CHAPTER 3

CONSERVATION THREATS

Introduction

Alabama faces the significant challenge of conserving one of the nation's most biologically diverse and distinctive regions while contending with a wide array of threats. The state's Species of Greatest Conservation Need (SGCN), and their key habitats, are subject to pressures that may compromise their long-term viability. Some threats operate on global or national scales, while others are more regional, statewide, or local in scope. Identifying and understanding these threats is a critical step in shaping effective conservation strategies within this State Wildlife Action Plan (SWAP).

Threats identify "problems which may adversely affect species of conservation need and their habitats." These problems include both direct threats, such as human activities or natural processes that negatively affect species and habitats, and indirect challenges such as data deficiencies or limited management resources. In this document, the term *threat* is used broadly to describe the full spectrum of human actions or natural events that may endanger fish, wildlife, and their habitats. The resulting effects on species or habitats are referred to as *stress responses* or *stressors*. Threats may act directly on a species or indirectly through the alteration or limitation of critical habitat conditions. Threats are addressed through targeted conservation actions that are implemented as resources and opportunities allow (**Element 4, Chapter 4**). The previous two chapters outlined Alabama's SGCN (**Element 1, Chapter 1**) and key habitats (**Element 2, Chapter 2**); while this Chapter focuses on the threats impacting SGCN and key habitats (**Element 3**).

Statewide Threats to Alabama's Wildlife and Key Habitats

Identifying SGCN and habitat threats (**Element 3**), included a review of original sources used in the 2005 and 2015 SWAP. Threats are based on the International Union for Conservation of Nature Conservation Measures Partnership (IUCN-CMP) Threats Classification System (IUCN, 2022), along with a number of current reports and updates. The IUCN-CMP have developed a standardized Threats Classification System that is used worldwide to identify and categorize the pressures affecting wildlife. This system organizes threats into ten broad categories: residential and commercial development, agriculture, energy production, transportation, biological resource use, human disturbance, natural system modifications, invasive species, pollution, geological events, and climate change, each with more specific subcategories (Table 3.1). By providing a consistent framework, the IUCN-CMP system allows conservation practitioners to compare threats across regions, ecosystems, and taxa,

and to prioritize actions that address the most pressing issues. For Alabama's SWAP, aligning threats with the IUCN classification ensures that local conservation needs are framed within an internationally recognized context, highlighting both global drivers and state-specific stressors. This standardized approach strengthens planning, monitoring, and evaluation by linking Alabama's species richness challenges to a broader conservation framework.

Table 3.1 The threats identified by the International Union for Conservation of Nature (IUCN) including the code, categories, and descriptions.

Code	Categories	Descriptions
1	Residential & Commercial Development	Urban Development, Recreation Areas
2	Agriculture & Aquaculture	Crops, Livestock farming, Aquaculture
3	Energy Production & Mining	Oil/Gas Drilling, Mining, Renewable Energy
4	Transportation & Service Corridors	Roads, Railroads, Utility Lines, Flight Paths
5	Biological Resource Use	Timber Harvest, Fish/Hunting, Collection
6	Human Intrusion & Disturbance	Recreational Activity, Military Activity
7	Natural System Modifications	Fire & Fire Suppression, Water Quality & Quantity (Dams), Lack of Management, Fragmentation
8	Invasive Species, Pathogens, & Genes	Pets, Genetic Modification, Diseases
9	Pollution	Sewage/Wastewater, Industrial Effluent, Solid Waste, Airborne Pollution
10	Geological & Biological Events	Temperature/Precipitation Change, Extreme Weather Events, Predation, Community Dynamics

1. Residential and Commercial Development

Residential and commercial development, as defined by the IUCN, includes threats from human settlements and non-agricultural land uses that have a substantial footprint on natural systems. Expanding urban areas, new housing developments, industrial facilities, and recreational infrastructure have converted forests, wetlands, and floodplains into built environments, reducing the availability and connectivity of natural habitats.

Rapid urban growth in metropolitan areas such as Birmingham, Huntsville, Mobile, and Montgomery has led to extensive habitat loss and fragmentation through the conversion of forests, wetlands, and grasslands into housing, roads, and industrial infrastructure (Rahman, 2014). Along the Gulf Coast, the expansion of beach resorts, marinas, and other

recreation facilities in Baldwin and Mobile counties has placed additional pressure on sensitive coastal ecosystems, including dunes, marshes, and sea turtle nesting beaches (Nelson et al., 2019). Suburban growth throughout the Tennessee Valley and Black Belt has altered hydrology, increased impervious surfaces, and contributed to sedimentation and nutrient loading in rivers and streams (Rahman, 2014; Shades Creek Management Plan, 2021). These developments also introduce invasive species, expand utility corridors, and generate noise and light pollution that affect wildlife behavior. Collectively, residential and commercial development continues to be one of the most pervasive and intensifying threats to SGCN and their habitats. These land-use changes not only eliminate critical areas for SGCN, but also intensify threats such as stormwater runoff, sedimentation, and invasive species spread. Unchecked development places added pressure on already vulnerable ecosystems, underscoring the need for strategic land use planning and conservation partnerships.

1.1 Housing and Urban Areas

Housing and urban areas, as defined by the IUCN, encompass human cities, towns, and settlements, including associated development such as schools, hospitals, airports, and infrastructure. In Alabama, rapid urbanization has transformed natural landscapes into sprawling residential and suburban developments, particularly in fast-growing regions such as Huntsville, Birmingham, Montgomery, and the Mobile Bay area. This expansion has resulted in the direct conversion and fragmentation of forests, wetlands, and grasslands, reducing habitat connectivity for wildlife. Increased impervious surfaces from roads and subdivisions have altered hydrology, leading to higher stormwater runoff, erosion, and nutrient loading in streams and rivers. Urban sprawl also facilitates the spread of invasive plants like Chinese privet and cogongrass (Patterson, 2004), while light and noise pollution disrupt nocturnal wildlife behaviors and migratory bird pathways. In Baldwin County, land-cover change from forest to urban areas has degraded wetland hydrology and elevated invasion by exotic species like Chinese privet (Flynt, 2012). Housing and urban development are among the most widespread and ongoing threats to SGCN, especially in ecologically sensitive regions like the Tennessee Valley, Black Belt, and Gulf Coast.

1.2 Commercial and Industrial Areas

Commercial and industrial areas, as defined by the IUCN, include factories, processing plants, warehouses, ports, and other large-scale built infrastructure with substantial ecological impacts. In Alabama, major industrial development has been concentrated along river corridors and coastal zones, where paper mills, chemical plants, and steel manufacturing facilities are sited near the Mobile, Tombigbee, and Black Warrior rivers. These operations contribute to habitat conversion, water and air pollution, and altered

hydrology through industrial discharge and increased impervious surfaces. The Port of Mobile, one of the largest in the Gulf of Mexico, has expanded to include extensive shipping, warehousing, and petrochemical infrastructure, adding further pressures on coastal wetlands, estuarine habitats, and the Mobile-Tensaw Delta. In the Birmingham and Huntsville regions, steel production, automotive plants, and associated industrial parks have fragmented surrounding forests and increased stormwater runoff and nutrient loading into local watersheds. Alabama's commercial and industrial development represents an ongoing threat to water quality, floodplain integrity, and SGCN dependent on aquatic and riparian systems.

1.3 Tourism and Recreation Areas

Tourism and recreation areas, as defined by the IUCN, include facilities such as resorts, golf courses, marinas, and large campgrounds that create substantial habitat modification. In Alabama, these impacts are most pronounced along the Gulf Coast in Baldwin and Mobile counties, where resort and condominium development, beach nourishment projects, and marina construction have altered dune systems, wetlands, and coastal habitats. These activities disturb nesting sea turtles and shorebirds, increase light and noise pollution, and fragment sensitive dune and maritime forest ecosystems. Golf course and campground development in the Black Belt, Appalachian foothills, and longleaf pine landscapes has contributed to habitat loss, water withdrawal, nutrient runoff, and the spread of invasive species. Recreation-based infrastructure within state parks and national forests, while providing public access and education, can also lead to soil compaction, erosion, and disturbance to SGCN when not carefully managed. Overall, tourism and recreation developments in Alabama represent a growing land-use pressure that must be balanced with conservation goals to protect fragile coastal and upland ecosystems.

2. Agriculture and Aquaculture

Agriculture and aquaculture, as defined by the IUCN, include threats from farming, ranching, silviculture, and aquatic production that expand or intensify land and water use. In Alabama, agriculture remains one of the state's dominant land uses with approximately 37,100 farms in Alabama encompassing around 8.6 million acres (USDA NASS, 2023). Row-crop agriculture, particularly cotton, soybeans, corn, and peanuts, is concentrated in the Black Belt, Tennessee Valley, and Coastal Plain, where fertilizer and pesticide runoff contribute to nutrient loading and sedimentation in rivers and streams. Silviculture is widespread across the Coastal Plain, where industrial pine plantations have replaced native longleaf ecosystems, reducing species richness and altering fire regimes. Livestock production and pastures scattered throughout the state contribute to erosion, streambank degradation, and nutrient inputs in aquatic systems. Alabama also leads the nation in catfish aquaculture

(2nd), with more than 14,000 acres of production ponds in Hale, Greene, and Dallas counties. Hale County alone accounts for more than a third of the state's catfish sales. Nationwide, Alabama ranked 5th in aquaculture sales (Alabama Cooperative Extension System, 2024). While vital to the state's economy, these intensive land and water uses alter hydrology, fragment habitats, promote invasive species, and create long-term challenges for SGCN.

2.1 Annual and Perennial Non-timber Crops

Annual and perennial non-timber crops, as defined by the IUCN, include threats from the production of agricultural crops such as cotton, soybeans, corn, peanuts, and other row crops. This form of agriculture is widespread and concentrated in fertile regions such as the Tennessee Valley, Black Belt, and Coastal Plain, as well as the Wiregrass region where peanut cultivation dominates (Agriculture in Alabama, 2025). The conversion of prairies, wetlands, and riparian zones into cropland has fragmented and degraded habitats. Intensive row-crop practices often involve high levels of fertilizer, pesticides, and irrigation, contributing to nutrient enrichment, sedimentation, and chemical runoff that degrade streams, rivers, and downstream aquatic ecosystems (EPA, 2025). Mechanization and short crop rotation cycles further alter soil structure, increase erosion risk, and reduce habitat quality for ground nesting birds, pollinators, and other wildlife (Hamxa, 2005). Agriculture remains a critical part of Alabama's economy, but the expansion and intensification of annual and perennial crops continue to represent a significant ecological stressor for SGCN and their habitats.

2.2 Wood and Pulp Plantations

Wood and pulp plantations, as defined by the IUCN, include threats from intensively managed woody crops established for fiber, pulp, or biofuel production. In Alabama, this is most evident in the widespread conversion of native longleaf pine and mixed hardwood forests to industrial loblolly and slash pine plantations. These monoculture stands are often managed on short rotation cycles and maintained with intensive site preparation, herbicide treatments, and fertilizer applications that reduce native groundcover diversity, alter soil chemistry, and disrupt natural fire regimes. Plantations simplify habitat structure, limiting resources for wildlife dependent on diverse understory vegetation, open pine savannas, and natural disturbance cycles (Hausle, 2023). Sensitive habitats such as bogs, seepage slopes, and ephemeral wetlands embedded within plantation landscapes are especially vulnerable to hydrological alteration and chemical runoff. While industrial forestry remains a vital economic sector in Alabama, wood and pulp plantations have contributed significantly to the decline of longleaf pine ecosystems and continue to impact numerous SGCN reliant on fire-maintained and structurally diverse forests.

2.3 Livestock Farming and Ranching

Livestock farming and ranching, as defined by the IUCN, includes threats from domestic animals raised on local or imported resources, whether in open range, pasture based, or confined systems. In Alabama, cattle ranching is widespread in the Tennessee Valley, Black Belt, and Appalachian foothills, where overgrazing and pasture expansion have contributed to soil erosion, streambank degradation, and loss of native grassland habitats (Alabama A&M and Auburn Universities Cooperative Extension System, 2018). Conversion of native prairie and longleaf pine savanna into pastureland has reduced habitat diversity and increased the spread of invasive plants such as sericea lespedeza and bermudagrass. Poultry production, centered in north Alabama, is one of the state's largest agricultural industries, with concentrated poultry houses generating significant nutrient-rich waste that can run off into nearby streams and rivers, contributing to eutrophication (Lamba et al., 2020). Swine and dairy operations, though smaller in scale, also produce localized impacts on water quality and soil health (ADEM, nd). Livestock farming and ranching place pressure on aquatic and terrestrial ecosystems across the state, altering hydrology, degrading habitats, and impacting SGCN.

2.4 Marine and Freshwater Aquaculture Production

Marine and freshwater aquaculture, as defined by the IUCN, refers to the production of aquatic organisms for food, stocking, or other purposes in marine, estuarine, and freshwater systems. Alabama leads the nation in freshwater catfish aquaculture, particularly in the Black Belt region (Alabama Cooperative Extension System, 2023). While providing economic benefits, aquaculture facilities can alter water quality, discharge nutrients, and pose risks of disease transfer to native fish populations. On the Gulf Coast, marine aquaculture (e.g., oyster farming) is expanding, with potential impacts on estuarine systems if not managed carefully. Both freshwater and marine operations require careful oversight to avoid displacing or degrading habitats. Without careful management, aquaculture expansion and intensification continue to pose challenges for conserving SGCN, particularly mussels, crayfishes, and sensitive estuarine organisms.

3. Energy Production and Mining

Energy production and mining, as defined by the IUCN, encompass threats from the production of non-biological resources. These include oil and gas drilling (exploration, development, and production of petroleum and other hydrocarbons), mining and quarrying (extraction of coal, metals, sand, gravel, and other minerals), and renewable energy development (such as solar, wind, hydropower, tidal, and geothermal). Each of these activities can result in habitat loss, fragmentation, and degradation, as well as secondary impacts such as altered hydrology, pollution, and disturbance to wildlife populations.

3.1 Oil and Gas Drilling

Oil and gas drilling, as defined by the IUCN, includes threats from exploring for, developing, and producing petroleum and other hydrocarbons. In Alabama, these activities are most evident along the Gulf, where offshore exploration and production pose risks to sensitive coastal and marine ecosystems such as dunes, estuaries, and seagrass beds. Seismic surveys and exploratory drilling can disturb marine life, while spills, discharges, and infrastructure development increase the potential for long-term habitat degradation (NOAA, 2016). Inland, pipeline construction and associated facilities fragment terrestrial habitats and alter hydrology in river systems (SELC, 2020). Together, these activities contribute to habitat loss, water and soil contamination, and disturbance to both terrestrial and aquatic SGCN.

3.2 Mining and Quarrying

Mining and quarrying, as defined by the IUCN, include threats from exploring for, developing, and producing mineral resources such as coal, metals, sand, and gravel. In Alabama, coal mining, particularly in the Black Warrior Basin, has historically altered watersheds, contributing to habitat loss, stream channel modification, and sedimentation in rivers that support globally significant freshwater species richness (ADEM, 2019). Limestone quarrying is widespread across the state, removing karst and upland habitats while increasing sediment loads that impair aquatic ecosystems (ADEM, 2019). Sand and gravel extraction, especially from river systems, disrupts streambeds, alters natural hydrology, and reduces habitat quality for mussels, fish, and other aquatic SGCN. Collectively, these activities fragment landscapes, degrade water quality, and present long-term challenges for habitat restoration and species recovery.

3.3 Renewable Energy

Renewable energy, as defined by the IUCN, includes threats from the production of solar, wind, hydropower, tidal, and geothermal energy. In Alabama, hydropower has long been the most significant renewable energy source, with major dams on the Coosa, Tallapoosa, and Tennessee rivers providing electricity but also fragmenting river systems, inundating shoals, and altering natural flow regimes that sustain diverse aquatic life (Alabama Power Company, 2025). More recently, the state has seen rapid growth in solar energy, primarily in large utility-scale projects concentrated in the Black Belt and Tennessee Valley (GMC, 2017), which convert open land and agricultural fields into industrial sites, reducing available habitat and altering landscapes.

Wind development remains limited, but potential expansion into ridge-top areas could pose risks to migratory birds and bats (USFWS, 2021). Along the Gulf Coast, emerging interest in tidal and offshore renewable energy carries additional ecological considerations for coastal and marine habitats (BOEM, 2020; Ocean Conservancy, 2024). While renewable energy is

vital for reducing carbon emissions, its siting and management must be carefully planned to avoid compounding habitat loss and fragmentation in Alabama's already vulnerable ecosystems.

4. Transportation and Service Corridors

Transportation and service corridors, as defined by the IUCN, include threats from long, narrow transport routes and the vehicles that use them. This category encompasses the construction and operation of roads and railroads, utility and service lines such as electrical transmission, pipelines, and communication infrastructure, as well as shipping lanes and aircraft flight paths. These developments can fragment and degrade habitats, increase wildlife mortality through collisions, alter hydrology, and introduce noise and chemical pollution. They also facilitate the spread of invasive species and create long-term barriers to wildlife movement, reducing connectivity across landscapes.

4.1 Roads and Railroads

Roads and railroads, as defined by the IUCN, represent threats from both the construction and use of transportation networks. These corridors can cause direct habitat loss and fragmentation, creating long-term barriers to wildlife movement and reducing landscape connectivity. They are also a source of increased wildlife mortality through vehicle collisions, while contributing to pollution, noise, and light disturbances. Additionally, road and rail networks often serve as pathways for the spread of invasive species and facilitate human encroachment into previously intact habitats, compounding pressures on sensitive ecosystems and SGCN.

In Alabama, the expansion of interstate highways such as I-65, I-20/59, and I-85 has fragmented longleaf pine systems, wetlands, and riparian corridors, reducing habitat connectivity for wildlife (Brudvig et al., 2009). Major rail lines paralleling the Tennessee, Coosa, and Tombigbee rivers further bisect aquatic and floodplain habitats, increasing sedimentation and altering natural drainage patterns (Forman & Alexander, 1998; Trombulak & Frissell, 2000). These corridors contribute to significant wildlife mortality from vehicle collisions, with mammals and herpetofauna particularly affected. They also introduce secondary pressures, including noise and light disturbance, increased stormwater runoff, and the spread of invasive species along right-of-ways. Collectively, Alabama's road and rail networks pose ongoing challenges to landscape connectivity, ecosystem function, and the persistence of many SGCN.

4.2 Utility and Service Lines

Utility and service lines, as defined by the IUCN, include threats from the construction and operation of electrical transmission, water, oil and gas pipelines, and communications

infrastructure. In Alabama, extensive powerline corridors cross longleaf pine systems, wetlands, and upland forests, fragmenting habitats and creating open rights-of-way that facilitate the spread of invasive plants such as cogongrass and Chinese privet (Miller, 2003; USFWS, 2016). Transmission towers and lines can also cause direct mortality for raptors, migratory songbirds, and bats through collisions and electrocution (USFWS, 2016). Oil and gas pipelines, many of which cross the Tennessee, Coosa, and Tombigbee River basins, further disrupt riparian habitats, alter hydrology, and increase sedimentation risks during construction and maintenance (SELC, 2025). While these corridors serve vital human needs, their cumulative impacts reduce habitat connectivity and increase pressures on SGCN.

4.3 Shipping Lanes

Shipping lanes, as defined by the IUCN, include threats from ships and boats, as well as activities such as dredging, anchoring, and port expansion. In Alabama, these impacts are concentrated along the Gulf Coast, specifically in Mobile Bay where the Mobile Ship Channel, dredged regularly to accommodate one of the busiest ports in the United States, alters bottom habitats, increases turbidity, and disrupts seagrass beds and oyster reefs that support fisheries and wildlife (Mobile Baykeeper, 2025). Heavy vessel traffic also poses direct risks of collision and disturbance to SGCN such as the West Indian manatee (Cloyed et al., 2019) and coastal waterbirds (Jarret, 2021). The Dauphin Island Sea Lab and Alabama Marine Mammal Stranding Network have documented five total boat-strike incidents involving manatees in northern Gulf waters since 2013, underscoring the vulnerability of this species to heavy vessel traffic in Mobile Bay and coastal waters. These incidents highlight the importance of monitoring seasonal manatee presence in Alabama, expanding boater awareness programs, and maintaining vessel speed restrictions in sensitive areas to reduce collision risks (Dauphin Island Sea Lab, 2022).

Recreational boating, while economically and culturally important, contributes additional stress through shoreline erosion, propeller scarring in shallow waters, and the spread of invasive aquatic species (USFWS, 2013). Collectively, shipping activities along Alabama's coast represent a major interface between economic development and conservation, requiring careful management to balance commerce with ecosystem health.

4.4 Flight Paths Air

Flight paths, as defined by the IUCN, include threats from the development and operation of airports and regular aircraft routes. In Alabama, these impacts are most evident around major airports such as Birmingham-Shuttlesworth International, Huntsville International, Montgomery Regional, and Mobile Regional, as well as at numerous military airfields. Aircraft operations contribute to noise and light pollution, which can alter wildlife behavior, interfere with bird communication, and disrupt migratory flight patterns (Manci et al., 1998;

Slabbekoorn et al., 2013-2014). Bird strikes pose risks not only to aviation safety but also to species such as raptors and migratory waterfowl, which are vulnerable when flying through low-altitude corridors near airports. Between 1990 and 2023, thousands of wildlife collisions were recorded across U.S. airports, highlighting the risk for avian species traversing low-altitude flight paths in Alabama's airspace (FAA, 2024). Additionally, habitat conversion associated with airport infrastructure often results in the loss of wetlands, grasslands, and forest edges, further reducing habitat availability for SGCN. Together, air transportation infrastructure and flight activity represent a persistent source of disturbance that requires careful monitoring and mitigation in Alabama's conservation planning.

5. Biological Resource Use

Biological resource use, as defined by the IUCN, encompasses threats from the consumptive use of wild biological resources, including both deliberate and unintentional harvesting, as well as persecution or control of specific species. This category covers a wide range of human activities, such as hunting and collecting terrestrial animals, gathering wild plants and fungi, logging and wood harvesting, and fishing or harvesting aquatic resources. These activities may be for subsistence, or commercially driven, conducted legally or illegally, and often result in direct mortality, overharvest, bycatch, or habitat degradation from destructive methods of collection. Collectively, biological resource use can significantly alter population dynamics, reduce species abundance, and disrupt ecosystem balance, placing additional pressures on vulnerable species and habitats.

5.1 Hunting and Collecting Terrestrial Animals

Hunting and collecting terrestrial animals, as defined by the IUCN, includes threats from intentional and unintentional harvest of wildlife for food, sport, trade, or in retaliation. In Alabama, legal hunting is an important cultural and economic activity, with white-tailed deer, wild turkey, and small game providing substantial recreational value. However, unsustainable harvest, poaching, and incidental impacts can pose risks to certain SGCN. For example, illegal take of black bears has been documented (Code of Alabama § 9-11-481), while gopher tortoises and other reptiles are sometimes collected for the pet trade (protected reptiles and amphibians fall under Alabama regulation 220-2-.92). Snakes frequently suffer direct persecution. For instance, a common collection technique in the past was to introduce gasoline fumes into Gopher Tortoise burrows to drive out rattlesnakes. Due to concerns for tortoises and other SGCN, such as the Eastern Indigo Snake, Eastern Diamond-backed Rattlesnake, and Gopher Frog, that are associated with utilizing burrows as refuge, the Alabama Conservation Advisory Board in 2009 unanimously passed a motion to make it "illegal to introduce gasoline or any other noxious chemical for gaseous substance into wildlife burrows, dens or retreats."

Predator species such as coyotes and bobcats are occasionally persecuted as threats to livestock or game, further altering ecosystem dynamics. Non-target species, including turtles, raptors, and small mammals, may also be inadvertently harmed by traps or snares intended for other wildlife. While well-regulated hunting supports conservation funding through license sales and excise taxes, unregulated collecting and retaliatory killing continue to pressure vulnerable populations and habitats in Alabama.

5.2 Logging and Wood Harvesting

Logging and wood harvesting, as defined by the IUCN, include threats from cutting trees and other woody vegetation for timber, fuel, or other uses. In Alabama, these activities have historically shaped the landscape, from the widespread removal of longleaf pine forests during the 19th and 20th centuries to the ongoing conversion of native forests into intensively managed loblolly and slash pine plantations (Outcalt, 1996). Currently, industrial forestry practices rely heavily on fast-growing loblolly and slash pine plantations, which often involve clear-cutting, shortened rotation periods, and heavy herbicide use; practices that simplify forest structure, disrupt soil and water dynamics, and reduce native species richness (Alabama Forestry Commission, 2021). Hardwood bottomland forests along rivers and floodplains have also been heavily impacted by logging, leading to habitat loss for forest-dependent wildlife and increased sedimentation in aquatic systems (Aust, et al., 2012). While sustainable forestry and certification programs are growing, unsustainable wood harvesting practices continue to fragment habitats, reduce species richness, and place additional pressure on SGCN.

5.3 Fishing and Harvesting Aquatic Resources

Fishing and harvesting aquatic resources, as defined by the IUCN, include threats from the removal of aquatic animals and plants for food, materials, or other purposes. In Alabama, both historical and modern practices illustrate these pressures. Commercial mussel harvesting, once widespread in rivers such as the Tennessee and Coosa, severely depleted populations of many native mussel species, contributing to the decline of several, now listed as threatened or endangered (Williams, et al., 1993). Overfishing of riverine species has been compounded by incidental bycatch, which impacts non-target fishes, turtles, and other aquatic SGCN. Along the Gulf Coast, commercial and recreational fisheries targeting shrimp, oysters, and finfish contribute to habitat degradation through dredging, trawling, and the alteration of benthic environments. At the same time, Alabama leads the nation in catfish aquaculture production, with over 14,000 acres of ponds in the Black Belt, creating additional pressures on water use, water quality, and disease transfer to wild fish populations. Collectively, these activities have altered aquatic ecosystems, reduced

species richness, and increased stress on native species, underscoring the importance of sustainable management practices to protect Alabama's freshwater and marine resources.

In the Gulf, shrimp trawling historically accounted for large numbers of Loggerhead and Kemp's Ridley Sea Turtle deaths before the adoption of Turtle Excluder Devices (TEDs) (Crowder and Heppel, 2011). Since 1987, the United States has required all shrimping boats to equip their nets with turtle excluder devices TEDs. Crab traps often catch and drown Diamondback Terrapins, and the use of bycatch-reduction devices may help prevent terrapins from entering the traps (Dorcas et al. 2007).

In 2012 the Alabama Conservation Advisory Board approved regulations banning all commercial collection and killing of wild turtles and their eggs in public and private waters. The regulations are among the most protective state rules to prevent export-driven overharvest of native turtles in the southern United States.

6. Human Intrusion and Disturbance

Human intrusion and disturbance, as defined by the IUCN, refers to threats from human activities that alter, degrade, or disturb habitats and species through non-consumptive uses of biological resources. In Alabama, recreational activities such as beach use, off-road vehicles, and boating can disturb sensitive habitats and wildlife, including sea turtle nesting beaches in Baldwin County and coastal bird rookeries in Mobile Bay. Hiking, hunting, and other outdoor recreation in upland habitats may disturb ground-nesting birds and cause soil compaction or erosion in fragile systems such as longleaf pine sandhills and seepage bogs (Marion, 2017). Military training exercises, particularly at installations located within the longleaf pine ecosystem, contribute to habitat disturbance, though they are often balanced by conservation partnerships that protect large tracts of natural land (USDOD, 2018). Other localized activities, such as scientific research, industrial workforce presence, and utility maintenance, can also disrupt wildlife behaviors and increase human-wildlife interactions (Blumstein et al., 2005; Arlattaz et al.,2007). Collectively, these forms of disturbance fragment habitats, reduce reproductive success for sensitive species, and increase pressure on Alabama's SGCN.

6.1 Recreational Activities

Recreational activities, as defined by the IUCN, are threats from human leisure activities that directly or indirectly impact the environment. In Alabama, these threats are evident in multiple ecosystems and includes use of off-road vehicles, motorboats, jet-skis, and mountain bikes, hikers, birders, pets in recreation areas, temporary campsites, caving, and rock climbing, among others. Along the Gulf Coast, heavy beach use and artificial lighting from coastal recreation disturb nesting sea turtles and shorebirds, reducing hatchling

survival and reproductive success (Witherington et al., 2000; Burger, 1986). Off-road vehicle use in dune systems, streams, seepage bogs, and wetlands, causes soil compaction, vegetation loss, and erosion, degrading habitat for rare plants, fish, mussels, crayfish, and amphibians (Hosier & Eaton, 1980). Boating and water-based recreation in rivers, reservoirs, and coastal bays further contribute to erosion, propeller scarring of aquatic vegetation, and disturbance to manatees and colonial waterbirds. Ill-timed visits to caves can do great harm by rousing hibernating bats, causing them to expend critical energy, or by interfering with females caring for young, and even dropping them (Thomas, 1995; Speakman et al. 1991). Collectively, these recreational pressures compound existing habitat loss and fragmentation, placing additional stress on SGCN.

7. Natural System Modifications

Natural system modifications, as defined by the IUCN, are threats from actions that convert or degrade habitat in the service of managing natural or semi-natural systems for human welfare. In Alabama, these pressures are widespread and have reshaped entire landscapes and river basins. The suppression of natural fire regimes in longleaf pine ecosystems has allowed hardwood encroachment, loss of herbaceous understory, and declines in fire adapted species, requiring prescribed fire to restore ecosystem health (AFC, 2019). Across the Coosa, Tallapoosa, Black Warrior, Tombigbee, and Tennessee Rivers, the construction of large dams and reservoirs has fragmented free-flowing systems, inundated shoals, and altered flow regimes, eliminating critical habitat for aquatic wildlife. Other ecosystem modifications, such as drainage of wetlands, channelization of streams, and shoreline hardening, have reduced floodplain connectivity, increased sedimentation, and degraded habitats vital to amphibians, waterbirds, and freshwater SGCN. Collectively, these modifications have profoundly altered Alabama's ecological systems, making natural disturbance restoration and hydrological management central to long-term conservation.

7.1 Fire and Fire Suppression

Fire and fire suppression, as defined by the IUCN, includes threats from the absence or increase of fire outside of its natural regime. In Alabama, the legacy of widespread fire suppression has dramatically altered ecosystems historically maintained by frequent, low-intensity burns. Longleaf pine forests, once covering vast areas of the Coastal Plain, have experienced hardwood encroachment, loss of their open herbaceous groundcover, and declines in fire-adapted plant and animal species when natural fire regimes were interrupted (Frost, 1993). Similarly, oak woodlands and montane grasslands have lost structural diversity and habitat quality due to the absence of fire. Conversely, unseasonal or high-intensity fires can also damage sensitive systems such as bogs, seepage wetlands, and upland hardwood forests that are not adapted to frequent burning. Prescribed fire has

become an essential management tool across Alabama to restore natural ecosystem processes, reduce hazardous fuel loads, and support the numerous SGCN that depend on fire-maintained habitats.

Prescribed fire, also called prescribed burning or controlled burning, is the intentional application of fire in a defined area under specific weather conditions to achieve natural resource goals. It is one of the most important and effective tools for managing habitat for wildlife in Alabama and across the Southeast. Fire-dependent habitats can be found in every ecoregion of the state, from longleaf pine savannas in the Southern Coastal Plain, to the Southwest Appalachians, and in the high elevation of the Piedmont. A number of fire-dependent plants and terrestrial SGCN would disappear if their habitats were not maintained by fires. Examples include the Red-cockaded Woodpecker, Eastern Indigo Snake, Gopher Tortoise, Pitcher Plants, Bobwhite Quail, and many more.

7.2 Dams and Water Management/Use

Dams and water management or use, as defined by the IUCN, include threats from hydrological modifications such as dams, reservoirs, levees, channelization, drainage, and water withdrawals. In Alabama, these activities have profoundly reshaped river systems and aquatic habitats. The Coosa and Tallapoosa rivers are among the most heavily dammed in the United States, with a series of hydroelectric projects that inundated shoals, altered sediment transport, and eliminated critical spawning and nursery habitat for numerous fishes and mussels, many now listed as threatened or endangered (Alabama Rivers Alliance, nd). On the Tennessee River, impoundments have fragmented formerly free-flowing reaches, reducing connectivity for migratory species and altering downstream water quality. In the Black Belt and Coastal Plain, widespread channelization of streams and drainage of wetlands for agriculture have simplified habitats, reduced floodplain connectivity, and increased sedimentation. Groundwater extraction and surface water withdrawals, particularly in the Coastal Plain and Black Belt, place additional stress on aquifers, springs, and aquatic communities dependent on natural flow regimes (Ponprasit et al., 2023). Collectively, these modifications have contributed to significant declines in Alabama's aquatic species.

7.3 Other Ecosystem Modifications

Other ecosystem modifications, as defined by the IUCN, include threats from actions that alter or degrade habitats in the process of managing natural or semi-natural systems. In Alabama, dredging of the Mobile Ship Channel and associated navigation projects in Mobile Bay and the Gulf Intracoastal Waterway have increased turbidity, altered bottom habitats, and disrupted seagrass beds and oyster reefs critical to marine species (Cushway, 2024). Shoreline hardening through seawalls, bulkheads, and jetties along the Gulf Coast has

disrupted natural sediment transport, accelerating erosion in adjacent areas and reducing coastal resilience (Boyd, 2012). Inland, widespread channelization of streams in the Black Belt and Coastal Plain for agricultural drainage has simplified stream morphology, increased sedimentation, and disconnected floodplains from river channels. Beach nourishment along the Gulf Coast, while important for tourism and storm protection, can bury dune vegetation and alter nesting habitat for sea turtles and shorebirds. Collectively, these modifications reduce the natural function of aquatic and coastal ecosystems and contribute to long term declines in SGCN dependent on intact hydrological and geomorphological processes.

8. Invasive Species, Diseases, and Genes

Invasive species, diseases, and problematic genes, as defined by the IUCN, include threats from non-native organisms, infectious pathogens, diseases, and genetic material that disrupt ecosystems and harm wildlife and their habitats. The movement and introduction of genetic material can alter the natural genetic composition of populations, having detrimental effects on SGCN. In Alabama, invasive plants such as Chinese privet, cogongrass, and kudzu dominate riparian zones, forests, and disturbed habitats, reducing native plant diversity and altering fire regimes. Aquatic non-native species such as the Zebra Mussel, Hydrilla, and Asian Carp compete with native mussels and fishes, clog waterways, and disrupt food webs (Fuller, 2018). Feral hogs are among the most destructive terrestrial invaders, rooting through wetlands, floodplains, and upland forests, causing soil erosion, water contamination, and direct predation on native reptiles, amphibians, and ground-nesting birds (Causey, 2001). As a result, invasive species often outcompete native species in acquiring food, water, shelter and space, which are the four primary factors that comprise wildlife habitat.

Wildlife diseases caused by environmental contaminants, genetic abnormalities or infectious pathogens further threaten SGCN. For instance, wildlife species may face toxicosis or other forms of disease as a result of exposure to human-made or environmental contaminants such as heavy metals, pesticides, or forever chemicals. Infectious diseases also impact SGCN such as the fungal disease in bats, white-nose syndrome, which continues to threaten bat populations across Alabama (Alabama Bat Working Group, 2012). Chytrid fungi affects herpetofauna and aquatic wildlife statewide with concerns about the introduction of another chytrid fungus that is native to East and Southeast Asia, *Batrachochytrium salamandrivorans*. Additionally, the movement and introduction of invasive species can further promote pathogen spread, threatening native wildlife without immunity, in addition to the other negative consequences of invasive species. Collectively, invasive species, pathogens, and genetic risks represent some of the most significant and rapidly expanding threats to SGCN, often compounding other exacerbating threats.

8.1 Invasive Non-Native/Exotic Species

Invasive non-native species, as defined by the IUCN, include plants, animals, and other organisms that occur outside of their natural range and cause harm to native species richness, habitats, or ecosystem processes. Invasive species can usurp native species populations, introduce novel infectious pathogens, alter food webs, and damage ecosystems. There are several examples of introduced, invasive species, including feral cats and European starlings, which place additional depredation and competition pressures on native birds, small mammals, and herpetofauna (Loss et al., 2013; U.S. Department of Agriculture, 2025). Collectively, invasive non-native species continue to expand in range and intensity across Alabama, presenting significant and compounding threats to SGCN and the integrity of native ecosystems.

8.2 Disease

Diseases, as defined by the IUCN, include threats from introduced or native pathogens, including viruses, fungi, bacteria and parasites that negatively affect wildlife and ecosystems. In Alabama, several common and emerging diseases pose serious risks to native fauna. White-nose syndrome, caused by the fungus *Pseudogymnoascus destructans*, has decimated populations of cave-dwelling bats across north and central Alabama, leading to significant declines in species such as the Indiana bat and tri-colored bat. Amphibians and aquatic wildlife are threatened by chytrid fungi and ranaviruses, both of which cause mass mortality events and population instability in frogs, salamanders, and turtles. Other pathogens, including avian influenza and West Nile virus, have the potential to affect birds and mammals across diverse habitats. Collectively, these diseases reduce population viability, exacerbate existing habitat and weather stressors, and represent a growing threat to SGCN.

8.3 Problematic Native Species

Native species can exert problematic ecological effects under altered environmental conditions, often because of human disturbance, habitat fragmentation, or changes in land management. For instance, White-tailed Deer (*Odocoileus virginianus*) have become overabundant in some areas, especially in parks and the fringes of developed areas where hunting is not permitted. Game fish stocked into semi-permanent and normally fishless amphibian breeding ponds can prevent reproduction of some frog and salamander species. Fire-intolerant trees such as Sweetgum, Red Maple, and Eastern Redcedar may invade habitats such as longleaf pine forests, bogs, prairies, and glades if prescribed fire is not part of the management strategy. Native mesopredators such as raccoons (*Procyon lotor*) and Virginia opossums (*Didelphis virginiana*) may reach elevated abundances in fragmented or

urbanized landscapes, increasing nest predation pressure on ground and shrub nesting birds, reptiles, and amphibians. Native beaver (*Castor canadensis*) can also cause localized conflicts by flooding sensitive habitats or impeding aquatic connectivity when population levels are high and unregulated. While these species are integral components of Alabama's ecosystems, their altered population dynamics illustrate how native wildlife can become problematic in modern landscapes, necessitating careful monitoring, adaptive management, and, where appropriate, targeted population control to maintain ecological balance and conserve vulnerable species and habitats.

8.4 Introduced Genetic Material

Introduced genetic material includes genetically modified plants, seed stock, and insects which may be introduced for biocontrol, pesticide resistance, or increased productivity. Introduction of genetic material poses risks to the integrity of native populations leading to loss of adapted traits, genetic homogenization, and reduced fitness (Manning et al., 2022). Introduced genetic material, however, can also be a conservation tool, such as the restoration of the American chestnut (Newhouse et. al. 2014).

9. Pollution

Pollution, as defined by the IUCN, includes threats from the introduction of excess materials or energy from point and nonpoint sources that degrade air, water, and soil quality. In Alabama, agricultural and forestry effluents are among the most widespread contributors to water quality impairment, with fertilizer, pesticides, herbicides, and sediment runoff from croplands in the Black Belt, Tennessee Valley, and Coastal Plain entering streams and rivers, leading to eutrophication and habitat degradation for mussels, fishes, and amphibians (ADEM, 2017). Industrial and municipal effluents, particularly in the Mobile, Tombigbee, and Black Warrior River basins, introduce heavy metals, chemicals, and thermal pollution, placing stress on aquatic ecosystems and downstream estuaries (Black Warrior Riverkeeper, 2017). Urban stormwater runoff from expanding metropolitan areas such as Birmingham, Huntsville, and Montgomery contributes additional nutrient and contaminant loads, further degrading water quality and increasing flash flooding risk (Baldwin County Commission, 2025). Along the Gulf Coast, sewage and solid waste runoff into Mobile Bay, combined with light pollution from coastal development, disturb nesting sea turtles and colonial waterbirds (U.S. Fish and Wildlife Service, 2024). Airborne pollutants, including greenhouse gases and acid deposition from energy production, add additional stressors to terrestrial and aquatic systems (United States Senate, 2000). Collectively, pollution remains one of the most significant and cross-cutting threats to SGCN, potentially causing disease and amplifying the impacts of habitat loss, extreme weather events, and invasive species.

The Alabama Department of Environmental Management (ADEM) conducts a variety of monitoring programs to assess and protect the state's air, land, and water resources. Through its Water Division, ADEM operates statewide surface water and groundwater monitoring networks to evaluate water quality conditions, track compliance with federal Clean Water Act standards, and identify impaired waters for Alabama's 303(d) list. Biological monitoring of fish, macroinvertebrates, and habitat conditions is also performed to assess aquatic ecosystem health and support Total Maximum Daily Load (TMDL) development. In addition, ADEM implements the Nonpoint Source Pollution Monitoring Program, which evaluates nutrient and sediment runoff from agricultural, silvicultural, and urban sources, while its Air Division monitors criteria air pollutants and greenhouse gases to ensure compliance with National Ambient Air Quality Standards (NAAQS). Data from these programs are used to guide regulatory decisions, restoration projects, and conservation planning, making ADEM's monitoring system a cornerstone for understanding and addressing threats to Alabama's wildlife and habitats (**Element 5**).

In 2006, the Alabama Rivers and Streams Network (ARSN), was formed through a coalition of ADCNR, U.S. Fish and Wildlife Service (USFWS), Geological Survey of Alabama (GSA), and Alabama Forestry Commission (AFC), and other non-profit organizations, private companies, and concerned citizens. ARSN completed an assessment of Alabama's streams and rivers and developed Strategic Habitat Units (SHU) and Strategic River Reach Units (SRRUs) (Table 3.2). The SHU were selected based on the presence of Federally listed and State imperiled species, designated critical habitat, and expert knowledge about essential habitat components required for these species to thrive. These SHUs have been designated to improve water quality and quantity, preserve biotic integrity, and promote restoration efforts for Alabama's critical waterways (http://alh2o.org/shus/). The SHU concept promotes multi-agency/organizational partnerships for the purpose of addressing long-term habitat and water quality needs for Alabama's SGCN freshwater species. Biologists collect and analyze aquatic insects and fish as part of non-point source pollution studies and watershed assessment projects (**Element 5**).

Table 3.2 Alabama Strategic Habitat Units (SHUs) by sub-region.

Middle Tennessee - Elk sub-region
Bear Creek
Cypress Creek
Elk River
Limestone Creek
Flint River
Paint Rock River
Tennessee River downstream of Wilson Dam
Tennessee River downstream of Guntersville Dam

Tennessee River downstream of Nickajack Dam

Mobile – Tombigbee sub-region
Sucarnoochee River
Trussels Creek
Sipsey River
Lubbub Creek
Coalfire Creek
Luxapalila Creek
Buttahatchee River
East Fork Tombigbee River
Bull Mountatin Creek
North River
Locust Fork
Mobile - Tensaw River Delta
Lower Tombigbee River

Alabama sub-region
Big Flat Creek
Bogue Chitto Creek
Upper Cahaba River
Hatchet Creek
Yellowleaf Creek
Kelly Creek
Cheaha Creek
Shoal Creek
Big Canoe Creek
Terrapin Creek
Oostanaula River
Uphapee Creek
Upper Tallapoosa River
Lower Alabama River
Coosa River downstream of Jordan Dam
Coosa River downstream of Logan Martin Dam
Lower Choccolocco Creek
Weiss Lake Bypass

Choctawhatchee-Escambia sub-region
Murder Creek
Amos Mill Creek
Five Runs Creek
Upper Pea River
West Fork Choctawhatchee River

Flat Creek
Limestone Creek
Wrights Creek
Bruce Creek
Holmes Creek
Conecuh-Escambia River
Lower Pea River
Lower Choctawhatchee River
Yellow River

Apalachicola sub-region
Upper Chipola River
Uchee Creek
Lower Chipola River

9.1 Household Sewage and Urban Waste

Household sewage and urban wastewater, as defined by the IUCN, include threats from municipal discharges, untreated sewage, septic failures, and stormwater runoff. In Alabama, urban centers such as Birmingham, Huntsville, Montgomery, and Mobile contribute significant municipal wastewater and stormwater inputs to rivers and streams (ADEM, 2022). Combined sewer overflows in older urban areas discharge untreated waste during heavy rain events, increasing nutrient and bacterial loads. In rural counties, particularly across the Black Belt, failing septic systems are a chronic source of untreated wastewater because clay soils hinder proper drainage, allowing raw sewage to enter groundwater, streams, and wetlands (Connelly, 2024). These discharges contribute to nutrient enrichment, algal blooms, oxygen depletion, and pathogen contamination that degrade aquatic habitats and increase health risks for both humans and wildlife. Along the Gulf Coast, urban stormwater runoff carries sediments, oil, heavy metals, and bacteria into Mobile Bay, stressing seagrass beds, oyster reefs, and estuarine habitats critical to SGCN (Dauphin Island Sea Lab, 2016). Collectively, household sewage and urban wastewater remain pervasive, long-term stressors that require infrastructure improvements, stormwater management, and wastewater treatment upgrades to protect Alabama's aquatic ecosystems.

9.2 Industrial Effluents

Industrial effluents, as defined by the IUCN, include pollutants discharged from factories, mills, processing facilities, and power plants into terrestrial, freshwater, and marine systems. In Alabama, discharges from paper mills, chemical plants, steel facilities, and mining operations are concentrated along the Mobile, Tombigbee, Black Warrior, and Tennessee river basins, where industrial activity has historically aligned with major

waterways (ADEM, 2023). These effluents often contain heavy metals, nutrients, hydrocarbons, and other toxic chemicals that degrade water quality, reduce dissolved oxygen, and impair sensitive aquatic communities. Thermal pollution from industrial cooling systems, particularly at power plants, further alters aquatic habitats by raising water temperatures and stressing fish and mussel populations. Downstream ecosystems, including the Mobile-Tensaw Delta and Mobile Bay, are particularly vulnerable to cumulative effects from upstream discharges, where contaminants can settle in sediments, bioaccumulate in aquatic organisms, and disrupt estuarine habitats critical to SGCN. Despite improvements in regulation and treatment, industrial effluents remain a persistent stressor on Alabama's aquatic resources.

9.3 Agricultural and Forestry

Agricultural and forestry effluents, as defined by the IUCN, include nutrient, chemical, and sediment runoff generated from croplands, pastures, and silvicultural operations. In Alabama, fertilizer and pesticide applications in intensive row-crop regions such as the Black Belt, Tennessee Valley, and Coastal Plain contribute significant nitrogen and phosphorus loads to streams and rivers, driving eutrophication, algal blooms, and oxygen depletion that impair fish, amphibian and mussel populations (ADEM, 2018). Poultry litter, widely used as fertilizer in north Alabama, adds additional nutrient and pathogen inputs, elevating risks to aquatic ecosystems (Lamba, 2020). Forestry practices, particularly in industrial pine plantations across the Coastal Plain, contribute to sedimentation and turbidity when clear-cutting, conducting site preparation, and applying herbicides which destabilize soils and alter hydrology (Anderson et al., 2011). Stream crossings and unbuffered logging operations increase erosion and reduce habitat quality for sensitive aquatic species. Collectively, agricultural and forestry effluents represent some of the most pervasive nonpoint source pollutants in Alabama, stressing aquatic communities and reducing habitat viability for numerous SGCN.

9.4 Garbage and Solid Waste

Garbage and solid waste, as defined by the IUCN, refers to rubbish and other solid materials, including municipal and industrial refuse, plastics, and human debris that are deliberately or accidentally released into the environment, resulting in harmful effects on wildlife and ecosystems. In Alabama, these threats are most apparent in aquatic and coastal systems where discarded plastics, fishing gear, and household trash accumulate in rivers, wetlands, and bays. Such materials degrade habitat quality, create entanglement and ingestion risks for SGCN, and alter the ecological integrity of sensitive habitats. Land-based refuse, including illegal dumping and poorly managed landfills, contribute to the contamination of soils and waterways, intensifying stress on aquatic mussels, fish, and coastal bird

populations (ADEM, 2025). Addressing garbage and solid waste is an essential component of safeguarding and maintaining the ecological functions of its terrestrial and aquatic systems.

9.5 Airborne Pollutants

Airborne pollutants, as defined by the IUCN, include atmospheric emissions such as acid rain, smog, greenhouse gases, ozone, mercury, and other particulates that alter the chemical balance of air, water, and soil. In Alabama, airborne pollutants primarily originate from energy production, industrial facilities, and transportation corridors (GASP, nd). These emissions can deposit nitrogen, sulfur, and mercury into waterways and forest systems, compounding stress on aquatic habitats and terrestrial communities (EPA, 2024). Acid deposition contributes to soil acidification and stream impairment in the Appalachian and Piedmont regions, while airborne mercury accumulates in riverine and coastal food webs, increasing risks to fish, mussels, and piscivorous birds (National Acid Precipitation Assessment Program, 2005; Chen, 2012). Addressing airborne pollutants is therefore critical to sustaining water quality, forest health, and long-term resilience for SGCN.

10. Geological and Biological Events

Geological and biological events, as defined by the IUCN, include catastrophic disturbances such as earthquakes, landslides, hurricanes, tornadoes, and floods, as well as large-scale biological events like disease outbreaks, insect infestations, and mass mortality events. In Alabama, while earthquakes and landslides are relatively uncommon, the state is highly vulnerable to hurricanes, tornadoes, and extreme flood events that can rapidly alter habitats, displace species, and fragment ecological communities. Periodic floods within river basins such as the Mobile, Black Warrior, and Tennessee can reshape stream channels, scour mussel beds, and dislodge aquatic vegetation critical to SGCN. Similarly, biological events such as an outbreak of West Nile Virus, mass mortality caused by ranavirus infections, and invasive pest infestations have the potential to cause significant population declines and habitat disruptions. Although these events are often unpredictable and difficult to manage directly, incorporating resilience planning, rapid response capacity, and long-term monitoring into conservation strategies is essential.

11. Severe Weather

Severe weather, as defined by the IUCN, encompass long-term climatic shifts and acute weather events that alter habitat quality, availability, and stability. In Alabama, these threats are already evident through increasing temperatures, more variable precipitation patterns, prolonged droughts, stronger hurricanes, and more frequent flooding (EPA, 2016). Rising sea levels and storm surges threaten coastal marshes, estuaries, and barrier island systems that

support shorebirds and sea turtles (TNC, 2025). Inland, altered rainfall and hydrologic regimes affect the flow stability of rivers such as the Mobile, Tombigbee, and Tennessee, intensifying stress on mussel beds and fish populations already vulnerable to pollution and habitat fragmentation. Temperature extremes and prolonged drought also degrade upland forests, wetlands, and seepage habitats critical for amphibians and reptiles. Because extreme weather events act as a "threat multiplier," magnifying the effects of other stressors such as invasive species, disease, and pollution, it is essential to incorporate adaptation, resilience, and monitoring strategies into Alabama's conservation planning (National Climate Assessment, 2018).

11.1 Habitat Shifting and Alteration

Habitat shifting and alteration, as defined by the IUCN, refers to major changes in habitat composition, structure, or distribution that are often driven by long-term climate change. In Alabama, climate-driven changes in temperature and precipitation patterns are already shifting the suitability of ecosystems across ecoregions (EPA, 2016). Coastal marshes and barrier island systems face landward migration pressures due to sea level rise, while inland, altered hydrology and drought conditions threaten the persistence of bogs, seepage communities, and headwater streams that support amphibians, mussels, and rare plants (Smith et al., 2025); USGS, 2021). Upland forests may experience gradual shifts in dominant tree species as weather envelopes change, affecting habitat availability for birds, bats, and other SGCN (Davenport, 2007). Such alterations not only displace species from historic ranges but also increase their vulnerability to fragmentation, invasive species, and disease. Integrating weather adaptive management strategies, such as protecting migration corridors, conserving landscape connectivity, and planning for shifting habitats is essential for managing SGCN.

11.2 Droughts

Droughts, as defined by the IUCN, are extended periods of below-normal rainfall that diminish water availability and alter habitat quality. In Alabama, drought conditions have become more variable and severe in recent decades, affecting both aquatic and terrestrial systems (Alabama Extension, 2025). Reduced stream flows during prolonged droughts threaten mussel beds, fish spawning habitats, and amphibian breeding pools. Wetland dependent ecosystems such as bogs, seepage slopes, and floodplain forests are particularly vulnerable, as lowered water tables can disrupt plant communities and diminish habitat for SGCN (Alabama Agriculture Experiment Station, 2025). In uplands, drought stress weakens tree health, increasing susceptibility to pests, disease, and wildfire (U.S. Department of Agriculture, 2023). Because drought amplifies other threats, including water quality degradation, invasive species expansion, and habitat fragmentation, conservation

planning must incorporate adaptive strategies such as water resource monitoring, riparian buffer protection, and habitat connectivity to support resilience under changing weather conditions.

11.3 Temperature Extremes

Temperature extremes, as defined by the IUCN, occur when heat or cold conditions fall outside the natural range of variation, placing stress on ecosystems and species. In Alabama, extreme temperatures are projected to increase the frequency and intensity of prolonged heat waves (BHMer, 2023), particularly during summer months, which can reduce dissolved oxygen in streams, stressing fish and mussel populations already vulnerable to pollution and habitat loss. Extreme heat also impacts upland forests by intensifying drought and causing negative consequences to tree health (USFS, 2025). Conversely, unseasonal cold snaps and late frosts may disrupt amphibian breeding cycles, damage sensitive vegetation, and reduce reproductive success for early nesting bird species (Buss, 2021). Because these extremes interact with other pressures, such as altered hydrology, invasive species, and disease, they pose a significant and growing risk to SGCN. Building resilience through habitat connectivity, water quality protection, and adaptive management will be essential to buffer wildlife and ecosystems against these increasingly unpredictable events.

11.4 Storms and Flooding

Storms and flooding, as defined by the IUCN, include extreme weather events such as hurricanes, tornadoes, and heavy rainfall that result in rapid and often destructive hydrological changes. In Alabama, these events pose significant risks to both coastal and inland ecosystems. Along the Gulf Coast, hurricanes and storm surges inundate barrier islands, marshes, and estuaries, leading to erosion, saltwater intrusion, and habitat loss for shorebirds, sea turtles, and estuarine fisheries (USGS, 2020). Inland, intense rainfall and flash flooding reshape stream channels, scour mussel beds, wash away amphibian egg masses, and dislodge aquatic vegetation critical to fish and macroinvertebrate communities (Cushway, 2024). Prolonged flood events also degrade water quality by increasing sedimentation, nutrient loading, and contaminant transport into rivers. Because storms and floods can cause both immediate mortality and long-term ecological shifts, building resilience through floodplain restoration, riparian buffer protection, and conservation of natural hydrologic processes is essential to sustain SGCN during severe weather events.

Threats to Alabama SGCN

Alabama Wildlife, Volume 5 (Shelton-Nix, 2017) provided substantial updated information from the 2012 Nongame Wildlife Conference in identifying threats to SGCN. Additionally, through a series of surveys, meetings, and emails, experts identified the priority

conservation threats to SGCN from each taxa group according to the IUCN list of 10 threats (Table 3.1). Tables 3.3–3.11 list the identified priority threats for SGCN, as identified by experts in 2024 and 2025, for each respective taxa group (Tables 3.3 – 3.11). The crayfish, snail and plant taxa groups have an 11th threat category that indicates no threats were identified because of insufficient data for that species (Tables 3.7, 3.10 & 3.11).

Table 3.3 Amphibian species of greatest conservation need (SGCN) threats.

Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ambystoma bishopi	Reticulated Flatwoods Salamander	EX	X	X				X	X	X		X
Desmognathus auriculatus	Southern Dusky Salamander	EX	X	X				X	X	X		X
Lithobates sevosus	Dusky Gopher Frog	EX	X	X	X		X	X	X	X		X
Cryptobranchus alleganiensis	Hellbender	P1	X	X	X	X	X	X	X		X	X
Desmognathus pascagoula	Pascagoula Dusky Salamander	P1	X					X	X			
Dryophytes andersonii	Pine Barrens Treefrog	P1	X	X	X		X	X	X			
Lithobates areolatus	Crawfish Frog	P1		X	X	X		X	X			X
Lithobates capito	Gopher Frog	P1	X	X	X		X	X	X	X		X
Lithobates heckscheri	River Frog	P1	X		X		X		X	X	X	
Necturus alabamensis	Black Warrior Waterdog	P1	X	X	X	X	X	X	X	X	X	X
Pseudacris ocularis	Little Grass Frog	P1		X				X	X	X		
Ambystoma texanum	Small-mouthed Salamander	P2	X	X		X			X		X	X
Ambystoma tigrinum tigrinum	Eastern Tiger Salamander	P2	X	X		X			X			X
Amphiuma pholeter	One-toed Amphiuma	P2	X						X		X	X
Aneides aeneus	Green Salamander	P2			X	X	X	X	X			X
Desmognathus aeneus	Seepage Salamander	P2	X				X		X			X
Eurycea sphagnicola	Bog Dwarf Salamander	P2	X						X			X
Gyrinophilus palleucus	Tennessee Cave Salamander	P2	X	X			X	X	X		X	X
Lithobates sylvaticus	Wood Frog	P2	X				X		X			X
Necturus maculosus	Mudpuppy	P2	X	X			X		X		X	X

Table 3.3 Amphibian species of greatest conservation need (SGCN) threats.											
Scientific Name	**Common Name**	**Rank**	**Threats**								
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Phaeognathus hubrichti	Red Hills Salamander	P2		X		X	X		X			X
Pseudotriton montanus	Mud Salamander	P2	X	X			X		X			
Siren reticulata	Reticulated Siren	P2		X					X		X	
Siren sphagnicola	Seepage Siren	P2	X						X			X
Anaxyrus quercicus	Oak Toad	P3	X	X			X			X	X	X
Desmognathus ocoee	Ocoee Salamander	P3	X				X	X	X	X		X
Eurycea aquatica	Brown-backed Salamander	P3	X	X			X	X	X			X
Eurycea quadridigitata	Dwarf Salamander	P3	X				X		X			X
Gyrinophilus porphyriticus	Spring Salamander	P3	X	X			X		X		X	X
Hemidactylium scutatum	Four-toed Salamander	P3	X	X			X		X			
Necturus beyeri	Western Waterdog	P3	X	X			X	X	X		X	
Necturus moleri	Apalachicola Waterdog	P3	X	X			X	X	X		X	
Necturus mounti	Escambia Waterdog	P3	X	X			X	X	X		X	
Plethodon serratus	Southern Red-backed Salamander	P3	X				X					
Pseudacris brachyphona	Mountain Chorus Frog	P3	X	X			X					X
Pseudacris ornata	Ornate Chorus Frog	P3	X	X			X		X	X		X
Siren lacertina	Greater Siren	P3		X			X		X	X	X	

Table 3.4 Bird species of greatest conservation need (SGCN) threats.											
Scientific Name	**Common Name**	**Rank**	**Threats**								
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Antigone canadensis pulla	Mississippi Sandhill Crane	EX	X	X					X		X	X
Campephilus principalis	Ivory-billed Woodpecker	EX						X	X			
Corvus corax	Common Raven	EX	X				X	X	X			X
Thryomanes bewickii	Bewick's Wren	EX	X				X		X	X		
Thryomanes bewickii bewickii	Appalachian Bewick's Wren	EX	X				X			X		X
Anarhynchus nivosus	Snowy Plover	P1	X					X	X	X	X	X
Anarhynchus wilsonia	Wilson's Plover	P1	X					X	X	X	X	X
Calidris canutus rufa	Red Knot	P1	X					X	X		X	X
Centronyx henslowii	Henslow's Sparrow	P1	X	X			X		X	X		
Charadrius melodus	Piping Plover	P1	X					X	X	X	X	X
Charadrius nivosus nivosus	Southeastern Snowy Plover	P1	X					X				X
Egretta rufescens	Reddish Egret	P1	X					X	X		X	X
Falco sparverius paulus	Southeastern American Kestrel	P1	X	X	X	X	X		X	X	X	X
Haematopus palliatus	American Oystercatcher	P1	X					X	X	X	X	X
Laterallus jamaicensis jamaicensis	Eastern Black Rail	P1							X	X	X	X
Rynchops niger	Black Skimmer	P1	X					X	X	X	X	X
Setophaga cerulea	Cerulean Warbler	P1	X		X		X		X			X
Ammodramus savannarum	Grasshopper Sparrow	P2	X	X				X	X	X		X
Ammospiza maritima	Seaside Sparrow	P2	X					X	X	X	X	X
Ammospiza maritima fisheri	Louisiana Seaside Sparrow	P2	X						X		X	X

Table 3.4 Bird species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ammospiza nelsoni	Nelson's Sparrow	P2	X						X	X	X	X
Anas fulvigula	Mottled Duck	P2	X				X		X	X	X	X
Aquila chrysaetos	Golden Eagle	P2	X			X		X	X		X	X
Botaurus exilis	Least Bittern	P2	X		X				X	X	X	X
Chordeiles minor	Common Nighthawk	P2	X					X	X			X
Colinus virginianus	Northern Bobwhite	P2	X	X			X		X	X		X
Coturnicops noveboracensis	Yellow Rail	P2	X	X					X	X	X	X
Dryobates borealis	Red-cockaded Woodpecker	P2	X	X		X	X	X	X	X		X
Euphagus carolinus	Rusty Blackbird	P2	X	X			X		X	X		X
Gelochelidon nilotica	Gull-billed Tern	P2	X					X	X	X	X	X
Lanius ludovicianus	Loggerhead Shrike	P2	X	X		X			X	X		X
Peucaea aestivalis	Bachman's Sparrow	P2	X	X			X	X	X	X		
Rallus elegans	King Rail	P2	X			X	X		X	X	X	X
Sterna hirundo	Common Tern	P2	X					X	X		X	X
Sternula antillarum	Least Tern	P2	X			X		X	X	X	X	X
Tringa semipalmata	Eastern Willet	P2	X		X		X	X	X		X	
Ammospiza leconteii	Le Conte's Sparrow	P3	X						X	X		X
Anas rubripes	American Black Duck	P3		X			X	X	X	X	X	X
Antrostomus carolinensis	Chuck-will's-widow	P3	X				X		X		X	X
Antrostomus vociferus	Eastern Whip-poor-will	P3	X	X			X		X			X
Botaurus lentiginosus	American Bittern	P3	X		X	X			X	X	X	X
Butorides virescens	Green Heron	P3	X				X	X	X		X	X

Table 3.4 Bird species of greatest conservation need (SGCN) threats.											
Scientific Name	**Common Name**	**Rank**	**Threats**								
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Chaetura pelagica	Chimney Swift	P3	X	X				X	X			X
Circus hudsonius	Northern Harrier	P3	X	X					X		X	X
Cistothorus palustris marianae	Marian's Marsh Wren	P3	X						X		X	X
Colaptes auratus	Northern Flicker	P3	X				X		X	X		
Columbina passerina	Common Ground-dove	P3					X	X	X		X	
Egretta caerulea	Little Blue Heron	P3	X					X	X		X	X
Egretta tricolor	Tricolored Heron	P3	X					X	X	X	X	X
Elanoides forficatus	Swallow-tailed Kite	P3	X		X		X	X	X			X
Falco sparverius	American Kestrel	P3	X									
Hydroprogne caspia	Caspian Tern	P3										
Mycteria americana	Wood Stork	P3	X	X				X	X			X
Nycticorax nycticorax	Black-crowned Night-heron	P3	X					X	X		X	X
Passerina ciris	Painted Bunting	P3	X					X	X			
Pooecetes gramineus	Vesper Sparrow	P3	X						X			
Porphyrio martinicus	Purple Gallinule	P3	X				X	X	X	X	X	X
Progne subis	Purple Martin	P3							X			
Protonotaria citrea	Prothonotary Warbler	P3	X		X				X			X
Rallus crepitans	Clapper Rail	P3	X		X		X		X	X	X	X
Scolopax minor	American Woodcock	P3	X						X	X		
Spiza americana	Dickcissel	P3	X	X	X				X			
Spizella pusilla	Field Sparrow	P3	X	X					X	X		
Sturnella magna	Eastern Meadowlark	P3	X	X	X				X	X		X
Thalasseus sandvicensis	Sandwich Tern	P3	X					X				X
Tyto furcata	American Barn Owl	P3	X	X		X		X	X	X	X	

Table 3.4 Bird species of greatest conservation need (SGCN) threats.											
Scientific Name	**Common Name**	**Rank**	**Threats**								
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Vermivora cyanoptera	Blue-winged Warbler	P3	X	X	X				X			X

Table 3.5 Mammal species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Bison bison	American Bison	EX					X					
Canis rufus	Red Wolf	EX						X		X		
Cervus elaphus	Elk	EX	X				X	X		X		X
Puma concolor	Cougar	EX						X				
Myotis grisescens	Gray Myotis	P1				X		X		X		
Myotis lucifugus	Little Brown Myotis	P1	X	X	X	X		X	X	X	X	X
Myotis septentrionalis	Northern Myotis	P1	X	X			X	X	X	X		X
Myotis sodalis	Indiana Myotis	P1	X	X			X	X	X	X		X
Perimyotis subflavus	Tri-colored Bat	P1	X	X			X	X	X	X		X
Peromyscus polionotus ammobates	Alabama Beach Mouse	P1	X	X	X	X	X	X	X	X		X
Peromyscus polionotus trissyllepsis	Perdido Key Beach Mouse	P1	X					X				
Sylvilagus obscurus	Appalachian Cottontail	P1	X					X				
Trichechus manatus	West Indian Manatee	P1					X		X	X		X
Ursus americanus floridanus	Florida Black Bear	P1						X			X	
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	P2						X	X	X		
Geomys pinetis	Southeastern Pocket Gopher	P2	X	X	X							X
Lasiurus cinereus	Hoary Bat	P2		X	X	X	X		X			
Lasiurus intermedius	Northern Yellow Bat	P2	X	X	X		X		X			X
Microtus ochrogaster	Prairie Vole	P2	X		X							X
Myotis austroriparius	Southeastern	P2	X	X								

Table 3.5 Mammal species of greatest conservation need (SGCN) threats.											
Scientific Name	**Common Name**	**Rank**	**Threats**								
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	Myotis											
Myotis leibii	Eastern Small-footed Myotis	P2	X	X		X	X	X	X	X		X
Neotoma magister	Allegheny Woodrat	P2	X	X			X		X	X		X
Sorex fumeus	Smoky Shrew	P2						X	X	X		
Sorex hoyi	American Pygmy Shrew	P2					X		X			
Spilogale putorius	Eastern Spotted Skunk	P2					X		X			X
Sylvilagus palustris	Marsh Rabbit	P2	X	X		X	X		X	X		
Zapus hudsonius	Meadow Jumping Mouse	P2						X		X		X
Blarina brevicauda	Northern Short-tailed Shrew	P3	X						X			
Eptesicus fuscus	Big Brown Bat	P3	X									X
Lasionycteris noctivagans	Silver-haired Bat	P3		X						X		
Neogale frenata	Long-tailed Weasel	P3		X	X		X				X	
Neogale vison	American Mink	P3	X	X		X		X	X	X		
Neotoma floridana haematoreia	Southern Appalachian Woodrat	P3	X	X		X						
Ondatra zibethicus	Common Muskrat	P3								X		
Peromyscus maniculatus	Deer Mouse	P3	X							X		
Peromyscus polionotus	Oldfield Mouse	P3										X
Sciurus niger	Eastern Fox Squirrel	P3	X									X
Ursus americanus	American Black Bear	P3	X			X			X			

Table 3.6 Reptile species of greatest conservation need (SGCN) threats.											
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Heterodon simus	Southern Hog-nosed Snake	EX	X	X			X	X	X			
Caretta caretta	Loggerhead Sea Turtle	P1	X	X	X	X	X	X	X		X	X
Chelonia mydas	Green Sea Turtle	P1	X	X	X	X	X	X	X		X	X
Dermochelys coriacea	Leatherback Sea Turtle	P1	X	X	X	X	X	X	X		X	X
Drymarchon couperi	Eastern Indigo Snake	P1	X	X	X	X	X	X	X	X	X	X
Farancia erytrogramma	Rainbow Snake	P1	X	X	X	X	X	X	X		X	
Lepidochelys kempii	Kemp's Ridley Sea Turtle	P1		X	X		X	X	X			X
Malaclemys terrapin pileata	Mississippi Diamond-backed Terrapin	P1	X			X	X	X				X
Micrurus fulvius	Harlequin Coralsnake	P1	X	X		X	X	X	X	X		
Ophisaurus mimicus	Mimic Glass Lizard	P1	X	X	X		X	X	X	X		X
Pituophis melanoleucus lodingi	Black Pine Snake	P1	X	X	X	X	X		X	X		
Pseudemys alabamensis	Alabama Red-bellied Cooter	P1	X	X	X	X		X	X	X	X	X
Sternotherus depressus	Flattened Musk Turtle	P1	X	X	X	X	X	X	X	X	X	X
Crotalus adamanteus	Eastern Diamond- backed Rattlesnake	P2	X	X	X	X	X	X	X	X		
Deirochelys reticularia reticularia	Eastern Chicken Turtle	P2	X	X	X	X	X	x	X			X
Gopherus polyphemus	Gopher Tortoise	P2		X	X	X	X	X	X	X		
Graptemys barbouri	Barbour's Map Turtle	P2	X	X	X	X	X	X	X	X	X	X
Graptemys ernsti	Escambia Map Turtle	P2	X	X		X	X	X	X		X	X
Lampropeltis getula	Common Kingsnake	P2			X	X	X	X	X			
Lampropeltis nigra	Eastern Black Kingsnake	P2			X	X	X	X	X			

Table 3.6 Reptile species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Lampropeltis rhombomaculata	Northern Mole Kingsnake	P2			X	X	X	X	X			
Liodytes pygaea pygaea	Northern Florida Swampsnake	P2	X	X					X			
Nerodia clarkii clarkii	Gulf Saltmarsh Watersnake	P2	X					X	X			X
Nerodia floridana	Florida Green Watersnake	P2				X	X	X	X			
Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	P2		X			X		X			
Pituophis melanoleucus melanoleucus	Northern Pine Snake	P2	X	X	X	X	X		X			
Pituophis melanoleucus mugitus	Florida Pine Snake	P2	X	X	X	X	X		X			
Plestiodon anthracinus anthracinus	Northern Coal Skink	P2										
Plestiodon anthracinus pluvialis	Southern Coal Skink	P2										
Plestiodon egregius similis	Mole Skink	P2		X			X		X			
Plestiodon inexpectatus	Southeastern Five- lined Skink	P2							X			
Sistrurus miliarius miliarius	Carolina Pygmy Rattlesnake	P2					X		X	X		
Sistrurus miliarius streckeri	Western Pygmy Rattlesnake	P2					X		X	X		
Apalone mutica calvata	Gulf Coast Smooth Softshell	P3	X			X	X	X	X		X	
Apalone mutica mutica	Midland Smooth Softshell	P3	X			X	X	X	X		X	
Chrysemys dorsalis	Southern Painted Turtle	P3				X	X			X		
Graptemys pulchra	Alabama Map Turtle	P3	X	X	X		X	X	X	X	X	
Heterodon platirhinos	Eastern Hog-nosed Snake	P3	X	X				X	X	X		
Kinosternon baurii	Striped Mud Turtle	P3		X		X	X	X	X		X	

Table 3.6 Reptile species of greatest conservation need (SGCN) threats.

Scientific Name	Common Name	Rank	Threats									
			1	2	3	4	5	6	7	8	9	10
Lampropeltis calligaster	Yellow-bellied Kingsnake	P3			X	X	X	X	X			
Lampropeltis elapsoides	Scarlet Kingsnake	P3	X			X	X	X	X			
Lampropeltis triangulum	Milksnake	P3			X	X	X	X	X			
Macrochelys temminckii	Alligator Snapping Turtle	P3	X	X		X	X	X	X		X	X
Nerodia cyclopion	Mississippi Green Watersnake	P3				X	X	X	X			
Sternotherus carinatus	Razor-backed Musk Turtle	P3	X	X			X	X	X		X	
Sternotherus minor	Loggerhead Musk Turtle	P3	X	X			X	X	X		X	
Tantilla coronata	Southeastern Crowned Snake	P3					X		X			
Terrapene carolina major	Gulf Coast Box Turtle	P3	X	X		X	X		X			X

Table 3.7 Crayfish species of greatest conservation need (SGCN) threats.

Scientific Name	Common Name	Rank	Threats										
			1	2	3	4	5	6	7	8	9	10	11
Barbicambarus simmonsi	Tennessee Bottlebrush Crayfish	P1	X	X		X		X		X	X		
Cambarus clairitae	Zebra Crayfish	P1	X	X	X	X				X	X		
Cambarus cracens	Slenderclaw Crayfish	P1	X	X			X	X	X	X	X		
Cambarus distans	Boxclaw Crayfish	P1		X			X			X	X		
Cambarus diupalma	Mountain Fork Crayfish	P1	X	X		X			X	X	X		
Cambarus jonesi	Alabama Cave Crayfish	P1	X	X				X	X	X	X	X	
Cambarus laconensis	Lacon Exit Cave Crayfish	P1	X	X		X			X		X	X	
Cambarus pecki	Phantom	P1	X	X				X	X	X	X		

Table 3.7 Crayfish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
	Cave Crayfish												
Cambarus pyronotus	Fireback Crayfish	P1		X						X	X		
Cambarus veitchorum	White Spring Cave Crayfish	P1	X	X				X	X		X	X	
Creaserinus danielae	Speckled Burrowing Crayfish	P1	X					X	X				
Lacunicambarus freudensteini	Banded Mudbug	P1										X	
Lacunicambarus mobilensis	Lonesome Gravedigger	P1							X				
Orconectes sheltae	Shelta Cave Crayfish	P1	X			X		X	X		X	X	
Procambarus barbiger	Jackson Prairie Crayfish	P1											X
Procambarus escambiensis	Escambia Crayfish	P1	X	X									
Procambarus holifieldi	Celestial Crayfish	P1		X									
Cambarellus diminutus	Least Crayfish	P2	X							X	X		
Cambarellus rotatus	Twisted Dwarf Crayfish	P2							X	X			
Cambarus gentryi	Linear Cobalt Crayfish	P2		X	X				X	X	X		
Cambarus howardi	Chattahoochee Crayfish	P2	X	X					X	X	X		
Cambarus lentiginosus	Speckled Crayfish	P2	X	X	X	X			X	X	X		
Cambarus manningi	Greensaddle Crayfish	P2	X	X	X				X	X	X		
Cambarus parvoculus	Mountain Midget Crayfish	P2		X						X	X		
Cambarus rusticiformis	Depression Crayfish	P2		X			X	X	X	X	X		
Cambarus speleocoopi	Sweet Home Alabama Cave Crayfish	P2	X	X		X		X	X	X	X	X	

Table 3.7 Crayfish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Faxonius cooperi	Flint River Crayfish	P2	X	X	X	X		X	X	X	X		
Faxonius durelli	Saddle Crayfish	P2		X	X				X	X	X		
Faxonius jonesi	Sucarnoochee River Crayfish	P2		X						X	X		
Faxonius spinosus	Coosa River Spiny Crayfish	P2		X					X		X		
Hobbseus prominens	Prominence Riverlet Crayfish	P2											X
Procambarus capillatus	Capillaceous Crayfish	P2			X								
Procambarus clemmeri	Cockscomb Crayfish	P2	X	X									
Procambarus evermanni	Panhandle Crayfish	P2	X								X		
Procambarus hagenianus hagenianus	Southeastern Prairie Crayfish	P2		X									
Procambarus hayi	Straightedge Crayfish	P2					X		X				
Procambarus lagniappe	Lagniappe Crayfish	P2					X			X			
Procambarus lecontei	Mobile Crayfish	P2	X	X									
Procambarus planirostris	Flatnose Crayfish	P2											X
Procambarus viaeviridis	Vernal Crayfish	P2	X	X				X					
Cambarellus shufeldtii	Cajun Dwarf Crayfish	P3	X	X						X			
Cambarus bartonii cavatus	Appalachian Brook Crayfish	P3							X				
Cambarus englishi	Tallapoosa Crayfish	P3	X	X					X	X			
Cambarus hamulatus	Prickly Cave Crayfish	P3	X	X		X		X	X	X	X		
Cambarus	Longnose	P3		X						X	X		

Table 3.7 Crayfish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
longirostris	Crayfish												
Cambarus tenebrosus	Cavespring Crayfish	P3	X	X				X	X	X	X		
Cambarus unestami	Blackbarred Crayfish	P3		X				X	X	X	X		
Creaserinus burrisi	Burrowing Bog Crayfish	P3	X			X	X	X	X	X	X		
Creaserinus byersi	Lavender Burrowing Crayfish	P3	X					X	X		X		
Faxonius placidus	Bigclaw Crayfish	P3											X
Lacunicambarus miltus	Rusty Grave Digger	P3	X										
Orconectes australis	Southern Cave Crayfish	P3	X					X	X		X		
Procambarus bivittatus	Ribbon Crayfish	P3											X
Procambarus hubbelli	Jackknife Crayfish	P3		X			X						
Procambarus hybus	Smoothnose Crayfish	P3		X			X						
Procambarus lewisi	Spur Crayfish	P3											X
Procambarus marthae	Crisscross Crayfish	P3		X			X						
Procambarus okaloosae	Okaloosa Crayfish	P3					X						
Procambarus paeninsulanus	Peninsula Crayfish	P3					X						
Procambarus shermani	Gulf Crayfish	P3	X										
Procambarus verrucosus	Grainy Crayfish	P3											X
Procambarus zonangulus	Southern White River Crawfish	P3											X

Table 3.8 Fish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Allohistium cinereum	Ashy Darter	EX						X	X		X	
Ammocrypta vivax	Scaly Sand Darter	EX	X	X				X	X			
Hiodon alosoides	Goldeye	EX						X	X		X	
Lepisosteus platostomus	Shortnose Gar	EX						X	X		X	
Noturus crypticus	Chucky Madtom	EX		X				X	X		X	
Scaphirhynchus platorynchus	Shovelnose Sturgeon	EX			X	X		X	X		X	
Acipenser fulvescens	Lake Sturgeon	EX-CAU		X	X	X	X	X	X	X	X	
Erimonax monachus	Spotfin Chub	EX-CAU		X					X			
Acantharchus pomotis	Mud Sunfish	P1	X	X			X	X	X		X	X
Alburnops chalybaeus	Ironcolor Shiner	P1		X				X	X	X	X	X
Alburnops hypsilepis	Highscale Shiner	P1	X	X				X	X		X	
Alosa alabamae	Alabama Shad	P1		X			X	X	X		X	X
Cottus paulus	Pygmy Sculpin	P1	X				X	X	X	X	X	X
Cyprinella caerulea	Blue Shiner	P1	X	X	X			X	X	X	X	
Cyprinella callitaenia	Bluestripe Shiner	P1	X	X	X			X	X	X	X	
Elassoma alabamae	Spring Pygmy Sunfish	P1	X	X				X	X		X	
Etheostoma birminghamense	Birmingham Darter	P1	X			X		X	X		X	
Etheostoma boschungi	Slackwater Darter	P1	X	X				X	X		X	X
Etheostoma brevirostrum	Holiday Darter	P1		X				X	X			
Etheostoma chermocki	Vermilion Darter	P1	X			X		X	X		X	
Etheostoma corona	Crown Darter	P1	X	X				X	X		X	
Etheostoma cyanoprosopum	Blueface Darter	P1	X	X	X			X	X		X	
Etheostoma gurleyense	Gurley Darter	P1	X			X		X	X		X	
Etheostoma kimberlae	Locust Fork Darter	P1	X	X				X	X		X	
Etheostoma michellae	Sipsey Fork Darter	P1					X		X			X
Etheostoma neopterum	Lollypop Darter	P1	X	X				X	X		X	
Etheostoma nuchale	Watercress Darter	P1	X	X	X	X		X	X		X	
Etheostoma phytophilum	Rush Darter	P1	X	X	X	X		X	X	X	X	
Etheostoma trisella	Trispot Darter	P1	X	X				X	X		X	
Lucania goodei	Bluefin Killifish	P1	X	X		X		X	X		X	

Table 3.8 Fish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Macrhybopsis hyostoma	Shoal Chub	P1	X	X				X	X		X	
Micropterus cataractae	Shoal Bass	P1	X	X			X	X	X	X	X	X
Micropterus warriorensis	Warrior Bass	P1	X	X	X	X		X	X	X	X	
Miniellus albizonatus	Palezone Shiner	P1	X	X	X	X		X	X		X	
Miniellus melanostomus	Blackmouth Shiner	P1	X			X		X	X		X	
Nothonotus camurum	Bluebreast Darter	P1					X		X		X	
Nothonotus wapiti	Boulder Darter	P1	X	X		X		X	X		X	
Notropis ariommus	Popeye Shiner	P1							X		X	X
Noturus munitus	Frecklebelly Madtom	P1	X	X	X	X		X	X		X	
Paranotropis buchanani	Ghost Shiner	P1							X		X	
Paranotropis cahabae	Cahaba Shiner	P1	X	X	X	X		X			X	X
Percina burtoni	Blotchside Logperch	P1	X	X	X	X		X	X		X	
Percina crypta	Halloween Darter	P1	X	X		X		X	X		X	
Percina phoxocephala	Slenderhead Darter	P1	X	X	X	X		X	X		X	
Percina sipsi	Bankhead Darter	P1		X	X	X		X	X		X	
Phenacobius mirabilis	Suckermouth Minnow	P1	X	X	X	X		X	X		X	
Pteronotropis cummingsae	Dusky Shiner	P1	X	X				X	X	X	X	
Pteronotropis euryzonus	Broadstripe Shiner	P1	X	X		X		X	X		X	
Pteronotropis welaka	Bluenose Shiner	P1	X	X		X	X	X	X	X	X	X
Sander sp. cf. vitreus	"Southern Walleye"	P1	X	X	X	X	X	X	X	X	X	
Scaphirhynchus suttkusi	Alabama Sturgeon	P1	X	X	X	X	X	X	X		X	
Speoplatyrhinus poulsoni	Alabama Cavefish	P1							X		X	
Acipenser desotoi	Gulf Sturgeon	P2	X				X	X	X		X	X
Elassoma evergladei	Everglades Pygmy Sunfish	P2	X	X				X	X			
Erimystax dissimilis	Streamline Chub	P2	X	X				X	X		X	
Etheostoma bellator	Warrior Darter	P2	X	X	X			X	X		X	
Etheostoma ditrema	Coldwater Darter	P2	X	X				X	X		X	

Table 3.8 Fish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Etheostoma tuscumbia	Tuscumbia Darter	P2	X	X				X	X			
Etheostoma zonistium	Bandfin Darter	P2	X	X	X	X		X	X		X	X
Hiodon tergisus	Mooneye	P2						X	X		X	
Micropterus chattahoochae	Chattahoochee Bass	P2	X	X			X	X	X	X	X	
Noturus eleutherus	Mountain Madtom	P2		X		X		X	X		X	
Noturus miurus	Brindled Madtom	P2	X	X	X			X	X		X	
Noturus sp. cf. flavus	"Highlands Madtom"	P2	X	X		X		X	X		X	
Percina aurolineata	Goldline Darter	P2	X	X	X	X		X	X		X	
Percina brevicauda	Coal Darter	P2	X	X	X				X		X	
Percina evides	Gilt Darter	P2	X	X	X	X		X	X		X	
Percina tanasi	Snail Darter	P2	X	X					X			
Phenacobius uranops	Stargazing Minnow	P2	X	X	X			X	X		X	
Pteronotropis grandipinnis	Apalachee Shiner	P2	X	X		X		X	X		X	
Alburnops petersoni	Coastal Shiner	P3							X		X	
Alosa chrysochloris	Skipjack Herring	P3						X	X		X	
Ameiurus serracanthus	Spotted Bullhead	P3	X	X					X	X		X
Atractosteus spatula	Alligator Gar	P3				X		X	X		X	
Campostoma pauciradii	Bluefin Stoneroller	P3		X				X	X		X	
Crystallaria asprella	Crystal Darter	P3	X	X				X	X		X	
Cycleptus elongatus	Blue Sucker	P3		X	X			X	X		X	
Cycleptus meridionalis	Southeastern Blue Sucker	P3	X			X		X	X		X	
Cyprinella whipplei	Steelcolor Shiner	P3		X				X	X			
Enneacanthus gloriosus	Bluespotted Sunfish	P3		X				X	X			
Enneacanthus obesus	Banded Sunfish	P3	X	X				X	X		X	
Erimystax insignis	Blotched Chub	P3	X	X				X				
Etheostoma crossopterum	Fringed Darter	P3	X	X				X	X		X	
Etheostoma lynceum	Brighteye Darter	P3	X	X							X	
Fundulus bifax	Stippled Studfish	P3	X	X			X	X	X		X	
Fundulus cingulatus	Banded Topminnow	P3	X	X		X		X	X		X	
Fundulus confluentus	Marsh Killifish	P3						X	X			

Table 3.8 Fish species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Fundulus dispar	Starhead Topminnow	P3	X	X		X		X	X		X	
Fundulus jenkinsi	Saltmarsh Topminnow	P3	X			X		X	X		X	
Fundulus pulvereus	Bayou Killifish	P3	X			X		X	X	X	X	
Hybognathus hayi	Cypress Minnow	P3	X	X	X			X	X		X	
Ichthyomyzon greeleyi	Mountain Brook Lamprey	P3	X	X	X	X		X	X		X	
Ictiobus cyprinellus	Bigmouth Buffalo	P3	X	X	X			X	X	X	X	
Ictiobus niger	Black Buffalo	P3					X					
Leptolucania ommata	Pygmy Killifish	P3	X						X		X	
Lethenteron appendix	American Brook Lamprey	P3	X	X				X	X		X	
Lythrurus fumeus	Ribbon Shiner	P3						X	X		X	
Macrhybopsis etnieri	Coosa Chub	P3	X	X				X	X		X	
Macrhybopsis pallida	Pallid Chub	P3	X	X					X			
Micropterus cahabae	Cahaba Bass	P3	X	X	X	X		X	X	X	X	
Miniellus uranoscopus	Skygazer Shiner	P3	X	X				X	X		X	
Moxostoma carinatum	River Redhorse	P3						X	X			
Moxostoma macrolepidotum	Shorthead Redhorse	P3						X	X			
Nothonotus douglasi	Tuskaloosa Darter	P3	X	X	X			X			X	
Notropis micropteryx	Highland Shiner	P3	X	X				X	X		X	
Notropis photogenis	Silver Shiner	P3		X					X		X	
Paranotropis sp. cf. spectrunculus	"Sawfin Shiner"	P3	X	X				X	X		X	
Percina austroperca	Southern Logperch	P3	X	X	X	X		X	X		X	
Percina lenticula	Freckled Darter	P3	X	X	X	X		X	X		X	
Pteronotropis merlini	Orangetail Shiner	P3	X	X					X			
Pteronotropis signipinnis	Flagfin Shiner	P3							X		X	
Typhlichthys subterraneus	Southern Cavefish	P3							X		X	X
Typhlichthys sp. cf. subterraneus	“Tennessee Cavefish”	P3							X		X	X

Table 3.9 Mussel species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Alasmidonta marginata	Elktoe	EX	X	X	X	X	X	X	X	X	X	X
Dromus dromas	Dromedary Pearlymussel	EX							X		X	X
Elliptio fraterna	Brother Spike	EX	X	X	X	X		X	X	X	X	X
Elliptio nigella	Winged Spike	EX	X	X	X	X		X	X	X	X	X
Elliptoideus sloatianus	Purple Bankclimber	EX		X		X			X	X	X	X
Epioblasma aureola	Golden Riffleshell	EX	X	X	X	X	X	X	X	X	X	X
Epioblasma obliquata	Catspaw	EX	X	X	X	X	X	X	X	X	X	X
Lasmigona subviridis	Green Floater	EX	X	X	X	X	X	X	X		X	X
Obovaria olivaria	Hickorynut	EX							X	X		X
Obovaria retusa	Ring Pink	EX							X	X		X
Ortmanniana pectorosa	Pheasantshell	EX							X	X	X	X
Paetulunio fabalis	Rayed Bean	EX	X	X	X			X	X	X	X	X
Pegias fabula	Littlewing Pearlymussel	EX	X	X	X	X	X	X	X		X	X
Plethobasus cooperianus	Orangefoot Pimpleback	EX							X			X
Pleurobema clava	Clubshell	EX							X			X
Pleurobema hartmanianum	Cherokee Pigtoe	EX			X		X		X	X	X	X
Pleurobema stabile	Coosa Pigtoe	EX	X	X	X	X	X	X	X	X	X	X
Potamilus leptodon	Scaleshell	EX	X	X	X	X	X	X	X		X	X
Ptychobranchus subtentus	Fluted Kidneyshell	EX	X	X	X	X	X	X	X	X	X	X
Theliderma intermedia	Cumberland Monkeyface	EX		X	X	X	X	X	X	X	X	X
Theliderma sparsa	Appalachian Monkeyface	EX		X	X	X	X	X	X	X	X	X
Epioblasma capsaeformis	Oyster Mussel	EX CAU	X	X	X	X	X	X	X	X	X	X
Epioblasma penita	Southern Combshell	EX CAU		X	X	X	X	X	X	X	X	X
Lemiox rimosus	Birdwing Pearlymussel	EX CAU		X	X	X	X	X	X	X	X	X
Medionidus parvulus	Coosa Moccasinshell	EX CAU	X	X	X	X	X	X	X	X	X	X

Table 3.9 Mussel species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Venustaconcha trabalis	Cumberland Bean	EX CAU	X	X	X	X		X	X	X	X	X
Alasmidonta triangulata	Southern Elktoe	P1	X	X	X		X		X	X	X	X
Alasmidonta viridis	Slippershell Mussel	P1	X	X	X	X	X	X	X	X	X	X
Cumberlandia monodonta	Spectaclecase	P1							X	X	X	X
Cyprogenia stegaria	Fanshell	P1		X					X	X	X	X
Elliptio arca	Alabama Spike	P1	X	X				X	X	X	X	X
Elliptio arctata	Delicate Spike	P1	X	X					X	X	X	X
Elliptio chipolaensis	Chipola Slabshell	P1	X	X			X	X	X	X	X	X
Elliptio purpurella	Inflated Spike	P1	X	X			X	X	X	X	X	X
Epioblasma brevidens	Cumberlandian Combshell	P1	X	X	X	X	X	X	X	X	X	X
Epioblasma triquetra	Snuffbox	P1	X	X	X	X	X	X	X	X	X	X
Eurynia dilatata	Spike	P1	X	X	X	X	X	X	X	X	X	X
Fusconaia cor	Shiny Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Fusconaia cuneolus	Finerayed Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Fusconaia subrotunda	Longsolid	P1	X	X	X		X	X	X	X	X	X
Hamiota subangulata	Shinyrayed Pocketbook	P1	X	X		X	X	X	X	X	X	X
Hemistena lata	Cracking Pearlymussel	P1	X	X	X				X	X	X	X
Lampsilis virescens	Alabama Lampmussel	P1	X	X	X	X	X	X	X	X	X	X
Lasmigona etowaensis	Etowah Heelsplitter	P1	X	X	X	X	X	X	X	X	X	X
Lasmigona holstonia	Tennessee Heelsplitter	P1	X	X	X	X	X	X	X	X	X	X
Ligumia recta	Black Sandshell	P1							X	X	X	X
Margaritifera marrianae	Alabama Pearlshell	P1	X	X	X	X	X	X	X	X	X	X
Medionidus acutissimus	Alabama Moccasinshell	P1	X	X	X	X	X	X	X	X	X	X
Medionidus conradicus	Cumberland Moccasinshell	P1	X	X	X	X	X	X	X	X	X	X

Table 3.9 Mussel species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Medionidus penicillatus	Gulf Moccasinshell	P1	X	X	X	X	X	X	X	X	X	X
Obovaria arkansasensis	Southern Hickorynut	P1	X	X	X	X			X	X	X	X
Obovaria choctawensis	Choctaw Bean	P1	X	X	X	X	X	X	X	X	X	X
Obovaria subrotunda	Round Hickorynut	P1	X	X	X	X	X	X	X	X	X	X
Obovaria unicolor	Alabama Hickorynut	P1	X	X	X				X	X	X	X
Ortmanniana abrupta	Pink Mucket	P1							X	X	X	X
Ortmanniana ligamentina	Mucket	P1	X						X	X	X	X
Plethobasus cicatricosus	White Wartyback	P1							X	X	X	X
Plethobasus cyphyus	Sheepnose	P1							X	X	X	X
Pleurobema athearni	Canoe Creek Clubshell	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema beadleianum	Mississippi Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema cordatum	Ohio Pigtoe	P1							X	X	X	X
Pleurobema georgianum	Southern Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema hanleyianum	Georgia Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema oviforme	Tennessee Clubshell	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema perovatum	Ovate Clubshell	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema plenum	Rough Pigtoe	P1							X	X	X	X
Pleurobema pyriforme	Oval Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema rubellum	Warrior Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Pleurobema sintoxia	Round Pigtoe	P1							X	X	X	X

Table 3.9 Mussel species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pleurobema taitianum	Heavy Pigtoe	P1							X	X	X	X
Pleuronaia barnesiana	Tennessee Pigtoe	P1	X	X	X	X	X	X	X	X	X	X
Pleuronaia dolabelloides	Slabside Pearlymussel	P1	X	X	X	X	X	X	X	X	X	X
Ptychobranchus fasciolaris	Kidneyshell	P1	X	X	X	X	X	X	X	X	X	X
Ptychobranchus foremanianus	Rayed Kidneyshell	P1	X	X	X	X	X	X	X	X	X	X
Ptychobranchus greenii	Triangular Kidneyshell	P1	X	X	X	X	X	X	X	X	X	X
Ptychobranchus jonesi	Southern Kidneyshell	P1	X	X	X	X	X	X	X	X	X	X
Pustulosa archeri	Tallapoosa Orb	P1	X	X	X				X	X	X	X
Reginaia rotulata	Round Ebonyshell	P1			X				X	X	X	X
Strophitus undulatus	Creeper	P1	X	X	X	X	X	X	X	X	X	X
Theliderma metanevra	Monkeyface	P1						X	X	X	X	X
Toxolasma corvunculus	Southern Purple Lilliput	P1	X	X	X	X	X		X	X	X	X
Toxolasma cylindrellus	Pale Lilliput	P1	X	X	X	X	X	X	X	X	X	X
Utterbackia peggyae	Florida Floater	P1		X			X	X	X	X	X	X
Cambarunio nebulosus	Alabama Rainbow	P2	X	X	X	X	X	X	X	X	X	X
Cambarunio taeniatus	Painted Creekshell	P2	X	X	X	X	X	X	X	X	X	X
Fusconaia burkei	Tapered Pigtoe	P2	X	X	X	X	X	X	X	X	X	X
Fusconaia escambia	Narrow Pigtoe	P2		X		X	X	X	X	X	X	X
Hamiota altilis	Finelined Pocketbook	P2	X	X	X	X	X	X	X	X	X	X
Hamiota australis	Southern Sandshell	P2	X	X	X	X	X	X	X	X	X	X
Hamiota perovalis	Orangenacre Mucket	P2	X	X	X	X	X	X	X	X	X	X

Table 3.9 Mussel species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Leaunio umbrans	Coosa Creekshell	P2	X	X	X	X	X	X	*X*	X	X	X
Pleurobema decisum	Southern Clubshell	P2	X	X	X	X	X	X	X	X	X	X
Pleurobema strodeanum	Fuzzy Pigtoe	P2	X	X	X	X	X	X	X	X	X	X
Potamilus inflatus	Inflated Heelsplitter	P2				X			X	X	X	X
Pseudodonoideus connasaugaensis	Alabama Creekmussel	P2	X	X	X	X	X	X	X	X	X	X
Pustulosa infucata	Sculptured Pigtoe	P2	X		X	X	X	X	X	X	X	X
Theliderma cylindrica	Rabbitsfoot	P2	X		X	X	X		X	X	X	X
Theliderma johnsoni	Southern Monkeyface	P2							X	X	X	X
Villosa villosa	Downy Rainbow	P2	X	X				X	X	X	X	X
Amblema elliottii	Coosa Fiveridge	P3	X	X			X	X	X	X	X	X
Arcidens confragosus	Rock Pocketbook	P3		X			X		X	X	X	X
Cambarunio iris	Rainbow	P3	X		X	X	X	X	X	X	X	X
Elliptio crassidens	Elephantear	P3					X		X	X	X	X
Elliptio mcmichaeli	Fluted Elephantear	P3	X	X			X		X	X	X	X
Lampsilis fasciola	Wavyrayed Lampmussel	P3	X		X	X	X	X	X	X	X	X
Lasmigona alabamensis	Alabama Heelsplitter	P3		X			X		X	X	X	X
Lasmigona costata	Flutedshell	P3	X	X	X	X	X	X	X	X	X	X
Pseudodonoideus subvexus	Southern Creekmussel	P3	X		X	X	X	X	X	X	X	X
Quadrula nobilis	Gulf Mapleleaf	P3							X	X	X	X
Strophitus williamsi	Flatwoods Creekshell	P3	X	X	X	X	X	X	X	X	X	X
Toxolasma paulum	Iridescent Lilliput	P3	X	X	X	X	X	X	X	X	X	X
Utterbackiana hart-fieldorum	Cypress Floater	P3						X	X	X	X	X
Utterbackiana heardi	Apalachicola	P3						X	X	X	X	X

Table 3.9 Mussel species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	Floater											

Table 3.10 Snail species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Io fluvialis	Spiny Riversnail	EX										X
Leptoxis foremani	Interrupted Rocksnail	EX										X
Lithasia curta	Knobby Rocksnail	EX									X	
Probythinella emarginata	Delta Hydrobe	EX										X
Rhodacmea hinkleyi	Knobby Ancylid	EX										X
Valvata bicarinata	Two-ridge Valvata	EX										X
Elimia varians	Puzzle Elimia	EX										X
Amphigyra alabamensis	Shoal Sprite	X										X
Clappia umbilicata	Umbilicate Pebblesnail	X										X
Elimia brevis	Short Spire Elimia	X										X
Elimia catenoides	Lirate Elimia	X										X
Elimia clausa	Closed Elimia	X										X
Elimia fusiformis	Fusiform Elimia	X										X
Elimia gibbera	Shouldered Elimia	X										X
Elimia hartmaniana	High-spired Elimia	X										X
Elimia impressa	Constricted Elimia	X										X
Elimia jonesi	Hearty Elimia	X										X
Elimia laeta	Ribbed Elimia	X										X
Elimia macglameriana	Wrinkled Elimia	X										X
Elimia pilsbryi	Rough-lined Elimia	X										X
Elimia pupaeformis	Pupa Elimia	X										X
Elimia pupoidea	Bot Elimia	X										X

Table 3.10 Snail species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Elimia pygmaea	Pygmy Elimia	X											X
Gyrotoma excisa	Excised Slitshell	X											X
Gyrotoma lewisii	Striate Slitshell	X											X
Gyrotoma pagoda	Pagoda Slitshell	X											X
Gyrotoma pumila	Ribbed Slitshell	X											X
Gyrotoma pyramidata	Pyramid Slitshell	X											X
Gyrotoma walkeri	Round Slitshell	X											X
Leptoxis clipeata	Agate Rocksnail	X											X
Leptoxis formosa	Maiden Rocksnail	X											X
Leptoxis ligata	Rotund Rocksnail	X											X
Leptoxis lirata	Lirate Rocksnail	X											X
Leptoxis minor	Knob Mudalia	X											X
Leptoxis occultata	Bigmouth Rocksnail	X											X
Leptoxis showalterii	Coosa Rocksnail	X									X		
Leptoxis torrefacta	Squat Rocksnail	X											X
Leptoxis vittata	Striped Rocksnail	X											X
Marstonia olivacea	Olive Marstonia	X											X
Neoplanorbis carinatus	Carinate Flat-top Snail	X											X
Neoplanorbis smithi	Angled Flat-top Snail	X											X
Neoplanorbis tantillus	Little Flat-top Snail	X											X
Neoplanorbis umbilicatus	Umbilicate Flat-top Snail	X											X
Pomatiopsis hinkleyi	Alabama Walker	X											X
Antrorbis breweri	Manitou Cavesnail	P1	X	X	X			X		X	X		
Athearnia anthonyi	Anthony's Riversnail	P1	X								X		
Campeloma decampi	Slender Campeloma	P1	X						X		X		
Elimia annettae	Lilyshoals Elimia	P1	X		X						X		
Elimia bellacrenata	Princess Elimia	P1	X					X	X		X		
Elimia broccata	Brooch Elimia	P1						X	X		X		

Table 3.10 Snail species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Elimia capillaris	Spindle Elimia	P1		X	X						X	X	
Elimia cochliaris	Cockle Elimia	P1	X	X				X	X		X		
Elimia crenatella	Lacy Elimia	P1									X		
Elimia lachryma	Teardrop Elimia	P1				X					X		
Elimia melanoides	Black Mudalia	P1		X	X						X		
Elimia mihalcikae	Latticed Elimia	P1									X		
Elimia nassula	Round-ribbed Elimia	P1	X						X				
Elimia teretria	Auger Elimia	P1						X	X		X		
Elimia ucheensis	Creek Elimia	P1									X		
Elimia vanuxemiana	Cobble Elimia	P1									X		
Fontigens nickliniana	Watercress Snail	P1	X					X	X				
Leptoxis compacta	Oblong Rocksnail	P1			X						X		
Leptoxis coosaensis	Painted Rocksnail	P1									X		
Leptoxis picta	Spotted Rocksnail	P1				X			X		X		
Leptoxis plicata	Plicate Rocksnail	P1		X	X						X		
Lepyrium showalteri	Flat Pebblesnail	P1	X		X			X			X		
Lioplax cyclostomatiformis	Cylindrical Lioplax	P1	X					X	X		X		
Lioplax pilsbryi	Choctaw Lioplax	P1							X		X		
Lithasia salebrosa	Muddy Rocksnail	P1								X	X		
Marstonia pachyta	Armored Marstonia	P1	X					X	X	X			
Pleurocera corpulenta	Corpulent Hornsnail	P1								X	X		
Pseudotryonia grahamae	Salt Spring Hydrobe	P1						X	X				
Rhodacmea cahawbensis	Cahaba Ancylid	P1	X		X			X			X		
Rhodacmea filosa	Wicker Ancylid	P1	X								X		
Stiobia nana	Sculpin Snail	P1						X			X		
Clappia cahabensis	Cahaba Pebblesnail	P2	X		X						X		
Elimia acuta	Acute Elimia	P2	X					X	X		X		

Table 3.10 Snail species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Elimia ampla	Ample Elimia	P2	X	X	X				X		X		
Elimia boykiniana	Flaxen Elimia	P2		X				X	X		X		
Elimia dickinsoni	Stately Elimia	P2		X									
Elimia exusta	Fire Elimia	P2		X									
Elimia olivula	Caper Elimia	P2				X					X		
Elimia perstriata	Engraved Elimia	P2	X					X	X		X		
Leptoxis ampla	Round Rocksnail	P2	X					X	X		X		
Lithasia armigera	Armored Rocksnail	P2									X		
Lithasia lima	Warty Rocksnail	P2							X		X		
Marstonia angulobasis	Angled Marstonia	P2		X				X	X				
Marstonia scalariformis	Moss Pyrg	P2	X					X	X		X		
Tulotoma magnifica	Tulotoma	P2									X		
Amnicola limosus	Mud Amnicola	P3							X		X		
Callinina intertexta	Rotund Mysterysnail	P3							X				
Cincinnatia integra	Midland Siltsnail	P3									X		
Dilatata brogniartiana	Disc Sprite	P3									X		
Elimia alabamensis	Mud Elimia	P3									X		
Elimia albanyensis	Black-crest Elimia	P3	X	X					X		X		
Elimia bellula	Walnut Elimia	P3	X					X	X				
Elimia buffyae	Iris Elimia	P3		X				X	X		X		
Elimia bullula	Yellowleaf Elimia	P3	X	X				X	X		X		
Elimia chiltonensis	Prune Elimia	P3	X					X	X		X		
Elimia clenchi	Slackwater Elimia	P3		X									
Elimia comma	Hispid Elimia	P3	X										
Elimia cylindracea	Cylinder Elimia	P3		X		X					X		
Elimia glarea	Gravel Elimia	P3		X									
Elimia lecontiana	Rippled Elimia	P3									X		
Elimia showalterii	Compact Elimia	P3									X		
Galba cubensis	Carib Fossaria	P3							X				
Lioplax sulculosa	Furrowed Lioplax	P3									X		
Littoridinops	Cockscomb	P3							X				

Table 3.10 Snail species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
monroensis	Hydrobe												
Littoridinops palustris	Bantam Hydrobe	P3							X				
Lyogyrus granum	Squat Duskysnail	P3	X	X				X	X		X		
Marstonia hershleri	Coosa Pyrg	P3						X	X		X		
Marstonia sp.	Cahaba Marstonia	P3	X								X		
Notogillia wetherbyi	Alligator Siltsnail	P3							X				
Planorbula armigera	Thicklip Ramshorn	P3		X								X	
Pleurocera attenuata	Attenuate Hornsnail	P3		X									
Pleurocera brumbyi	Spiral Hornsnail	P3	X								X		
Pleurocera foremanii	Rough Hornsnail	P3							X				
Pleurocera postelli	Broken Hornsnail	P3									X		
Pleurocera showalteri	Upland Hornsnail	P3									X		
Pleurocera trochiformis	Sulcate Hornsnail	P3									X		
Pleurocera vestita	Brook Hornsnail	P3		X	X			X	X				
Pleurocera walkeri	Telescope Hornsnail	P3		X				X	X		X	X	
Pomacea paludosa	Florida Applesnail	P3							X				
Rhapinema dacryon	Teardrop Snail	P3		X							X		
Rhodacmea elatior	Domed Ancylid	P3		X									
Somatogyrus aureus	Golden Pebblesnail	P3									X		
Somatogyrus biangulatus	Angular Pebblesnail	P3									X		
Somatogyrus constrictus	Knotty Pebblesnail	P3									X		
Somatogyrus coosaensis	Coosa Pebblesnail	P3									X		
Somatogyrus crassus	Stocky Pebblesnail	P3									X		
Somatogyrus currierianus	Tennessee Pebblesnail	P3									X		
Somatogyrus	Hidden	P3									X		

Table 3.10 Snail species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
decipiens	Pebblesnail												
Somatogyrus excavatus	Ovate Pebblesnail	P3									X		
Somatogyrus georgianus	Cherokee Pebblesnail	P3									X		
Somatogyrus hendersoni	Fluted Pebblesnail	P3									X		
Somatogyrus hinkleyi	Granite Pebblesnail	P3									X		
Somatogyrus humerosus	Atlas Pebblesnail	P3									X		
Somatogyrus nanus	Dwarf Pebblesnail	P3									X		
Somatogyrus obtusus	Moon Pebblesnail	P3									X		
Somatogyrus pilsbryanus	Tallapoosa Pebblesnail	P3									X		
Somatogyrus pumilus	Compact Pebblesnail	P3									X		
Somatogyrus pygmaeus	Pygmy Pebblesnail	P3									X		
Somatogyrus quadratus	Quadrate Pebblesnail	P3									X		
Somatogyrus sargenti	Mud Pebblesnail	P3									X		
Somatogyrus strengi	Rolling Pebblesnail	P3									X		
Somatogyrus substriatus	Choctaw Pebblesnail	P3									X		
Somatogyrus tennesseensis	Opaque Pebblesnail	P3									X		
Somatogyrus walkerianus	Gulf Coast Pebblesnail	P3									X		

Table 3.11 Plant species of greatest conservation need (SGCN) threats.													
Scientific Name	**Common Name**	**Rank**	**Threats**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Balduina atropurpurea	Purpledisk Honeycombhead	EX	X				X	X	X	X			

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Coreopsis delphiniifolia	Larkspurleaf Tickseed	EX											X
Eleocharis wolfii	Wolf's Spikerush	EX											X
Gaultheria procumbens	Wintergreen	EX											X
Helianthus glaucophyllus	Whiteleaf Sunflower	EX											X
Liparis loeselii	Loesel's Twayblade	EX											X
Najas filifolia	Narrowleaf Naiad	EX		X			X	X	X	X	X		
Najas gracillima	Thread Like Naiad	EX											X
Phoebanthus tenuifolius	Pineland False Sunflower	EX		X					X				
Polygonella fimbriata	Sandhill Jointweed	EX											X
Polygonum glaucum	Seabeach Knotweed	EX											X
Sabulina michauxii	Rock Sandwort	EX											X
Sabulina paludicola	Godfrey's Sandwort	EX											X
Spiranthes brevilabris	Short Lipped Ladies' Tresses	EX	X					X	X	X			
Thermopsis fraxinifolia	Ashleaf Golden Banner	EX											X
Aconitum uncinatum	Blue Monkshood	P1	X	X					X				
Agalinis auriculata	Auriculate False Foxglove	P1											X
Agalinis gattingeri	Gattinger's False Foxglove	P1	X			X		X	X				
Agalinis georgiana	Georgia False Foxglove	P1	X	X				X	X				
Agrimonia incisa	Incised Groovebur	P1		X				X	X				
Allium speculae	Little River	P1	X					X				X	

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
	Canyon Onion												
Ampelaster carolinianus	Carolina Aster	P1											X
Andropogon arctatus	Pinewoods Bluestem	P1		X				X	X				
Arabis georgiana	Georgia Rockcress	P1	X	X			X	X	X	X			
Arabis patens	Spreading Rockcress	P1	X						X				
Aristida mohrii	Mohr's Three Awn	P1		X				X		X			
Aristida simpliciflora	Southern Three Awn	P1		X					X	X			
Arnica acaulis	Leopardsbane	P1											X
Arnoglossum diversifolium	Variable Leaf Indian Plantain	P1		X			X	X	X				
Asclepias connivens	Large Flower Milkweed	P1	X	X		X			X				
Asclepias purpurascens	Purple Milkweed	P1	X			X	X	X		X	X		
Asclepias viridula	Southern Milkweed	P1	X	X				X	X	X			
Asplenium abscissum	Cutleaf Spleenwort	P1	X					X	X			X	
Asplenium monanthes	Single Sorus Spleenwort	P1	X			X		X	X				
Asplenium scolopendrium var. americanum	American Hart's Tongue Fern	P1					X	X				X	
Asplenium tutwilerae	Scott's Spleenwort	P1	X	X				X	X	X			
Astragalus obcordatus	Florida Milkvetch	P1		X				X	X	X			
Astrolepis integerrima	Southwestern Cloak Fern	P1											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Aureolaria patula	Spreading False Foxglove	P1	X	X		X		X	X	X			
Baptisia hirsuta	Hairy Wild Indigo	P1		X				X	X	X			
Berberis canadensis	American Barberry	P1	X	X			X	X	X	X			
Bolboschoenus fluviatilis	River Bulrush	P1											X
Bulbostylis warei	Ware's Hairsedge	P1	X					X	X				
Callirhoe papaver	Woods Poppy Mallow	P1		X				X	X				
Callirhoe triangulata	Clustered Poppy Mallow	P1											X
Calopogon multiflorus	Many Flower Grass Pink	P1	X				X	X	X	X			
Carex acidicola	Acid Loving Sedge	P1	X				X	X	X	X			
Carex austrodeflexa	Southern Sedge	P1											X
Carex austrolucorum	Southern Blue Ridge Sedge	P1											X
Carex baltzellii	Baltzell's Sedge	P1	X	X			X	X	X	X			
Carex barrattii	Barratt's Sedge	P1						X	X				
Carex exilis	Coastal Sedge	P1		X					X	X			
Carex fissa var. aristata	Hammock's Sedge	P1											X
Carex godfreyi	Godfrey's Sedge	P1											X
Carex oklahomensis	Oklahoma Sedge	P1											X
Carex thornei	Thorne's Sedge	P1	X					X	X	X			
Carex timida	Timid Sedge	P1	X				X	X	X	X			
Carex vestita	Velvet Sedge	P1	X					X	X				

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Castilleja kraliana	Cahaba Paintbrush	P1					X	X	X	X			
Celastrus scandens	Climbing Bittersweet	P1											X
Chasmanthium nitidum	Shiny Spikegrass	P1											X
Chrysopsis god-freyi	Godfrey's Golden Aster	P1						X	X	X			
Chrysosplenium americanum	American Golden Saxifrage	P1											X
Cirsium muticum	Swamp Thistle	P1	X	X					X				
Cirsium nuttallii	Nuttall's Thistle	P1		X		X			X				
Cladium mariscoides	Twig Rush	P1											X
Claytosmunda claytoniana	Interrupted Fern	P1											X
Cleistesiopsis bifaria	Small Spreading Pogonia	P1											X
Clematis morefieldii	Morefield's Leather Flower	P1	X			X		X	X	X			
Clematis socialis	Alabama Leather Flower	P1	X			X							
Clematis versicolor	Pale Leather Flower	P1											X
Clethra acuminata	Mountain Pepperbush	P1											X
Clinopodium glabellum	Ozark Savory	P1				X			X	X			
Coelorachis tuberculosa	Florida Jointgrass	P1		X				X		X			
Collinsia verna	Spring Blue Eyed Mary	P1											X
Coreopsis grandiflora var. inclinata	Ketona Tickseed	P1											X
Coreopsis nudata	Georgia Tickseed	P1	X			X		X	X	X	X	X	

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Crataegus alabamensis var. teres	Montgomery Hawthorn	P1											X
Crataegus ashei	Ashe's Hawthorn	P1	X	X		X	X	X	X	X			
Crataegus austromontana	Valley Head Hawthorn	P1											X
Crataegus furtiva	Albany Hawthorn	P1											X
Crataegus meridionalis	Southern Downy Hawthorn	P1											X
Crataegus mollis	Downy Hawthorn	P1											X
Crataegus triflora	Three Flower Hawthorn	P1	X				X	X	X	X			
Croton elliottii	Elliott's Croton	P1		X				X	X				
Cuthbertia rosea	Piedmont Roseling	P1											X
Cypripedium candidum	Small White Lady's Slipper	P1	X	X				X	X				
Cypripedium kentuckiense	Southern Lady's Slipper	P1	X	X				X	X				
Dalea cahaba	Cahaba Prairie Clover	P1						X	X				
Dalea foliosa	Leafy Prairie Clover	P1	X	X		X		X					
Dendrolycopo-dium obscurum	Tree Clubmoss	P1											X
Didiplis diandra	Water Purselane	P1						X		X			
Draba ramosissima	Rocktwist	P1						X	X		X		
Drosera rotundifolia	Roundleaf Sundew	P1											X
Eleocharis bifida	Glades Spikerush	P1		X				X	X				
Epilobium coloratum	Purple Leaf Willow Herb	P1											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Erigeron dolomiticola	Cahaba Daisy Fleabane	P1	X					X					
Eriogonum harperi	Harper's Umbrella Plant	P1	X			X		X	X				
Euphorbia inundata	Florida Pineland Spurge	P1	X	X				X	X				
Eurybia eryngiifolia	Coyote Thistle Aster	P1		X		X		X	X				
Eurybia jonesiae	Jones's Aster	P1		X		X		X	X	X			
Eurybia macrophylla	Large Leaf aster	P1											X
Eustachys floridana	Two Spike Finger Grass	P1	X	X									
Evolvulus sericeus	Creeping Morning Glory	P1											X
Fimbristylis brevivaginata	Glade Fimbrystylis	P1	X					X	X				
Fothergilla milleri	Dwarf Witch Alder	P1		X		X		X	X	X			
Fuirena longa	Chapman's Umbrella Sedge	P1	X						X				
Galactia floridana	Florida Milk Pea	P1		X		X		X	X				
Gordonia lasianthus	Loblolly Bay	P1	X	X				X	X	X			
Gratiola amphiantha	Little Amphianthus	P1	X		X			X			X		
Habenaria quinqueseta	Michaux's Orchid	P1						X	X				
Harperella nodosa	Harperella	P1	X	X				X	X				
Helianthus floridanus	Florida Sunflower	P1											X
Helianthus verticillatus	Whorled Sunflower	P1	X	X		X		X	X	X			
Hexastylis finzelii	Finzel's Wild Ginger	P1						X				X	

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Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Hexastylis rollinsiae	Rollins' Wild Ginger	P1	X			X		X		X			
Hymenophyllum tayloriae	Taylor's Filmy Fern	P1								X		X	
Hypericum lloydii	Lloyd's St. John's Wort	P1						X	X				
Hypericum microsepalum	Flatwoods St. John's Wort	P1		X				X	X	X			
Iris prismatica	Slender Blue Iris	P1	X					X	X	X			
Isoetes boomii	Boom's Quillwort	P1		X		X	X						
Isoetes flaccida	Southern Quillwort	P1		X				X	X				
Isoetes graniticola	Granite Loving Quillwort	P1	X					X					
Isoetes hyemalis	Winter Quillwort	P1	X						X				
Isoetes louisi-anensis	Louisiana Quillwort	P1					X	X					
Isotrema macro-phyllum	Pipevine	P1											X
Juglans cinerea	Butternut	P1											X
Juncus dudleyi	Dudley's Rush	P1											X
Juncus paludosus	Swamp Rush	P1		X					X				
Juniperus communis var. depressa	Ground Juniper	P1										X	
Lachnocaulon engleri	Engler's Bogbutton	P1	X					X	X				
Lathyrus palustris	Vetchling Peavine	P1											X
Leavenworthia crassa	Fleshy Fruit Gladecress	P1	X			X		X		X			
Leavenworthia torulosa	Necklace Gladecress	P1				X		X	X				

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Leptogramma burksiorum	Alabama Streak Sorus Fern	P1					X					X	
Liatris cylindracea	Slender Blazing Star	P1											X
Liatris oligocephala	Cahaba Torch	P1					X	X	X				
Lilium iridollae	Panhandle Lily	P1				X		X	X	X			
Lindera melissifolia	Pondberry	P1	X	X		X	X		X	X			
Lindera subcoriacea	Bog Spicebush	P1		X				X	X	X			
Linum harperi	Harper's Grooved Flax	P1											X
Linum macrocarpum	Flax	P1	X	X				X	X	X			
Lithospermum decipiens	Alabama Marbleseed	P1	X				X						
Lobelia boykinii	Boykin's Lobelia	P1	X	X				X	X				
Lycium carolinianum	Christmas Berry	P1				X		X	X				
Lycopodium clavatum	Running Pine	P1											X
Lygodesmia aphylla	Rose Rush	P1											X
Lysimachia fraseri	Fraser's Loosestrife	P1	X			X			X				
Macranthera flammea	Flame Flower	P1	X			X		X	X	X			
Magnolia fraseri	Fraser's Magnolia	P1										X	
Matelea alabamensis	Alabama Anglepod	P1	X	X			X	X	X	X			
Melanthium woodii	Wood's False Hellebore	P1	X	X						X			
Melica nitens	Three Flower Melic Grass	P1	X	X				X	X	X			

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Micranthes careyana	Carey Saxifrage	P1											X
Mitreola angustifolia	Narrowleaf Hornpod	P1	X	X		X		X	X				
Monotropsis odorata	Sweet Pinesap	P1		X					X				
Oenothera curtissii	Curtiss' Evening Primrose	P1		X		X			X				
Orbexilum lupinellus	Lupine Scurfpea	P1		X				X	X	X			
Orbexilum simplex	Single Stem Scurfpea	P1											X
Orthochilus ecristatus	Crestless Eulophia	P1	X					X	X	X			
Panicum philadelphicum ssp. lithophilum	Flatrock Panic Grass	P1			X			X	X				
Parnassia grandifolia	Large Leaf Grass of Pasrnassus	P1											X
Paronychia americana	American Nailwort	P1											X
Paronychia argyrocoma	Silvery Nailwort	P1	X					X	X				
Paronychia herniarioides	Coastal Plain Nailwort	P1											X
Paronychia virginica	Yellow Nailwort	P1											X
Paysonia densipila	Duck River Bladderpod	P1						X	X	X			
Paysonia lyrata	Lyrate Bladderpod	P1	X	X		X		X	X	X			
Phacelia strictiflora var. robbinsii	Prairie Scorpion Weed	P1											X
Phemeranthus parviflorus	Small Flowered Flame Flower	P1											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Phlox pulchra	Wherry's Phlox	P1		X		X		X	X	X			
Phyllanthopsis phyllanthoides	Maidenbush	P1											X
Physostegia leptophylla	Tidal Marsh Obedient Plant	P1											X
Pilularia americana	American Pillwort	P1	X	X				X					
Pinguicula planifolia	Chapman's Butterwort	P1	X	X				X	X				
Pinguicula pumila	Small Butterwort	P1											X
Pinus serotina	Pond Pine	P1	X	X					X	X			
Pityopsis pinifolia	Sandhill Golden Aster	P1		X				X	X				
Platanthera conspicua	Large White Fringed Orchid	P1											X
Platanthera integra	Yellow Fringeless Orchid	P1											X
Platanthera nivea	Snowy Orchis	P1	X	X		X		X	X	X			
Pleea tenuifolia	Rush Featherling	P1		X				X	X	X			
Polanisia tenuifolia	Slenderleaf Clammyweed	P1	X	X		X			X	X			
Polygala balduinii	White Milkwort	P1											X
Polygala leptostachys	Georgia Milkwort	P1		X					X				
Polygala senega	Senega Snakeroot	P1											X
Polygonella macrophylla	Large Leaf Jointweed	P1	X			X			X				
Primula frenchii	French's Shooting Star	P1	X						X	X			
Pterocaulon virgatum	Wand Blackroot	P1	X	X		X			X	X			

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Pycnanthemum curvipes	Mountain Mint	P1		X				X	X				
Pycnanthemum nudum	Coastal Plain Mountain Mint	P1	X	X		X		X	X	X			
Pycnanthemum virginianum	Virginia Mountain Mint	P1											X
Quercus minima	Dwarf Live Oak	P1	X						X			X	
Quercus oglethorpensis	Oglethorpe's Oak	P1	X	X		X	X		X				
Quercus similis	Bottomland Post Oak	P1	X				X						
Ranunculus longirostris	Eastern White Water Crowfoot	P1											X
Rhexia aristosa	Awned Mead-owbeauty	P1		X					X				
Rhexia parviflora	White Mead-owbeauty	P1	X	X				X	X				
Rhexia salicifolia	Panhandle Meadowbeauty	P1		X			X						
Rhododendron cumberlandense	Cumberland Azalea	P1				X	X	X	X	X		X	
Rhus typhina	Staghorn Sumac	P1											X
Rhynchospora alba	White Beakrush	P1											X
Rhynchospora brachychaeta	West Indian Beakrush	P1	X	X		X			X				
Rhynchospora capillacea	Horned Beakrush	P1											X
Rhynchospora fernaldii	Fernald's Beakrush	P1	X	X		X			X				
Rhynchospora harperi	Harper's Beakrush	P1				X		X	X	X			
Rhynchospora pinetorum	Small's Beakrush	P1	X	X		X			X				
Rhynchospora pleiantha	Brown's Beakrush	P1				X		X	X				

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Rhynchospora stiletto	Stiletto Beaksedge	P1	X	X					X				
Rubus hispidus	Swamp Dewberry	P1											X
Rudbeckia nitida	Shiny Coneflower	P1											X
Rudbeckia palustris	Seep Orange Coneflower	P1											X
Ruellia noctiflora	Night Flowering Wild Petunia	P1		X					X				
Sabatia grandi-flora	Large Flowered Pink	P1											X
Sabatia quadrangula	Four Angled Pink	P1											X
Sabulina fontinalis	Seepage Starwort	P1		X				X	X				
Sagittaria secundifolia	Kral's Water Plantain	P1		X			X	X	X		X		
Salix floridana	Florida Willow	P1		X			X	X					
Sarracenia alabamensis ssp. alabamensis	Alabama Canebrake Pitcher Plant	P1											X
Sarracenia alabamensis ssp. wherryi	Wherry's Sweet Pitcher Plant	P1											X
Sarracenia oreophila	Green Pitcher Plant	P1	X	X				X	X				
Sarracenia rubra ssp. gulfensis	Gulf Coast Red Pitcher Plant	P1											X
Sceptridium jenmanii	Alabama Grapefern	P1	X	X				X	X				
Schoenus nigricans	Blacksedge	P1											X
Schwalbea americana	American Chaffseed	P1		X			X		X	X			
Sedum pusillum	Granite Rock Stonecrop	P1						X	X				

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Sideroxylon thornei	Georgia Bully	P1						X	X	X			
Silene regia	Royal Catchfly	P1											X
Silphium glutinosum	Sticky Rosinweed	P1						X	X	X			
Silphium perplexum	Old Cahaba Rosinweed	P1		X				X	X	X			
Sisyrinchium calciphilum	Glade Blue Eyed Grass	P1						X	X				
Solanum pseudogracile	Dune Nightshade	P1											X
Solanum pumilum	Dwarf Horse Nettle	P1	X		X	X		X	X	X			
Solidago arenicola	Locust Fork Goldenrod	P1						X	X	X			
Solidago leavenworthii	Leavenworth's Goldenrod	P1											X
Solidago porteri	Porter's Goldenrod	P1	X	X									
Spigelia alabamensis	Alabama Pinkroot	P1						X				X	
Spigelia gentianoides	Gentian Pinkroot	P1	X	X				X	X	X		X	
Spiraea tomentosa	Hardhack	P1				X				X		X	
Spiranthes floridana	Florida Ladies' Tresses	P1											X
Spiranthes lucida	Shining Ladies' Tresses	P1											X
Sporobolus curtissii	Pineland Dropseed	P1	X					X	X				
Sporobolus floridanus	Florida Dropseed	P1											X
Stachys alabamica	Alabama Hedge-nettle	P1		X				X					
Stachys nelsonii	Nelson's Hedge-nettle	P1		X				X					

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Steironema gramineum	Grassleaf Loosestrife	P1	X	X				X	X	X			
Steironema lewisii	Lewis' Yellow Loosestrife	P1					X	X					
Stillingia aquatica	Water Toothleaf	P1	X			X		X	X				
Stylisma pickeringii	Pickering's Morning Glory	P1	X	X				X	X	X			
Symphyotrichum chapmanii	Savannah Aster	P1		X			X	X		X			
Symphyotrichum oolentangiense	Sky Blue Aster	P1											X
Synandra hispidula	Guyandotte Beauty	P1											X
Thelesperma filifolium	Stiff Greenthread	P1											X
Thermopsis mollis	Appalachian Golden Banner	P1	X	X		X		X	X				
Thermopsis villosa	Hairy False Lupine	P1						X	X				
Trifolium reflexum	Buffalo Clover	P1						X	X	X			
Trilisa paniculata	Hairy Chaffhead	P1	X	X		X			X	X			
Trillium grandiflorum	Large Flower Trillium	P1											X
Trillium reliquum	Relict Trillium	P1						X	X				
Utricularia olivacea	Dwarf Bladderwort	P1	X			X		X	X	X	X		
Utricularia resupinata	Northeastern Bladderwort	P1											X
Verbena hastata	Blue Vervain	P1											X
Verbesina walteri	Carolina Crownbeard	P1	X	X				X	X				
Viburnum ashei	Ashe's Arrowwood	P1	X	X		X		X		X			

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Viburnum obovatum	Small Leaf Viburnum	P1	X	X		X			X	X			
Viburnum rafinesqueanum	Downy Arrowwood	P1											X
Vitis mustangensis	Mustang Grape	P1											X
Waldsteinia lobata	Piedmont Barren Strawberry	P1						X	X	X			
Warea sessilifolia	Sessile Leaf Warea	P1		X				X	X				
Xerophyllum asphodeloides	Turkeybeard	P1	X	X				X	X				
Xyris brevifolia	Shortleaf Yellow Eyed Grass	P1											X
Xyris chapmanii	Chapman's Yellow Eyed Grass	P1	X	X					X				
Xyris flabelliformis	Savanna Yellow Eyed Grass	P1											X
Xyris isoetifolia	Quillwort Yellow Eyed Grass	P1		X				X	X				
Xyris spathifolia	Ketona Yellow Eyed Grass	P1			X		X	X		X			
Actaea rubifolia	Appalachian Bugbane	P2						X	X				
Agalinis aphylla	Leafless False Foxglove	P2											X
Agalinis divaricata	Pineland False Foxglove	P2		X					X				
Agalinis filicaulis	Thin Stem False Foxglove	P2		X					X				
Agastache nepetoides	Yellow Giant Hyssop	P2											X
Allium tricoccum	Wild Leek	P2											X
Amorpha nitens	Indigo Bush	P2											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Amphicarpum muehlenbergi-anum	Blue Maidencane	P2											X
Amsonia rigida	Stiff Bluestar	P2											X
Andropogon capillipes	Chalky Bluestem	P2											X
Andropogon perangustatus	Narrowleaf Bluestem	P2											X
Apios priceana	Price's Potato Bean	P2	X					X		X			
Aristida spiciformis	Pine Barren Three Awn	P2											X
Asclepias cinerea	Carolina Milkweed	P2											X
Asclepias exaltata	Poke Milkweed	P2											X
Asplenium ruta-muraria	Wall Rue Spleenwort	P2						X	X				
Astragalus villosus	Hoary Milkvetch	P2											X
Baptisia aberrans	Blue Wild Indigo	P2	X					X					
Baptisia megacarpa	Apalachicola Wild Indigo	P2	X	X		X	X	X	X	X			
Blephilia subnuda	Smooth Blephilia	P2	X	X				X		X			
Boykinia aconitifolia	Brook Saxifrage	P2	X					X	X				
Brickellia cordifolia	Flyr's Brickell Bush	P2	X	X		X	X	X	X	X			
Calamovilfa arcuata	Cumberland Sandgrass	P2					X	X					
Calliphysalis carpenteri	Carpenter's Groundcherry	P2					X	X	X				
Callirhoe alcaeoides	Clustered Poppy Mallow	P2											X
Calopogon oklahomensis	Oklahoma Grass Pink	P2											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Canna flaccida	Bandana of the Everglades	P2											X
Carex austrina	Southern Sedge	P2											X
Carex austrocaroliniana	Tarheel Sedge	P2											X
Carex brysonii	Bryson's Sedge	P2	X	X				X		X			
Carex dasycarpa	Velvet Sedge	P2											X
Carex eburnea	Ebony Sedge	P2											X
Carex impressinervia	Impressed Nerve Sedge	P2	X	X				X	X	X			
Carex mesochorea	Midland Sedge	P2											X
Castilleja coccinea	Scarlet Indian Paintbrush	P2											X
Chamaecrista horizontalis	Florida Senna	P2	X	X		X	X	X	X	X			
Chelone lyonii	Pink Turtlehead	P2						X	X	X			
Cirsium lecontei	LeConte's Thistle	P2	X	X					X	X			
Claytonia caroliniana	Carolina Spring Beauty	P2											X
Coelorachis tessellata	Lattion Jointgrass	P2	X	X		X		X	X				
Comandra umbellata	Eastern Bastard Toadflax	P2						X		X			
Coreopsis pulchra	Woodland Tickseed	P2	X	X			X	X	X				
Crataegus aemula	Rome Hawthorn	P2	X					X	X				
Crataegus alabamensis var. alabamensis	Alabama Hawthorn	P2											X
Crataegus alabamensis var. florens	Mississippi Hawthorn	P2											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Crataegus aprica	Sunny Hawthorn	P2											X
Crataegus macrosperma	Eastern Hawthorn	P2											X
Crataegus mendosa	Albertville Hawthorn	P2											X
Crataegus munda	Batesburg Hawthorn	P2											X
Crataegus pruinosa var. pruinosa	Frosted Hawthorn	P2											X
Crataegus quaesita var. quaesita	Florida Hawthorn	P2											X
Crataegus venusta	Red Mountain Hawthorn	P2											X
Crocanthemum arenicola	Coastal Sand Frostweed	P2	X			X		X	X				
Croton alabamensis	Alabama Croton	P2	X	X				X	X				
Cuscuta harperi	Harper's Dodder	P2	X				X	X	X				
Delphinium carolinianum ssp. calciphilum	Glade Larkspur	P2											X
Desmodium floridanum	Florida Tick Trefoil	P2											X
Dichanthelium nudicaule	Naked Stem Witch Grass	P2		X			X		X	X			
Didymoglossum petersii	Dwarf Bristle Fern	P2						X	X				
Drosera tracyi	Tracy's Sundew	P2	X			X		X	X				
Dyschoriste oblongifolia	Oblong Leaf Drychoriste	P2											X
Eleocharis rostellata	Beaked Spikerush	P2	X					X	X				
Elodea canadensis	Broad Waterweed	P2											X

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Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Equisetum arvense	Field Horsetail	P2											X
Erythronium albidum	White Trout Lily	P2											X
Eurybia spectabilis	Showy Aster	P2	X			X		X					
Fimbristylis perpusilla	Harper's Fimbristylis	P2	X	X									
Fothergilla major	Mountain Witch Alder	P2											X
Galium lanceolatum	Torrey's Wild Licorice	P2											X
Hedeoma drummondii	Drummond's Pennyroyal	P2		X					X	X			
Helianthus eggertii	Eggert's Sunflower	P2											X
Helianthus porteri	Confederate Daisy	P2	X					X	X				
Heuchera longiflora	Long Flower Alumroot	P2	X					X	X				
Hexastylis speciosa	Harper's Heartleaf	P2	X		X			X	X	X			
Hibiscus coccineus	Brilliant Hibiscus	P2											X
Hottonia inflata	Featherfoil	P2											X
Huperzia lucidula	Shining Clubmoss	P2											X
Huperzia porophila	Rock Clubmoss	P2	X					X	X				
Hydrophyllum appendiculatum	Appendage Waterleaf	P2											X
Ilex amelanchier	Serviceberry Holly	P2		X					X				
Iva microcephala	Small Head Marsh Elder	P2		X		X			X				
Juncus gymnocarpus	Naked Fruit Rush	P2	X	X			X		X				

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			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Juncus interior	Inland Rush	P2											X
Kalmia hirsuta	Hairy Laurel	P2	X	X				X	X				
Lachnocaulon digynum	Pineland Bogbutton	P2											X
Leavenworthia alabamica	Alabama Glade-cress	P2	X	X		X	X	X	X				
Leavenworthia exigua var. lutea	Pasture Gladecress	P2				X		X	X				
Leavenworthia uniflora	Michaux's Gladecress	P2						X		X			
Liatris chapmanii	Chapman's Gayfeather	P2	X	X					X				
Lilium canadense	Canada Lily	P2											X
Lilium michiganense	Michigan Lily	P2											X
Lilium superbum	Turk's Cap Lily	P2	X	X		X	X	X	X	X			
Liparis liliifolia	Lily Leaf Twayblade	P2											X
Lithospermum molle	False Gromwell	P2											X
Ludwigia arcuata	Pond Seedbox	P2											X
Luziola bahiensis	Brazilian Luziola	P2											X
Lygodium palmatum	Climbing Fern	P2											X
Marshallia mohrii	Mohr's Barbara's Buttons	P2	X			X		X	X	X	X		
Matelea baldwyniana	Baldwin's Milkvine	P2											X
Melanthium hybridum	Slender Bunchflower	P2											X
Melanthium parviflorum	Small Flower False Hellebore	P2											X

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			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Nemastylis geminiflora	Prairie Pleatleaf	P2											X
Neviusia alabamensis	Alabama Snow Wreath	P2	X	X				X	X	X			
Nuphar ulvacea	Sea Lettuce Pondlily	P2	X		X				X	X	X		
Nymphaea mexicana	Banana Water Lily	P2	X			X				X	X		
Oenothera hetero-phylla ssp. orientalis	Alabama Evening Primrose	P2		X		X			X	X			
Paronychia rugelii	Rugel's Nailwort	P2	X	X									
Pediomelum subacaule	Nashville Breadroot	P2	X					X	X				
Penstemon kralii	Kral's Beardtongue	P2	X			X			X	X			
Penstemon multiflorus	Many Flower Beardtongue	P2											X
Perideridia americana	Eastern Yampah	P2	X					X	X				
Persicaria hirsuta	Hairy Smartweed	P2											X
Phacelia dubia var. georgiana	Georgia Scorpion Weed	P2											X
Phacelia maculata	Flatrock Phacelia	P2	X	X					X				
Phemeranthus calcaricus	Limestone Fame Flower	P2	X					X	X				
Phemeranthus teretifolius	Appalachian Rock Pink	P2											X
Physalis arenicola	Cypress Head Ground Cherry	P2				X		X	X	X			
Pieris phillyreifolia	Climbing Fetterbush	P2		X		X		X	X				
Pilea fontana	Springs Clearweed	P2											X

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			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Plantago cordata	Heartleaf Plantain	P2	X					X	X		X		
Platanthera integrilabia	White Fringeless Orchid	P2	X	X		X	X	X	X				
Platanthera lacera	Green Fringed Orchid	P2											X
Platanthera peramoena	Purple Fringeless Orchid	P2											X
Polygala crenata	Crenate Milkwort	P2											X
Polygala hookeri	Hooker Milkwort	P2											X
Polygonella americana	Southern Jointweed	P2	X	X				X					
Polymnia laevigata	Tennessee Leafcup	P2	X	X					X				
Prosartes maculata	Spotted Mandarin	P2											X
Ptilimnium costatum	Ribbed Mock Bishopweed	P2	X	X				X	X				
Quercus boyntonii	Boynton's Sand Post Oak	P2					X		X	X		X	
Quercus georgiana	Georgia Oak	P2	X	X			X		X	X			
Ranunculus flabellaris	Yellow Water Crowfoot	P2											X
Rhododendron colemanii	Red Hills Azalea	P2	X	X		X	X	X	X	X		X	
Rhododendron prunifolium	Plumleaf Azalea	P2	X	X			X	X	X	X		X	
Rhynchospora decurrens	Swamp Forest Beakrush	P2	X	X				X	X				
Rhynchospora macra	Southern White Beakrush	P2		X		X		X	X				
Rhynchospora saxicola	Stone Mountain Beakrush	P2						X	X	X			
Rhynchospora thornei	Thorne's Beakrush	P2		X				X	X				

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Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Ribes cynosbati	Prickly Gooseberry	P2											X
Rubus allegheniensis	Allegheny Blackberry	P2											X
Rudbeckia auriculata	Eared Coneflower	P2	X	X		X		X					
Rudbeckia heliopsidis	Sun Facing Coneflower	P2	X			X	X	X	X	X			
Rudbeckia mollis	Soft Hair Coneflower	P2	X			X		X	X				
Rudbeckia triloba var. pinnatiloba	Pinnate Leaf Coneflower	P2											X
Sabatia brevifolia	Short Leaved Pink	P2											X
Sageretia minutiflora	Small Flower Buckthorn	P2						X	X	X			
Sagittaria isoetiformis	Slender Arrowhead	P2											X
Salvia chapmanii	Chapman's Nettle Leaf Sage	P2	X	X		X	X						
Sarracenia leucophylla	Whitetop Pitcher Plant	P2						X	X	X			
Sarracenia rosea	Rose Pitcher Plant	P2						X	X				
Schisandra glabra	Bay Starvine	P2						X	X				
Schizachyrium maritimum	Gulf Bluestem	P2	X					X	X	X			
Schoenoplectus deltarum	Delta Bulrush	P2	X						X				
Schoenoplectus subterminalis	Water Bulrush	P2											X
Scutellaria alabamensis	Alabama Skullcap	P2	X			X		X	X				
Scutellaria glabriuscula	Glabrous Skullcap	P2	X	X				X	X				
Sedum nevii	Nevius' Stonecrop	P2						X	X				

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Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Sideroxylon reclinatum	Buckthorn	P2						X	X	X			
Silene rotundifolia	Roundleaf Catchfly	P2											X
Sporobolus teretifolius	Wireleaf Dropseed	P2		X					X				
Stewartia ovata	Mountain Camellia	P2	X					X	X				
Stylophorum diphyllum	Celandine Poppy	P2											X
Symphyotrichum elliottii	Elliott's Aster	P2											X
Symphyotrichum pratense	Prairie Aster	P2											X
Thalia dealbata	Powdery Thalia	P2											X
Thalictrum mirabile	Little Mountain Meadowrue	P2						X	X				
Tradescantia ernestiana	Ernest's Spiderwort	P2											X
Trillium sessile	Toadshade	P2											X
Trillium sulcatum	Southern Red Trillium	P2											X
Triphora trianthophoros	Three Birds Orchid	P2											X
Utricularia floridana	Florida Bladderwort	P2	X			X		X	X	X			
Valeriana pauciflora	Valerian	P2											X
Viburnum alabamense	Alabama Arrowwood	P2											X
Viburnum bracteatum	Limerock Arrowwood	P2	X					X					
Viola canadensis	Canada Violet	P2						X	X	X			
Xyris longisepala	Kral's Yellow Eyed Grass	P2	X	X					X				

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Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Xyris louisianica	Louisiana Yellow Eyed Grass	P2	X	X					X				
Xyris serotina	Acid Swamp Yellow Eyed Grass	P2											X
Xyris tennesseensis	Tennessee Yel-low Eyed Grass	P2				X			X				
Zanthoxylum americanum	Northern Pricky Ash	P2	X	X		X		X		X			
Zephyranthes simpsonii	Red Margin Zephyr Lily	P2		X		X		X	X				
Agalinis linifolia	Flax Leaf False Foxglove	P3											X
Agalinis oligophylla	Ridge Stem False Foxglove	P3		X		X			X				
Aplectrum hyemale	Puttyroot	P3											X
Aralia racemosa	American Spikenard	P3											X
Asclepias rubra	Red Milkweed	P3											X
Asplenium bradleyi	Bradley's Spleenwort	P3											X
Astragalus canadensis	Canadian Milkvetch	P3											X
Astragalus tennesseensis	Tennessee Milkvetch	P3		X				X	X				
Bidens cernua	Nodding Beggarticks	P3											X
Boltonia apalachicolensis	Apalachicola Doll's Daisy	P3	X				X						
Carex decomposita	Cypress Knee Sedge	P3											X
Clinopodium talladeganum	Talladega Wild Basil	P3						X	X				
Corallorhiza odontorhiza	Autumn Coralroot	P3											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Cotinus obovatus	American Smoketree	P3											X
Crataegus alabamensis var. ravenelii	Ravenel's Hawthorn	P3											X
Crataegus alleghaniensis	Allegheny Hawthorn	P3											X
Crataegus calpodendron	Pear Hawthorn	P3											X
Crataegus frugiferens	Fruitful Allegheny Hawthorn	P3											X
Crataegus lacrimata	Pensacola Hawthorn	P3											X
Crataegus opaca	Riverflat Hawthorn	P3											X
Crataegus pruinosa var. gattingeri	Gattinger's Frosted Hawthorn	P3											X
Crataegus quaesita var. egens	Sand Barren Hawthorn	P3											X
Crataegus quaesita var. floridana	Jacksonville Hawthorn	P3											X
Crataegus sargentii	Sargent's Hawthorn	P3											X
Crataegus sororia	Sister Hawthorn	P3											X
Crataegus visenda	Bristol Hawthorn	P3											X
Croomia pauciflora	Croomia	P3	X						X	X			
Dalea gattingeri	Gattinger's Prairie Clover	P3											X
Danthonia epilis	Bog Wild Oatgrass	P3											X
Delphinium alabamicum	Alabama Larkspur	P3	X	X				X		X			

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Desmodium ochroleucum	Cream Tick Trefoil	P3	X			X		X	X	X			
Diarrhena americana	American Beakgrain	P3											X
Echinacea simulata	Prairie Purple Coneflower	P3	X	X		X							
Eleocharis melanocarpa	Black Fruit Spikerush	P3											X
Eleocharis robbinsii	Robbins' Spikerush	P3											X
Elymus churchii	Church's Wild Rye	P3		X					X				
Eriocaulon lineare	Narrow Pipewort	P3											X
Eriocaulon texense	Texas Pipewort	P3											X
Eupatorium anomalum	Florida Thoroughwort	P3	X					X					
Eurybia surculosa	Creeping Aster	P3						X		X			
Galactia mollis	Soft Milk Pea	P3											X
Geum vernum	Spring Avens	P3											X
Helanthium tenellum	Mud Babies	P3											X
Helianthus longifolius	Longleaf Sunflower	P3						X		X			
Helianthus smithii	Smith's Sunflower	P3		X					X				
Hymenocallis coronaria	Shoals Spider Lily	P3						X	X		X		
Hypericum dolabriforme	Straggling St. John's Wort	P3											X
Hypericum nudiflorum	Pretty St. John's Wort	P3											X
Isoetes appalachiana	Appalachian Quillwort	P3											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Isoetes butleri	Butler's Quillwort	P3											X
Isoetes piedmontana	Piedmont Quillwort	P3	X	X				X	X				
Isotria verticillata	Large Whorled Pogonia	P3											X
Jamesianthus alabamensis	Jamesianthus	P3		X		X		X	X	X	X		
Juncus georgianus	Georgia Rush	P3	X		X			X					
Juncus nodatus	Stout Rush	P3											X
Kosteletzkya pentacarpos	Southern Seashore Mallow	P3											X
Lepuropetalon spathulatum	Little People	P3											X
Lilaeopsis carolinensis	Carolina Lilaeopsis	P3											X
Ludwigia spathulata	Spathulate Seedbox	P3	X	X			X	X	X				
Mikania cordifolia	Florida Keys Hempweed	P3		X		X				X			
Mirabilis albida	Pale Umbrella Wort	P3											X
Monarda clinopodia	Basil Beebalm	P3											X
Muhlenbergia sobolifera	Cliff Muhly	P3											X
Nestronia umbellula	Nestronia	P3											X
Oxalis grandis	Giant Woodsorrel	P3											X
Panicum philadelphicum	Philadelphia Panic Grass	P3											X
Physalis angustifolia	Coastal Ground Cherry	P3						X	X				
Pinguicula primuliflora	Small Butterwort	P3	X	X				X	X	X			

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Pityopsis oligantha	Coastal Plain Golden Aster	P3		X					X				
Psilotum nudum	Whiskfern	P3											X
Pyrularia pubera	Buffalo Nut	P3											X
Quercus macrocarpa	Bur Oak	P3	X	X					X	X			
Rhododendron austrinum	Orange Azalea	P3	X			X	X	X		X		X	
Rhododendron minus	Carolina Rhododendron	P3	X				X	X					
Rhynchospora crinipes	Mosquito Beakrush	P3	X	X					X				
Rhynchospora microcephala	Small Head Beakrush	P3											X
Rhynchospora stenophylla	Chapman Beakrush	P3											X
Rhynchospora tracyi	Tracy's Beakrush	P3											X
Sabatia capitata	Rose Gentian	P3		X			X						
Silene caroliniana var. wherryi	Wherry's Catchfly	P3											X
Silphium brachiatum	Cumberland Rosinweed	P3	X				X		X			X	
Silphium mohrii	Mohr's Rosin-weed	P3											X
Solidago brachyphylla	Dixie Goldenrod	P3	X			X			X				
Solidago buckleyi	Buckley's Gold-enrod	P3	X					X	X				
Spiranthes longilabris	Giant Spiral Ladies' Tresses	P3											X
Stellaria corei	Chickweed	P3					X	X					
Stenanthium texanum	Crow Poison	P3											X

Table 3.11 Plant species of greatest conservation need (SGCN) threats.												
Scientific Name	**Common Name**	**Rank**	**Threats**									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Stewartia malacodendron	Silky Camellia	P3	X					X	X				
Stylisma aquatica	Water Southern Morning Glory	P3											X
Symphyotrichum kralii	Kral's Aster	P3							X				
Symphyotrichum simmondsii	Simmond's Aster	P3											X
Thalictrum debile	Southern Meadowrue	P3					X	X					
Thalictrum macrostylum	Piedmont Meadowrue	P3											X
Trillium pusillum var. ozarkanum	Ozark Wakerobin	P3	X	X		X	X	X					
Trillium recurvatum	Prairie Trillium	P3											X
Trillium rugelii	Southern Nodding Trillium	P3						X	X				
Trillium vaseyi	Vasey's Trillium	P3											X
Uvularia floridana	Florida Bellwort	P3						X	X				
Veronicastrum virginicum	Culver's Root	P3											X
Viola egglestonii	Eggleston's Violet	P3	X						X				
Xyris scabrifolia	Harper's Yellow Eyed Grass	P3	X	X			X		X				
Xyris stricta	Pineland Yellow Eyed Grass	P3											X

ALABAMA INVASIVE SPECIES

Introduction

Invasive species represent one of Alabama's most critical conservation challenges. The spread of non-native organisms poses serious threats to Species of Greatest Conservation Need (SGCN) across the Southeast. These species, once established, can outcompete native populations, degrade habitats, and disrupt ecological processes. Many SGCN are highly vulnerable because invasives compete for limited resources, alter food webs, and displace native species. The impacts are loss of species richness, long-term ecosystem change, and millions of dollars in management costs each year. Effective control relies on early detection, consistent monitoring, and rapid response, paired with strong public awareness and engagement to prevent new introductions. Alabama Administrative Code 220-2-.26, governs restrictions on the possession, sale, importation, and release of certain animals and fish in the state to prevent ecological disruption of invasive species, reduce risks of disease and predator threats to native species, and ensure proper regulation of wildlife commerce and management in the state.

Alabama has formed several invasive species programs and initiatives that span government agencies, citizen science reporting, management plants, and outreach efforts (Table 3.12) (**Element 5**).

Table 3.12 Alabama Invasive Species Programs

Program	Lead Agency	Mission
Cogongrass Mitigation Program	Mobile Bay Natural Estuary Program	Assists private landowners reduce Cogongrass infestations.
Aquatic Nuisance Species (ANS) Plan	Alabama Wildlife & Freshwater Fisheries	Combats invasive aquatic species through monitoring, prevention, and control initiatives.
Wild Spotter App & Invasive Species Ambassador Training	Alabama Cooperative Extension System	Supports the Wild Spotter Program to equip volunteers to identify and report invasive species via a mobile app.
Weed Warriors	University of Alabama Arboretum	A volunteer initiative where participants receive training to identify and remove invasive plants.

Alabama Coastal Foundation	The Nature Conservancy & Others	Coordinated volunteer driven invasive species removals in coastal areas.
Mobile Bay National Estuary Program Invasive Management	Mobile Bay Natural Estuary Program	Manages, and when possible, eradicates invasive species in the Mobile Bay watershed through habitat restoration and public involvement.
Auburn Mapping Program	City of Auburn	Auburn's Landscape and Sustainability Division maps the spread of exotic species within city limits and green spaces.
Alabama Invasive Plant Council	Various Partners	Serves as a hub for promoting invasive plant management and best practices and collaboration among professionals and land managers. Identifies top ten worst invasive weeds in the Southeast (Appendix 3.1).
Alabama Fire Ant Management Program	Auburn University, Alabama A&M, Alabama Cooperative Extension, and U.S. Department of Agriculture-Agriculture and Industries	Implements and monitors biological control agents.

Terrestrial

Invasive terrestrial invasives identifies as having severe negative effects on SGCN. Control measures for these species have met with limited success. Three species of parasitic flies (*Pseudacteon* spp.,) have been purposely introduced into Alabama as part of the Alabama Fire Ant Management Program based at Auburn University. These flies are thought to be important in regulating fire ant populations in South America. It is hoped that they will reduce the overall level of fire ants as they spread across Alabama. The Alabama Feral Hog Control Council's objectives are to disseminate information, to promote and conduct effective research, and to consult with policy makers and to give advice to people on feral hog control. The proliferation of invasive plants is principally abetted by anthropogenic disturbances. While disturbance is a normal part of natural ecosystem dynamics, in many systems the alteration of disturbance regimes and the introduction of novel disturbances produce

increased opportunities for invasion (Hobbs 2000). The fragmentation of forest habitats by residential development and land management practices create patches of disturbed land and opportunities for invasion, and the linear openings formed by roads and utility rights-of-way serve as the pathways for spread of invasives. Invasive woody shrubs (e.g., Multiflora Rose, Autumn Olive, and Tallowtree) typically appear in forest openings because they produce abundant fruit and seeds carried long distances by birds. Other species produce abundant seeds or propagate by root fragments that are transported on vehicle tires or the soles of hiking shoes. Woody shrubs are also typical invaders in grassland habitats, especially old fields where mowing and other management mechanisms have been curtailed. In pastures, invasive shrubs with abundant thorns (e.g., Multiflora Rose) are mostly avoided by grazing animals and may eventually overrun some fields. A list of terrestrial invasives in Alabama, the threat they pose, and where they can be found (Table 3.3), and watchlist of potential invasive species threats on the horizon (Table 3.5) are provided.

Aquatic

With over 132,000 miles of rivers and streams; 563,000 acres of ponds, lakes and reservoirs; over 3.6 million acres of marshes and wetlands (ARA 2020); 60 miles of coast with 400,000 acres of estuaries (EAL 2020), Alabama offers a wealth of water resources to sustain the states fish, mussel, snail, and crayfish species richness that surpasses all states (Garner 2017; Henderson and Smith 2017; Rider 2017). While Alabama's abundance of water resources provides ideal habitats for the more than 795 species from these taxa, they also act as a conduit for the invasion of aquatic nuisance species. Although some non-native species exist with native species in Alabama, they are relatively benign and cause little ecological impacts. However, other non-native species are harmful and defined as Aquatic Nuisance Species (ANS) that are introduced outside of their native ranges that can grow in or are closely associated with the aquatic environment. These species (e.g., aquatic plants, fish, mussels, snails, and crayfish) can alter, damage, or destroy these resources, affecting aquatic species richness, ecology, human health, and the state's economy. Examples of problematic ANS in Alabama include hydrilla, water hyacinth, giant salvinia, zebra mussels, island apple snails, bighead carp, and silver carp.

Many anthropogenic introductions of ANS to Alabama's waterways, some deliberate while others accidental, pose a significant threat to aquatic ecosystems and the SGCN within them. These species can have harmful effects on the local economy, human health, and ecology. For example, silver carp (*Hypophthalmichthys molitrix*) have recently invaded the Tennessee River basin and have the potential to negatively affect native (i.e., sport and imperiled) fish distribution and abundance by competing for phytoplankton and zooplankton. This can affect local economies if sportfish populations decline causing anglers to limit their fishing expenditures due to poor population conditions. This example

exemplifies how ANS can negatively affect Alabama and why a proactive approach is pivotal to prevent, control, and minimize ANS threats like that of silver carp.

With more than 6,600 invasive species established across the conterminous United States (Simpson and Eyler 2018), and many more on the horizon, the overwhelming need to formulate management actions to abate ANS issues was identified by WFF, along with members of the Alabama ANS Task Force. In November 2021, the Alabama ANS Management Plan (Appendix 3.2) was approved by the U.S. Fish and Wildlife Service ANS Task Force, and subsequent funding was acquired to develop the statewide Alabama ANS program. The newly formed program addresses pathways and species for comprehensive management with the goal of preventing, controlling, and managing the introduction of new and existing ANS in Alabama to minimize impacts on native species, environmental quality, human health, and economics. Strategies developed for the Alabama ANS program to achieve these goals include:

1. Coordinate local, state, regional, federal, and international activities and programs pertaining to ANS.
2. Prevent, control, and manage the introduction and spread of new and existing ANS through education about species and pathways, targeting the general public, industries, user groups, government agencies, and non-governmental agencies.
3. Eliminate, control, and manage ANS through monitoring, early detection, and rapid response.
4. Prevention of ANS through legislation, regulation, and enforcement.

These strategies will be important in protecting Alabama's aquatic SGCN, and their habitats, most susceptible to the spread of existing, and the introduction of new invasive species to the state's waterways. A more comprehensive look at strategies and action items proposed to combat ANS can be found in the Alabama ANS Management Plan, along with the appropriate program contacts, on our agency website:
https://www.outdooralabama.com/research/aquatic-nuisance-management-plan
Detailed ANS profiles currently affecting Alabama's waterways and other invaders on the horizon are found here as well.

Based on information regarding ANS in neighboring states and across the nation, strong threats to Alabama's aquatic SGCN are on the horizon. With direct connection to bordering states waterways, Alabama's potential for the expansion of existing and documentation of new ANS is high. Identifying the pathways in which these problems can arise and focusing efforts on education and awareness to all stakeholders is important. Increased coordination by the Alabama ANS program with representatives from state and federal agencies, academia, research institutes, and private sector industries will bolster eradication and

management efforts. Coordination with these representatives, coupled with continued monitoring of Alabama waterways, educational awareness of issues faced, and new regulations aimed to prevent entry of new ANS and minimize the spread of existing ANS in the state will be pivotal in conserving aquatic SGCN and their habitats in Alabama.

The issues ANS pose to Alabama's SGCN can be complicated to measure, requiring a multidisciplinary approach toward resolution. Because prevention is the most effective means to manage ANS, it is important to identify existing ANS as well as species with potential to cause future problems. The task of compiling a complete list of verified ANS currently in Alabama was met through multiple intra- and inter-agency discussions. Through these discussions, database queries, and subject matter experts' input, a list of ANS for Alabama waterways by general taxa group (Table 3.13). Additionally, Table 3.14 provides a list of invasive aquatic plants. A watchlist of potential ANS threats on the horizon is also provided (Table 3.15).

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
AMPHIBIANS					
Eleutherodactylus planirostris	Greenhouse Frog	Disease introduction	Amphibians	Southeastern Plain (Gulf Coast)	Swamp, Bogs & Seepage Communities, Riparian & Floodplain Forest, Anthropogenic, Isolated Wetlands & Ponds
Osteopilus septentrionalis	Cuban Tree Frog	Direct competition for food and space; disease introduction	Frogs	Southeastern Plain (Gulf Coast)	Swamp, Bogs & Seepage Communities, Riparian & Floodplain Forest, Anthropogenic, Isolated Wetlands & Ponds
Hemidactylus garnotii	Indo-Pacific House Gecko	Direct competition for food and space	Lizards, bats, frogs	Statewide	ALL
Hemidactylus frenatus	Typical House Gecko	Direct competition for food and space	Lizards, bats, frogs	Statewide	Anthropogenic
Gekko monarchus	Spotted House Gecko	Direct competition	Lizards, bats, frogs	Statewide	ALL

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		for food and space			
Incilius nebulifer	Gulf Coast Toad	Direct competition for food and space	Fowler's Toad, Southern Toad	Statewide	Coastal Prairies, Wetlands, Pine Flatwoods, Anthropogenic
Tarentola mauritanica	Moorish Gecko	Direct competition for food and space	Lizards, bats, frogs	Statewide	ALL
REPTILES					
Salvator merianae	Black and White Argentine Tegu	Direct competition for food and space; predation on eggs of sea turtles, tortoises, and ground nesting birds; disease introduction	Ground nesting birds, shorebirds, sea turtles, Gopher Tortoise	Statewide	ALL
Norops sagrei	Brown Anole	Direct competition for food and space; predation on amphibians and reptiles	Amphibi-ans and reptiles	Statewide	ALL
Trachemys scripta elegans	Red-eared Slider	Direct competition	Native turtles	Statewide	ALL

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		for food and space; habitat degradation; hybridization with native species; disease introduction			
Indotyphlops braminus	Brahminy Blinksnake	Direct competition for food and space	Southea-stern Crowned Snake, Worm Snake, and other small amphibi-ans and reptiles	Statewide	ALL
BIRDS					
Columba livia	Rock Pigeon	Direct competition for food and space; habitat destruction; disease introduction	Woodpe-ckers, Barn Owl	Statewide	ALL
Lonchura punctulata	Scaly-breasted Munia	Direct competition for food and space; disease introduction	Purple Martin	Southern Coastal Plain	ALL

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
Passer domesticus	House Sparrow	Direct competition for food and space	Purple Martin, Northern Flicker, Tree Swallow	Statewide	ALL
Sturnus vulgaris	European Starling	Direct competition for food and space	Woodpeckers, Purple Martin, American Kestrel	Statewide	ALL
Streptopelia decaocto	Eurasian Collared Dove	Direct competition for food and space; disease introduction	ALL SGCN Birds	Statewide	ALL
MAMMALS					
Dama dama	Fallow Deer	Direct competition for food and space; disease introduction; habitat degradation	Ground nesting birds and small mammals	Southern Coastal Plain	ALL
Felis catus	House Cat	Direct predation on birds, mammals, and herps; disease introduction	Birds, mammals	Statewide	ALL
Mus musculus	House Mouse	Direct competition for food and	Alabama Beach Mouse,	Statewide	Anthropogenic and

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		space; disease introduction	Perdido Key Beach Mouse, small mammals, birds, and reptiles		Woody Areas
Myocastor coypus	Nutria	Habitat degradation; disease introduction	Waterfowl, wading birds, marsh birds, amphibia-ns, fish, and mussels	Southeas-tern Plains, Southwes-tern Appalach-ians	Freshwater Marshes, Swamp, Anthropog-enic
Rattus rattus	Roof Rat	Direct competition for food and space; predation on nests, eggs, and young ground nesting birds, small mammals, frogs, lizards & snakes; disease introduction	Alabama Beach Mouse, Perdido Key Beach Mouse, small mammals, birds, and reptiles	Statewide	Anthropog-enic
Rattus norvegicus	Norway Rat	Direct competition for food and habitat;	Alabama Beach Mouse, Perdido Key	Statewide	Anthropog-enic, Woodlands, and many

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		predation on nests, eggs, and young ground nesting birds, small mammals, frogs, lizards & snakes; disease introduction	Beach Mouse, possibly other small mammal, bird, and reptile SGCN		other habitats near human settlements
Sus scrofa	Feral Swine	Direct competition for food and space; predation on nests, eggs, and young birds, small mammals, frogs, lizards, and snakes; habitat destruction and degradation; disease introduction; spread invasive plants	Small mammals, Black Bear, Bobwhite Quail, birds, Gopher Tortoise, sea turtles, amphibians, and reptiles	Statewide	Wet Pine Savanna & Flatwoods; Maritime Forest & Coastal Scrub
CRAYFISH					
Faxonius juvenilis	Kentucky River crayfish	Direct competition for food and	Coosa River Spiny Crayfish,	Ridge and Valley	Medium Streams, Reservoirs

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		space; direct predation; disease introduction	native snails of Coosa River		and Large Lakes, Large Rivers
Faxonius palmeri palmeri	Gray-Speckled Crayfish	Direct competition for food and space	Longsnout Crayfish	Ridge and Valley	Medium Streams, Reservoirs and Large Lakes, Large Rivers
Faxonius virilis	Virile Crayfish	Direct competition food and space; direct predation	Slendercl-aw, Boxclaw and Mountain Midget Crayfish	Southwest ern Appalachi ans, Ridge and Valley, Piedmont	Medium Streams, Reservoirs and Large Lakes, Large Rivers
FISH					
Alosa aestivalis	Blueback Herring	Direct competition for food and space	Skipjack Herring	Piedmont	Reservoirs and Large Lakes, Large Rivers
Archocentrus nigrofasciatus	Convict Cichlid	Direct competition for food and space; direct predation in Cahaba River	Cahaba Bass, Cahaba Shiner; Any Cahaba endemic. Other predator or omnivore natives (Skipjack Herring,	Southeast ern Plains	Medium Streams, Reservoirs and Large Lakes, Estuaries

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
			Alabama Shad)		
Astronotus ocellatus	Oscar	Direct competition for food and space; direct predation on smaller fish	Blackmouth Shiner Other small predators or small omnivore natives	Southeastern Plains, Southern Coastal Plain	Medium Streams, Reservoirs and Large Lakes, Estuaries
Carassius auratus	Goldfish	Direct competition for food and space; direct predation of fish eggs; habitat destruction through rooting and increased turbidity	Bigmouth Buffalo, Black Buffalo, River Redhorse, Shorthead Redhorse.	Statewide	Headwaters, Springs, and Small Streams, Medium Streams, Large Rivers, Reservoirs and Large Lakes
Ctenopharyngodon idella	Grass Carp	Direct competition for food and space; direct predation on aquatic insects and disturb habitats	Bigmouth Buffalo, Alabama Sturgeon or other small to medium omnivores, some insectivores.	Statewide	Isolated Wetlands and Ponds, Medium Streams, Large Rivers, Reservoirs and Large Lakes

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
Cyprinella lutrensis	Red Shiner	Direct competition for food and space with smaller native Cyprinids; dilute gene pools of native Cyprinella	Blue Shiner	Piedmont, Southeastern Plains	Headwaters, Springs, and Small Streams, Medium Streams, Large Rivers, Reservoirs and Large Lakes
Cyprinus carpio	Common Carp	Direct competition for food and space; habitat destruction and increases turbidity; predation on small fish, eggs, and larvae	Black Buffalo, River Redhorse, Shorthead Redhorse	Statewide	Headwaters, Springs, and Small Streams, Medium Streams, Large Rivers, Reservoirs and Large Lakes
Cyprinus rubrofuscus	Koi	Direct competition for food and space; direct predation as omnivore, consume fish eggs and larvae	Black Buffalo, River Redhorse, Shorthead Redhorse	Statewide	Headwaters, Springs, and Small Streams, Medium Streams, Large Rivers, Reservoirs and Large Lakes

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
H. molitrix x nobilis	Silver x Bighead Carp	Direct competition for food and space; plankton, omnivore resource competitor	Bigmouth Buffalo or other small filter-feeding fishes	Southwes-tern Appalach-ians, Interior Plateau, Southeas-tern Plains	Medium Streams, Reservoirs and Large Lakes, Large Rivers
Hypophthalmic hthys molitrix	Silver Carp	Direct competition for food and space	Bigmouth Buffalo, Skipjack Herring or other small filter-feeding fishes.	Southwes-tern Appalach-ians, Interior Plateau, Southeas-tern Plains	Medium Streams, Reservoirs and Large Lakes, Large Rivers
Hypophthalmic hthys nobilis	Bighead Carp	Direct competition for food and space; plankton, omnivore resource competitor	Bigmouth Buffalo, Skipjack Herring	Statewide	Medium Streams, Reservoirs and Large Lakes, Large Rivers
Misgurnus anguillicaudat-us	Pond Loach (not in ALANS Plan)	Direct competition for food and space; resource competitor for macroinverte brates; predator on	Tullatoma Snail, Coosa Coldwater Darter, Stippled Studfish	Statewide	Medium Streams, Reservoirs and Large Lakes, Large Rivers

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		small invertebrates			
Mylopharyngo-don piceus	Black Carp	Direct competition for food and space with native species; predation on native mussels and snails	Black Buffalo, River Redhorse, Shorthead Redhorse	Southeas-tern Plains, Southern Coastal Plain	Reservoirs and Lakes, Large Rivers
Oreochromis aureus	Blue Tilapia	Direct competition for food and space. Direct predation native fishes.	Coastal Shiner, Cypress Minnow; Blackmout h Shiner; coastal natives in Fundulus	Southeast ern Plains, Southern Coastal Plain	Isolated Wetlands and Ponds, Medium Streams, Reservoirs and Large Lakes, Large Rivers
Oreochromis mossambicus	Mozambiq-ue Tilapia	Direct competition for food and space; direct predation native fishes		Southeas-tern Plains, Southern Coastal Plain	Isolated Wetlands and Ponds, Medium Streams, Reservoirs and Large Lakes, Large Rivers

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
Oreochromis niloticus	Nile Tilapia	Direct competition for food and space; direct predation native fishes; introduced foreign parasites	Coastal Shiner, Cypress Minnow; Blackmouth Shiner. Any small P3 coastal natives in Fundulus	Southeastern Plains, Southern Coastal Plain	Isolated Wetlands and Ponds, Medium Streams, Reservoirs and Large Lakes, Large Rivers
Phractocephalus hemioliopterus	Redtail Catfish	Direct competition for food and space; predation on small to medium size native fishes (reach up to 1.3 m, 80 Kg); habitat generalist of large bodies water and estuaries	Saltmarsh Topminnow, Alligator Gar	Southeastern Plains, Southern Coastal Plain	Reservoirs and Large Lakes, Large Rivers, Estuaries
Piaractus brachypomus	Red-bellied Pacu	Direct competition for food and space; direct predation on native plants and plankton as larvae	Any larval or adult fishes utilizing zooplankton, soft vegetation	Southeastern Plains, Southern Coastal Plain	Medium Streams, Large Rivers, Isolated Wetlands and Ponds, Estuaries

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
Poecilia reticulata	Guppy	Direct competition for food and space	Coastal Shiner, Cypress Minnow; Blackmouth Shiner; any small natives in Fundulus	Southern Coastal Plain	Medium Streams, Large Rivers, Isolated Wetand and Ponds, Estuaries
Pterygoplichthys sp.	Sailfin Armored Catfish	Direct competition for food and space; habitat destruction from burrowing	Florida Manatee, herbivorous turtles	Southern Coastal Plain	Headwaters, Springs, and Small Streams, Medium Streams
Tilapia zillii	Redbelly Tilapia	Direct competition for food and space; habitat destruction of native plants	Native Centrarchids. Coastal Shiner, Cypress Minnow; Blackmouth Shiner; any small natives in Fundulus	Southeastern Plains, Southern Coastal Plain	Isolated Wetlands, Medium Streams, Reservoirs and Large Lakes, Large Rivers
MUSSELS					
Corbicula fluminea	Corbicula clam or Freshwater Golden Clam	Direct competition for food and space	Alabama Pearlshell, Ropund Ebonyshell, Southern	Statewide	Medium Streams, Reservoirs and Large

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
			Kidneyshell, Canoe Creek Clubshell, Alabama Hellsplitter		Lakes, Large Rivers
Dreissena polymorpha	Zebra Mussel	Direct competition for food and space	Native unionids	Interior Plateau, Southwestern Appalachians, Southeastern Plains	Reservoirs and Large Lakes, Large Rivers
SNAILS					
Cipangopaludina chinensis	Chinese mysterysnail	Direct competition for space	Native detritivores and algivorous snails	Southeastern Plains	Reservoirs and Large Lakes, Large Rivers
Cipangopaludina japonica	Japanese mysterysnail	Direct competition for food and space; alters benthic community structure	Native detritivores and algivorous snails.	Southeastern Plains	Reservoirs and Large Lakes, Large Rivers
Melanoides tuberculata	Red-rim melania	Direct competition for food and space; introduce non-native parasites; predation on	Blackmouth Shiner, Pygmy Killifish; egg masses of any native snails,	Southeastern Plains, Southern Coastal Plain	Isolated Wetlands and Ponds, Medium Streams, Large Rivers, Reservoirs

Table 3.13 Alabama Invasive List

Scientific Name	Common Name	Threat(s)	Species at Risk	Ecoregion	Course Habitat
		native snails and fish	small shiners or darters		and Large Lakes
Pomacea diffusa	Spike-topped applesnail	Direct competition for food and space	Native coastal snails, amphibia-ns	Southern Coastal Plain	Medium Streams
Pomacea maculata	Island or Giant Apple Snail	Direct competition for food and space; predation on native amphibian and fish eggs; habitat destruction	Native amphibian and fish; Pickerel Frog, Northern Leopard Frog and American Toad	Southeas-tern Plains, Southern Coastal Plain	Medium Streams
Pomacea paludosa	Florida applesnail	Direct competition for food and space	Round Ebonyshell	Southern Coastal Plain	Large Rivers
INSECTS					
Solenopsis invicta	Fire Ants	Predation on eggs, hatchlings, and young	Sea turtles, birds, amphibia-ns, Bob-white Quail, ground nesting birds & reptiles	Statewide	ALL

Table 3.14 Alabama Aquatic Invasive Plant List

Scientific Name	Common Name	Habitat
Alternanthera philoxeroides	Alligatorweed	Aquatic
Colocasia esculenta	Wild Taro, Elephant Ears, Coco Yam	Aquatic
Cyperus blepharoleptos	Cuban Bulrush	Aquatic
Egeria densa	Brazilian Elodea, Egeria, Waterweed	Aquatic
Eichhornia crassipes	Common Water Hyacinth	Aquatic
Hydrilla verticillata	Water Thyme; Hydrilla	Aquatic
Iris pseudacorus	Yellow Iris	Aquatic
Landoltia punctata	Dotted Duckweed	Aquatic
Ludwigia uruguayensis	Uruguayan Waterprimrose, Creeping Primrose	Aquatic
Lyngbya wollei	Blue-Green Algae	Aquatic
Lythrum salicaria	Purple Loosestrife	Wetland
Murdannia keisak	Marsh Dewflower, Asiatic Dewflower, Wartremoving Herb	Wetland
Myriophyllum aquaticum	Parrotfeather	Aquatic
Myriophyllum spicatum	Eurasian Milfoil, Eurasian Watermilfoil	Aquatic
Najas minor	Brittle Naiad, Spinyleaf Naiad	Aquatic
Panicum repens	Torpedograss	Aquatic
Phragmites australis	Common Reed, Phragmites	Aquatic
Pistia stratoites	Water Lettuce	Aquatic
Salvinia molesta	Giant Salvinia	Aquatic
Triadica sebifera	Chinese Tallowtree, Popcorn Tree, Tallow Tree	Wetland
Vallisneria sudorosulata	Hybrid Eelgrass	Aquatic
Xanthosoma sagitiifolium	Elephant Ear	Aquatic

Table 3.15 Alabama Invasive Species Watch List

Scientific Name	Common Name	Potential Threats
REPTILES		
Python molurus bivittatus	Burmese Python	Pet trade; disease introduction; direct competition for food and space
Centrochelys sulcata	African Spurred Tortoise	Pet trade; habitat degradation
Python regius	Ball Python	Pet trade; direct competition for food; disease introduction
Rhinella marina	Cane Toad	Habitat degradation; direct competition for food and space
Xenapus tropicalis	Tropical Clawed Frog	Direct competition for food and space
FISH		
Channa argus and C. aurolineata. 3+ other species	Northern and Goldline Snakehead, Pongee	Anglers, Aquarium trade. Direct competition for food and space.
Family Clariidae	Walking Catfish	Aquarium trade. Direct competition for food and space.
Monopterus albus	Asian Swamp Eel, Rice Eel	Aquaculture, U.S. retail food markets. Aquarium trade.
Mylopharyngodon piceus	Black Carp	Aquaculture. Direct competition for food and space.

Alabama Wildlife Health

Introduction

Wildlife health is a complex, dynamic topic that can be difficult to define and measure. It is more than just the presence or absence of disease caused by pathogens or contaminants; rather it can be defined by a population's ability to withstand challenges, which may include climate change, habitat loss, or the introduction of a disease-causing agent. Thus, health is the result of interacting biological, social, and environmental determinants (Stephen 2014).

Diseases can have significant impacts on wildlife populations. The development of disease depends on factors related to the host organism, its environment, and the disease-causing agent. Pathogens (e.g. bacteria, viruses, parasites, and prions) and contaminants are normally present in wildlife populations, with disease typically occurring at low levels, but can become more prevalent when hosts are under high levels of stress. An emerging disease is defined as "one that has recently been discovered; has recently increased in incidence, geography, or host range; or is newly evolved" (Rachowicz et al. 2005).

Two hypotheses can apply to an emerging disease: the novel pathogen hypothesis states that the disease has recently spread into new geographic areas, whereas the endemic pathogen hypothesis suggests that it has been present in the environment but recently has affected new hosts or increased in its ability to cause disease (Rachowicz et al. 2005). For example, in North America, chytridiomycosis, caused by the fungus *Batrachochytrium dendrobatidis*, and white-nose syndrome, caused by the fungus *Pseudogymnoascus destructans*, have emerged following pathogen introduction and have had devastating impacts on amphibian and bat populations, respectively.

Disease can have direct impacts, such as mortality, or can have indirect impacts, such as reproductive failure or increased likelihood of co-morbidities; both types of impacts can lead to population declines. As some species disappear from the landscape, others can proliferate, causing an imbalance in predator-prey relationships or overuse of resources. Sometimes these diseases are zoonotic and threaten human health as well. According to the World Health Organization, 70-80% of emerging infectious diseases are zoonotic in origin. Wildlife health is a critical component of One Heath, which is the intersection of human health, animal health, and environmental health. Therefore, discussions of wildlife health must consider connections with humans, domestic animals, and ecosystems. Such connections may include game species as a food source for humans, pathogens that can be transmitted between wildlife and humans or domestic animals, and the habitats needed to support wildlife populations. In addition, healthy ecosystems provide a variety of ecosystem services for humans, including agricultural production and recreation.

The research, surveillance, and management of disease-causing agents are necessary to achieve conservation goals and safeguard the health of wildlife populations in Alabama, especially for species of greatest conservation need (SGCN). To preserve, enhance, and maintain wildlife in Alabama, WFF maintains a wildlife health program (WHP) to examine, manage, and educate about common diseases and health issues affecting wildlife. The "Alabama Wildlife Health Surveillance and Management Plan" outlines the objectives and activities of the program. Additionally, this plan is constantly adapting to the needs of Alabama's wildlife populations and is responsive to emerging diseases.

This Chapter will provide a summary of the known existing and emerging pathogens that may affect SGCN of each taxa. Other environmental contaminants, toxins, agents and conditions that may negatively impact wildlife health are also discussed.

Reptiles and Amphibians

There are several threats that herpetofauna in Alabama face, but disease-causing pathogens are some of the greatest threats, especially in recent years with the rise of emerging diseases. The prevalence and distribution of many of these disease-causing agents is not well understood and warrants further evaluation. This section details some of the major common and emerging diseases known to affect herpetofauna, however, there are other diseases not mentioned here that have the potential to negatively impact herpetofaunal health. Additionally, there is the possibility for future emerging disease threats that are currently unknown. Safeguarding reptile and amphibian health requires the prevention and preparation for currently unknown disease threats that we may need to address in the coming years.

Snake Fungal Disease

Snake fungal disease, or ophidiomycosis, is a relatively common disease caused by infection with the fungus *Ophidiomyces ophidiicola (Oo)*. Infection with *Oo* is a significant threat for snakes in North America since all species tested to date appear to be susceptible. The most common and obvious physical signs of *Oo* infection include lesions on the body. In some cases, the lesions can go deep into the skin tissue, affecting muscles and leading to potential facial disfiguration. Depending on the location of lesions, they can impact an individual's ability to feed, breed, defecate, and shed (Haynes and Allender 2021).

One study demonstrated that the skin biome was altered after infection with *Oo*, and this was present across the surface of the scales, not just in the areas surrounding lesions (Allender et al. 2018). The changed skin biome may negatively impact snake health in the long-term, however, there is much that is still unknown about this disease. In addition to long term effects, there are questions about transmission vectors and population impacts.

In the wild, the disease does not appear to cause large-scale die offs of snake species, however the negative effects to snake health has been seen in species of greatest conservation need such as Eastern indigo snakes (*Drymarchon couperi*) and pygmy rattlesnakes (*Sistrurus miliarius* spp.; P2) (Chandler et al. 2019; Lind et al. 2018). However, the latter study involving pygmy rattlesnakes demonstrated that individuals were able to recover from infection (Lind et al. 2018). The way that other species can respond to infection and how much it may serve as an additive mortality for snakes has yet to be determined.

The distribution of SFD in Alabama is not well understood and increased surveillance and monitoring should be done at sites throughout the state to elucidate prevalence. Further research is needed to better understand how this disease is impacting SGCN in Alabama and potential management techniques.

Snake Lungworm Disease

There are several species of pentastomes that can parasitize reptilian and mammalian lungs. One species of pentastome, *Raillietiella orientalis*, is an invasive pentastome from Asia and Africa that is causing an emerging pentastomiasis, or snake lungworm disease, in North American snake species. The pentastome was likely introduced to North America via the exotic pet trade, specifically from Burmese pythons (*Python bivittatus*) (Guzy et al. 2023). Since the introduction of this pathogen, parasitic spillover into native snake species has occurred in several counties throughout Florida, with some positive detections in captive snakes as well. In 2024, the pathogen was detected in a Florida cottonmouth (*Agkistrodon conanti*) in Okaloosa County, FL which borders Covington County in south Alabama (Palmisano et al. 2025).

In the transmission of *R. orientalis*, intermediate hosts are utilized which may include anurans, lizards, and invertebrates (Palmisano et al. 2022). The human-aided movement of both wild and captive snakes and intermediate hosts such as tegus (*Salvator merianae*), tokay geckos (*Gekko gecko*), and Burmese pythons (*Python bivittatus)* can therefore aid in the transmission of *R. orientalis* to uninfected individuals.

In some species of snake, there has been evidence of severe cases of snake lungworms, leading to mortalities. For instance, a wild adult female eastern indigo snake (*D. couperi*) in Hendry County, Florida, was collected for recolonization in a captive breeding colony and died four months after collection; upon necropsy, *R. orientalis* parasites were recovered in the lung (Bogan et al. 2022). Although it could be argued that capture myopathy contributed to the death of this individual, it is also likely that *R. orientalis* infection was at least a contributing factor, if not the primary cause of death. *D. couperi* is a P1 SGCN and the presence of this disease in AL populations could greatly impact conservation efforts.

Additionally, in Volusia County, Florida, three pygmy rattlesnake (*Sistrurus miliarius*) deaths were attributed to *R. orientalis* infection (Farrell et al. 2019). *S. miliarius* is a P2 SGCN in Alabama and mortalities attributed to this invasive pentastome could negatively impact conservation efforts.

Although this invasive pentastome is not known to occur in Alabama as of 2025, there are concerns with detections in bordering Florida counties. Additionally, *R. orientalis* has been detected in a captive Florida banded water snake (*Nerodia fasciata*) in Michigan, where it was acquired at a reptile exposition (Farrell et al. 2023). The human movement of herpetofauna and potentially *R. orientalis*, could be a threat to Alabama's native wildlife. It is also a possibility that *R. orientalis* is present in some snake species of Alabama but due to a lack of past surveillance efforts, the pathogen has avoided detection. Future surveillance and research efforts should aim to gain a better understanding of the range of *R. orientalis*, potential routes of introduction to Alabama, and impacts that infection with the pathogen can have on reptile and amphibian SGCN.

Turtle fraservirus 1 (TFV1)

An emerging pathogen effecting freshwater turtle species in Florida, including softshell turtles and cooters, is turtle fraservirus 1 (TFV1). This pathogen is a negative-sense RNA virus that was isolated from live and dead diseased freshwater turtles at multiple sites on the west coast of Florida. Symptomatic individuals experienced neurological issues, extended necks, reduced withdrawal reflexes, minimal responsiveness, ocular lesions, and sunken eyes (Waltzek et al. 2022).

The Florida Fish and Wildlife Conservation Commission (FWC) has current surveillance projects underway to investigate the prevalence and distribution of this pathogen in Florida. In Alabama, there has previously not been active surveillance for this newly identified virus but the threat that this pathogen poses to freshwater turtle species in Alabama warrants further investigation. Species that are of conservation concern and may be impacted by TFV1 in Alabama include the Alabama red-bellied cooter (*Pseudemys alabamensis*), Gulf Coast smooth softshell (*Apalone mutica calvata*), flattened musk turtle (*Sternotherus depressus*), and map turtles (*Graptemys spp.*).

Chytridiomycosis

Chytrid fungi, including *Batrachochytrium dendrobatidis* (*Bd*), causes chytridiomycosis. These fungi affect the skin of amphibians, causing various impacts to species depending on the host's susceptibility. In the Southeast United States, *Bd* has been detected in both frog and salamander species but the impact on populations is not fully understood. The first occurrence of *Bd* was in east-central Alabama in 2008 where it was detected in a Southern

two-lined salamander (*Eurycea cirrigera*) (Byrne et al. 2008). Another study done in the Mobile-Tensaw Delta recorded a *Bd* prevalence ranging from 19-28% in amphibians and 18-27% in anurans (Chiari et al. 2017).

The *Bd* pathogen may be prevalent in amphibian populations across the Southeast, however, impacts on populations seem to be species-specific and involve other factors such as stress, concurrent infections, and environmental factors. For example, wild eastern hellbenders (*Cryptobranchus a. alleganiensis*) in Western North Carolina had a *Bd* prevalence of 27.9% but no evidence that pathogen infection was causing negative impacts on infected individuals (Williams and Groves 2014). However, Green et al. (2002) recovered amphibians from mortality events and found that chytrid fungal infections were linked to multiple population declines; their study also identified co-infections with ranaviruses (discussed more in the next section) which highlights the impact that multiple diseases can play in co-morbidities of amphibians.

Batrachochytrium salamandrivorans (*Bsal*) is another chytrid fungus that has caused mass mortalities of fire salamanders in Europe; however, this fungus has not previously been detected in wild amphibians of North America (Waddle et al. 2020). Therefore, with *Bsal*, proactive response and prevention is the current priority to prevent the introduction into wild amphibians in the Southeast United States. Strategies to prevent the introduction of *Bsal* and the further spread of *Bd* in Alabama include establishing and enforcing regulations related to captive wildlife, in addition to the other management and surveillance actions listed in the "Management and Monitoring" section.

Despite chytrid fungi being prevalent worldwide for several decades, there is still much that we do not know about the impacts that infection with chytrid fungi may have on amphibian populations. With the diversity of amphibian species in Alabama and the number of SGCN, further monitoring of *Bd* and the prevention of *Bsal*'s introduction to the Southeast is crucial in safeguarding these populations.

Ranavirosis

Ranavirosis is caused by infection with ranaviruses, a group of DNA viruses that tend to cause disease in fish, amphibians and reptiles. In North America, the ranaviruses that cause disease in reptiles and amphibians include Frog virus 3 (FV3) and *Ambystoma tigrinum virus* (ATV). Ranaviruses are prolific as they are known to persist outside of a host and in aquatic environments for extended periods of time, even in cold temperatures (Duffus et al. 2021).

Outbreaks of ranaviruses have caused die-offs and tend to most severely impact metamorphs and tadpoles, however, mortalities can be observed in adults as well. The family of amphibians that has been the most affected appears to be Ranidae or the true frog

family. However, there have been ranavirus detections in at least 49 amphibian species from eight different families (Duffus et al. 2013). For example, tadpole Gopher Frogs (*Lithobates capito*) were dying off at multiple sites in Florida during a two-month long outbreak in which FV3 was identified as the cause (Hartmann et al. 2021). Additionally, ranavirosis has been detected in hellbenders (*Cryptobranchus alleganiensis*), in middle and eastern Tennessee (Souza et al. 2012; Hardman et al. 2020). In Alabama, both the gopher frog and the eastern hellbender are P1 SGCN and die offs in these species could be detrimental to populations and potential conservation efforts.

Ranavirosis not only affects amphibian species, the class of ranaviruses can also infect and cause mortalities in reptiles. We know that ranaviruses have been detected in Alabama as a study detected wild box turtles with FV3 in Jackson County, AL; three out of four of these tested turtles were also deceased when recovered (Jordan 2024). So far in the USA, ranaviral infections have been documented in at least eight reptilian species, including one lizard and seven Chelonian species (Duffus et al. 2021). Some studies have also indicated the potential for transmission from fish to Chelonians (Brenes et al. 2014).

Severe Perkinsea Infection (SPI)

A protozoan is the cause of Severe Perkinsea Infection (SPI), mainly in species of the family Ranidae. This protist typically affects the tadpole life-stage in wild amphibians. This disease has caused localized die-offs of amphibian populations in the Southeast, including in southern leopard frogs (*Rana sphenocephala*) in Georgia (Davis et al. 2007) and dusky gopher frogs (*R. sevosa*) in Mississippi (Isidoro-Ayza et al. 2018). Infection with the parasite causes organ failure, causing death to occur rapidly, and can be seen year-round in the south, but is most common in the summer months.

The mortality rates in die-off events have been even as high as 95% (Green et al. 2002). It is likely that there have been SPI die-off events in Alabama that have not been documented and the prevalence of this pathogen in the state is currently unknown. Additionally, Perkinsea has been detected in cuban treefrogs (*Osteopilus septentrionalis*) in Louisiana, which are an invasive species encroaching on parts of the Southeast (Galt et al. 2021).

With the human movement of amphibian species, including invasives, there is the potential to spread SPI parasites. In the coming years, it may become increasingly common to see die-offs of amphibian tadpoles with SPI. In Alabama, we have several P1 SGCN that could be impacted by SPI, including the Pine barrens treefrog (*Dryophytes andersonii*), northern crawfish frog (*Lithobates areolatus circulosus*), gopher frog (*Lithobates capito*), and the river frog (*Lithobates heckscheri*). Surveillance for the protozoan that causes SPI is crucial to better understanding the prevalence and impacts the disease may have on SGCN.

Additionally, understanding the range of this pathogen in Alabama will further inform management and conservation efforts.

Birds

Avian species are susceptible to a range of pathogens that can cause disease and potentially lead to mortality. Individuals can transmit infectious pathogens to various species, causing local die-offs and hampering conservation efforts. Pathogens are often readily spread between individuals at bird feeders and shared nest boxes, requiring considerations of infectious pathogens when performing activities to research, restore, or protect SGCN. This section highlights three major diseases that are either common or emergent in several species of birds: avian influenza, West Nile disease, and salmonellosis. However, this is not a comprehensive list of all diseases potentially affecting birds in Alabama.

Avian Influenza

Influenza A virus is the causative agent of avian influenza (AI) and there are different serotypes based on the immune response of two surface proteins, hemagglutinin and neuraminidase. AI is further subdivided into low pathogenic (LPAI) or highly pathogenic (HPAI) based on the effect of the virus serotype on chickens. HPAI includes the H5 and H7 subtypes and often results in more severe clinical symptoms whereas LPAI strains are milder.

The specific virus strain and the species affected can result in different reactions or clinical signs. For instance, waterfowl with AI infections often display few to no symptoms. On the other hand, other species like Golden Eagles (*Aquila chrysaetos*), infected with HPAI can have severe clinical signs including neurological symptoms, lethargy, anorexia and death. AI in birds has been seen in almost all North American duck species with dabbling ducks more often affected. Additionally, die-offs of colonially nesting shorebirds and raptors have occurred because of HPAI infection (Puryear and Runstadler 2024).

The more recently evolved strains of HPAI originating in avian species have also shown the potential to spill over into mammalian species, causing die-offs in global species of pinnipeds and farmed mink (Zohari et al. 2014). Other mammalian species have also been demonstrated to display neurologic and respiratory symptoms. Additionally, avian influenzas are zoonotic, meaning they have the potential to infect humans.

As a result of HPAI's potential impact on human health, agriculture, and wildlife, it is a disease that is heavily monitored by the United States Department of Agriculture (USDA). USDA Wildlife Services (USDA WS) leads the surveillance of HPAI in wild birds. In Alabama, WFF assists USDA WS with disease surveillance efforts, including the testing of animal

morbidities and mortalities. Additionally, WFF assists with any research projects evaluating the prevalence and effect of AIs on wildlife species.

Since avian influenza has the potential to impact a wide range of species from different taxonomic groups, it has the potential to impact several SGCN such as the Red Knot (P1), Golden Eagle (P2), Common Tern (P2), and Least Tern (P2). Any morbidities and mortalities of SGCN from rehabilitation centers, the public, or partner agencies should be sent for diagnostic testing to screen for HPAI and serotyped if positive. Additionally, further research is needed to identify potential transmission routes from mammalian hosts of influenza A viruses. Potential methods for the prevention of transmission and frequency of die-off events in SGCN also require further evaluation.

West Nile Disease

West Nile Disease is caused by West Nile Virus (WNV) and is primarily transmitted by *Culex* mosquitoes but can be transmitted by other vectors as well. The transmission of WNV can also occur through shared resources such as food and water sources. The virus has been detected in over 300 bird species and all species tested to date have been found to be susceptible. Corvid species and greater sage grouse have been found to be the most susceptible with a 100% mortality rate. Other bird species may not have as high of mortality but experience serious illness including several species of songbirds and raptors, many of which are SGCN in Alabama. Additionally, West Nile Disease has been found in humans and other mammals as well, although not as common (Nemeth and Yabsley, 2021, p. 282).

To monitor and surveillance for WNV, the testing of dead birds, especially crows, raptors and blue jays, should be conducted for reported mortalities. Alleviating and reducing mosquito populations may also help to reduce the incidence of WNV. Mosquito population control can be done through the removal of standing water and promoting wetland management. Additionally, encouraging the overall health and ecosystem balance of critical SGCN habitats is critical for ensuring resilience to West Nile Disease

Salmonellosis

Salmonellosis is caused by infection with *Salmonella spp.* bacteria, most commonly, *Salmonella enterica*. Several species of gulls, raptors, and columbids carry the bacteria and serve as reservoirs but do not typically have systemic disease, unless otherwise immunocompromised. Additionally, reptiles are carriers of *Salmonella* bacteria but do not typically have any clinical signs. In certain species of songbirds and young wading birds, however, die-offs from *Salmonella* infection can be observed, especially in the winter months when there are fewer resources and birds are congregated into shared areas such as backyard bird feeders (Nemeth and Yabsley, 2021, pp. 286-289).

Clinical signs in birds include ruffled feathers, diarrhea and lethargy; individuals may also have plaques in and around the mouth, difficulty swallowing, loss of appetite, and convulsions (Nemeth and Yabsley, 2021, p. 286). Large-scale die offs as a result of salmonellosis for songbird SGCN in Alabama such as the Bachman's Sparrow (*Peucaea aestivalis*), Grasshopper Sparrow (*Ammondramus savannarum*), Cerulean Warbler (*Setophaga* cerulea), Field Sparrow (*Spizella pusilla*), and Purple Martin (*Progne subis*) could be detrimental to conservation efforts. Additionally, wading birds such as White Ibises *(Eudocimus* albus) can be carriers of the bacterium, having significant health consequences if transmitted to nestlings of other wading bird species (Hernandez et al. 2016).

Prevention of unintentional spread of salmonellosis is important in safeguarding songbird and wading bird populations. Therefore, outreach and education about the importance of regularly cleaning bird feeders is needed. In the case of reported die-offs, diagnostic testing should be done to evaluate infection status. Further research to better understand the effects of *Salmonella* on various avian and reptilian species is also necessary.

Mammals

Similar to the other taxa groups described in this chapter, there are several bacteria, viruses, fungi, and parasites that can have negative health consequences on mammalian species. Some diseases are described here, however there are several other diseases that are not covered such as tularemia infection and rabies, which are also zoonotic, or having the potential to impact humans.

Rabbit Hemorrhagic Disease Virus

Rabbit hemorrhagic disease virus 2 (RHDV2) is highly infectious and affects lagomorph species. In the United States, this disease in the wild is mainly limited to the Southwest United States, however, domestic cases of RHDV2 have occurred in the eastern United States in Ohio and New York. Species of the *Sylvilagus* genus have been shown to be highly susceptible, resulting in mortality (Ringenberg et al. 2024).

Outbreaks of this disease are ongoing in the Southwest United States with periodic cases in domestic rabbits. Although the threat currently to wild lagomorphs of Alabama is believed to be low, passive surveillance for this disease in cases of sick or dead lagomorphs is necessary to help safeguard imperiled species, including the Appalachian cottontail (*Sylvilagus obscurus;* P1).

Mange

Mange is caused by different parasitic mite species including *Demodex ursi*, *Ursicoptes americanus,* and *Sarcoptes scabiei*. Over 100 species of wild mammals are susceptible to

mange and for some infected individuals, there can be no associated disease; however, for individuals with severe lesions, symptoms can include lethargy, emaciation, and depression (Nemeth and Yabsley 2021, pp. 125-126). Cases of mange in the American Black Bear (*Ursus americanus*), have been increasing in recent years in the eastern United States. It is believed that regional differences in the prevalence of mange are due to varying immune system responses, possibly due to genetic or weather factors.

With increasing cases observed in the eastern United States, including in Georgia where both subclinical and clinical mange was observed (Broadhurst et al. 2025), there are increasing concerns for *U. americanus* populations in Alabama. The Florida Black Bear (*Ursus americanus floridanus*) is present in southwest Alabama and is state listed as a P1 species. Mange has not been observed in this population to date, however, clinical infections of mange in this population could have significant consequences including loss of females and thus decreased reproductive output. As this population is already small and experiencing minimal to no population growth annually, mange is important to monitor. Lastly, mange can infect other mammalian species, and reports of suspect morbidities and mortalities should be investigated.

White-Nose Syndrome

White-nose syndrome (WNS) is a disease that affects several species of bats across North America, in which several are listed as SGCN in Alabama, including the tri-colored bat (*Perimyotis subflavus*; P1), Indiana myotis (*Myotis sodalis*; P1), little brown bat (*Myotis lucifugus*; P1), northern myotis (*Myotis septentrionalis*; P1), and the gray bat (*Myotis grisescens*). WNS is caused by a fungus, *Pseudogymnoascus destructans* (Pd), first reported in New York in 2006. Infected hibernating bats tend to awaken more frequently from hibernation, resulting in unusual day-time activity during the winter. Clinical signs of infection include visible fungal growth on the muzzle and wing membranes, appearing fuzzy and white (Nemeth and Yabsley 2021; pp. 212-214).

Mortality rates from WNS have reached 90% for hibernating species like the tri-colored bat, northern long-eared bat, and little brown bat in less than a decade (Cheng et al. 2021). In Alabama, it was detected for the first time at Russell Cave in 2012. It has since been confirmed in 15 counties across Alabama, with the furthest south detection being in Bibb County, Alabama. Signs of the fungal infection have also been observed in Cleburne County but have not yet been confirmed. There have been detections of WNS in critical bat hibernacula of the endangered Gray Bat, little brown bat and the tri-colored bat in North and Central Alabama.

In South Alabama, there have been no confirmations or signs of Pd. The continued monitoring and surveillance for the fungus in Central and South Alabama is crucial to understanding the pathogen's range and the impacts on bat species, especially those that are federally threatened or endangered and listed as SGCN. Additionally, certain management actions can be implemented to prevent the further spread of Pd to uninfected caves including limiting access to critical bat hibernacula and roosts. Additionally, limiting the disturbance to hibernating bats in the winter is critical to protect bat species and aid conservation efforts.

Aquatic Invertebrates

Aquatic invertebrates of Alabama include snails, mussels and crayfish. Species within these categories also experience infectious pathogens and disease. For instance, freshwater mussels are often sensitive to mussel mortality events (MMEs) which may be caused by environmental stressors but can also be caused by infectious diseases. Many of the effects of infectious pathogens and contaminants on aquatic species, however, are hard to determine as deceased individuals are often not recovered quickly enough to adequately determine the cause of death. There are specific pathogens that are known to affect aquatic invertebrates in North America; however, the full suite of infectious pathogens that may infect aquatic invertebrates require further study. Understanding the impacts of pathogens on Alabama's aquatic species is crucial given the great species richness of aquatic species and the number that are SGCN.

Bacterial Pathogens

Pheasantshell (*Ortmanniana pectorosa*) a freshwater mussel species that is now extirpated from Alabama, Lives in the Tennessee River Basin. Examination of MMEs in Tennessee and Virgina, USA found a bacterium, *Yokenella regensburgei* associated with each mortality event. It is unclear, however, whether this bacterium was the cause of the MMEs or if *Y. regensburgei* colonizes mussels that are already stressed due to environmental contaminants or poor nutrition (Leis et al. 2023). Additionally, investigations of MMEs at Pickwick Lake, AL, also in the Tennessee River Basin, found other bacterial pathogens in diseased individuals including *Fusconaia ebena* as a result of infection with multiple bacteria including *Hafnia alvei, Enterobacter* spp., *Seromonas schubertii,* and *Aeromonas spp.* (Starliper et al. 2011).

Viral Pathogens

Infectious viruses can also infect aquatic invertebrates and be the cause of MMEs. For instance, one study identified 17 viruses in Clinch River pheasantshells with one novel

densovirus being linked to morbidity (Richard et al. 2020). Densoviruses can impact not only aquatic mussels but crayfish as well. In addition to densoviruses, White Spot Syndrome Virus (WSSV) is another virus that can impact crayfish populations and has been previously detected in Alabama red swamp crayfish (*Procambarus clarkii*). Although this species is not listed as an SGCN, there are 100 known species of native crayfish residing in Alabama that can be threatened by the introduction of WSSV. The first detection of WSSV occurred in Alabama in the spring of 2022 in a fishery in Auburn, AL (Bruce et al. 2023). The surveillance for this pathogen and examination of crayfish mortality events is crucial in understanding the extent of WSSV and its potential impacts on crayfish conservation efforts.

Parasitic Pathogens

Parasites are also known to infect aquatic invertebrates and can have negative impacts on individuals and populations. For instance, a trematode (*Rhipidocotyle campanula*), the unionicolid mite, *Unionicola intermedia,* and an ectoparasite, the invasive zebra mussel *Dreissena polymorpha*, are three examples of parasitic pathogens known to infect mussels; one study of a European mussel found that even at low prevalences, these parasites resulted in decreased reproductive output and larval condition of infected native species (Brian et al. 2021). More studies of parasitic effects on freshwater mussel species are needed in the Southeast United States as there are invasive reservoirs such as the zebra mussel present that may act as ectoparasites to native mussel species in various watersheds.

Fish

Freshwater fish of Alabama can be impacted by the same infectious pathogens that also infect amphibian species such as Severe Perkinsea Infection, chytridiomycosis and ranaviruses, including Frog Virus 3. In addition to these pathogens, there are other viruses, bacteria, fungi, and parasites that may impact freshwater fish populations. This section highlights just two examples of known diseases or potential threats to fish health in the Southeast.

Parasitic Pathogens

There are several parasites that use freshwater fish species as a host and can lead to morbidity or mortality. Some parasites are introduced by invasive species, such as the trematode *Haplorchis pumilio*, which is spread by invasive snails of the *Melanoides tuberculata* and *Tarebia granifera* species (Huston et al. 2014). Other parasitic pathogens are fungal-like including those in the class of Mesomycetozoea which have various emerging parasites that have high mortality in fish populations. For instance, *Sphaerothecum destruens,* or the rosette agent, is a parasite within the Mesomycetozoea family that is

spread by the invasive species, *Pseudorasbora parva*. Although *P. parva* is not known to have been introduced to the United States, the introduction of this species and thus infectious parasites would be detrimental to freshwater fish species, especially in Alabama where the climate and geography would be suitable (Fletcher et al. 2016).

Viral Pathogens

A class of viruses, sturgeon nucleocytoplasmic large DNA viruses (sNCLDVs) have been detected in wild sturgeon populations across North America. sNCLDVs are associated with a lethal disease in some instances and in others, a chronic debilitating wasting syndrome that impairs the growth of juveniles (Mugetti et al. 2020). Although it is common to detect these pathogens in hatcheries of *Acipenseridae* species, it is not impossible for the introduction of these viruses to occur in wild sturgeon populations of Alabama, including the Alabama sturgeon (*Scaphirhynchus suttkusi*) which is an SGCN.

Plants

Just like animals, plants in Alabama are susceptible to a range of diseases caused by pathogens and invasive pests. Many of the diseases in the Southeast target pines specifically and are of concern to the logging industry, however, there are some diseases that may have negative impacts on plant SGCN in Alabama. Three of these common and emerging diseases are highlighted in this section.

Laurel wilt disease

Laurel wilt disease is caused by the fungus *Raffaelea lauricola* and the primary vector is the redbay ambrosia beetle (*Xyleborus glabratus Eichhoff*). The fungus causes trees to wilt as a result of water transport blockage. The pathogen has spread throughout the Southeastern United States, affecting species in the Lauracea family and has been detected in Alabama (Hughes et al. 2018). In Alabama, the federally endangered and P1 species in this family, pondberry (*Lindera melissifolia*), is known to be highly susceptible to infection, although it is not typically infected as the beetles are more attracted to trees of larger diameter (Fraedrich et al. 2011). Still, with a very limited range of this species to the Geneva State Forest and Conecuh National Forest, surveillance for the invasive redbay ambrosia beetle and surveys of this plant species can provide valuable information about this species' conservation status.

Oak Wilt

Oak wilt is a disease caused by infection with *Ceratocystis facacearum* and has had a great impact on hardwood forests of the eastern United States since the mid-twentieth century. The disease was limited to the Midwest and Texas but has started to encroach further south

in recent years, with detections occurring in bordering states including Tennessee and Mississippi. Red oaks are susceptible to infection and will succumb to the disease, especially for live oaks, whereas white oaks tend to be immune (Wilson 2005). As a result, the state-listed P1 SGCN, the Dwarf Live Oak (*Quercus minimus*), could be susceptible to infection and thus tree loss.

Southern Pine Beetle

In the Southeastern United States, several pine species are impacted by the Southern Pine Beetle (SPB), an insect pest that causes disease in several pine species. The beetle resides in pine bark and feeds on the phloem tissue, causing tree death once the tree has been colonized. One pine that is an SGCN could be affected by SPBs, the pond pine (*Pinus serotina* Michx.), which is state listed as a P1 SGCN. Periodically, outbreaks of SPBs can occur that are destructive to pines. In some areas, preventative measures such as thinning dense stands and applying insecticides can be used to help preserve and conserve pine species (Meeker et al. 2004).

Environmental Contaminants and Toxins

Throughout history, there are numerous examples of the impacts of environmental contaminants on wildlife species, such as the effect of DDT on the Bald Eagle (*Haliaeetus leucocephalus*). Although efforts have been made to ban or limit the use of certain contaminants, there are other contaminants and toxins in the environment that are either created or exacerbated by humans. Several of these environmental contaminants or toxins are biologically relevant and can have negative health impacts on SGCN including, but not limited to anticoagulant rodenticides, lead and other heavy metals, per- and polyfluoroalkyl substances (PFAS) or forever chemicals, organophosphates and carbamate pesticides, organochlorine pesticides and PCB compounds, aflatoxins, and harmful algal blooms.

The effects of these various contaminants and toxins are generally not species- or taxa-specific, impacting mammals, birds, fish, mussels, and other aquatic species. Additionally, runoff of several contaminants into waterways contributes to their spread and potential negative health consequences in a variety of ecosystems. The contaminants previously listed are also not a complete list as there are many other known and unknown contaminants that may undermine SGCN conservation efforts and ecosystem health. This section highlights a few major toxins and contaminants that may affect Alabama wildlife.

Heavy Metal Toxicosis

Wild animals may be exposed to heavy metals through several sources and experience a range of effects depending on the levels ingested and the species. Lead (Pb) is a common

heavy metal that has caused toxicosis in wildlife due to the use of lead in ammunition and fishing jigs. Birds are sensitive to lead exposure through direct consumption of lead in the environment or prey items that have been exposed to lead. Over 120 species have been documented to be exposed to lead, and this exposure can cause sublethal or lethal consequences for impacted individuals (Haig et al. 2014). One study of California Golden Eagles (*Aquila chrysaetos*) detected lead at subclinical rates and one individual with a level of toxicity reported to cause lead poisoning (>100 µg/dL) (Kelly et al. 2011).

Lead toxicity, however, is not just limited to birds. Exposure to lead can cause toxic effects on fish, resulting in physiological and neurological disorders (as reviewed in Lee et al. 2019). Additionally, lead exposure has been observed in mammalian species (Hough et al. 2020), but the extent to which it effects mammals, including SGCN and federally endangered species such as the Perdido Key beach mouse (*Peromyscus polionotus* trissyllepsis) in Alabama, are not well understood.

In addition to lead toxicity, there are several other heavy metals including cadmium (Cd), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn) which occur naturally or are used in manufacturing processes that can impact the health of wild animals. For instance, there is evidence of the bioaccumulation of cadmium in freshwater vertebrates and invertebrates; the exposure to cadmium may cause morphological damage to larvae as well as decrease successful reproductive output in adults (Burger 2008). Numerous studies have been done on heavy metal exposure in various species of different taxa with many finding subclinical or clinical effects to individuals, highlighting the critical impact these metals may have on species conservation efforts.

Anticoagulant Rodenticides

Anticoagulant rodenticides, or ARs, are used globally to control rodent populations in urbanized areas. There are two groups of these chemicals, first generation and second-generation or, FGARs and SGARs, respectively. Both groups of chemicals affect vitamin K and thus clotting factors in the liver of intoxicated animals which causes hemorrhaging. However, SGARs remain in tissues for longer and can therefore affect an individual for a longer period. Non-target wildlife can be exposed through the consumption of intoxicated animals or primary direct contact with the ARs themselves (Nemeth and Yabsley 2021, pp. 16-19).

Previous studies have identified ARs in the livers of raptor species, namely Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles (*Aquila chrysaetos*), in which the latter is a P2 SGCN. For instance, one study found that exposure rates were over 80% in eagles from across the United States that were submitted to the Southeastern Cooperative Wildlife

Disease Study (SCWDS) for diagnostic testing (Niedringhaus et al. 2021). Although researchers only determined that AR exposure was the primary cause of death in 4% of eagles examined, it is unclear what subclinical lethal effects may exist that contribute to mortality. Additionally, toxic compounds belonging to SGARs were the only ones found to primarily cause death in the studied eagles (Niedringhaus et al. 2021).

In addition to eagles, Southeastern American Kestrels (*Falco sparverius paulus*) are a P1 SGCN and may also be susceptible to FGARs and SGARs. One study in Kentucky found that over 50% of birds examined had previous exposure to at least one AR compound and although mortality wasn't directly contributed to AR exposure, they did find a significant association in birds with poor nutritional condition and these compounds present in the body (Smallwood et al. 2024).

It is evident based on these previous studies that ARs can have health impacts on raptor species, including SGCN that are present in Alabama. SGARs in particular are a significant concern as they remain in the body for longer and can therefore cause greater health impacts. In addition to raptors, there are also concerns for SGAR exposure to other non-target animals such as small mammals and songbirds where AR bait is used, which has been demonstrated in a previous study (Elliott et al. 2014). The exposure of small mammals and songbirds such as the prairie vole (*Microtus ochrogaster*), Allegheny woodrat (*Neotoma magister*), and Grasshopper Sparrow (*Ammodramus savannarum*) to ARs in Alabama requires further study and monitoring to better understand how these compounds may affect the health of various species in the states, and thus conservation efforts.

Forever Chemicals

Forever chemicals include a class of chemicals called poly- and perfluoroalkyl substances (PFAS). Perfluorooctane sulfonate (PFOS) is considered a legacy PFAS as these have been phased out over the last several decades by the Environmental Protection Agency (EPA) due to public health concerns. Forever chemicals are human-made, and their manufacturing began in the mid-twentieth century; the name "forever chemicals" refers to the ability for these compounds to exist in the environment for extended periods of time, allowing these compounds to bioaccumulate and biomagnify in wildlife food chains.

Animals can be exposed to PFAS through exposure to contaminated sites, but also via contaminated waterways. Effects can thus be seen on a variety of wild animals, including those that are apex predators such as raptors and mesocarnivores. It has even been previously observed that forever chemicals can be transferred maternally in several species of wild birds, with offspring having higher rates than their mothers (as reviewed by Ricolfi et al. 2024).

PFAS have also been observed in blood sera of the West Indian Manatee (*Trichechus manatus*), a large herbivorous marine mammal, in Florida and Puerto Rico (Palmer et al. 2019). As previous studies have demonstrated that aquatic vegetation may be a concentrator of PFAS from surface waters, it is likely that the seropositive manatees acquired PFAS through their diet (Griffin et al. 2023).

The contamination of waterways and terrestrial sites with PFAS is a concern for both terrestrial and aquatic wildlife of all taxa. There is much that is still not understood about PFAS and their effects on wildlife, including imperiled species. Future research is needed to understand how exposure to PFAS may affect various species as well as the prevalence of these chemicals in different regions of Alabama.

Pesticides

There are several human-made chemicals commonly used as pesticides that cause negative health consequences for many wildlife species. These chemicals often run off into rivers, lakes, streams, and the ocean from agricultural fields, invasive aquatic plant control, and through aerosolized drift, affecting wildlife through effects on nutrient and food availability, water visibility, and the growth of harmful algal blooms. With polluted waters, the species richness of aquatic species is also threatened, as well as individuals that consume prey items containing toxins, which then bioaccumulate up the food chain.

For one marine mammal that is listed as an SGCN in Alabama, the West Indian Manatee *(Trichecus manatus*), it has been demonstrated that exposure to glyphosate, a commonly used organophosphate pesticide, causes negative immune effects in the Florida subspecies (De Maria et al. 2024). As a result of a suppressed immune system, individuals may be at an increased risk of co-infections and mortality. In fish, the effects of organophosphate exposure include phenotypic changes to the gills and lungs, decreased reproductive effort, larval stage mortality, and developmental defects. Pesticide pollution has also been seen to affect other aquatic vertebrates with evidence of bioaccumulation in amphibians and effects to reproductive efforts of birds (as reviewed in Kadiru et al. 2022).

Pesticides can also negatively affect aquatic invertebrates. For instance, one study evaluated the effect of exposure to a high concentration of neonicotinoid, a commonly used insecticide, on freshwater mussels and found changes in behavior that indicated stress (Szostak et al. 2025). Understanding pesticide exposure in wildlife is complex as there are several different compounds with varying effect and individual species may react differently. More research is needed to understand the exposure of wildlife to pesticides and potential negative consequences to populations.

Management and Monitoring

As the previous sections have highlighted, there are several diseases caused by pathogens, environmental contaminants and invasive pests. These diseases can have negative health consequences for birds, herpetofauna, mammals, aquatic invertebrates, fish and plants. Therefore, health monitoring studies are important for SGCN at multiple parts of their ranges. Health studies should include surveillance and monitoring for the pathogens described in this chapter as well as future emerging pathogens and overall health conditions. Additionally, reported mass mortalities or potential outbreaks should be thoroughly investigated through diagnostic testing of infected individuals, as many diseases can present similar clinical signs and the occurrence of co-infections with multiple pathogens is common.

The WFF Wildlife Health Program has several objectives that can be applied to SGCN from various taxa groups. The approaches to health and disease monitoring are susceptible to change with additional information gathered from surveillance efforts and research. Additionally, management of diseases can be done in some cases to prevent the spread of pathogens, help bolster effected populations, treat infected individuals, and increase immunity of susceptible animals. The objectives of the WFF WHP are outlined below (**Element 5**).

1. **Implement prevention protocols**
    a. Establish biosecurity protocols for disinfection when working in habitats with SGCN, including aquatic habitats, cave systems, and other sensitive habitats.
    b. Reduce the risk of pathogen spillover from captive wildlife to wild animals.
        i. Individuals introduced for population recovery efforts should be screened for common and emerging diseases prior to introduction.
        ii. Restrict wildlife rehabilitation and release practices that may inadvertently spread wildlife diseases.
    c. Reduce the risk of spillover from domestic animals to wild animals.
    d. Create a communication plan to educate about species diversity and pathogen prevention for target audiences.
    e. Evaluate the efficiency and efficacy of vaccines or other disease prevention methods developed for wildlife species.
2. **Establish surveillance efforts**
    a. Identify high-risk target species and habitats for the diseases listed in this chapter as well as future emerging diseases.
    b. Coordinate regular surveillance to document the occurrence and range of known pathogens.
    c. Work with partner agencies and organizations to accomplish established surveillance goals.

d. Establish a network and system for reporting disease-related morbidities and mortalities to the WFF WHP.
e. Utilize technologies such as eDNA to evaluate pathogen prevalence and population health for cryptic species.

3. **Engage in proactive management**
    a. Assess certain areas for limited access or closures to prevent the introduction and spread of pathogens.
    b. Manage healthy wildlife populations, including the protection and enhancement of habitats for SGCN.
    c. Effectively manage vector populations near critical areas for SGCN.
    d. Conduct education and outreach about best management practices with relevant stakeholders.
    e. Apply biological and environmental management techniques proven to aid in the decrease of pathogen prevalence or transmission.
4. **Follow an established response and management plan**
    a. Develop and implement disease-specific management plans.
    b. Plan and prepare for infectious disease outbreaks or unexplained wildlife die-offs for various SGCN and disease systems.
5. **Research**
    a. Evaluate the long-term impacts of pathogen infections on SGCN.
    b. Support research of improved diagnostic techniques for various infectious pathogens.
    c. Support research used to develop preventative measures and management actions of wildlife diseases.
    d. Conduct regular health surveys on SGCN populations.

Conclusion

Understanding and managing wildlife health requires a multifaceted approach that acknowledges the intricate interplay between biological, environmental, and social factors. As highlighted, disease emergence in wildlife is not solely dependent on the presence of a pathogen but also on stressors like habitat loss, climate change, and human activities that can tip the balance toward outbreaks. Whether caused by novel introductions or the resurgence of endemic pathogens, these diseases can have profound effects on populations, especially for SGCN where the negative consequences of disease may undermine conservation efforts.

Efforts like Alabama's WFF Wildlife Health Program (WHP) play a crucial role in monitoring, researching, and responding to disease threats that impact species of greatest conservation

need. Through adaptive planning and targeted surveillance, programs like the WHP help mitigate risks associated with both emerging and existing diseases, as well as other health stressors like contaminants and habitat degradation. Continued investment in wildlife health infrastructure, education, and collaboration across sectors will be essential for maintaining species richness, supporting ecosystem services, and protecting the interconnected health of wildlife, humans, and the environment.