mass rearing the wasps and scale insects, which had been imported from Europe.

Despite the forward momentum, however, an unexpected discovery occurred in 2008. Before they had a chance to release the insects, while surveying Arundo near Laredo and Eagle Pass, Goolsby found that a population of the wasp, *Tetramesa romana*, was already present. Other surveys revealed populations in multiple locations around Texas, from Austin to San Antonio, to several points along the Rio Grande. A few years earlier, Adam Lambert, then a postdoc in Tom Dudley's lab in California, had made a similar discovery in Arundo stands there. It was unknown where the wasps came from or how long they had been in North America. It was also poorly understood why they didn't seem to be damaging the plant—perhaps they were a different genetic strain, or had not achieved sufficient numbers. But in neither California nor Texas did the insects seem to be having an impact on the plant's abundance.

Nevertheless, the biological control program forged ahead. Between 2009 and 2012, some 1.2 million wasps and 600,000 scale insects were unleashed upon the Rio Grande's Arundo infestation. To achieve sufficient dispersal, the wasps were placed under cold storage, put by the dozens into hundreds of paper boxes, and dropped from the hatch of a low-flying Cessna 206. As they fell, the wasps would thaw, exit the boxes, and enter the Arundo thickets. The planes flew three days a week, year round, for nearly four years. The scale insects, which could not be dropped from planes, were released at various points by ground teams. "It really welled up inside of you to realize you were having an impact," said Goolsby.

That impact seemed to be noteworthy, at least according to Goolsby's team.

In November of 2014, evaluating the same sites that had been measured for a baseline, the team found an average of 22 percent reduction of above ground Arundo biomass. The results were published in a 2015 paper that concluded that "the Arundo wasp is having a significant impact as a biological control agent." A subsequent paper, co-authored by Goolsby and others, including another USDA-ARS scientist named Patrick Moran, looked at five of the original 10 sample areas and found an additional 32 percent reduction, for a total of 54 percent at those sites. When other locations were taken into account, the team arrived at a slightly different number, an estimated 45 percent reduction of overall biomass by the spring of 2016. A third paper found an additional 55 percent reduction in areas where the scale insect had been established versus sites where only the wasp had been released.

Based on those results, Goolsby deemed the program a success. In a 2022 publication, he and Moran, once again asserting a 54 percent reduction, estimated that the biological control program was saving up to $10.8 million per year in conserved water. Furthermore, the scientists noted, the program had increased visibility and improved access for law enforcement. In an interview last year, Goolsby said that the effort had also broken new ground scientifically. "A lot of people were skeptical that a plant this aggressive and fast growing, and also a grass, you know, could be a suitable target for bio-control," he said. "But I think we proved that it could be."

But not everyone was convinced. In 2018, another scientist with the USDA named Allan Showler co-published a paper that disputed the biological control program. Bluntly titled "The arundo wasp, *Tetramesa romana*, does not control giant river reed, *Arundo donax*, in Texas, USA," the paper showed that after five years of study, Arundo stands in Kerr County, Texas, did not seem to be impacted significantly by infestation with the wasp. The plant was still able to propagate, even from offshoots that had been damaged by the wasp, and the established shoots of Arundo were not killed by the wasp. "*T. romana* is a parasite that is well-adapted to *A. donax* by not killing stalks, reducing stand density, and hindering propagation," wrote Showler's team. "Hence, the exotic wasp is ineffective as a biological control agent against *A. donax*."

The paper went on to directly address what it viewed as flaws in Goolsby's methodology. First, changing hydrological conditions in the region could produce fluctuations in biomass, Showler noted, and hydrological data was not provided in the published results. Goolsby had briefly preempted this concern in the 2015 paper, stating that "hydrological conditions on the Rio Grande are fairly stable for giant reed," but he did not provide evidence for this claim. In a recent email, Showler, who retired from USDA-ARS in November of last year, wrote that the Arundo

biomass reductions Goolsby's team observed "may have been more due to water availability than to the wasp." Additionally, Showler questioned Goolsby's method of evaluating biomass, and noted that the high variation in Goolsby's results from site to site meant that the purported decline was "not substantiated statistically."

Despite repeated requests, Goolsby declined to respond to these or any other criticisms of the biological control program.

Skepticism of the program, however, is not limited to Showler. Bernd Blossey, a widely cited biological control expert at Cornell University, said in an interview in September that it was impossible to determine whether the wasp caused a decline in Arundo biomass. "We have no idea whether that was a result of *Tetramesa* or some other associated factor," he said, later adding: "There's no evidence that suggests that this is a giant success." Adam Lambert, Dudley's former postdoc who had discovered and studied populations of the wasp in California, said he also had doubts: "I think a lot of us sort of found it a little bit questionable having such huge reductions when we're not seeing that in California." Lambert pointed to the lack of ongoing monitoring — essential to evaluate the long-term success of biological control — as a major flaw in the program. Dudley, for his part, was even harsher in his criticism. "In my mind," he said, "it was a total waste of money."

Today along the Rio Grande, although there is no ongoing monitoring of the impact of the insects, USDA and Border Patrol are still committed to the biological control program. In Fiscal Year 2025, the federal government spent at least $4 million to treat Arundo, including funding work to "top" the cane—mow it at about one meter of height using enormous sawblades mounted on tractors. In addition to providing greater visibility for Border Patrol, the topping is intended to cause the Arundo to produce more sideshoots, which the wasps prefer. But according to Cy Tongate, the project coordinator with the Rio Grande Vegetative Management Program, even the Border Patrol agents ostensibly working to support the biological control program have lost faith in its efficacy. "Our human eyes can't tell the difference," he said.

"The insects, I think, had a lot of cooperation from Border Patrol, a lot of support from Border Patrol and DPS at first," Tongate said. "And just the lack of immediate results that could, you know, were obviously different to the human eye, kind of led to them losing some of that support."

The loss of faith, however, has not been accompanied by a shift in approach. "My guess would be it's a typical, classic bureaucratic case where something gets started and it's very hard to stop it, right?" said Tongate. "You know, it becomes something that is somebody's job."

He put it another way: "Nothing's so permanent as a temporary government program."

Over the course of the 2010s, despite the differing viewpoints on the Texas program, Patrick Moran, Goolsby's main collaborator, attempted to initiate a similar program in California. He transferred to a unit specializing in biological control at a USDA facility in Albany, in the Bay Area, and began collecting and shipping thousands of wasps from established sites in Texas to his new lab. In early 2017, he hired a postdoc named Ellyn Bitume to collaborate on the project, and they began searching for locations to release the wasps.

The effort in California proceeded on a much smaller scale than the Texas program. DHS, whose funding had allowed the Texas scientists to scale up their operation rapidly, had no involvement in California—Arundo didn't pose problems for Border Patrol in that state—leaving Moran's team reliant on a much smaller allocation from USDA. Bitume, who was tasked with finding suitable release sites, encountered many of the same problems that had bedeviled Arundo control teams for decades—the labyrinthine patchwork of landownership, for example, and the sundry attitudes of the landowners. As she put it: "You can imagine a female alone, showing up to an almond farm in Fresno in a government truck, asking this old guy if I can release wasps next to his almond farm. Wasn't always a very pleasant conversation, but I did eventually succeed."

The team secured nine sites across central and Northern California. Establishing the wasps, however, proved difficult. Northern California's climate was much dryer than Texas, and even that of Southern California where the wasps were also established, and Bitume suspected that the new climate caused the insects to struggle. At one point, she resorted to misting the stands of Arundo with a spray bottle in an attempt to replicate the more humid conditions of Texas. The team did eventually manage to establish populations at the majority of the sites, but the insects never thrived as they had in Texas, and their population density remained disappointingly low. Nevertheless, the scientists were keen to evaluate the effects of the wasps on the Arundo. "We were at the threshold to look at impact," Moran said.

But it was never meant to be. In January of 2025, the Trump administration took power, and Elon Musk's Department of Government Efficiency initiative started a cascade of funding cuts, layoffs, and agency restructuring. "We, as federal scientists, were under attack," said Bitume in an interview last August. "That's really what it felt like, every day. It was psychological warfare."

In the name of downsizing for the sake of efficiency, federal scientists were offered early resignation programs, and many, including Bitume and Moran, took them. "All of our long-term entomologists who have all the expertise and wisdom, and all of our younger scientists who had motivation and ambition, they're all gone," Bitume said, adding: "It's been devastating." Moran, who believes the jury is still out on whether biological control on its own can be effective in California, said that the research, at least for now, appears to have shifted to the academic realm.

Within academia, however, support for biological control of Arundo—at least with the wasp and scale insect—has waned. Dudley, initially an enthusiastic supporter of the approach, has changed his stance. "I kind of evolved quite a while ago to thinking that insects weren't going to do it," he said. Similarly, his former postdoc, Adam Lambert, has also become skeptical, at least of the insects tried thus far. They both, along with other scientists, have expressed interest in exploring other biological control agents—not only other insects, but perhaps even fungal or bacterial pathogens—but that research has not progressed meaningfully. "We're hoping that we find that silver bullet in an insect," said Lambert. "But in the meantime, we still are deferring to the sort of traditional, high intensity methods of removing Arundo in the river."

But those methods—the mechanical and chemical approach developed by Vartanian and others more than 30 years ago—remain mired in the same dysfunction they always have. On the Santa Clara River, where Dudley and Lambert focus much of their research, no organization, agency, or individual has emerged to direct a coordinated Arundo removal campaign. Although some work has taken place, Arundo control in that watershed has mostly been small-scale, scattershot, and ultimately ineffective, hindered in no small part by the river flowing through two counties and countless private landholdings. "Too many cooks in the kitchen," said Jason Giessow, the Arundo removal consultant. "It's sad, I mean really, ultimately, the river and the habitat are paying the price."

Martin Schenker, restoration field crew manager with the Ojai Valley Land Conservancy, at a site on the Ventura riverbottom. **Kitra Cahana/Undark**

A few miles to the north of the Santa Clara River, however, a different watershed seems to be offering a glimmer of hope. The Ventura River, much smaller and far less complex, has managed to make progress on a whole-watershed, top-down Arundo removal strategy. Led by the Ojai Valley Land Conservancy and bolstered by a multimillion-dollar grant from the California

Department of Forestry and Fire Protection, the Ventura River is on the cusp of securing permits that would allow work year-round in the entire watershed—as opposed to individual parts of it. The approach, part of California's "cutting the green tape" initiative, is a "first of its kind," according to Tom Maloney, the OVLC's executive director.

Early one morning in September, a group of young scientists working on the project descended into the Ventura riverbottom. In one section of the channel where Arundo removal had taken place previously, the team set to work counting and classifying native species that had returned to the area. "There's so much life in this section, you can just feel it," said Martin Schenker, OVLC's restoration field manager. Farther down the riverbed, in an area that had not been treated, a solid wall of Arundo reached from one bank to the other. "You go in there and it's just stagnant," said Schenker.

The team hopes that the cleared area is a vision of the future. With the permitting process nearing completion, Arundo removal has already begun, with 36 acres cleared so far. And though he is eager to see it gone, Schenker concedes a certain grudging esteem for the plant. "As much as I hate Arundo, it always impresses me," he said. "Its vigor and its willingness to live, you got to give it the respect it deserves. You know, it's not it's fault it's here. So admire it where it is. And then remove it."

In Texas, when Cy Tongate joined what was then called the Rio Grande Carrizo Cane Eradication Program in 2019, the effort was already struggling. The program had been created in 2015 to "help meet the Governor's border security priorities," according to its website, but it was left mostly unfunded until 2017, when it began receiving $1.5 million per year. Administration of the program fell to the Texas State Soil and Water Conservation Board, which in turn delegated most of the field work to the Pecan Bayou Soil and Water Conservation District, located hundreds of miles away from the Rio Grande itself—"nobody else wanted to do it," said Tongate. Fresh out of college, Tongate was excited for the challenge, viewing it as "an opportunity for us to kind of take some big swings."

The bureaucratic headaches began at once. The Department of Public Safety had urged the program to focus on certain "priority areas," but the majority of those sites were located on land owned by the US Fish and Wildlife Service. When Tongate and his supervisor met with USFWS officials, it was a disaster. The officials said that for any work to take place on their land, the program would have to conduct an environmental impact assessment. The cost was estimated to be between $5 million and $10 million, many times the annual budget of the entire program. The officials also expressed concerns about the program's herbicide, Imazapyr, though it turned out, according to Tongate, they themselves also used the chemical. "It was pretty clear it was more of a turf fight than actual concern," Tongate said.

At Amistad National Recreation Area, near Del Rio, officials expressed interest in allowing the program to work on their land, but by the time a formal proposal was put together by officials at Amistad, Tongate's program had run out of funding for the year. When the new fiscal year began, the proposal had expired and the official who had spearheaded it had retired. The effort collapsed.

In Big Bend National Park, Tongate and his colleagues managed to establish a memorandum of understanding with park officials, an encouraging first step toward treating Arundo there. But when Tongate sent the document to superiors at his own agency, they refused to sign, unsure whether state agencies could enter into MOUs with federal agencies. The MOU was kicked to the attorney general for input, kicked back to Tongate's team for revisions, re-submitted to the National Park Service to approve the revisions, and finally, after many months, signed. But that was just a memorandum of understanding—any formal plans to do work would have to undergo their own byzantine approval processes. "A lot of Texans would be offended to think that their bureaucracy is as slow and incompetent as California's," Tongate said. "But it is."

When the work did manage to proceed, it encountered difficulties. Spraying herbicide from helicopters, which until 2022 was the program's favored approach, did not seem to achieve the desired results. An assessment conducted by the US Geological Survey in collaboration with the carrizo cane program in 2020 and 2021 found that the aerial spraying only reduced the plant's coverage by 14 percent, far from the 85 percent reduction stipulated in the program's request for proposals—the job description that contractors bid on. To make matters worse, the work could also be dangerous.

Once, while one of Tongate's contractors was surveying Fronton Island, a large landmass in the Rio Grande used by cartels, border officials came upon an unexploded hand grenade in an abandoned backpack. Another time, a contractor applying herbicide from his boat came under fire, an unseen gunman spraying dozens of rounds into the side of his aluminum boat. "The

contractor after the incident told us that he wasn't going to come back until he had built an armored boat," said Tongate. "He never did come back."

Following the failure of the helicopter spraying, the program shifted its focus to drones. The drones, Tongate said, could get lower, penetrating the Arundo canopy and achieving better coverage with the herbicide. Although a formal assessment hasn't been conducted, Tongate said that the drone method appears to be achieving a much higher rate of reduction, knocking back the thick monocultural stands like the ones near Shelby Park. But early on, the drone work encountered a problem of its own.

According to an interim report issued by the Texas State Soil and Water Conservation Board in February of 2024, Barry Mahler, one of the board's members, may have participated in votes that benefited a company where his son, Matt Mahler, was either an employee or a subcontractor. The conflict was not disclosed in board meeting minutes, as required by Texas law. Barry Mahler did not respond to requests for comment. When the younger Mahler was eventually fired from that company, he allegedly launched a harassment campaign against the carrizo cane program, calling in spurious complaints about the use of "unpermitted" chemicals to state officials. The debacle delayed the drone spraying program for months, and it remains unresolved—Tongate believes a DPS investigation is ongoing. Meanwhile, Tongate said that a proposed $29 million funding increase for the program was shelved in the wake of the turmoil.

As those events were unfolding, a second corruption scandal erupted that could have bearing on the future of Arundo control efforts. In May of 2024, Democratic Rep. Henry Cuellar, who had been the chief advocate for Arundo removal in Washington D.C, was indicted along with his wife by a federal grand jury on bribery charges. The pair allegedly accepted some $600,000 from an Azerbaijani oil and gas company and a Mexican bank in return for agreeing to exert beneficial legislative influence. The congressman's website claims that he had secured $5 million by 2022 for Arundo removal, and he was likely behind a $50 million provision for the treatment of Arundo and other invasive species that appeared in the House version of the One Big Beautiful Bill Act. (The provision was absent from the final version of the bill.) Cuellar was pardoned by Trump in early December 2025, but quickly drew the president's ire for a perceived "lack of loyalty" after refusing to switch parties, a move that would have bolstered the slim Republican majority in the House. Now, Cuellar is facing a tough reelection battle in November.

"Corruption, it's like an invasive species," said Tongate. "It spreads really fast, it's hard to get rid of, and it forms a kind of a monoculture."

Further complicating matters, the carrizo cane program, which changed its name in 2025 to the Rio Grande Vegetative Management Program ("eradication is a high bar," said Tongate) often finds itself at odds with the other two actors involved in Arundo control along the Rio Grande: Border Patrol and USDA. Both of those agencies have funded work that has helped the biological control wasps flourish.

"If anything, I'd say our programs are competitive," said Tongate. "Land that's signed up for the carrizo wasps or the Arundo scale are not willing to participate in our stuff, because the idea is that if we kill the cane with our chemical, they don't have anything to eat."

But Tongate views mechanical control like mowing, dozing, or mulching as detrimental. "In most cases, it's going to be counterproductive," he said. "The cane, whenever you disturb it, it tends to activate the rhizomes and it'll really take off. And also, you can get rhizomes on equipment and spread it to other places. It's generally our experience that it's not helpful."

In an email to *Undark*, Michael Mascari, a public affairs officer with US Customs and Border Protection, which oversees Border Patrol, wrote that questions about Carrizo Cane eradication should be directed towards the Texas State Soil and Water Conservation Board, despite CBP's budget for the 2025 fiscal year containing millions for carrizo cane removal. He did not respond to follow up questions. USDA-APHIS, the branch of the agency Goolsby said is now responsible for overseeing the biological control effort, did not respond to requests for comment.

For a brief time, the Department of Homeland Security's Center of Excellence at Texas A&M University (one of several university collaborations that sought solutions to national security threats) tried to bring the programs together to better coordinate their approaches. But in the spring of 2025, the center, like California's biological control program before it, fell under the chainsaw of Elon Musk's DOGE. It lost funding, and the Arundo programs retreated to their siloes. "We're all pulling on the same rope," Tongate said. "Sometimes we're not all pulling in exactly the same direction."

Compounding these difficulties is one glaring, inescapable truth, the "elephant in the room," as Tongate says. Standing on the bank of the Rio Grande on a bright October afternoon, Tongate cast his eyes to the far side of the river. There, just 50 feet away in Mexico, large tufts of *Arundo donax* sprouted from the water's edge. The plant grows everywhere on the Mexican side, unmolested, uninterrupted, largely ignored, and spreading. (Officials at Mexico's Comisión Nacional de Áreas Naturales Protegidas did not respond to interview requests.) At any moment, a piece of rhizome from any upriver stand could free itself, float downriver, and lodge in an area recently cleared by Tongate's drones. And then the whole battle would renew. "Everything's going to just break off, re-establish down here," Tongate said. "It's just part of it."

Understanding this grave threat to his progress, Tongate has spoken with Mexican officials about the possibility of spraying on their side of the river too. They've supported the idea, Tongate said, but have little funding to contribute. Therefore, the work in Mexico would have to be paid for with Texas's general revenue funds, which may not be legal. Tongate's request for clarity on the legal question rose up the bureaucratic ladder, ping-ponged around, and then vanished.

A section of the bank of the Rio Grande in Eagle Pass, Texas, that has been cleared of Arundo donax, photographed in October 2025. **Fletcher Reveley/Undark**

Still, facing considerable headwinds, Tongate remains steadfast. His program has managed to treat some 4,000 acres with the new, more successful, drone approach, and he expects work to soon begin in Big Bend National Park, a rare bureaucratic victory after so many months of wrangling. The relative success of the drone work has inspired legislators to increase the program's

budget to $3.5 million per year. Eventual success, Tongate said, will require “time, perseverance, and maybe a little bit more cleverness than we’ve shown thus far.”

Meanwhile, *Arundo donax* does not wait. While Tongate and others claw through the crooked timber, the plant spreads, sprouts, and colonizes, continuing its milennia-long march across the globe. In the face of such an unyielding adversary, Tongate remains sober in his appraisal: “You know, in some ways I’m very pessimistic,” he said. “But in some ways I’ve got the endless optimism of a bureaucrat.”

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