

**ENVIRONMENTAL DISASTER
IN THE GULF SOUTH**

The Natural World of the Gulf South

Craig E. Colten, Series Editor

**ENVIRONMENTAL
DISASTER**
— IN THE —
GULF SOUTH

**TWO CENTURIES of CATASTROPHE,
RISK, and RESILIENCE**

EDITED BY CINDY ERMUS
AFTERWORD *by* TED STEINBERG

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Para mi mamá y mi papá,
Elsa y Jorge Ermus

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**ENVIRONMENTAL DISASTER
IN THE GULF SOUTH**

SWAMP THINGS

Invasive Species as Environmental Disaster in the Gulf South

ABRAHAM H. GIBSON *and* CINDY ERMUS

People have sought to explain the apparently capricious origins of disastrous events for thousands of years. For most of recorded history, people perceived disasters as acts of God, believing that every calamity, however large or small, was actively prescribed and deliberately executed by one or many supernatural deities. This explanation has fallen out of favor as cultures around the world have grown increasingly science-based, eschewing religious explanations in favor of natural ones. Many insist that disasters are caused by “forces of nature,” described as the accidental and, ultimately, random convergence of Earth’s various hydrological, climatological, and geological processes. Still others insist that humans are ultimately to blame for disastrous events. According to this view, naturally occurring phenomena like hurricanes and earthquakes merely throw light on already disastrous human processes. This means that people can no longer shift blame for disasters to God or to nature. It is human action and, not infrequently, human *inaction* that render any given event disastrous. We have only ourselves to blame.¹

Most of the scholars who study the history of disasters focus on nonbiological events. Some focus on naturally occurring phenomena, like fires, floods, and tornadoes, while others focus on more clearly human-caused disasters, like nuclear meltdowns, worksite explosions, and toxic spills. In both cases, the catalysts are abiotic in nature.² There are important exceptions, however. Many researchers (including one contributor in this volume) study disease-causing microbes within the context of disaster studies, and there is a large body of scholarship devoted to the complex relationship between plagues and peoples. Even so, epidemics remain outnumbered by abiotic disasters. Consider, for

example, that one recent encyclopedia lists more than two hundred of the most famous disasters in human history, yet only fourteen of these disasters are biological in nature. Thirteen describe epidemics, and one describes a locust plague.³

We sense that historians of disaster might be missing an opportunity. In this essay, we seek to advance the literature on disaster studies by asking whether macroscopic organisms ever deserve to be called disasters. More specifically, we will ask whether introduced nonnative populations, sometimes known as “invasive species,” qualify as disasters in the traditional sense of the word. We are not the first to do so. In 2011, biologist Anthony Ricciardi and coauthors stated that “biological invasions are fundamentally analogous to natural disasters,” and they insisted that we should manage them accordingly. As they explain, treating invasive species as disasters would allow biologists, wildlife management officials, and all levels of government to develop the same kinds of safety codes, emergency preparedness standards, and rapid response measures that are normally reserved for nonbiological disasters. In other words, it would allow biologists and policy makers to implement more precise hazard-reduction plans. “Just as building codes are designed to protect people and structures from earthquakes,” the authors write, “we argue that a precautionary system should be in place to manage vectors and pathways to safeguard against all potentially disastrous invasive species.”⁴

There are several good reasons for taking their suggestion seriously. After all, biologists and management officials are in widespread agreement that invasive species are disastrous for local environments. In 1992, the famed Harvard naturalist E. O. Wilson described invasive species as the second biggest threat to biodiversity in the twenty-first century, and scientists have echoed the claim innumerable times for more than two decades.⁵ Many biologists now insist that invasive species place more than half the native species in the United States under the threat of extinction. In addition to the ecological reasons, however, there are also economic ones. Some estimate that invasive species cost the U.S. economy more than \$100 billion on an annual basis, and that they cost the world economy hundreds of billions more.⁶

And yet, despite this consensus, a growing number of people now question whether invasive species have truly earned their terrible reputation. Echoing similar conclusions from disaster studies, many people now highlight humanity's complicit role in so-called "invasions."⁷ Many biologists recognize that human activity drives the invasion process, and some have thus suggested that we relabel "invasive species" as "disturbance specialists."⁸ Others are more insistent, denouncing invasion biology as "pseudoscience."⁹ They note that the "invasive" label is entirely subjective, and that it is not at all clear what qualifies as "native" versus "invasive." In many (and perhaps all) cases, the "native" population is itself derived from an "invasive" ancestor, and so one can never truly designate any particular time period or ecological condition as a "natural" baseline. Scholars have also shown that invasion biology, the scientific discipline that studies the introduction, spread, and impacts of nonnative populations, is sometimes rife with nativism and xenophobia.¹⁰ In his recent book, *American Perceptions of Invasive Species*, historian Peter Coates situates the history of immigrant plants and animals within the wider history of human immigration. He allows that invasion biology might be scientifically sound, but he also writes that the field is not immune from overtly "racist anthropomorphizing." His numerous examples show that Americans have often mobilized racial and ethnic stereotypes in an attempt to disparage nonnative populations, human or otherwise.¹¹

This essay will assess whether invasive species qualify as disasters, and whether two previously distinct bodies of scholarship (invasion biology and disaster studies) offer anything of service to each other. The essay is divided into three sections. The first provides a brief history of invasion biology that introduces readers to some of the biggest controversies in the field. In particular, we show that there is disagreement among biologists regarding the purportedly "disastrous" nature of biological invasions. The second section focuses on introduced nonnative animal populations in the Gulf South. The decision to focus on fauna rather than flora reflects the authors' interests and expertise, but we readily acknowledge that the Gulf South is also home to many different introduced nonnative plant species (most notably kudzu) that have

helped shape the region's ecology and its identity.¹² The Gulf South is defined as the five states that border the northern Gulf of Mexico: Texas, Louisiana, Mississippi, Alabama, and Florida. There are several reasons for restricting our analysis to this particular region. Many biologists have called the Gulf South a "biodiversity hotspot" because the region contains such a large number of plant and animal species found nowhere else on Earth.¹³ Alas, biodiversity hotspots are especially prone to invasions, and, as a result, the Gulf South is home to more invasive species than any other region of the continental United States.¹⁴ The third and final section will compare and contrast the central insights from invasion biology and disaster studies and will assess whether biological invasions qualify as environmental disasters.

A Brief History of Invasion Biology

People often overlook the evolutionary significance of geographical features like deserts, mountains, and oceans, even though these features have influenced the history of life on Earth in profound ways. For millions of years, these physical barriers have served as reproductive barriers, preventing plants and animals from migrating to different parts of the world and thus restricting gene flow. As a result, life incubated within certain well-defined ecological theaters, known as biogeographical realms, and there was relatively little opportunity for the flora and fauna in one arena to migrate into another. That famously changed in the late fifteenth century, when Christopher Columbus and the first generation of transatlantic explorers chanced to "discover" the Western Hemisphere (where millions of people already lived), and thus initiated the greatest biological "reshuffling" in the history of our planet. As explorers and colonizers crisscrossed the globe over the next several centuries, innumerable species were transplanted to new continents, where ecological conditions were often dramatically different. Many of these species were introduced on purpose, though just as many, if not more, were introduced accidentally.¹⁵

Identifying the earliest scientific accounts of introduced species is not easy, especially since the labels used to describe these populations

have changed so much over time. Even so, people have acknowledged the conspicuous ecological impact of nonnative species for hundreds of years. As early as the 1620s, English natural philosopher Francis Bacon described numerous different species from the Indies that had been accidentally introduced to European ports. When Swedish botanist Peter Kalm visited Pennsylvania in the 1740s, he identified more than a dozen European plant and animal species that had been introduced to the New World, knowingly or otherwise. Recognizing that the planet's rapidly reshuffling biota warranted new terminologies, English naturalist Hewett Cottrell Watson proposed the labels "native" and "alien" to describe displaced biological entities in 1846. In the decades thereafter, his countryman Alfred Russell Wallace acknowledged the singular success of nonnative species when describing the planet's aforementioned biogeographic realms, but he neither celebrated nor condemned their existence.¹⁶

As appreciation for biodiversity increased in the late nineteenth and early twentieth centuries, scientists adopted increasingly hostile attitudes toward nonnative species. The great naturalist Aldo Leopold devoted his life to developing a land ethic that would extend dignity to the rest of nature, but he adopted increasingly negative opinions about nonnative species in the 1930s and 1940s. He feared that they would disrupt established energy flows within preexisting biological communities, and that they would decrease biodiversity. Some have suggested that Leopold's position reflected the undercurrents of nativism that were pervasive in the United States at the time. It is true that Leopold believed most "runaway populations" were "foreigners" from distant lands, though he acknowledged native species were equally capable of "pest behavior."¹⁷ Meanwhile, American zoologist Marston Bates described humanity's conspicuous ecological footprint in a 1956 essay titled "Man as an Agent in the Spread of Organisms."¹⁸

The most influential book in the history of invasion biology is Charles Elton's *Ecology of Invasions by Plants and Animals* (1958). In exceedingly readable prose, Elton describes the three basic components of invasion biology: "the evolution of distinct biotas in isolation, the shattering of that isolation by human trade and travel, and the di-

sastrous impacts of some of this mixing.”¹⁹ Significantly, he portrayed nonnative species as an existential threat. “It is not just nuclear bombs and wars that threaten us, though these rank very high on the list at the moment: there are other sorts of explosions, and this book is about ecological explosions.” On two separate occasions in the book, he explicitly refers to biological invasions as “disasters,” and several of his examples are drawn from the Gulf South.²⁰ Elton’s book shaped all debates about nonnative species for decades thereafter, and it even helped launch a new field of study known as “invasion biology.”²¹ American ecologist Daniel Simberloff has gone so far as to call Elton’s *Ecology of Invasions* the “Bible of invasion biology.”²² To be sure, most of the subsequent literature has adopted Elton’s resolute opinion that nonnative species represent a threat and need to be eliminated.²³

That being said, Elton’s legacy is more complicated than many biologists appreciate. Consider, for example, that he recognized humanity’s complicit role in biological invasions, and he acknowledged that many “invasive” species had been deliberately imported. What is more, he admitted that most invasions occurred in soils that had been recently disturbed by people. “It will be noticed that invasions most often come to cultivated land, or to land much modified by human practice,” he wrote.²⁴ Contemporary biologists share Elton’s belief that humans are invariably complicit in biological invasions. According to Simberloff, nonnative species that translocate on their own (via winds, waves, and so forth), without human participation, cannot be “invasive” as such.²⁵ The invasive label therefore connotes that humans are both the aggrieved party *and* the responsible party. Moreover, many of the biologists who have studied nonnative species in Elton’s wake have managed to resist his overtly militaristic rhetoric.²⁶ In fact, the field of invasion biology has inspired a “cottage industry of criticisms” during its relatively brief existence.²⁷ The field’s most extreme critics insist that invasion biology is little more than a “pseudoscience” that is motivated by nativism, xenophobia, and fear.²⁸ The world’s leading invasion biologists have been forced to defend their science and their character. “The goal is not a reduction of numbers of nonindigenous species per se,” ecologist David Lodge and philosopher Kristin Shrader-Frechette

write, but rather “a reduction in the damage caused by invasive species, including many sorts of environmental and economic damage.”²⁹ Some doubt whether the two sides will ever find common ground. After all, disputes over the legitimacy of invasion biology are really cultural disputes over “differing worldviews.”³⁰

Introduced Nonnative Animal Populations in the Gulf South

The Gulf South is one of North America’s most distinct ecosystems. The five states that comprise the region boast a relatively warm and humid climate that supports diverse plant and animal species. The coastline from southern Texas to southern Florida arcs more than sixteen hundred miles around the northern Gulf of Mexico, but this measurement does not include the coastline’s seemingly infinite inlets and waterways, which provide the Gulf South with tens of thousands of extra miles of meandering coastline. Inland from the water’s edge, the Gulf Coastal Plain features flat expanses, wide riverine shallows, and numerous marshy wetlands. Habitats range from mangrove swamps to coastal grasslands, from sandy pine barrens to muddy riparian deltas. The broad Mississippi River slices right through the middle of the region and discharges into the Gulf of Mexico. Displaced silt from the continent’s vast interior collects at the mouth of the river. These delicate wetlands support diverse forms of life and numerous human industries.³¹

It is appropriate that we should begin our analysis of introduced species in the Gulf South with a discussion on feral pigs (*Sus scrofa*), who are frequently cited as among the worst invasive species in the United States.³² They forage for food in the soil, generally destroying any landscape they encounter. Their rooting damages forests, wildlife, soil, and water quality, and their parasitic pathogens threaten human lives.³³ Free-ranging pigs have been blamed for the decline and extinction of numerous plant and animal species. Their impact is not merely environmental, however. Officials estimate that the animals cost the nation approximately \$1.5 billion in crop damages every year, while others insist that they are responsible for more than \$20 billion in damages

per year. Feral pigs will live just about anywhere, but they have thrived especially well in the Gulf South. In fact, more than half of the nation's six million free-ranging pigs live in the five Gulf states. Biologists and management officials have waged a "war on pigs" for the past several decades, but the pigs have nevertheless proven almost impossible to eradicate.³⁴

Pigs first entered the Gulf South along with Spanish explorer Hernando De Soto in 1539. The thirteen pigs he transported later swelled to several hundred as his army meandered across the Gulf South, from Florida to Texas, for the next several years. Generations of historians have suggested that some of the conquistador's animals might have escaped and established feral populations, but conclusive proof is lacking. In any event, the region's pig population boomed during the early national period, when thousands of people migrated into the Florida peninsula and the Old Southwest alongside their livestock.³⁵ The open range persisted in the Gulf South long after it had closed in the more densely settled regions of the Northeast and Midwest. As a result, tourist sportsmen and sportswomen who hunted waterfowl in the region were surprised to discover that feral pigs roamed the land and provided thrilling sport.³⁶

Pigs did not become invasive, in name or fact, until the twentieth century, when the southern range finally collapsed. Thereafter, pigs were legally prohibited from existing anywhere other than inside a pen. However, closing the commons did not automatically eject the large numbers of feral pigs who inhabited the pine forests, scrub prairies, and riverine shallows. Instead they persisted for years thereafter. When American ecologist Tom McKnight studied the biogeography of feral animals in 1964, he reported around 1.5 million pigs in the United States. He noted that they were concentrated in the Gulf South, and that they were highly destructive.³⁷ When ecologists Jack Mayer and Lehr Brisbin described feral pigs in 1991, they estimated that approximately two million pigs lived in the United States, and that the vast majority lived in the Gulf South. When Mayer and Brisbin revisited the topic in 2009, they reported that the problem had grown considerably worse. The number of states reporting feral pigs had increased from nineteen

to forty-four, while the national population had grown from around 3 million to nearly 6 million. Among this total, well over half (around 4,315,000) lived in the five Gulf states.³⁸

In 2014, Congress approved \$20 million in funding for the National Feral Swine Damage Management Program, the first time the U.S. Department of Agriculture addressed feral pigs on a national level. Despite the new funds, however, success is by no means guaranteed. Biologists and management officials employ a variety of weapons in their battle against feral pigs, including guns, poisons, and helicopters, but the pig population remains as high as ever. One would think that they could call upon the region's comparatively large number of hunters for help, especially since pigs are now the second most popular hunting targets in the Gulf South, trailing only whitetail deer, but that has not happened.³⁹ In fact, paradoxical though it may sound, pig hunting is actually making the so-called invasion much worse. Biologists, management officials, and even hunters agree that hunters bear primary responsibility for the population explosion. On numerous occasions, hunters have knowingly translocated pigs so they can have a hunting quarry closer to home. In other words, the desire to hunt pigs is fueling the pig invasion.

Of course, pigs are not the only mammals who have been introduced to the Gulf South. In addition, millions of nonnative nutrias live in the region. These large rodents (adults weigh around twenty pounds) are found in all five Gulf states, but they prefer wetland habitats and are therefore most abundant in Louisiana. Officials at the local, state, and national levels regard Louisiana's nutrias as highly invasive.⁴⁰ They explain that nutrias overfeed on marsh plants and thus contribute directly toward the destruction of Louisiana's fragile wetlands. When areas with especially high nutria populations are denuded of their vegetation, they eventually convert to open water.⁴¹ Experts estimate that Louisiana has lost about 22,000 acres of marshland to nutrias, and that the animals negatively affect another 100,000 acres. Nutrias are also accused of devastating agriculture by foraging on crops and weakening irrigation structures. They are especially destructive toward Louisiana's most valuable crops—soybeans, rice, and sugarcane—and thus threaten the state's multibillion-dollar agricultural industry.⁴²

Although nutrias are “now almost universally reviled,” that was not always the case.⁴³ In fact, prospective pelt farmers in Louisiana deliberately imported the animals in 1937.⁴⁴ Popular legend has long held that Edward Avery McIlhenny, head of the Tabasco Company, was responsible for the nutrias’ dispersal throughout the wetlands.⁴⁵ Shane K. Bernard’s research in the company archives has conclusively shown that McIlhenny was not the first person to bring nutrias to Louisiana, and that at least two other farmers acquired nutrias prior to him. In fact, when McIlhenny resolved to raise pelts for the fur industry in 1938, he acquired his first nutrias from farmers in Louisiana. By the following decade, he had discovered that it was far more cost-effective to release the animals into the wild, and so he “liberated” the nutrias into the wetlands in 1945.⁴⁶ In the years thereafter, nutrias expanded their range in every direction.⁴⁷ Although trappers collected just 18,000 pelts in 1946, they annually collected more than 400,000 pelts by 1956.⁴⁸ Even so, this harvest was a small fraction of the actual population, which numbered closer to twenty million in the late 1950s.⁴⁹ Between the early 1960s and the early 1980s, trappers annually harvested more than a million nutrias from coastal wetlands.

Global demand for fur sustained these oversized harvests, and thus helped mitigate the animals’ impact on Louisiana’s wetlands.⁵⁰ Things began to change in the late 1980s and 1990s, as fur began falling out of fashion around the world. The dropping demand for pelts led to relaxed anthropogenic selection of Louisiana’s nutria populations. Although trappers collected 1.7 million pelts in 1976, they collected fewer than 115,000 pelts a decade later. Populations swelled as harvests decreased.⁵¹ Predictably, reports about nutria-caused damage increased exponentially.⁵² By the turn of the century, trappers collected fewer than 30,000 pelts annually, and as a result, the nutria population continued to expand. In 2002, Louisiana implemented the Coastwide Nutria Control Program, which pays hunters and trappers a four-dollar bounty for every animal they collect. By 2006, trappers and hunters were again harvesting approximately 400,000 from the wetlands on an annual basis.⁵³ In 2015, they collected another 340,000.⁵⁴ Meanwhile, untold millions remain at large in the wetlands. Management officials

have accepted that nutrias cannot be removed from the region, but they are still eager to limit their numbers.⁵⁵

Mammals are not the only animals who have “invaded” the Gulf South. On the contrary, insects have descended on the region and successfully reshaped its flora and fauna in dramatic fashion. This is especially true of fire ants, who are now widespread throughout the Gulf South and beyond. Many scientists insist that fire ants outcompete and displace native ants, and that they reduce species density on local and biogeographic scales.⁵⁶ In addition to the environmental costs, however, there are financial costs. One recent study found that fire ants cost the Texas cattle industry more than \$250 million annually.⁵⁷ Another study found that fire ants may well cost American citizens more than \$6 billion annually in control measures, medical treatment, and property damage.⁵⁸ Once again, understanding how these introduced animals “conquered” the Gulf South reveals as much about humans as it does about insects.

Fire ants are native to South America. They first entered North America as stowaways on a ship that reached Mobile, Alabama, in 1918. Another wave of fire ants arrived in Mobile in the 1930s, and it was this later wave that would eventually “invade” the rest of the Gulf South.⁵⁹ Throughout the 1940s and 1950s, fire ants expanded their range both east and west. By 1958, fire ants covered more than 62 million acres in the United States, including the entire Gulf South.⁶⁰ In an effort to stem the ants’ advance, Congress gave the U.S. Department of Agriculture approximately \$2.4 million in 1957 to develop an effective eradication campaign using chemicals and pesticides.⁶¹ It soon became clear that the pesticides were not eradicating the fire ants but were killing off just about every other kind of animal in the vicinity. Rachel Carson discussed fire ants at length when she published *Silent Spring* in 1962. Among other things, Carson insisted that fire ants were not at all invasive, writing that “the fire ant has never been a menace to agriculture and that the facts concerning it have been completely misrepresented.” She maintained that the reckless overuse of chemical pesticides was the only real disaster associated with the ants. Authorities at the state and federal levels continued using chemical pesticides to attack fire

ants in the years thereafter, but they eventually abandoned the practice in the 1970s.⁶² The ants had won.

The case of the fire ants provides several lessons. First, Carson's observation that the pesticides were more disastrous than the pests—that the medicine was worse than the illness—was largely proved true. Between the 1940s and 1970s, government officials employed broad-spectrum poisons that killed any and all animals *except* fire ants. As Joshua Blu Buhs recently observed, fire ants simply “reinvaded the poisoned parcels of land, mocking the eradication ideal.”⁶³ Meanwhile, much as humans are ultimately to blame for the disastrous effects of pigs and nutrias, humans are also fueling the fire ants' expansive radiation. After all, fire ants only colonize disturbed habitats, and nothing has disturbed the soils of the Gulf South quite so much as the vast suburbanization that C. Vann Woodward called the “bulldozer revolution.”⁶⁴ As a result, anthropogenic activities are fueling the fire ants' radiation.⁶⁵ As biologists Joshua R. King and Walter R. Tschinkel recently remarked, “Human activity, not biological invasion, is the primary driver of negative effects on native communities and of the process of invasion itself.” They hypothesize that fire ants, and, indeed, all invasive species, would be more accurately described as “disturbance specialists.”⁶⁶ Finally, the Gulf South is not only the scene of fire ant invasions, but also the source. Genetic analyses have shown that most of the world's displaced fire ant populations were not introduced from South America, but rather from the Gulf South. This complicates traditional ideas about invasions, and for that matter, blame.⁶⁷

Other supposedly invasive insects have yielded different lessons. Consider the case of the boll weevil, who began wreaking environmental and economic havoc in the Gulf South more than one hundred years ago. The insect's disastrous impact prompted one federal agent to describe the first boll weevils in the region as a “wave of evil.”⁶⁸ In 1908, Mississippi Delta planter LeRoy Percy wrote to a friend that “the weevil will bring with him disaster.” Despite its devastating impact on the region, some communities hold the boll weevil in high regard. Throughout the Gulf South, people have celebrated boll weevils in artwork, songs, sculptures, and folklore. As Fabian Lange recently remarked, “The boll weevil is America's most celebrated agricultural pest.”⁶⁹

To understand this strange state of affairs, one must first understand cotton's unique place in the history of the Gulf South. In the second half of the nineteenth century, the rapid expansion of railroads in the region facilitated the rapid expansion of cotton cultivation. By the early twentieth century, "No region of the country, perhaps the world, was more devoted to mass production of the fleecy white crop." That is what made the earliest reports about boll weevils so alarming. The insects live their entire lives inside cotton bolls, an ecological niche that destroys the plant.⁷⁰ Boll weevils first appeared along the southern Texas coast in 1892. Within a few years, total cotton production declined by nearly 50 percent.⁷¹ The insects spread across the Gulf South, advancing between 40 to 160 miles per year.⁷² They reached Louisiana by 1903, and Mississippi by 1908.⁷³ As cotton fields were destroyed, sharecroppers abandoned the fields and moved en masse. As a result, many researchers have credited the boll weevil infestation with triggering a "Great Migration" of African Americans from the Gulf South to urban centers farther north.⁷⁴ Some credit boll weevils with vanquishing King Cotton and finally forcing planters to diversify. According to this narrative, boll weevils are "liberators."⁷⁵ In 1919, this sentiment inspired the people in Enterprise, Alabama, to erect a statue in the insect's honor.⁷⁶

Yet there are reasons to doubt that narrative. While it is true that some places abandoned cotton cultivation in the wake of the boll weevil onslaught, other places doubled down.⁷⁷ In Mississippi, prime ecological conditions allowed planters to withstand the boll weevils' initially devastating impact, and to extract ever more labor from the region's overwhelmingly African American workforce.⁷⁸ Indeed, statistics reveal that cotton cultivation increased dramatically in some parts of the Gulf South.⁷⁹ Ten years after the people of Enterprise erected a statue honoring the boll weevils' liberating influence, the county's farmers were harvesting just as much cotton as they had before the insects' arrival. In 1929, most farms in Alabama, Mississippi, and Louisiana still received the majority of their profits from cotton.⁸⁰ According to this narrative, boll weevils did not challenge the region's devotion to monoculture.

There are several lessons that one can draw from the case of boll weevils. First, the contested history of the boll weevils proves that

invasions, including their purportedly disastrous effects, are open to interpretation. Second, farmers in the Gulf South could track the boll weevils' inexorable advance for several years prior to the insects' actual arrival. In this way, the insects represented a hazard for which planters could, in theory, prepare. More frequently, they expanded cotton cultivation, "as if trying to squeeze one last big crop rather than beginning to diversify away from their threatened staple."⁸¹ Finally, the current status of boll weevils is also instructive. Since the 1980s, the USDA has administered a campaign that has almost completely eradicated boll weevils from the Gulf South (scattered pockets remain in southern Texas). There is a sense that the invasion has been thwarted—that the disaster has been successfully navigated—but those conclusions are premature.

Animals known as exotics have also moved into the region recently, and none have generated as much publicity as the Burmese python. "The python invasion may rival all others in terms of its potential to completely alter the structure of native ecosystems and to capture the public's attention," biologists Michael E. Dorcas and J. D. Willson write. They add: "Invasive pythons in the United States have become an environmental specter that urgently warrants public concern." How did all of these pythons come to populate the region? As their name suggests, Burmese pythons are native to Southeast Asia. They might have remained there, but the growing demand for exotic pets ensured that some were plucked from their homeland and shipped to traders in the United States. In the late twentieth century, business was booming. Between 1989 and 2000, traders imported more than 400,000 snakes, including more than 100,000 Burmese pythons. The vast majority of these live shipments passed through South Florida, which was the nexus of the international exotic-pet trade.⁸²

To be sure, these facts may explain how pythons made it to South Florida, but they do not explain how they escaped into the Everglades. There are many theories about how the snakes got there, but the truth is that researchers do not know if the first snakes were intentionally released or whether they somehow escaped from captivity. The earliest reports of pythons in Everglades National Park date back to the late

1990s, though sightings increased dramatically in the years thereafter. In 2004, biologist Skip Snow reported that four pythons recently taken from the Everglades contained thirty-five eggs among them.⁸³ The rising number of pythons began receiving international attention in 2005, when news outlets around the world circulated a photograph taken in the Everglades. The photograph showed a dead python with a dead alligator protruding from the snake's stomach. For many, the grim scene neatly encapsulated the tension between a great many native and non-native species.⁸⁴ Later that same year, biologist Robert N. Reed warned that pythons could easily establish populations in the Florida wilds.⁸⁵ Sure enough, pythons began appearing in the park with even greater frequency. In 2006, scientists discovered several python nests within the boundaries of the national park.

As of late 2015, more than two thousand pythons have been removed from the park and surrounding areas. Officials are generally cautious when calculating the total number of pythons living in the Everglades, but estimates range from ten thousand to thirty thousand. The pythons are not going anywhere, and, as a result, the park's fauna looks considerably different from how it appeared just a few short years ago. Several scientific studies have confirmed that the rising number of pythons has led to fewer mammals and birds.⁸⁶ Meanwhile, the pythons' explosive population growth has prompted a spirited debate in the scientific literature over their potential range expansion.⁸⁷ Understandably, the debate is growing more urgent. Pet pythons have killed several children in Florida over the past twenty years.⁸⁸ Wild pythons have not yet claimed any human lives, but that has hardly quelled fears.⁸⁹ State and federal wildlife officials have spent millions of dollars trying to combat the growing python infestation, and they have utilized a variety of tools and methods, including traps, bounties, and organized hunts, yet these efforts have so far failed to produce substantive results.⁹⁰ Further complicating matters, state and federal agencies have spent more than \$100 million rebuilding stork and muskrat populations, yet Burmese pythons feed on both of these species voraciously.⁹¹ Despite everything, even the pythons have their defenders. Dorcas and Willson have argued, "In general, snakes have an undeserved bad reputation. Like most other

animals, snakes are generally afraid of people."⁹² Indeed, it is hard to blame the pythons for their invasion when humans quite clearly were responsible.

Other exotic animals have invaded not only the lands bordering the Gulf of Mexico, but the Gulf itself. Perhaps no aquatic invader is more notorious than the lionfish. Native to Indo-Pacific waters, these visually striking fish were first transported to the Western Hemisphere to serve as ornamental pets. Some were released from their aquaria and established populations in the wild. Lionfish first arrived in North American waters in 1985, when fishermen spotted them on the east coast of Florida.⁹³ They expanded their range up the Atlantic Coast in the years thereafter, and were first seen in the Florida Keys in 2009.⁹⁴ By 2010, they were being identified in the northern Gulf of Mexico, and they are now found off the coast of all five Gulf states.⁹⁵ Meanwhile, recent research has shown that lionfish are not only taking over reefs, but also growing more abundant at greater depths.⁹⁶

There is widespread consensus that lionfish have a negative ecological impact, not least because they prey on already critically endangered reef fish.⁹⁷ Accordingly, in addition to the ecological implications, there is an economic impact as lionfish disrupt existing ecosystems and food webs, and thus threaten the seafood industry of the Gulf South. Struggling to respond to this invasion as it happens, officials have suggested a variety of control measures. Some think we should import still more voracious species to feed on the lionfish.⁹⁸ Others think that *people* ought to start eating them, and many are now promoting the fish as edible fare. These inventive efforts notwithstanding, many scientists and officials have resigned themselves to defeat.⁹⁹

Recent events suggest that the threat from exotic populations will only grow more acute in the future. For example, researchers in Florida, which has the largest number of introduced amphibians and reptiles in the world, have recently confirmed that the Nile crocodile (*Crocodylus niloticus*) is now living in the state, though we do not know for certain how many there are.¹⁰⁰ Over the last ten years, many Nile crocodiles have been imported from South Africa and Madagascar for display in zoos, or as part of the exotic-pet trade. Much like the Burmese python, it

is the latter that most likely explains the introduction of the Nile crocodile to Florida.¹⁰¹ If these animals become established in their new home, they will pose a serious threat both to local fauna and to human beings. Unlike their gentler cousin, the American crocodile, who grows to four meters and is satisfied with fish, crustaceans, and turtles, the Nile crocodile grows to six meters, weighs over one and a half tons (it is the second largest reptile on earth), and is known to eat large mammals such as zebras, hippos, and humans. In 2015 alone, there were eighty-eight documented attacks against human beings in Africa, fifty-eight of which were fatal.¹⁰² While there is no cause for fear or panic at this point, we have yet to see what the effects will be, if any, of this more recently introduced species in the Gulf South.

Conclusion: Biological Invasions as Disasters

Disasters are generally measured in three different ways: economic costs, environmental devastation, and loss of human life. We must admit that this lattermost metric—loss of human life—scarcely factors into debates over biological invasions. Earthquakes and plagues routinely kill hundreds, sometimes thousands of people, but even the most pernicious invasive species do not threaten human lives. For all their terrifying ubiquity, the Burmese pythons inhabiting the Everglades have not yet claimed any human victims. Thus, when locals remark that the Gulf South has been “biologically traumatized” by nonnative species, one must take the observation with a grain of salt.¹⁰³ In this way, we must allow that biological invasions are not like disasters, and that the stakes are always much higher when human lives are at risk.

That important qualification out of the way, it is equally important to highlight the numerous ways in which biological invasions and disasters *do* resemble one another. Both categories of events pose unique threats to the ecosystems and, indeed, the very landscapes of the Gulf South. Like so many abiotic disasters, nonnative species destroy enormous swaths of fragile wetlands, and as Roberto Barrios and Kevin Fox Gotham both explain in their respective contributions to this volume, the destruction of wetlands most seriously affects those people who

derive their livelihood and identity from the wetlands. In other words, biological invasions and natural hazards both disproportionately affect the most vulnerable. Meanwhile, the ways in which researchers conceptualize these events have also changed. For instance, disasters were once regarded as discrete events. As Andy Horowitz explains elsewhere in this volume, “many writers continue to narrate so-called natural disasters as acute events that erupt in a catastrophic instant.” In similar fashion, biologists have long regarded invasions as comparatively sudden phenomena. Elton even likened them to explosions. “I use the word ‘explosion’ deliberately,” he explained, “because it means the bursting out from control of forces that were previously held in restraint by other forces.”¹⁰⁴ In both fields, however, practitioners have begun to adopt more nuanced views. Researchers now agree that the worst effects of many so-called biological invasions unfold over years, decades, and in some cases, centuries—an example, in other words, of a slow disaster.

Another conspicuous similarity between biological invasions and disasters concerns humanity’s invariably complicit role in both. Just as humans are frequently to blame for the worst aspects of disasters, so humans are likewise to blame for the most disastrous effects of non-native species. Put differently, just as each disaster lays bare existing social structures and vulnerabilities, each biological invasion reveals something different about humanity’s complicit role in disasters. The desire to hunt and to kill paradoxically fuels the region’s booming population of feral pigs. Changing tastes in fashion ultimately explain the explosive growth of nutrias in the Gulf South. The rapid expansion of fire ants would have never been possible without people first sprawling into previously undisturbed habitats. In similar fashion, neither pythons nor lionfish would inhabit the Gulf South if not for humanity’s passion for collecting dangerous novelties and exotic beauties, respectively. Meanwhile, boll weevils have been largely eradicated from the region, but they remain a threat to communities dependent on cotton production.

Given humanity’s complicit role in all biological invasions, it should come as no surprise that some regard humans as the most invasive

species of all. The famed American conservationist George Perkins Marsh was among the first to focus on humanity's disruptive tendencies. "Man is everywhere a disturbing agent," he wrote in the early twentieth century, adding, "wherever he plants his foot, the harmonies of nature are turned to discords."¹⁰⁵ Contemporary researchers are more explicit still. Some cite humanity's exponential growth and unsustainable behavior as evidence that our species is destroying the rest of the planet and that we collectively behave like a malignant tumor.¹⁰⁶ Others note that humans are driving one of the largest extinction events in the long history of the planet.¹⁰⁷ According to this view, invasive species are not the cause of disaster but rather the instrument, and biological translocations will continue to increase as globalization accelerates. Many fear that biomes and cultures will grow increasingly "homogenized" in the years ahead.¹⁰⁸ Elton and Crosby both warned about this possibility, and others have since followed suit. "The earth is hurtling towards one world culture and (maybe) one world ecosystem," Australian biologist Timothy Low writes.¹⁰⁹ Meanwhile, scientists predict that anthropogenic climate change will facilitate even more species displacement in the years ahead.¹¹⁰ But much can be done to help slow this disruptive process.

Like the other essayists in this volume, who suggest ways to increase resilience following disasters, we too would like to offer a few suggestions. While some might prefer to prevent immigration altogether, we find that position unwise and untenable. Instead, we assert that increasing resilience requires that *we* change. It requires that humans accept responsibility for the biotic composition of the planet, and that we proceed with deliberate care when cultivating and pruning our shared future. Since we are looking for guidance, it is perhaps fitting that we close by revisiting the "Bible of invasion biology," Charles Elton's *Ecology of Invasions*. Even though Elton is now most frequently remembered for his militaristic attitude toward nonnative species, he offers surprisingly measured advice in the book's final chapter: "From now on, it is vital that everyone who feels inclined to change or cut away or drain or spray or plant any strip or corner of the land should ask themselves three questions: what animals and plants live in it, what

beauty and interest may be lost, and what extra risk changing it will add to the accumulating instability of communities.”¹¹¹ Inhabitants of the Gulf South may not have it within their power to remove or control nonnative species, but that does not mean that they cannot forestall disasters.

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