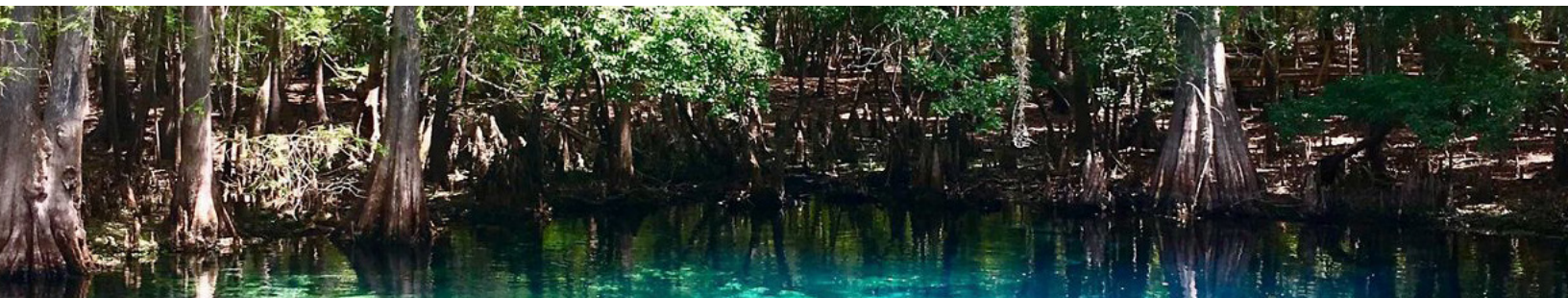


SFI CONSERVATION GRANT EXPLAINER



QUANTIFYING THE CONTRIBUTION OF SUSTAINABLE FOREST PRACTICES TO AT-RISK SPECIES AND TERRESTRIAL AND AQUATIC COMMUNITIES



Project Lead	National Council of Air and Stream Improvement (NCASI) Foundation Tangled Bank Conservation (TBC)
Project Term	2021-2025
Location	Alabama and Florida, United States
Partners	US Fish and Wildlife Service National Alliance of Forest Owners Wildlife Conservation Initiative Auburn University Museum of Natural History

- SFI-Certified Organizations:**
- Conservation Resources
 - Forest Investment Associates
 - Hancock Forest Management
 - Molpus Woodlands Group
 - Potlatch Deltic Corporation
 - Rayonier
 - Resource Management Service, LLC
 - The Westervelt Company
 - Weyerhaeuser Company



In 2021, the NCASI Foundation led an SFI Conservation Grant project to quantify the role of sustainably managed forest landscapes in conserving at-risk species, listed species, and maintaining aquatic and terrestrial communities.

KEY POINTS

- Conducted the largest biodiversity survey on private working forests to date, combining eDNA, camera traps, turtle trapping, and visual surveys
- Demonstrated that SFI-certified private working forests provide habitat for many at-risk species
- Recorded 5,098 detections of 240 species spanning fish, reptiles, birds, amphibians, mammals, and bivalves
- Detected 41 species of conservation concern on private forestland, including the Red Hills Salamander, Alabama Pearlshell, and Alligator Snapping Turtle

WHY IT MATTERS

Private working lands play a critical role in supporting biodiversity, particularly in the southeastern United States, one of the most biodiverse regions in North America. In the United States (US), private forest owners manage more than 450 million acres of forestland, which represents 60% of US forests – making managed forests critical to successful conservation initiatives across landscapes.

Sustainably managed forests on public lands, like those certified under the [Sustainable Forestry Initiative \(SFI\) 2022 Forest Management Standard](#), aim to maintain diverse forest conditions that support a wide range of species, including those that are rare or designated at-risk. Through conservation-related management practices, sustainably managed private forests often actively contribute to biodiversity conservation. Conservation-related management practices on SFI-certified land include maintaining forest structure (e.g., snags, down wood), protecting riparian areas, and promoting native species. Yet, contributions of these forests to biodiversity and recovery of species at-risk has historically been under-documented. Understanding and documenting biodiversity is inherently challenging: many species are elusive, seasonal, or difficult to detect, meaning they can easily go unnoticed even in areas where they are present. These detection challenges create knowledge gaps about where species occur and how they respond to management, underscoring the need for improved monitoring approaches to fully recognize biodiversity conservation on working lands. To quantify biodiversity, researchers are working with SFI Certified Organizations to use varied approaches and techniques best suited for target species, combining multiple monitoring techniques to provide documented observations demonstrating that sustainably managed forests support wildlife and can maintain aquatic and terrestrial communities across forest landscapes.



HOW IT RELATES TO THE SFI STANDARDS

This project demonstrates that forests managed to the SFI Standards contribute to conserving biological diversity, a major factor in the SFI 2022 Forest Management Standard (Objective 4). This study provides evidence that the assessed SFI-certified lands provide a diversity of forest types and conditions that sustain at least 240 species, consistent with Performance Measure 4.1. Detecting 41 species of conservation concern—including threatened and endangered species such as the Red Hills Salamander and Alabama Pearlshell—highlights how these forests may contribute to habitat for at-risk species and ecologically important sites, supporting Performance Measures 4.2 and 4.3.

The project also demonstrates the value of applying research and monitoring technologies to better understand biodiversity outcomes on working forests, aligning with Performance Measure 4.4 and with Objective 12: Forestry Research, Science and Technology. By combining multiple monitoring approaches tailored to target species, the study advances the use of science-based methods to document species presence on sustainably managed forests. While the project documented species occurrence rather than population trends or responses to specific management actions, it provides important baseline information that can support future research, monitoring, and adaptive management efforts.

Objective 4. Conservation of Biological Diversity

To maintain or advance the conservation of biological diversity at the stand- and landscape-level and across a diversity of forest and vegetation cover types and successional stages including the conservation of forest plants and animals, aquatic species, threatened and endangered species, Forests with Exceptional Conservation Value, old-growth forests and ecologically important sites.

Performance Measure 4.1. Certified Organizations shall conserve biological diversity

Performance Measure 4.2. Certified Organizations shall protect threatened and endangered species, critically imperiled and imperiled species (Forests with Exceptional Conservation Values), and natural communities, and old-growth forests.

Performance Measure 4.3. Certified Organizations shall manage to protect ecologically important sites in a manner that takes into account their unique qualities.

Performance Measure 4.4. Certified Organizations shall apply knowledge gained through research, science, technology, field experience and the results of monitoring of the effectiveness of conservation-related programs to manage wildlife habitat and contribute to the conservation of biological diversity.

The findings also support Objective 3: Protection and Maintenance of Water Resources, particularly where monitoring efforts include aquatic and riparian species that depend on healthy streams, wetlands, and other water bodies. Species such as the Alabama Pearlshell can serve as indicators of watershed condition and water quality, helping demonstrate the ecological benefits of implementing best management practices and water protection programs required under Objective 3.

Looking ahead, emerging technologies offer significant opportunities for SFI-certified organizations to apply the best available science to monitor key biodiversity and species indicators at larger spatial and temporal scales. As these technologies develop, they can generate more consistent and cost-effective data that improves understanding of management outcomes and provides stronger evidence of the biodiversity conservation benefits delivered by sustainably managed working forests.



Figure 1. JJ Apodaca conducting Red Hill Salamander Surveys

ABOUT THE PROJECT

In 2021, SFI awarded a 3-year Conservation Grant to NCASI Foundation, in close partnership with TBC, and with a coalition of partners working through the Wildlife Conservation Initiative to determine species occurrences in a landscape dominated by SFI certified, private forests. The project combined four types of traditional active and technological passive field surveys with advanced monitoring techniques, such as environmental DNA (eDNA), a method that determines species presence from DNA collected in environmental samples (e.g., soil and water), rather than directly from individual organisms.

This large-scale multi-technique survey, to inventory biodiversity at scale on private forestlands, had never been attempted for private lands. The project particularly focused on determining the presence of 31 target at-risk species, including Alabama Map Turtle, Alligator Snapping Turtle, Gopher Tortoise, Red Hills Salamander, and Eastern Diamondback Rattlesnake.

Researchers conducted 148 site visits during 2021 to 2025 across private working forestland locations in Alabama and Florida. They used multiple sampling methods to document presence of targeted species, including transect searches for red hill salamanders, opportunistic visual surveys for gopher tortoises in upland pine stands, visual and netting sampling for freshwater turtles, and camera traps. These motion-activated camera systems capture photos of wildlife, here used to monitor small terrestrial animals. In addition, the team collected and processed eDNA to survey aquatic species across the study area. They also retrieved publicly available environmental data about the sampled areas, including hydrological (waterbodies and streams), terrestrial (landcover), and meteorological (temperature, precipitation) data, to account for spatial patterns of diversity across the study area. Additionally, they compiled historical records on species-level data via NatureServe and iNaturalist to compare species identified in this study to previously inventoried species.

RESULTS AND OUTCOMES



Biodiversity on Managed Forest Lands

Across 148 sample sites, researchers documented 5,098 detections of 240 wildlife taxa from 80 families. This included 88 species of fish, 48 reptiles, 32 birds, 29 amphibians, 27 mammals, and 16 bivalves (Table 1; Note that this study was not designed to target bird species). Among the surveying methods deployed, eDNA sampling was the only method to detect taxa from all six major taxonomic groups and detected the most species compared to the other survey methods (Table 1). To identify species that were newly detected in this study, they compared surveyed detections to those with previous publicly available detections (NatureServe, iNaturalist) and documented 138 species not found in previous records.

Table 1. Sampling efforts and biodiversity detection results by survey method on managed forestlands in Southeastern US.

SURVEY METHOD	SAMPLING EFFORT	DETECTIONS OF BIODIVERSITY
Red Hills Salamander Transect Surveys	32 transects	31 burrows observed
Freshwater Turtle Visual Surveys and Trapping	28 hoop net trap nights and visual surveys	6 species detected: • Spiny Softshell Turtle (<i>Apalone spinifera</i>) • Common Snapping Turtle (<i>Chelydra serpentina</i>) • Alligator Snapping Turtle (<i>Macrochelys temminckii</i>) • Intermediate Musk Turtle (<i>Sternotherus intermedius</i>) • Stripe-necked Musk Turtle (<i>Sternotherus peltifer</i>) • Pond Slider (<i>Trachemys scripta</i>)
Upland Pine Visual Surveys	354 visual opportunistic detections	44 taxa detected: 3 major taxonomic groups (amphibians, mammals, and reptiles) 8 taxa were uniquely detected among this survey method: • Oak Toad (<i>Anaxyrus quercicus</i>) • Cope's Gray Treefrog (<i>Dryophytes chrysoscelis</i>) • Green Treefrog (<i>Dryophytes cinereus</i>) • Southeastern Dwarf Salamander (<i>Eurycea quadridigitata</i>) • North American River Otter (<i>Lontra canadensis</i>) • Florida Cottonmouth (<i>Agkistrodon conanti</i>) • Mud Snake (<i>Farancia abacura</i>) • Dusky Pygmy Rattlesnake (<i>Sistrurus miliarius barbourin</i>)
Camera Trap Arrays	69 camera trap arrays deployed for 11,759 days monitor across all seasons to monitor small terrestrial animals	63 wildlife species identified, 24 of which were unique to this survey method
Environmental DNA and Metabarcoding	262 water samples for environmental DNA metabarcoding across 131 sites (2 samples per site)	197 taxa detected, of which 157 were species uniquely detected in the study
Total	148 site visits + multiple surveys/samples analyzed	5,098 detections of 240 wildlife taxa from 80 families. This included number of species: • 88 fish • 48 reptiles • 32 birds • 29 amphibians • 27 mammals • 16 bivalves (e.g., clams, mussels, oysters)

Detections for Species of Concern

During surveys, 41 species were detected that are of state and/or global conservation concern. This included one species designated as “Critically Imperiled”, seven “Imperiled”, and three “Vulnerable” at the global level, according to NatureServe rankings, including four endangered species: American Eel (*Anguilla rostrata*), Alabama Pearlshell (*Margaritifera marrianae*), Coal Shiner (*Percina brevicauda*), and Red Hills Salamander (*Phaeognathus hubrichtii*). Within the various surveys, they identified 18 of 31 target species detected to species or genus level (Table 2).

Table 2. Thirty-one target species detected across all sampling approaches in a study documenting biodiversity on WCI-managed forestlands in south Alabama and northwest Florida, USA, 2019-2024.

DETECTED – COMMON NAME (<i>SCIENTIFIC NAME</i>)	NOT DETECTED – COMMON NAME (<i>SCIENTIFIC NAME</i>)
1. Alabama Shad (<i>Alosa alabamae</i>)	1. Atlantic (Gulf) Sturgeon (<i>Acipenser oxyrinchus desotoi</i>)
2. Carolina Gopher Frog (<i>genus - Aquarana sp.</i>)	2. Eastern Indigo Snake (<i>Drymarchon couperi</i>)
3. Eastern Diamond-backed Rattlesnake (<i>Crotalus adamanteus</i>)	3. Narrow Pigtoe (<i>Fusconaia escambia</i>)
4. Alabama Spike (<i>genus - Elliptio sp.</i>)	4. Round Ebonyshell (<i>Fusconaia (=Reginaia) rotulata</i>)
5. Delicate Spike (<i>genus - Elliptio sp</i>)	5. Black-knobbed Map Turtle (<i>Graptemys nigrinoda</i>)
6. Gopher Tortoise (<i>Gopherus polyphemus</i>)	6. Alabama Map Turtle (<i>Graptemys pulchra</i>)
7. Escambia Map Turtle (<i>Graptemys ernsti</i>)	7. Gray Bat (<i>Myotis grisescens</i>)
8. Southern Sandshell (<i>Hamiota (=Lampsilis) australis</i>)	8. Choctaw Bean (<i>Obovaria (=Villosa) choctawensis</i>)
9. Orangenacre Mucket (<i>genus- Lampsilis sp.</i>)	9. Alabama Hickorynut (<i>Pseudemys alabamensis</i>)
10. Southern Hognosed Snake (<i>genus- Heterodon sp.</i>)	10. Inflated Heelsplitter (<i>Potamilus inflatus</i>)
11. Alligator Snapping Turtle (<i>Macrochelys temmincki</i>)	11. Alabama Red-belly Turtle (<i>Pseudemys alabamensis</i>)
12. Alabama Pearlshell (<i>Margaritifera marrianae</i>)	12. Southern Kidneyshell (<i>Ptychobranhus jonesi</i>)
13. Red Hills Salamander (<i>Phaeognathus hubrichti</i>)	13. Alabama Sturgeon (<i>Scaphirhynchus suttkus</i>)
14. Florida Pinesnake (<i>Pituophis melanoleucus mugitus</i>)	
15. Southern Clubshell (<i>genus - Pleurobema sp.</i>)	
16. Ovate Clubshell (<i>genus - Pleurobema sp.</i>)	
17. Fuzzy Pigtoe (<i>genus - Pleurobema sp.</i>)	
18. Rayed Creekshell (<i>Strophitus radiatus</i>)	



Figure 2. Eastern Hognose Snake

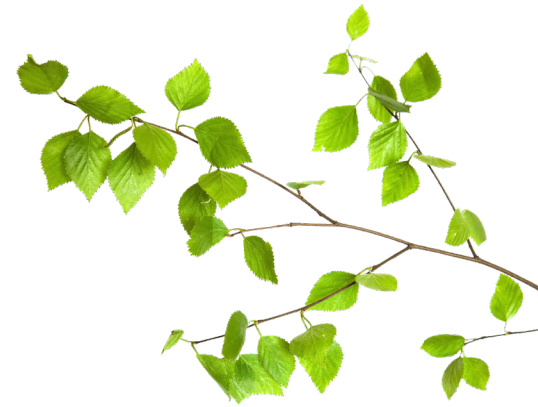
Patterns of Species Richness among Camera Trapping Sites

Camera trapping sites were located across a range of latitudes with different environmental conditions, including mean daily temperature, annual precipitation, mean daily humidity, land cover, and distance from the nearest major waterbody. To examine variation in local species richness detected by camera traps among sites, researchers constructed two Generalized Linear Models – one for amphibians and one for reptiles – to determine if variables influenced species.

Amphibian species richness was significantly and positively associated with both annual precipitation and distance to nearest major waterbody. In contrast, reptile species richness was influenced only by detectability-related factors—specifically seasonality, sampling duration, and their interaction—rather than environmental variables. This suggests that additional factors, such as land management practices, may help explain variation in reptile richness across the study area.

Recommendations for Future Research and Collaboration

To better understand how conservation actions on managed lands relate to species richness and community composition, further analyses are recommended. These should incorporate local and regional management variables such as stand age, proximity to roads, tree density and composition, management stage, soil type, and characteristics of streamside management zones, including their size and age. Including these factors as covariates will provide deeper insight into how management practices influence wildlife diversity.



HOW THE PROJECT HELPS FOREST MANAGERS

This project demonstrates that SFI-certified private forests can play a critical role in providing habitat for a range of species, including species of conservation concern. As a collaborative effort across private forest lands, NCASI brought together partners, including SFI-certified organizations and nonprofit organizations, such as TBC, to assess biodiversity at a regional landscape scale. The results highlight the collective impact of coordinated stewardship that can enable proactive conservation, including identifying occurrence of species of concern on working forests. Additionally, using varied sampling methods—such as eDNA, camera traps, turtle trapping, and visual surveys—shows how combining approaches can overcome detection challenges and produce a more complete picture of wildlife presence.

Because SFI-certified organizations practice active forest management, understanding how these forests contribute to species conservation is essential. This project indicates the conservation value of private, working forests and highlights how current management actions, like high compliance with state-approved forest best management practices, can provide habitat for species of concern. This study confirmed presence of upland amphibians, terrestrial reptiles, freshwater turtles, fish, mussels, and plants—demonstrating the diversity these forests sustain.

Resources

Apodaca, J. J., Killian, H., Krohn, A. R., Pekny, J. E., & Godwin, J. (2025, May). Quantifying the contribution of sustainable forest practices to at-risk species and terrestrial and aquatic communities: Final report (Project Code FO-EWG-2147; Agreement No. 4000-006-2021). NCASI Foundation. https://www.ncasifoundation.org/wp-content/uploads/2025/09/FO-EWG-2147-Final-Report_2025.pdf

NCASI Foundation. (n.d.). *Wildlife Conservation Initiative: Quantifying the contribution of sustainable forest practices to at-risk species and terrestrial and aquatic communities*. <https://www.ncasifoundation.org/projects/wci-quantifying-the-contribution-of-sustainable-forest-practices-to-at-risk-species-and-terrestrial-and-aquatic-communities/>

Sustainable Forestry Initiative. (2022). *SFI 2022 Standards and Rules*. <https://forests.org/sfi-2022-standards/>