RESTORE Council FPL 3 Proposal Document

General Information

Proposal Sponsor:
U.S. Department of Agriculture – Forest Service

Title:
The Apalachicola Regional Restoration Initiative: Strategies 2 & 3

Project Abstract:
The U.S. Department of Agriculture, through the U.S. Forest Service, is requesting $12.5M in Council-Selected Restoration Component funding for the proposed Apalachicola Regional Restoration Initiative (ARRI). This request includes implementation funds as FPL Category 1. The ARRI will support the primary RESTORE Comprehensive Plan goal to restore water quality and quantity through activities implemented as an extension of the Tate's Hell Strategy 1 project funded in the Council's 2015 Initial FPL. ARRI Strategies 2 & 3 are collaborative, landscape-level projects focused on restoring longleaf pine, coastal ecosystems, and hydrology within the Apalachicola Region of Florida. Activities include improvement to water quality and quantity, outreach to public landowners, monitoring, and targeted education to minority students. Under Strategy 2, project partners will implement ecological restoration activities including: region-wide restoration for approximately 250,000 acres of longleaf habitat, targeted silvicultural treatments for about 18,000 acres of dense pine forests, hydrologic restoration for around 5,000 acres, increased regional prescribed fire, invasive species treatments, and imperiled wetland restoration. Under Strategy 3, the Florida Forest Service will lead a partnership to advise private forest landowners in active management and restoration, and educate landowners on stewardship and sustainable forest management.

The combined ARRI Strategies 2 & 3 restoration efforts will help restore and conserve critical habitat, water quantity and quality, and benefit the economy. Program duration is 5 years.

FPL Category: Cat1: Planning/ Cat2: Implementation

Activity Type: Program

Program: The Apalachicola Regional Restoration Initiative: Strategies 2 & 3

Co-sponsoring Agency(ies):
FL

Is this a construction project?:
Yes

RESTORE Act Priority Criteria:
(I) Projects that are projected to make the greatest contribution to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast region, without regard to geographic location within the Gulf Coast region.
(II) Large-scale projects and programs that are projected to substantially contribute to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast ecosystem.

Priority Criteria Justification:
Many of the ARRI methods and deliverables are transferrable to other areas impacted by the Deepwater Horizon oil spill. While ARRI is not mentioned directly in Florida's State Expenditure plan, the restoration and monitoring activities align with the Florida Forest Service (FFS) 10-year management plan for Tate's Hell State Forest, Florida Fish & Wildlife Conservation Commission (FWC) Freshwater Priority Resources, and Northwest Florida Water Management District's Apalachicola River and Bay Surface Water Improvement and Management Plan. ARRI will improve and maintain healthy ecosystem services including water storage and filtration in upland forests, wetlands, and coastal ecosystems throughout the Apalachicola Region. Dense pine plantations targeted for treatment will improve healthy, open canopy longleaf ecosystems and thus allow more precipitation to percolate into the shallow surficial aquifer, streams/rivers, and ultimately into estuaries and bays. Targeted hydrologic restoration will restore natural sheet flow and improve water quality by increasing sediment retention, nutrient assimilation, and aquatic organism passage. A robust monitoring program will help quantify the effectiveness of restoration activities to improve forest health and hydrology over time.

In Strategy 3, the FFS will use innovative, proven marketing techniques to identify and engage private landowners. Within the Apalachicola Region, privately-owned working forests provide vital benefits to local communities in the form of 10,000+ jobs, a combined payroll of more than $350 million, and a total economic output of nearly $1.2 billion. ARRI will accelerate forest restoration, provide benefits to coastal communities and ecosystems, and create increased continuity and acreage of actively managed forests leading to expanded public benefits in the form of water quality protections, water recharge, improved wildlife habitat, cleaner air, better quality of life, and expanded economic activity.

Project Duration (in years): 5

Goals

Primary Comprehensive Plan Goal:
Restore Water Quality and Quantity

Primary Comprehensive Plan Objective:
Restore, Improve, and Protect Water Resources

Secondary Comprehensive Plan Objectives:
Restore , Enhance, and Protect Habitats
Restore and Enhance Natural Processes and Shorelines

Secondary Comprehensive Plan Goals:
Restore and Conserve Habitat

PF Restoration Technique(s):
Protect and conserve coastal, estuarine, and riparian habitats: Habitat management and stewardship
Reduce excess nutrients and other pollutants to watersheds: Agriculture and forest management
Reduce excess nutrients and other pollutants to watersheds: Erosion and sediment control
Restore hydrology and natural processes: Restore hydrologic connectivity

Location

Location:
Florida counties within the Apalachicola River Watershed, including the Apalachicola National Forest.

HUC8 Watershed(s):
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(Apalachicola)
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(New)
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(Apalachicola Bay)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(St. Andrew-St. Joseph Bays)
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(Chipola)
South Atlantic-Gulf Region(Suwannee) - Aucilla-Waccasassa(Aucilla)
South Atlantic-Gulf Region(Ochlockonee) - Ochlockonee(Apalachee Bay-St. Marks)

State(s):
Florida

County/Parish(es):
FL - Calhoun
FL - Franklin
FL - Gadsden
FL - Wakulla
FL - Bay
FL - Gulf
FL - Washington
FL - Jackson
FL - Jefferson
FL - Leon
FL - Liberty

Congressional District(s):
FL - 5
FL - 2

Narratives

Introduction and Overview:
The Apalachicola River, bay, and estimated 2 million acres of undeveloped (public and private) forest lands are central to the region's status as a North American biodiversity "hotspot" [1]. Groundcover diversity within the region's prevalent longleaf pine ecosystem positions it within the most species rich plant communities outside the tropics [2]. Abundant embedded wetlands provide valuable ecosystem services in the form of floodwater storage, microclimate regulation, recharge, and natural filtration functions [3] for one of the most productive aquifer systems in the world—the Floridan aquifer [4].

Freshwater inflow into the Apalachicola River and bay from upland forests are critical elements that structure physical, biogeochemical, and hydrologic conditions in near-shore coastal systems, and thus the biological communities that inhabit them. Timing, quantity, and quality of freshwater flows from forests change salinity, and total suspended solid levels which directly impacts riverine and estuarine productivity, distribution of species, and phenology [5]-[7]. For decades, significant reductions in freshwater discharge from the Apalachicola River have resulted from greater upstream storage and use coinciding with noticeable reduction in productivity of Apalachicola's commercially and culturally important seafood industries [8]. Moreover, variations in climate are projected to cause seasonal shifts for runoff and sediment further affecting system phenology, shifts in migration, breeding, and distributions [9].

Florida's aquifers play a central role in surface water body conditions which impact spring flow, streamflow, water levels in lakes and wetlands, saltwater intrusion, and general ecosystem health. Water entering the aquifer from rainfall exits as stream baseflow, evapotranspiration (ET), discharge to the coast, and recharge to deeper aquifers [10], [11]. Surface water bodies are inextricably connected to groundwater from aquifers and provide a direct method of recharge and/or discharge [12]. Depending on location and hydrologic conditions, rivers and streams can serve as both recharge and discharge areas. When water levels in lakes, ponds or streams are higher than the surrounding groundwater, they provide recharge to the aquifer. Conversely, when water levels in the aquifer are higher than the adjacent surface water bodies, then the surface water may receive groundwater discharge. Spring-fed rivers such as the Wakulla and St. Marks are key regional examples of recharge/discharge areas for Florida's aquifer systems.

The surficial aquifer system in Florida is significant because it is used for local water supplies, but also underlies the majority of the Apalachicola Region (Figure 2). A large percentage of surficial aquifer water is returned to the atmosphere by ET [12]. Water not returned to the atmosphere by ET or direct runoff into water bodies percolates downward into the surficial aquifer system, and then moves laterally through the system until it discharges to a surface water body or the Gulf of Mexico. Increased ET may shift the fraction of precipitation that runs off as surface water or infiltrates as recharge. Long-term shifts in recharge patterns can change groundwater levels and subsequently groundwater surface water interactions and soil moisture [13] which then disrupts the balance, creates a negative feedback loop and further impacts the forested ecosystems, hydrologic resources and depressional wetlands that are scattered across the region.

The Apalachicola Region includes large tracts of conservation land under federal, state, and private ownership. Yet, ecological function of these lands has been reduced through management practices, including hydrologic alteration, off-site tree planting rather than site-appropriate longleaf, and modified natural fire regimes. Since many project areas have been formerly logged and planted with overly-dense off-site slash or sand pine, successful restoration necessitates understanding the historic distribution of natural communities, variability of natural range, ecology of those communities, and their current conditions. Site-level structure, overstory species, groundcover composition, and surrounding habitats can all affect the outcomes of alternative management strategies—thinning and continuing prescribed fire as opposed to clear-cut and planting longleaf pine and groundcover species. As well, forest stand density affects water distribution, growth, forest health and subsequently most functions of forested ecosystems [14]. Forest biomass reduction through silvicultural management practices (selective thinning, clear-cuts, prescribed fire) can increase streamflow by as much as 65% [15], [16], and reduces ecosystem water use [17], [18]. Strong associations are observed between basal area (BA), leaf area index (LAI), and groundcover that explain most observed variation in water use [18]. By significantly reducing ET from dense vegetation in coastal and nearshore ecosystems through implementation of much needed restoration activities, water yield can be increased and made available to local and regional surface, and groundwater resources [3], [18].

Net water yield is precipitation (PPT) minus ET. ET is essentially the largest global terrestrial water flux accounting for approximately 70% of PPT in the southeastern United States [19], and more water than runoff [15], [20]. The more water is lost to ET, the less water is accessible for surface flow, infiltration, and therefore streamflow [21]. In mature dense pine plantations in Florida, ET losses of over 90% have been reported [22], [23]. Under warming conditions, ET will continue to deplete groundwater over the contiguous U.S. [24]. That said, small reductions in ET can have a significant impact on water yield [25]. McLaughlin et al. [25] reports that reducing ET/PPT from 90 to 80% doubles the water yield (from 10 to 20%). The authors further clarify that naturally regenerated open pine stands in Florida have been shown to exhibit significantly lower ET than dense pine plantations, suggesting a substantial increase in water yield from uplands restored and maintained at lower stand-level basal areas [26], [27]. Reducing ET over large landscapes will help us solve the principal dilemmas of how to increase water quantity and where some of this additional volume will come from. Because water quantity is inextricably linked to water quality, improvements to water quantity (magnitude, frequency, duration, timing) can greatly improve water quality (temperature, state, constituent concentration) [28]-[31].

In the flat coastal plain of the Apalachicola Region, there are countless unpaved roads, failing and degraded drainage culverts and poorly engineered/maintained ditches contributing to sedimentation and nutrients [32]. Replacement of substandard culverts, installing wing ditches, ditch plugs, and low-water crossings are specific hydrologic improvement strategies proven to result in better water quality and quantity when designed and directed properly [33]. For example, when stream flows approach culvert design capacity, or when culverts fail, water tends to pond upstream of inlets causing sedimentation and bank erosion. Proper engineering of road crossing structures will minimize channel blockage during high sediment-transporting flows so erosion and deposition can be mitigated. Simple low-water crossings are highly useful in naturally unstable channels, or in channels with extreme flow variations. Because they are less obstructive, they are less likely to cause flow diversions or accelerations which can worsen channel instability. They are also relatively inexpensive to construct, less likely than culverts to be damaged or plugged by debris and are good for “storm-proofing” roads where large amounts of sediment and debris are expected following big storms or wildfires.

Roadside ditches are a very common feature on the Apalachicola landscape, particularly in timber production areas where excessively wet soil conditions limit tree growth and access to harvesting. While ditches have been a boon for slash pine timber production in wet areas, they have a significant downside in that they serve as pathways for sediment, nutrients, and pollutants from adjacent lands (e.g., nitrogen and phosphorus). For example, if soils are phosphorus rich, ditches can serve as a mobilizing mechanism [34]. In this region, ditches can create alternating conditions of drying and wetting. During dry periods, wetland soils are oxidized and aerobic decomposition of soil organic matter increases, which increases the potential for soils to release phosphorus. When the water table rises, released phosphorus can be transported to ditches via subsurface flow [35]. Extended periods with saturated conditions can create anoxia or hypoxia which can result in iron being reduced from ferric to the ferrous form. Ferric iron holds phosphorus while the ferrous form releases it. Therefore, strategies to improve water quality should include reducing drainage scope and the effect of ditches which can export mobilized phosphorus, but also capture some mobile phosphorus already in the waterway.

This is particularly the case with the 202,436-acre Tate’s Hell State Forest (THSF) which shares much of its boundary and multiple watersheds with the 576,680-acre Apalachicola National Forest (ANF). In the 1950s and 1960s, roadside ditches were excavated in THSF to provide road fill material, and to drain adjacent wetlands where pine stands were often bedded, planted at high densities, and fertilized with nitrogen and phosphorus [36]-[38]. In fact, it is this same silvicultural activity that created most of the hydrologic concerns for THSF and adjacent waters. In general, water quality in and around the largely undeveloped area is good, but the effects of ditching and bedding are the most significant source of water quality degradation [39]. As well, natural fire regimes were suppressed in the 50s and 60s resulting in large-scale habitat alterations which have impacted historical ecological communities, and the magnitude, timing, and quality of surface water runoff discharged from Tate's Hell Swamp to Apalachicola Bay, East Bay, St. George Sound and surrounding waters [36]-[38]. The State of Florida began purchasing the property from timber companies in 1994 with the specific goal of re-establishing historic surface water drainage patterns, improving water quality of surface runoff into the Apalachicola Bay system, and restoring wetland ecosystems [36]-[38]. Since then, much restoration work has been accomplished on THSF and adjacent lands within the lower Apalachicola Region.

The Apalachicola Regional Restoration Initiative (ARRI) Strategies 2 & 3 are long-term, collaborative efforts focused on using an ecosystem-based approach and science-based decision support tools to restore the ecosystems surrounding the Apalachicola River and bay. In this proposal ARRI seeks $12.5 million over 5 years to address stressors of poor water quality, low-water quantity, degraded longleaf pine and wetland habitat, failing infrastructure, insufficient wildlife and rare plant habitat, non-native invasive species, post hurricane risks (wildland fire, forest diseases and pests), lack of sufficient monitoring, limited public outreach to private forest landowners, and minimal natural resource management education for underrepresented minorities.

The USDA Forest Service, The Nature Conservancy (TNC), Apalachicola Regional Stewardship Alliance (ARSA), Florida Forest Service (FFS), Florida A&M University (FAMU), University of Florida (UF), and the Center for Spatial Ecology & Restoration (CSER) at FAMU will partner to implement a range of region-wide ecological restoration activities on more than 250,000 acres of federal, state and private lands. The impacts of these restoration activities will be measured through a comprehensive monitoring program (see monitoring). To prepare the next generation of land managers, wildland fire training certification will be provided by national experts and delivered to underrepresented minority students at FAMU. Results will be delivered to regional and Gulf-wide restoration partners through peer-reviewed publications, technical reports, and Web-based mapping and decision support tools being developed in Tate's Hell Strategy 1 [40], [41]. By working through established partnerships, using recognized and effective restoration techniques for a range of current conditions, and advanced geospatial techniques we can implement verified land management activities and improve structure, composition, function, and connectivity of the Apalachicola landscape.

This project closely aligns with several goals, objectives, and commitments of the Gulf Coast Ecosystem Restoration Council Comprehensive Plan 2016 update [42]. Proposed activities have been developed using a regional, ecosystem-based approach to restoration that leverages resources and partnerships from an ongoing RESTORE project (Tate's Hell Strategy 1) and science-based decision support tools developed for this project [40], [41]. Proposed restoration activities will address several of the primary goals and objectives from the Comprehensive Plan including restoring, enhancing/improving, and protecting habitats and water resources and protecting and restoring living coastal resources. The proposed activities may have a deferred effect on enhancing community resilience and revitalizing the Gulf economy by supporting environmental restoration and monitoring jobs. This project will also promote natural resource stewardship and environmental education (Objective 6) both through outreach and education to private forest landowners and through a targeted education component for minority students. This project will leverage spatial decision support tools from Tate's Hell Strategy 1 and add an advanced drone-based monitoring component to accompany field-based monitoring efforts. The science-based decision-making interface combined with spatially-explicit hydrologic models will link adaptive management to appropriate temporal and spatial scales to guide future ARRI and Gulf-wide restoration efforts.

Proposed Methods :

Increased water availability and improved water quality are primary objectives of ARRI Strategy 2, while Strategy 3 focuses on private forest landowner engagement and enrollment in approved management plans. For Strategy 2, the specific goal is to affect water recharge by reducing forest biomass and thus, evapotranspiration rates through targeted silvicultural and prescribed fire activities on the Apalachicola National Forest and across the region. This will be done by deploying an appropriate mixture of restoration activities (Table 1) within priority areas distributed across public and private lands. For all intents and purposes, Strategy 3 includes many of the same restoration activities and goals as Strategy 2, but private landowners must first be engaged and adopt approved management plans. Moreover, all proposed restoration treatments are proven methodologies for forest land management with reliable, repeatable results. We are also exploring new methods for restoration success, such as examining alternatives for converting slash pine plantations to longleaf pine in wet flatwoods. We will continue to develop detailed departure analyses to refine management activities based on restoration successes within our regional partnership (Apalachicola Regional Stewardship Alliance - ARSA). By applying a regional ecological condition framework, utilizing spatial decision support tools developed through Tate's Hell Strategy 1 [40], [41], prioritizing restoration efforts for maximum benefit, and leveraging knowledge and resources among partners, we will substantially increase the pace and scale of restoration of terrestrial habitats, which will then support regional resilience and improved hydrologic conditions in Apalachicola's watersheds. As well, by distributing restoration treatments in multiple habitat types and conditions across the landscape, operations can continue year-round to mitigate risk (see Risk & Uncertainties).

Potential regional target treatment locations (Figures 3 and 4) have already been developed (leveraging) and are based on products produced by CSER to estimate forest damage following Hurricane Michael [41], current hydrologic conditions, Florida Fish and Wildlife priority watersheds, Florida Department of Environmental Protection waters not attaining standards, Florida Natural Areas Inventory (FNAI) High Priority Natural Communities [43], [44], land cover [45], imagery, recent high-resolution LiDAR data, past land management activities including THSF, and years of professional restoration experience across the region. Vegetation structure estimates based on remote sensing and other data products have been compared to natural community condition benchmarks and used to identify areas where current conditions depart from desired future conditions.

Based on the detailed ecological condition assessments of multiple natural communities on the ANF [46], at least half of the conservation lands are in poor condition, which suggests a potential scale of work that is not feasible within the scope of this project. Therefore, to identify specific areas for targeted management activities we will apply further criteria based on maximizing restoration efficiency (i.e., cost, accessibility, likelihood of success, etc.) to increase connectivity of high-quality terrestrial systems to each other and to interdependent hydrologic systems.

CSER has also developed remotely-sensed ET estimates (leveraging) throughout the Apalachicola Region [47]. Further, derived ET estimates will be compared with calculated ET estimates using the modified Penman-Monteith equation [48] to produce an enhanced region-wide ET dataset to be used for soil water yield estimates. Areas likely to generate maximum positive change in water yield will be used to refine priority restoration sites within the landscape scale hydrologic assessment and restoration plan deliverables for Tate's Hell Strategy 1. This effort will ensure that land managers focus scarce restoration resources in areas that provide the greatest potential increase in water yield which will maximize freshwater availability for water resources, improved water quality, and critical habitat promoting a stronger and more resilient ecosystem.

Additional components of ARRI Strategy 2 (and 3) include hydrologic restoration, control of invasive species, and imperiled wetlands restoration. For hydrologic restoration, a targeted pre-proposal analysis has been conducted by CSER staff (leveraging) to identify priority hydrologic infrastructure on the ANF. This has provided many restoration options within high-priority watersheds (Figure 5). Within these watersheds, failing/damaged culverts, erosion features, and improperly designed ditches are all problematic, and need to be addressed. Given resources limitations, the primary focus will be on replacing failing culverts with low-water crossings. As mentioned, simple low-water crossings are highly effective, less obstructive, less likely to cause ?ow diversions or accelerations, relatively inexpensive to construct, less likely to be damaged or plugged by debris, and are good for "storm-proo?ng" roads. Where appropriate, ditch plugs, water bars and wing ditches may be installed to prevent erosion, restore wetlands or hydrologic connectivity.

Strategy 3 is a significant portion of ARRI and offers vital outreach to private forest property-owners who are the predominant forest landowners in this region [49] and pivotal to the conservation and restoration of longleaf and hydrologic resources. Specifically, the FFS will lead the effort to engage and advise private forest landowners in active management and restoration of their lands (Figure 3). Protecting forests at risk of conversion to more intensive uses, restoring native species, controlling invasive species, managing for resilience against catastrophic loss, and restoring forested wetlands, floodplains and riparian areas are critical to the health of the Gulf. This is particularly important considering the extensive damage from Hurricane Michael to privately-owned forests within Gulf watersheds. These forests are at increased risk for wildfire, invasive species and pest infestations, disease, and conversion to non-forest land uses. Outreach will consist of micro-targeting data analysis and social marketing strategies to engage priority landowners in sustainable forest management. As landowners respond to marketing they will be provided with consistent educational and stewardship communications, targeted newsletters, peer-led events, landowner cooperative associations, technical education programs and, on request, personal visits from natural resource professionals. Based on FFS experience and requested funding levels we expect these educational opportunities will inform over 300 landowners on techniques to improve forests and habitat conditions on private lands. Of these, approximately 100 will accept a forester visit to receive management advice and commit to a forest management plan. Workshops will focus on practice implementation, silvicultural and wildlife best management practices, and will facilitate the creation of 300+ practice plans covering 25,000 acres. Private forest owners will also be provided with prescribed fire assistance from the TNC restoration teams. Private prescribed fire assistance will be identified in coordination with the Strategy 3 Private Forests Initiative. Both public and private NNIS planning and assistance will be provided by the teams and contracted services. These activities will increase the quantity of private forest lands being actively managed with several different objectives including invasive species control, timber stand improvement, site preparation, hydrologic restoration, prescribed fire, and establishment of 5,000 forested acres with native species. The "on-the-ground" efforts will be directed by the FFS with assistance from the Florida Fish & Wildlife Conservation Commission, USDA NRCS, and other restoration team partners (leveraging).

On the whole, to affect change across the region, we intend to: 1) apply 18,000 acres of silvicultural treatments on the Apalachicola National Forest, 2) enroll regional private forest landowners in management plans across 25,000 acres, 3) apply prescribed fire and fuels treatments across 200,000+ acres across the entire region, 4) improve hydrologic connectivity in targeted locations on the Apalachicola National Forest that will impact 5,000 acres of high-priority watersheds, 5) apply treatments for controlling nonnative invasive species across 500 acres, and 6) restore 50 acres of wetlands to improve habitat for the imperiled frosted flatwoods salamander (Table 2).

Environmental Benefits:

Freshwater inflow into the Apalachicola River and bay have been significantly reduced in recent decades coinciding with upstream use and storage. This has impacted physical, biogeochemical, and hydrologic conditions in coastal and near-shore ecosystems and the productivity of the Apalachicola Region's commercially and culturally significant seafood industry. Increased water availability and improved water quality are primary objectives of ARRI Strategies 2 & 3. Specifically, the goal is to increase water recharge by reducing forest biomass and thus, evapotranspiration (ET) via targeted forest management implemented on high priority sites throughout the Apalachicola Region (Figures 3 and 4). Dense pine plantations have significantly higher levels of ET than naturally regenerated open pine forests [27], [28]. Stand densities will be reduced on up to 18,000 acres thus leading to increased water yield [26], surface flow, infiltration, and streamflow [22]. Moreover, improved forest management on 25,000 acres of private forests will expand and protect regional water resources. Because water quantity and quality are inextricably linked, improvements to water quantity will also improve water quality [30] – [33].

The Apalachicola River, bay, and surrounding forested lands are central to the region's status as a North American biodiversity "hotspot" [1]. Longleaf pine forests and savannahs are the predominant naturally occurring upland forest type and the region serves as a "Significant Geographic Area" for longleaf restoration according to America's Longleaf Restoration Initiative. Longleaf forests and abundant embedded wetlands provide critical habitat to several state and federally listed species including red-cockaded woodpecker and frosted flatwoods salamander, however recent work has shown that as much as half of the historic longleaf ecosystems in this area are in poor ecological condition and need ecological restoration [46].

ARRI Strategies 2 & 3 maximizes environmental benefits by utilizing spatial decision support tools and products developed through Tate's Hell Strategy 1 [40], [41] to prioritize much needed restoration efforts. Silvicultural treatments are prioritized to maximize water yield [47] and to improve habitat conditions for imperiled species. Hydrologic restoration is targeted to high priority watersheds identified in Tate's Hell Strategy 1 hydrologic assessment [40] and will restore natural sheet flow and improve water quality by increasing sediment retention and nutrient assimilation on up to 5,000 acres. Installation of simple low-water crossings will reduce flow diversions and/or accelerations which can worsen channel instability. Where appropriate ditch plugs, water bars and wing ditches may be installed to restore hydrologic connectivity and to reduce transport of sediment, nutrients, and pollutants from adjacent lands.

ARRI Strategies 2 & 3 leverage significant knowledge, resources, and partnerships from the ARSA and Tate's Hell Strategy 1 [40] to substantially increase the pace and scale of restoration across the Apalachicola Region. Over the 5-year ARRI timeline, region-wide ecological restoration activities will be implemented on approximately 250,000 acres of federal, state, and private lands (Table 2). This will include silvicultural restoration (e.g., thinning, planting longleaf) and prescribed fire application. In Strategy 3 up to 25,000 acres of private forestlands will also be covered under new practice plans which will conserve and improve critical habitat. Improving and restoring terrestrial habitats will also support regional resilience and improved hydrological conditions in Apalachicola's watersheds.

Progress towards improved regional habitat and hydrologic conditions will be monitored by CSER using field visits, remotely sensed data from drones and satellites, and hydrologic models. Monitoring results will be disseminated using Webmaps/storymaps, technical reports, peer-reviewed publications, and quarterly meetings of the Apalachicola Regional Stewardship Alliance (ARSA) to inform and adapt ongoing management activities. Monitoring and modeling data will also be used to update ecological and hydrologic conditions in decision support tools through time. This process includes not only prioritizing new restoration areas, but also maintaining areas already restored (e.g. with prescribed fire). By using this regional ecological framework to prioritize restoration efforts for maximum benefit, and leveraging knowledge and resources among partners, we will maximize and sustain environmental benefits, and reduce wildfire risks to communities. This approach and other methodologies used in ARRI are also transportable to other restoration efforts across the Gulf.

Protecting forests at risk of conversion to more intensive uses, restoring native species, controlling invasive species, managing for resilience against catastrophic loss and restoring forested wetlands, floodplains and riparian areas are vital to the health of Gulf waters. Strategy 3 offers invaluable support to private forest property-owners who are the predominant forest landowners in this region [49] and are pivotal to longleaf conservation and hydrologic restoration. Outreach efforts will consist of micro-targeting to engage priority landowners, educational workshops focusing on silviculture, and wildlife best management practices. In addition to direct environmental benefits, Strategy 3 will help educate landowners on land stewardship and sustainable forest management.

CSER and TNC will also implement a unique wildland fire training certification program specifically geared towards undergraduate minority students at FAMU. The program focuses on wildfire suppression and controlled burning as a natural resource management tool. Students completing this course will receive federal certification that allows them to compete for wildland fire related jobs. This effort will educate students on the importance of active forest management and should help to maintain the restoration investment by increasing the local wildland fire workforce.

ARRI restoration activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the practice implementation. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to resources of concern such as cultural resources or threatened and endangered species. This process will help document expected impacts and benefits of each activity for soil, water, plants, wildlife, and fisheries.

In summary, ARRI will improve and maintain healthy ecosystem services including water storage and filtration in upland forests, wetlands, and coastal ecosystems throughout the Apalachicola Region. Dense pine plantations targeted for treatment will improve healthy, open canopy longleaf ecosystems and thus allow more precipitation to percolate into the shallow surficial aquifer, streams/rivers, and ultimately into estuaries and bays. Targeted hydrologic restoration will restore natural sheet flow and improve water quality by increasing sediment retention, nutrient assimilation, and aquatic organism passage. ARRI will accelerate forest restoration, provide benefits to coastal communities and ecosystems, and create increased continuity and acreage of actively managed forests leading to expanded public benefits in the form of water quality protections, water recharge, improved wildlife habitat, cleaner air, better quality of life, and expanded economic activity.

Metrics:

Metric Title: HR004 : Habitat restoration - Acres restored
Target: 2,000
Narrative: Of the 18,000 acres of silvicultural restoration proposed in Strategy 2, 2,000 acres will be restored to resemble original habitat via thinning, planting, chopping and other target silvicultural activities . Remaining areas (approximately 16,000 acres) will be on the path to restoration as defined in the USDA Forest Service Southern Region Longleaf Pine Restoration Strategy [50] and A Desk Guide to the 3 Step Trigger System for Longleaf Pine

Restoration- Guidance on the Path Towards Restoration [51].

Metric Title: HR009 : Restoring hydrology - Acres with restored hydrology
Target: 5,000
Narrative: Install 15 low-water crossings and repair, replace 12 road crossing structures (including 2 box culverts). Opportunistic additions or upgrades to other accompanying hydrologic features is probable.

Metric Title: HM005 : Agricultural BMPs - acres under contracts/agreements
Target: 25,000
Narrative: For Strategy 3, it is anticipated that practice plans will cover 25,000 acres of private lands. These activities will increase the quantity of private forest lands being actively managed with several different objectives including invasive species control, timber stand improvement, site preparation, hydrologic restoration, prescribed fire, and establishment of native species.

Metric Title: HM006 : Habitat management and stewardship - Acres under improved management
Target: 250,000
Narrative: For Strategy 2, prescribed fire and silvicultural treatments will be spread across ARRI on up to 250,000 acres. For longleaf pine natural communities these management activities will restore approximately 2,000 acres (see HR004) and will put many more areas (approximately 218,000 acres) on the path to restoration as defined in the USDA Forest Service Southern Region Longleaf Pine Restoration Strategy [50] and A Desk Guide to the 3 Step Trigger System for Longleaf Pine Restoration- Guidance on the Path Towards Restoration [51].

Risk and Uncertainties:

The scope and scale of ARRI alone presents inherent risk. Consequently, incorporating risk analysis is a means of improving decision-making quality and thus adaptive management in the face of uncertainty. In ARRI Strategies 2 & 3, there are broad types of unpredictability that apply including risk from: 1) mega-scale events—hurricanes, wildfires, climate change, pandemics, and market failure, 2) strategic risk—risk from failed operational strategy, and assumed liability of undertaking landscape-level restoration on public and private lands to achieve desired environmental benefits, and 3) preventable risk—peril from breakdowns in routine operational processes.

Accounting for mega-factors, preventable and strategic risks all require different management strategies. Typically, preventable risks are managed through rule-based compliance while strategic risks are best managed by facilitators and experts (independent and embedded). To compensate for operational inefficiencies, there are many existing rule-based compliance elements in place that have been thoroughly vetted by multiple organizations following years of restoration successes. To help with strategic risks over the 5-year time horizon of ARRI, a facilitator/coordinator experienced in large-scale restoration will be hired specifically to help assess and mitigate risk. Moreover, attenuating factors to operational, strategic, and mega-factor risk have already been considered in the pre-proposal analysis in that activities can be distributed across agencies and the ARRI landscape among wet and dry, public and private locations among multiple habitat types while simultaneously considering value and impact to terrestrial and hydrologic resources all prioritized within a high-resolution spatial framework. This analysis spreads risk from multiple vectors across the region by using spatial technology to classify and quantify restoration targets before proven traditional ground-based restoration activities begin. Because all of this has been captured through the lens of remote sensing within the context of the landscape before the project begins, we can apply further granularity by supporting our prioritization scheme with volumes of high-quality LiDAR, vegetation and natural community data that have taken years to develop. This process has been leveraged from work conducted previously in Tate's Hell Strategy 1 and provided in this proposal with analytical results and figures depicting prioritized restoration targets throughout the region. Because seasonality and extreme weather are significant factors, having the array of spatial locations to operate will allow restoration teams to conduct activities somewhere within the region at any given time resulting in lower chance of work stoppage.

In general terms, risks from mega-scale events are clearly beyond the control of this project, but the way we respond is not. While it is probable that ARRI will experience severe and perhaps time-limiting weather or wildfire events, it is not likely that these events will be distributed region-wide for extended periods of time. It is noteworthy to mention that this region has already experienced multiple mega-scale events and there are team members attached to this project that are prepared to respond accordingly. However, there are unforeseen events that may understandably catch everyone off guard (e.g., coronavirus pandemic). Overall, to effectively demonstrate a consistent, scalable risk assessment framework in the sense that methodologies can be used to quantify risk at project, unit, landscape, regional, national and global scales is exceedingly complex and requires a level of effort beyond the scope of this proposal at this time.

Detailed analysis of potential effects of climate change on forest resources, or the effects of forest management activities on climate are impractical at the ARRI project scale. There is insufficient information to quantify effects of project activities on global phenomena such as air temperature increases, sea level rise, changes in precipitation patterns, and increased frequency of extreme weather events (e.g., heat waves, droughts, and floods). Similarly, it is of limited value to quantify potential effects of climate change on resources in this project given uncertainties in the range of future climate scenarios and responses of forest resources to potential changes. Whether or not to conduct restoration in low-lying coastal locations subject to sea-level rise should be a programmatic RESTORE decision on how to handle/respond to this issue Gulf-wide, and not for individual projects. As such, the consideration of climate change is limited to the discussion below.

Some activities proposed in this project will produce greenhouse gases (e.g., timber harvesting and prescribed fire). Of all the activities presented in this proposal, significant effort will be directed towards conversion of short-rotation pine plantations and other degraded habitats into resilient, diverse, long-rotation longleaf pine stands which will yield significant water quantity and quality improvements. This management shift will also sequester carbon in standing trees and continue to accumulate carbon for at least 120 years and possibly up to 450 years [52], [53]. When longleaf pines are harvested, they will primarily produce sawtimber products rather than pulp [54], which will sequester carbon beyond the life of the tree. Additionally, recent studies suggest that litter and understory C and N pools in longleaf/slash pine stands recover rapidly from fire [55], so the effects of prescribed burning on the overall carbon budget in this system are expected to be negligible. Essentially, the short-term production of greenhouse gases by the proposed activities in ARRI are likely be offset by increased carbon sequestration as desired vegetation responds to improved conditions. A no-action alternative would not directly result in increased greenhouse gas emissions but will result in higher catastrophic wildfire risk due to high fuel loads which could release a large pulse of CO_2 and particulates during a wildfire event.

Climate change scenarios for the southeastern United States frequently include a moderate increase in average air temperature along with a higher frequency and severity of droughts, fires, and hurricanes [55]. These changes may have a variety of effects on ecosystems and processes but planting longleaf pines accompanied by frequent prescribed fires should increase forest resistance to insect/disease, catastrophic wildfire and increase resilience to extreme weather events [53], [56]. In the context of climate change, the proposed activities will undoubtedly increase forest health and resilience to climate-related perturbation, whereas no action will result in forests that are less resistant and resilient to drought, disease, hurricanes, and insect damage.

Since there will be some small-scale contracting for hydrologic infrastructure improvements on the Apalachicola National Forest, there is some risk associated with scheduling and contracting delays, design shortfalls and cost overruns, but these are all minimal. In general, the process of installing culverts and other road crossing structures is a familiar workflow. The pre-proposal analysis conducted by CSER staff to target hydrologic infrastructure for restoration on the ANF provides many options within high-priority watersheds (Figure 5). Conversely, the no-action decision introduces risk of further degradation of hydrologic infrastructure in key coastal areas that can have a dramatic impact on water quality and resilience against flooding.

In ARRI Strategy 3, there is risk associated with non-participation from private forest landowners and the potential conversion of forest lands to other land uses including non-traditional uses such as hemp or solar. Given recent unforeseen economic events associated with Hurricane Michael and the coronavirus pandemic, landowners may be considering more lucrative land use options, or perhaps even be forced to sell property to remain financially viable. However, there is recent good news for private forest landowners in the Apalachicola Region. In a May 28, 2020 press release, Florida Agriculture Commissioner Nikki Fried, "applauded the signing of an agreement between the State of Florida and the U.S. Department of Agriculture to administer $380.7 million in grant funding to help Florida's timber industry recover following Hurricane Michael in 2018." Florida's timber producers may receive funding as early as fall 2020. It is likely that the USDA Farm Service Agency's Emergency Forest Restoration Program will help allay concerns regarding large-scale conversion induced from financial hardship experienced from economic impacts associated with Hurricane Michael or the coronavirus pandemic, and will help ensure a robust and viable timber market for decades to come. Under the agreement, the FFS will work directly with timber producers to help them verify and document timber losses. This could be a win-win in that the FFS will already be working with landowners to document timber damage which may provide opportunities to enroll property owners in approved management plans associated with ARRI Strategy 3. By providing forest landowners with financial and technical assistance, and information about the critical ecosystem services they provide (water quality, quantity, wildlife and fisheries habitat, and economic benefits), many are expected to opt for active forest management of their properties. ARRI Strategy 3 will also complement the Emergency Forest Restoration Program because it is not limited to private forests impacted by Hurricane Michael.

While hemp has become a "booming" industry in the U.S., there are several things that stand in the way for Florida's would-be hemp producers and thus forest landowners considering conversion. Indeed, Florida has considerable hemp production potential, but the state is not currently producing industrial hemp. Presently, the legal and regulatory framework for hemp is undergoing a nationwide transformation and there appears to be more questions than clear answers. Licensing for hemp cultivation in Florida has just recently begun. As of April 27, 2020, FDACS began accepting applications to grow industrial hemp. Therefore, it stands to reason that production and processing infrastructure are not firmly established for hemp which is also an impediment to conversion. As well, it is probable that current agricultural producers will be more likely to convert rather than forest landowners as this will require harvesting and clearing assuming landowner timber is ready for harvest. In general, there is probably greater risk to forest landowners associated with conversion to hemp, particularly since there is not an established product processing or distribution network within the state, nor is Multi-Peril Crop Insurance (MPCI) available to hemp producers in Florida.

In terms of conversion of forest lands to solar, the landscape has not been completely illuminated.

Forest landowners must first consider that the transfer of land from agricultural/forestry use may result in added tax liability, increased insurance, personal injury/liability concerns, and perhaps future environmental mitigation, or even the inability to transfer lands into other uses. Additionally, while Florida was 5th in the nation for solar installations (Q3 2019), the state prevents agreements by legal language such that any entity that buys or sells energy is considered a "public utility," and thus subject to regulations that third-party solar vendors are not ordinarily subjected to. Moreover, solar power generation in Florida suffered a 21.8% drop from March 2019 to March 2020 [57]. This currently remains an impediment to conversion although the solar industry will likely continue to expand in Florida.

The health of the Apalachicola Region's natural ecosystems, aquatic resources, rare and threatened species, commercial interests, and quality of life are all impacted by non-native invasive species. Nearly half of all species federally listed as threatened or endangered are thought to be at risk primarily because of invasive species [58]. As well, water quality and quantity problems have been linked to NNIS. For example, two invasive plants (giant reed and salt cedar) can impact riverine hydrology [59], [60], and both species are currently invading native habitats in north Florida. Large populations of invasive species can reduce stream and groundwater recharge through evapotranspiration and create physical barriers to surface flow. The positive hydrologic dilution potential associated with large-scale restoration proposed by ARRI, in an area known to have water scarcity issues resulting in elevated salinities in the Apalachicola Bay, should weigh heavily in favor of this project. Again, the results of a no-action response are self-evident.

Clearly, the goal of ARRI is to: 1) dramatically reduce water loss through evapotranspiration and thus restore water recharge by reestablishing significantly degraded ecosystem structure, function, and dynamic processes to a more natural, improved condition (e.g., converting dense slash pine stands to native longleaf habitat), and 2) restore disturbed surface and channel flows to less disruptive natural flows that reduce sedimentation and nutrients while allowing free aquatic organism passage. The positive water quantity and quality benefits derived from restoration and direct intervention are attainable and have been thoroughly outlined above. This project is not without risk, but these risks are manageable within the scope, scale, and time horizon of the project. The active and adaptive forest management activities proposed here could facilitate a more rapid and smooth transition to a new and perhaps novel future forest condition with lower risk to forests, habitat, communities and local economies, while providing water-related benefits all in light of the risk factors outlined above. Overall, there is a much greater risk from a no-action decision simply because it introduces risk of further degradation of the ecosystems in the Apalachicola Region and due to the fact that there will be fewer incentives for private landowners to maintain their lands in forest. Truthfully, the biggest threat/risk to the Apalachicola Regions' ecosystem services is from development associated with population growth. Over time, the efforts from ARRI may prove the ecosystem services provided from restored forest lands are invaluable particularly as projected population increases are realized.

Monitoring and Adaptive Management:

A comprehensive monitoring program will be implemented to ensure compliance, realize effectiveness, and adapt restoration methods as needed. CSER at FAMU, and a newly hired Stewardship Coordinator will lead monitoring activities and coordinate with partners. Monitoring will occur at scales ranging from individual sites to the landscape-level and results will be disseminated using Webmaps/storymaps, technical reports, peer-reviewed publications, and quarterly meetings of the Apalachicola Regional Stewardship Alliance (ARSA) to inform and adapt ongoing management activities.

Site-level data will be collected for all activities and accomplishments will be tracked in TNC's Conservation Activity Tracking Database, and USDA's Forest Activity Tracking System. Water quality

BMP monitoring will occur at all silvicultural, fire and hydrologic treatment sites to ensure compliance with state BMPs [61] and Clean Water Act requirements. Existing USDA standard operating procedures will also be followed for monitoring prescribed fire [62], and silvicultural treatment effectiveness [63], [64].

Hydrologic and wetland restoration will be monitored before, during and after treatments. Monitoring will include site visits using standard protocols developed by the CSER, USFS Center for Aquatic Technology Transfer and Southeast Aquatic Resource Partnership to: 1) assess conditions of cross drains, culverts, ditches and plugs, 2) improve hydrologic flow, 3) reduce sedimentation, and 4) improve aquatic organism passages [65]. A subset of hydrologic restoration sites will be more intensively monitored using very high-resolution drone-borne multispectral and thermal image sensors to map changing conditions (e.g., water levels, vegetation). Internet of Things (IoT) sensors may also be deployed at the same subset of sites to continuously measure water quantity and quality parameters of interest (e.g., water levels, soil moisture, turbidity) as well as changing parameters following major events (storms, wildfires, management activities). CSER, the FAMU School of Environment (SOE) Core Lab and the FAMU-FSU College of Engineering (COE) will pursue additional funding for students to conduct site-level water quality monitoring across a range of treatment categories and to analyze results for undergraduate and graduate research projects. For example, CSER/SOE/COE are currently funded by the USFS Southern Research Station's Florida Forested Watershed Research Program for a 2-year water quality study in the New River watershed on the ANF as part of a COE Ph.D. dissertation project.

Additionally, CSER is developing a drone-based prescribed fire efficiency monitoring program using very high-resolution multispectral data produced from drone-borne MicaSense RedEdge sensors flown pre and post fire to accurately map burned areas. For a subset of natural communities, drone data will be analyzed in conjunction with field fuel plot data collected pre and post fire to assess the efficacy of prescribed fire to enhance ecosystem conditions (e.g., increasing cover of native pyrogenic groundcover). Partner-developed monitoring opportunities (Big Plot Network) will be utilized (leveraging) for long-term monitoring, and consist of ultra-high density LiDAR point clouds, high spatial resolution 3D projected hyperspectral reflectance data, radiometrically calibrated thermal point clouds, and very high-resolution visual imagery overlaid onto existing detailed ground-based vegetation plot data.

Landscape-level monitoring will utilize remote sensing and field plots established across the ARRI landscape in Tate's Hell Strategy 1 [41], [45], [66], [67]. The structure and condition of forest ecosystems [46] will be updated annually and when combined with the spatially-explicit Regional Restoration Decision Support System (a deliverable under development for Tate's Hell Strategy 1) will help prioritize and adapt treatments each year based on past successes (e.g., improving hydrologic and ecological conditions). Hydrologic models such as the Soil and Water Assessment Tool [68] and the Better Assessment Science Integrating Point and Non-point Sources (USEPA) will also be explored to effectively estimate watershed to landscape-level improvements to water quantity and quality from management activities on public and private lands. Hydrologic models will incorporate best available in situ and geospatial data layers for calibration/validation and will be used to simulate water quantity and quality benefits over longer time scales and under more varied climatic conditions than will be possible through field measurements alone. Monitoring results will be shared through technical reports, peer-reviewed publications, Webmaps/storymaps, and social media all of which will be used to inform adaptive management decisions at quarterly meetings of ARSA.

Data Management:

Data management for ARRI Strategies 2 & 3 will be conducted by TNC, USFS, CSER and FFS/FDACS.

TNC will deploy and share their Conservation Activity Tracking Database (CATDB) for restoration activities including silvicultural and prescribed fire treatments, hydrology, cost accounting and location. CATDB is flexible and can accommodate ARRI workflows and some spatial data. CATDB data will be consumed by CSER and the Shared Stewardship Coordinator and ported into the USFS Forest Activities Tracking System (FACTS) and Field Sampled Vegetation (FSVeg) database to capture treatments and vegetation changes on national forest land. For LiDAR, imagery, large spatial datasets, spatial analysis intermediates and products, CSER will use infrastructure already assembled at FAMU (leveraging) including high-speed (10Gb) network storage arrays and Microsoft's Azure cloud computing framework. CSER has been analyzing and storing data locally while harnessing the power of the distributed cloud through multiple Azure services including AI and machine learning. The same processes will be utilized for ARRI Strategies 2 & 3. Specifically, for Strategy 3, outreach data will be managed by FFS/FDACS and consist of micro-targeting data analysis and social marketing strategies to reach and engage priority landowners in sustainable forest management. One of the deliverables for Tate's Hell Strategy 1 is a spatially-explicit Regional Restoration Decision Support System which will be deployed for ARRI data analysis and distribution along with ESRI's ArcGIS Online. Stakeholders and partners will be able to freely access data and products through existing technology assembled as part of Tate's Hell Strategy 1 (leveraging).

Collaboration:

ARRI Strategies 2 & 3 reestablish proven partnerships that precede Tate's Hell Strategy 1. Strategy 2 partnerships include the USDA Forest Service, TNC, ARSA, FFS, FAMU, UF, and CSER at FAMU. The National Forests in Florida has been partners with TNC for over 15 years and have a demonstrated record of conservation and restoration achievements within the Apalachicola Region. CSER at FAMU developed from Tate's Hell Strategy 1, serves as a model for government/academic/industry partnerships including direct and generous in-kind support from USDA, FAMU, UF, FNAI, Microsoft, SenseFly, Pix4D, Davis Instruments and Certified Ag Resources. Strategy 3 also builds upon projects predating Tate's Hell Strategy 1. The FFS with assistance from the Florida Fish & Wildlife Conservation Commission, NRCS, USFS and other restoration team partners will lead a private lands initiative with the specific purpose to partner with landowners.

Public Engagement, Outreach, and Education:

Apalachicola Regional Restoration Initiative (ARRI) - Public Engagement, Outreach and Education:

- Partner/Stakeholder meetings will mimic those already conducted through Tate's Hell Strategy 1 which included:
  - USDA Gulf Coast Ecosystem Restoration Team
  - National, regional, and state leadership and staff from U.S. Forest Service, NRCS, TNC, FAMU, FFS, and UF
  - AL, FL, and MS state foresters and conservationists, National Fish and Wildlife Foundation, American Forest Foundation, etc.
- FAMU research seminars - 4 to date
- ARRI session which included partner presentations conducted at the National Conference on Ecosystem Restoration, New Orleans, LA, August 2018.
- Deepwater Horizon Restoration Summit – Booth with exhibits, Ft. Walton Beach, FL, November 2019
- Peer-reviewed publications and technical reports
- CSER's social media accounts on LinkedIn, Twitter, Facebook, and YouTube, as well as Webmaps/storymaps shared through ArcGIS Online.

Additionally, the Apalachicola Regional Stewardship Alliance (ARSA) and planned Shared Stewardship Coordinator position will play vital roles in mitigating risk and coordinating treatments across managed lands and focal public restoration areas (Figures 3 & 4). Proposed treatments will be finalized at ARSA quarterly meetings and additional leveraging opportunities will be explored. FFS will lead a partnership effort to engage private forest landowners in active management and restoration of their lands. Outreach will consist of micro-targeting to engage priority landowners as well as workshops focusing on silviculture and wildlife best management practices. CSER and TNC will also implement a unique wildland fire training certification program specifically geared towards undergraduate minority students at FAMU. Classes will be conducted at FAMU and provide basic training in wildland fire management. The course focuses on wildfire suppression and controlled burning as a natural resource management tool. Course of study includes in-person lectures and field applications training where students will participate in live controlled burn experiences. Students completing this course will receive federal certification that allows them to compete for wildland fire related jobs.

Leveraging:

Funds: $7,500,000.00
Type: Bldg on Others
Status: Received
Source Type:
Description: -This project will build on hydrologic restoration efforts on Tate's Hell State Forest by restoring other high priority watersheds within the Apalachicola region to achieve large-scale results for improved water quantity/quality and improved habitat -Leverages hydrologic assessment to focus on additional high priority hydrologic restoration within the Apalachicola river watershed -Leverages existing baseline components of Regional Decision Support System (RRDSS, currently in early development) to focus ecosystem restoration on high priority areas -Leverages Council investment towards Center for Spatial Ecology and Restoration to monitor effectiveness of treatments and to adapt management activities accordingly.

Funds: $417,162.00
Type: Co-funding
Status: Committed
Source Type: State
Description: FAMU has committed a minimum of 20% match to a new 5-year participating agreement. This could include (but is not limited to): space for the Center for Spatial Ecology and Restoration, tuition/stipends for students, faculty and staff time and use of laboratory facilities (e.g., for analysis of water quality samples). For the past 2 years, FAMU has well exceeded this match threshold with a share of 30-40%.

Environmental Compliance:

USDA has advised the Council that these conservation practices are covered by USDA Categorical Exclusions (CEs). The Council is using these CEs for these activities, consistent with Section 4(d)(4) of the Council's National Environmental Policy Act (NEPA) Procedures, which enables the Council to use member CEs, where appropriate. Based on information provided by USDA, the Council has considered potential extraordinary circumstances, including potential negative effects to threatened and endangered species, essential fish habitat, Tribal interests, and historic properties, where applicable, and has determined that no such circumstances apply. In using these CEs, the sponsor will employ the mitigation measures included in the USDA CE documentation pertaining to aquatic resources, protected species, and cultural and archeological resources. In conjunction with the planning process, NRCS undertakes site specific environmental evaluations (EE) to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the CPA-52 (the NRCS EE form) before conservation/restoration implementation is initiated. The EE assesses the effects of conservation alternatives and provides information for the purpose of determining the need for additional consultation. In situations where a single conservation practice may result in increased risk to the condition of another resource, additional conservation practices are integrated into the conservation plan to avoid creating new resource concerns. The EE process helps to ensure that all potential impacts to natural resources are identified and appropriate alternatives and practices are available to the landowner. Each conservation plan and contract/agreement will be accompanied by an EE.

Bibliography:

[1] B. A. Stein, L. S. Kutner, and J. S. Adams, Precious heritage: the status of biodiversity in the United States. New York: Oxford University Press, 2000.

[2] R. K. Peet and D. J. Allard, “Longleaf pine-dominated vegetation of the southern Atlantic and eastern Gulf Coast region, USA,” in Proc. Tall Timbers Fire Ecology Conf., no. 18, Tallahassee, FL, 1993, pp. 45-81.

[3] D. L. McLaughlin and M. J. Cohen, "Realizing ecosystem services: wetland hydrologic function along a gradient of ecosystem condition," Ecological Applications, vol. 23, no. 7, pp. 1619-1631, 2013.

[4] J. A. Miller, HA 730-G Ground Water Atlas of the United States- Alabama, Florida, Georgia and South Carolina. U.S. Geological Survey Publications Warehouse, 1990. Accessed: Mar. 12, 2020. [Online]. Available: https://pubs.usgs.gov/ha/ha730/ch_g/G-text6.html.

[5] T. C. Brown, M. T. Hobbins, and J. A. Ramirez, “Spatial distribution of water supply in the coterminous United States,” Journal of the American Water Resources Association, vol. 44, no. 6, pp. 1474-1487, Dec. 2008.

[6] R. J. Livingston, “The relationship of physical factors and biological response in coastal seagrass meadows,” Estuaries, vol. 7, no. 4, pp. 377–390, 1984.

[7] D. Scavia, J. C. Field, D. F. Boesch, R. W. Buddemeier, V. Burkett, D. R. Cayan, and J. G. Titus, “Climate change impacts on U. S. coastal and marine ecosystems,” Estuaries, vol. 25, no. 2, pp. 149-164, 2002.

[8] Florida Sea Grant, “Apalachicola Bay Oyster Situation Report (TP-200),” Apr. 2013. Accessed: Mar. 10, 2020. [Online]. Available: https://www.flseagrant.org/wp-content/uploads/tp200_apalachicola_oyster_situation_report.pdf.

[9] P. A. Hovenga, D. Wang, S. C. Medeiros, S. C. Hagen, and K. Alizad, “The response of runo? and sediment loading in the Apalachicola River, Florida to climate and land use land cover change,” Earth’s Future, vol. 4, pp. 124–142, May 2016, doi: 10.1002/2015EF000348.

[10] Florida Department of Environmental Protection, "Source Water Assessment and Protection Program: Aquifer descriptions," Sept. 2015. Accessed: Mar. 11, 2020. [Online]. Available: https://fldep.dep.state.fl.us/swapp/Aquifer.asp.

[11] P. W. Bush and R. H. Johnston, “Ground-water hydraulics, regional flow, and ground-water development of the Floridan aquifer system in Florida and in parts of Georgia, South Carolina, and Alabama,” U.S. Geological Survey, Washington D.C., USGS Professional Paper 1403-C, 1988, doi: 10.3133/pp1403C.

[12] Southwest Florida Water Management District, “West-Central Florida’s aquifers: Florida’s great unseen water resources,” Oct. 2017. Accessed Mar. 11, 2020. [Online]. Available: https://www.swfwmd.state.fl.us/sites/default/files/store_products/flas_aquifers.pdf.

[13] L. E. Condon and R. M. Maxwell, “Systematic shifts in Budyko relationships caused by groundwater storage changes,” Hydrology and Earth System Sciences, vol. 21, no. 2, pp. 1117–1135, Feb. 2017.

[14] Z. Zhang, Y. Gong, and Z. Wang, "Accessible remote sensing data-based reference ET estimation modelling," Agricultural Water Management, vol. 210, pp. 59-69, Nov. 2018.

[15] M. D. Hoover, “Effect of removal of forest vegetation upon water yields,” Transactions, American Geophysical Union, vol. 25, no. 6, pp. 969-977, 1944.

[16] E. A. Johnson and J. L. Kovner, “Effect on streamflow of cutting a forest understory,” Forest

Science, vol. 2, no. 2, pp. 82-91, June 1956.

[17] P. J. Edwards and C. A. Troendle, “Water yield and hydrology,” in Cumulative watershed effects of fuel management in the Eastern United States, R. Lafayette, M. Brooks, J. Potyondy, L. Audin, S. Krieger, and C. Trettin, Eds., Asheville, NC, USA: USDA Forest Service, Southern Research Station, General Technical Report SRS-161, 2012, pp. 229-281.
[18] M. J. Cohen, D. L. McLaughlin, D. A. Kaplan, S. Acharya, “Managing forests for increased regional water availability,” Final Report to Florida Department of Agricultural and Consumer Services, Contract No. 20834, 2018.
[19] R. L. Hanson, “ET and Droughts,” in National water summary 1988-89—Hydrologic events and floods and droughts, R. W. Paulson, E. B. Chase, R. S. Roberts, and D. W. Moody, Eds., Reston, VA, USA: USGS Water-Supply Paper 2375, 1991, pp. 99-104.
[20] K. E. Trenberth, L. Smith, T. Qian, A. Dai, and J. Fasullo, “Estimates of the global water budget and its annual cycle using observational and model data,” Journal of Hydrometeorology – Special Section, vol. 8, pp. 758-769, 2007.
[21] H. W. Anderson, M. D. Hoover, and K. G. Reinhart, Forest and water; effects of forest management on floods, sedimentation, and water supply. Berkeley, CA, USA: USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, General Technical Report, PSW-18. 1976.
[22] H. L. Gholz and K. L. Clark, “Energy exchange across a chronosequence of slash pine forests in Florida”, Agricultural and Forest Meteorology, vol. 112, no. 2, pp. 87–102, Aug. 2002.
[23] G. Sun, A. Noormets, M. J. Gavazzi, S. G. McNulty, J. Chen, J. -C Domec, J. S. King, D. M. Amatya, and R. W. Skaggs, “Energy and water balance of two contrasting loblolly pine plantations on the lower coastal plain of North Carolina, USA,” Forest Ecology and Management, vol. 259, no. 7, pp. 1299-1310, Mar. 2010, https://doi.org/10.1016/j.foreco.2009.09.016.
[24] L. E. Condon, A. L. Atchley, and R. M. Maxwell, “ET depletes groundwater under warming over the contiguous United States,” Nature Communications vol. 11, Feb. 2020, Art. no. 873, https://doi.org/10.1038/s41467-020-14688-0.
[25] D. L. McLaughlin, D. A. Kaplan, and M. J. Cohen, “Managing forests for increased regional water yield in the Southeastern U.S. Coastal Plain,” Journal of the American Water Resources Association, vol. 49, no. 4, pp. 953-965, Aug. 2013, https://doi.org/10.1111/jawr.12073.
[26] T. L. Powell, G. Starr, K. L. Clark, T. A. Martin, and H. L. Gholz, "Ecosystem and understory water and energy exchange for a mature, naturally regenerated pine flatwoods forest in north Florida," Canadian Journal of Forest Research, vol. 35, no. 7, pp. 1568-1580, Aug. 2005, doi: 10.1139/x05-075.
[27] R. Bracho, T. L. Powell, S. Dore, J. Li, C. R. Hinkle, and B. G. Drake, “Environmental and biological controls on water and energy exchange in Florida scrub oak and pine flatwoods ecosystems,” Journal of Geophysical Research, vol. 113, G02004, June 2008, doi: 10.1029/2007JG000469.
[28] J. Ganoulis, Risk Analysis of Water Pollution, Second Edition, Weinheim, Germany: Wiley-VCH Verlag, 2009.
[29] N. L. Poff, J. D. Allan, M. B. Bain, J. R. Karr, K. L. Prestegaard, B. D. Richter, R. E. Sparks, and J. C. Stromberg, “The natural flow regime,” Bioscience vol. 47, no. 11, pp. 769–784, Dec. 1997.
[30] H. Chen, L. Ma, W. Guo, Y. Yang, T. Guo, C. Feng, "Linking water quality and quantity in environmental flow assessment in deteriorated ecosystems: A food web view," PLoS ONE vol. 8, no. 7, July 2013, Art. no. e70537, doi: 10.1371/journal.pone.0070537.

[31] C. Nilsson and B. M. Renöfält, “Linking flow regime and water quality in rivers: a challenge to adaptive catchment management,” Ecology and Society, vol. 13, no. 2, Dec. 2008.
[32] Northwest Florida Water Management District, “Apalachicola River and Bay Surface Water Improvement and Management Plan,” Accessed: Apr. 6, 2020. [Online]. Available at:

https://www.nwfwater.com/Water-Resources/Surface-Water-Improvement-and-Management/Apalachicola-River-and-Bay.
[33] K. Clarkin, G. Keller, T. Warhol, and S. Hixson, Low-water crossings: Geomorphic, biological, and engineering design considerations, Washington D.C., USA: USDA Forest Service National Technology and Development Program Report 0625 1808—SDTDC, 2006.
[34] A. N. Sharpley, T. Krogstad, P. Kleinman, B. Haggard, F. Shigaki, and L. S. Saporito, “Managing natural processes in drainage ditches for non-point source phosphorus control,” Journal of Soil and Water Conservation, vol. 62, no. 4, pp. 197-206, July 2007.
[35] P. A. Vadas, M. S. Srinivasan, P. J. A. Kleinman, J. P. Schmidt and A. L. Allen, “Hydrology and groundwater nutrient concentrations in a ditch-drained agroecosystem,” Journal of Soil and Water Conservation, vol. 62, no. 4, pp. 178-188, July 2007.
[36] Northwest Florida Water Management District (NWFWMD), “Tate’s Hell State Forest Hydrologic Restoration Plan - Executive Summary,” 2009. Accessed: May 4, 2020. [Online]. Available: https://www.nwfwater.com/content/download/5001/33687/Exec_070910a.pdf.
[37] NWFWMD, “Tate’s Hell State Forest Hydrologic Restoration Plan – Vol. 1,” 2009. Accessed: May 4, 2020. [Online]. Available: https://www.nwfwater.com/content/download/4722/32292/Tates_Hydro_Vol_1_081310a.pdf.
[38] NWFWMD, “Tate’s Hell State Forest Hydrologic Restoration Plan – Vol. 2,” 2009. Accessed: May 4, 2020. [Online]. Available: https://www.nwfwater.com/content/download/4687/32117/Tates_Hydro_Vol_2_081310a.pdf.
[39] C. Robert; T. Crisman, L. Anderson, and C. Kendell, "Comparative Ecosystem Analysis of Hydrologic Restoration of Tate’s Hell Swamp", University of Florida School of Geosciences Faculty and Staff Publication No. 1603. https://scholarcommons.usf.edu/geo_facpub/1603
[40] Gulf Coast Ecosystem Restoration Council, “Tate’s Hell Strategy 1 (Planning & Implementation)” in Resources and Ecosystem Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) Initial Funded Priorities List. 2015, pp. 183-189. Accessed May 6, 2020. [Online]. Available: https://www.restorethegulf.gov/sites/default/files/FPL_forDec9Vote_Errata_04-07-2016.pdf.
[41] J. St. Peter, C. Anderson, J. Drake and P. Medley, “Spatially quantifying forest loss at landscape-scale following a major storm event,” Remote Sensing, vol. 12, no. 7, Apr. 2020, Art. no. 1138, https://doi.org/10.3390/rs12071138.
[42] Gulf Coast Ecosystem Restoration Council, “Comprehensive Plan Update 2016,” Accessed: Mar. 30,2020. [Online]. Available: https://www.restorethegulf.gov/sites/default/files/CO-PL_20161208_CompPlanUpdate_English.pdf.
[43] Florida Natural Areas Inventory (FNAI), “Critical Lands and Waters Identification Project (CLIP) Version 4,” Accessed: Apr. 6, 2020. [Online]. Available at: https://www.fnai.org/clip.cfm.

[44] A. Jenkins, “Historic natural communities and rare plant surveys in the Apalachicola Region,” presented at National Conference on Ecosystem Restoration, New Orleans LA, Aug. 2018, Accessed: Apr. 6, 2020. [Online]. Available at: https://conference.ifas.ufl.edu/ncer2018/presentations/Salon%20C/Tuesday/1400%20Jenkins.pdf.
[45] J. St. Peter, J. Hogland, N. Anderson, J. Drake, and P. Medley, “Fine resolution probabilistic land cover classification of landscapes in the Southeastern United States,” International Journal of Geo-Information, vol. 7, no. 3, Mar. 2018, Art. no. 107, https://doi.org/10.3390/ijgi7030107.
[46] M. Trager, J. Drake, A. Jenkins, and C. Petrick, “Mapping and modeling ecological conditions of longleaf pine habitats in the Apalachicola National Forest,” Journal of Forestry, vol. 116, no. 3, pp. 304-311, May 2018.
[47] C. A. Crandall, J. St. Peter, V. Ibeanusi, P. Medley, J. Drake, C. Jagoe, J. Vernon and G. Chen, “Identification and prioritization of forested areas for hydrologic restoration in the Lower

Apalachicola River Basin and Apalachicola Gulf Coast Region," Journal of Ecohydrology, in preparation.
[48] H. L. Penman, "Natural evaporation from open water, bare soil and grass," Proceedings of the Royal Society of London, vol. 193, no. 1032, pp. 120– 145, Apr. 1948.
[49] J. P. Bamett, A. E. Tiarks, and M. A. Sword, "Sustaining productivity of planted forests in the Gulf Coast Region," in Current stresses and potential vulnerabilities: Implications of global change for the Gulf Coast Region of the United States, Z. H. Ning and K. K. Abdollahi, Eds., Baton Rouge, LA, USA: Gulf Coast Regional Climate Change Assessment Program, 2000, pp 76-85.
[50] USDA Forest Service Southern Region, "Longleaf Pine Restoration Strategy," Available in uploads section of proposal.
[51] USDA Forest Service Southern Region, "A Desk Guide to the 3 Step Trigger System for Longleaf Pine Restoration- Guidance on the Path Towards Restoration," Available in uploads section of proposal.
[52] J. S. Kush, R. S. Meldahl, C. K. McMahon, and W. D. Boyer, "Longleaf pine: A sustainable approach for increasing terrestrial carbon in the southern United States," Environmental Management, vol. 33, Supplement 1, pp. S139-S147, 2004, doi: 10.1007/s00267-003-9124-3.
[53] National Wildlife Federation, "Standing tall: How restoring longleaf pine can help prepare the Southeast for global warming," 2009. Accessed: Apr. 1, 2020. [Online]. Available at: https://www.nwf.org/~/media/PDFs/Global-Warming/Reports/LongleafPineReport.ashx.
[54] J. R. R. Avalapati, G. A. Stainback, and D. R. Carter, "Restoration of the longleaf pine ecosystem on private lands in the US South: an ecological economic analysis," Ecological Economics vol. 40, no. 3, pp. 411-419, March 2002.
[55] M. Lavoie, G. Starr, M. C. Mack, T. A. Martin, and H. L. Gholz, "Effects of a prescribed fire on understory vegetation, carbon pools, and soil nutrients in a longleaf pine – slash pine forest in Florida," Natural Areas Journal, vol. 30, no. 1, pp. 82-94, Jan 2010.
[56] K. H. Johnsen, J. R. Butnor, J. S. Kush, R. C. Schmidtling, and C. D. Nelson, "Hurricane Katrina winds damaged longleaf pine less than loblolly pine," Southern Journal of Applied Forestry, vol. 33, no. 4, pp. 178-181, 2009.
[57] US Energy Information Administration (USEIA), Utility Scale Facility Net Generation from Solar Thermal by State, by Sector. 2020. Accessed: Jun 9, 2020. [Online]. Available at: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_18_b.
[58] D. Wilcove, D. Rothstein, J. Dubow, A. Phillips, and E. Losos, "Quantifying threats to imperiled species in the United States," BioScience, vol. 48, no. 8, pp. 607-615, Aug. 1998, doi: 10.2307/1313420.
[59] P. Nagler, P. Shafroth, J. Labaugh, K. Snyder, R. Scott, D. Merritt, and J. Osterberg, "The potential for water savings through the control of saltcedar and Russian olive." In: Saltcedar and Russian olive control demonstration act science assessment, P. Shafroth, C. Brown, and D. Merritt, Eds., Ft. Collins, CO, USA: U.S. Geological Survey Scientific Investigations Report 2009–5247, 2010. Accessed: April 1, 2020. [Online]. Available at: https://pubs.usgs.gov/sir/2009/5247/.
[60] C. Yang, J. H. Everitt, and J. Goolsby, "Mapping giant reed (Arundo donax) infestations along the Texas-Mexico portion of the Rio Grande using aerial photography," Journal of Invasive Plant Science and Management, vol. 4, no. 4, pp. 402-410, Oct. 2011.
[61] Florida Forest Service , "Silviculture Best Management Practices," 2008. Accessed: June 5, 2020. [Online]. Available: https://www.fdacs.gov/ezs3download/download/25527/516407/Media/Files/Florida-Forest-Service-Files/silvicultural_bmp_manual.pdf.
[62] D. C. Kutes, R. E. Keane, J. F. Caratti, C. H. Key, N. C. Benson, S. Sutherland, and L. J. Gangi, FIREMON: Fire effects monitoring and inventory system, Ft. Collins CO, USA: USDA Forest Service Rocky Mountain Research Station General Technical Report RMRS-GTR-164-CD, 2006. Accessed: Mar. 24, 2020. [Online]. Available at: https://www.fs.usda.gov/treesearch/pubs/24042.
[63] USDA Forest Service Handbook, 2409.17, Silvicultural Practices Handbook. Accessed: Mar 24,

2020. [Online]. Available at: https://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?2409.17.
[64] USDA Forest Service Manual, 2400, Chapter 2470- Silvicultural Practices. Accessed: Mar 24, 2020. [Online]. Available at: https://www.fs.fed.us/im/directives/fsm/2400/wo_2470.doc.
[65] Center for Aquatic Technology Transfer (CATT), "Summary of aquatic organism passage surveys on the Apalachicola National Forest, Florida 2017-2019" USDA Forest Service Southern Research Station, "2019. Accessed: Mar.24, 2020. [Online]. Available at: https://srs.fs.usda.gov/catt/pdf/aop/2017-2019_FL_CATT_AOP_report.pdf.
[66] J. Hogland, D. L. R. Affleck, N. Anderson, C. Seielstad, S. Dobrowski, J. Graham and R. Smith, "Estimating forest characteristics for longleaf pine restoration using normalized remotely sensed imagery in Florida USA," Forests, vol. 11, Art. no. 426, 2020 https://doi.org/10.3390/f11040426.
[67] J. St. Peter, J. Drake, P. Medley and V. Ibeanusi, "Use of LiDAR and imagery to estimate forest structure and condition in Apalachicola region of Florida," Remote Sensing of Environment, in preparation.
[68] J. G. Arnold, D. N. Moriasi, P. W. Gassman, K. C. Abbaspour, M. J. White, R. Srinivasan, C. Santhi, R. D. Harmel, A. van Griensven, M. W. Van Liew, N. Kannan, and M. K. Jha, "SWAT: Model use, calibration, and validation," Transactions of the ASABE, vol. 55, no. 4, pp. 1491-1508, 2012.

Budget

Project Budget Narrative:
The budget request for this program is $12,500,000. 72% of the funds will be used for restoration practice implementation. Project management costs are incorporated into each component below.

Total FPL 3 Project/Program Budget Request:
$ 12,500,000.00

Estimated Percent Monitoring and Adaptive Management: 20 %
Estimated Percent Planning: 3 %
Estimated Percent Implementation: 72 %
Estimated Percent Project Management: 0 %
Estimated Percent Data Management: 5 %
Estimated Percent Contingency: 0 %

Is the Project Scalable?:
Yes

If yes, provide a short description regarding scalability.:
ARRI Strategies 2 & 3 are requesting $12.5 million to achieve regional-wide environmental benefits to water resources and ecosystems. This funding level will improve habitat on approximately 250,000 acres, apply silvicultural restoration to reduce ET on approximately 18,000 acres, restore hydrologic connectivity on 5,000 acres, enroll 25,000 acres of private forest lands into approved management plans, implement a comprehensive monitoring program to capture management strategy effectiveness, and help train a diverse workforce for careers in natural resource management. Because Gulf restoration is a multigenerational undertaking, this last component is imperative. Every component of ARRI is up or down scalable depending on available funding. The impact on water resources and habitat conservation/restoration will scale with the Council's investment in this effort. More or fewer acres can be treated, and the same applies to the number of private forest landowners engaged. A small reduction in funding could be absorbed across all project elements by reducing corresponding metrics. However, if funding is reduced significantly (> 10%) it

will not allow partners (TNC, FAMU) to hire personnel needed to accomplish the proposed work. Reduced funding would impact Strategy 2, monitoring and education more than Strategy 3 which is somewhat flexible. A mitigation option could be to use a phased approach with one or more components. For example, hydrologic restoration could be only done in years 4 and 5 and the target acreage for restored hydrologic connectivity could be reduced. Another option would be to remove a component of Strategy 2 entirely (e.g., silvicultural treatments). Yet, this would eliminate corresponding benefits to water resources and habitat which may make it more difficult for partners to obtain leadership support. Intuitively, a funding increase would allow for more acres to be treated across all project elements. This would result in improved water resources and habitat on more public and private lands and thus increase the pace and scale of regional restoration. Again, Strategy 3 could be scaled in a linear manor whereas increased funding for Strategy 2 would require partners to hire additional personnel (e.g., more trained crew members for prescribed fire). All proposed elements move the needle towards achieving the Council’s goals and objectives.

Environmental Compliance[1]

Environmental Requirement	Has the Requirement Been Addressed?	Compliance Notes (e.g.,title and date of document, permit number, weblink etc.)
National Environmental Policy Act	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to resources of concern.
Endangered Species Act	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to threatened and

[1] Environmental Compliance document uploads available by request (restorecouncil@restorethegulf.gov).

		endangered species.
National Historic Preservation Act	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to cultural resources.
Magnuson-Stevens Act	N/A	Note not provided.
Fish and Wildlife Conservation Act	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts fish and wildlife.
Coastal Zone Management Act	Yes	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations

		to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to coastal resources.
Coastal Barrier Resources Act	Yes	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to coastal barrier resources.
Farmland Protection Policy Act	Yes	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. Avoidance and minimization measures will be applied to ensure there are no adverse

		impacts to prime, unique, or agricultural lands of importance.
Clean Water Act (Section 404)	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to waters of the United States.
River and Harbors Act (Section 10)	Yes	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to rivers and harbors.
Marine Protection, Research and Sanctuaries Act	N/A	Note not provided.
Marine Mammal Protection Act	N/A	Note not provided.
National Marine Sanctuaries Act	N/A	Note not provided.

Migratory Bird Treaty Act	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to migratory birds.
Bald and Golden Eagle Protection Act	Yes	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to Bald or Golden Eagles.
Clean Air Act	No	These program activities are covered by USDA-NRCS Categorical Exclusions. NRCS undertakes site specific environmental evaluations to address NEPA requirements, other requirements for protection of the environment, and NRCS regulations. This

		evaluation will be documented in the environmental evaluation before conservation/restoration implementation is initiated. Avoidance and minimization measures will be applied to ensure there are no adverse impacts to air quality.
Other Applicable Environmental Compliance Laws or Regulations	N/A	https://restorethegulf.gov/sites/default/files/FPL_EClib_GW_Gulf_Coast_Conservation_Reserve_CE_signed.pdf (also attached).

Maps, Charts, Figures

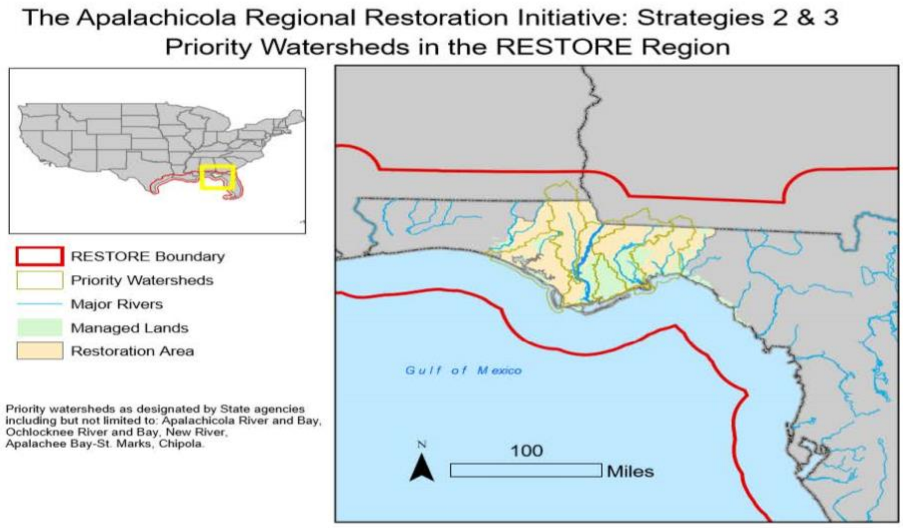

Figure 1: Project Location

Other Uploads

Main Uploads_0:
1_ARRI_SupportLetters.pdf
Caption : N/A
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/612/36

Main Uploads_2:
4_ARRI_Ref47_NFFLongleafDeskGuide.pdf
Caption : N/A
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/614/36

Main Uploads_3:
3_ARRI_Ref46_R8LongleafStrategy.pdf
Caption : N/A
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/615/36

Main Uploads_4:
2_ARRI_References (Complete).pdf
Caption : N/A
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/617/36

Tables_9:
Tables_ ARRI Strategy 2 proposed restoration activities.
Tables
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/831/36