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

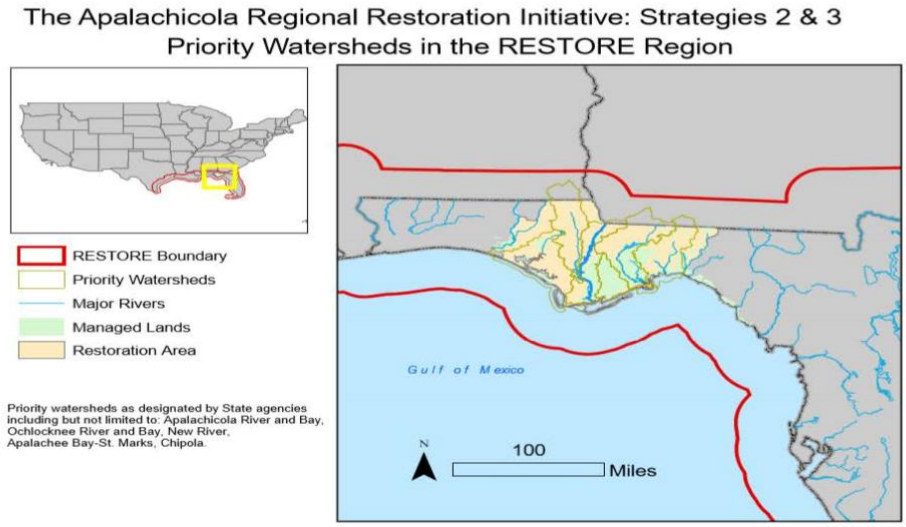

Figure 1: Project Location

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

ARRI Maps, Charts, Figures

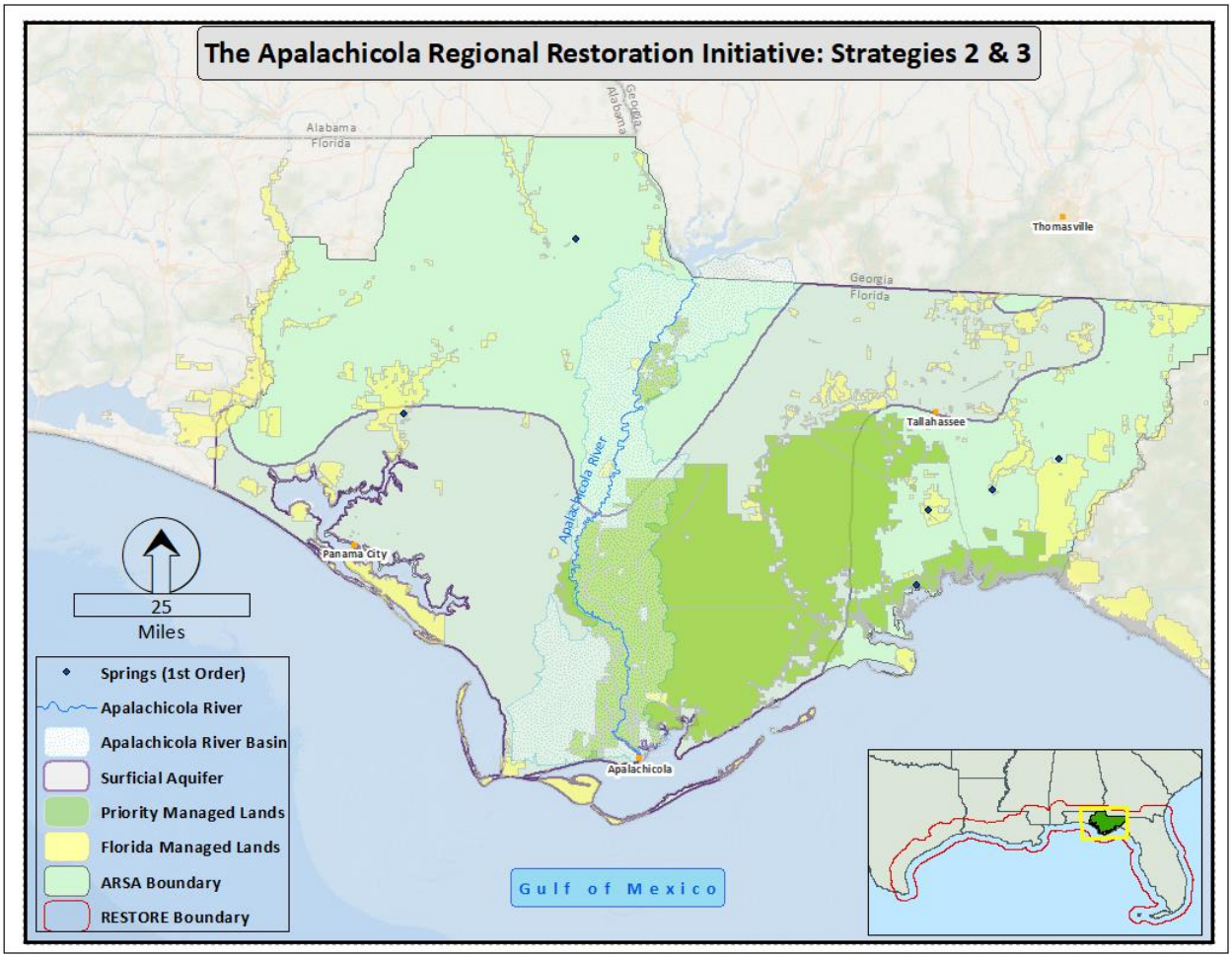

Figure 2. ARRI reference map – shallow surficial aquifer, priority managed lands, and the Apalachicola Regional Stewardship Alliance (ARSA) Florida operational area.

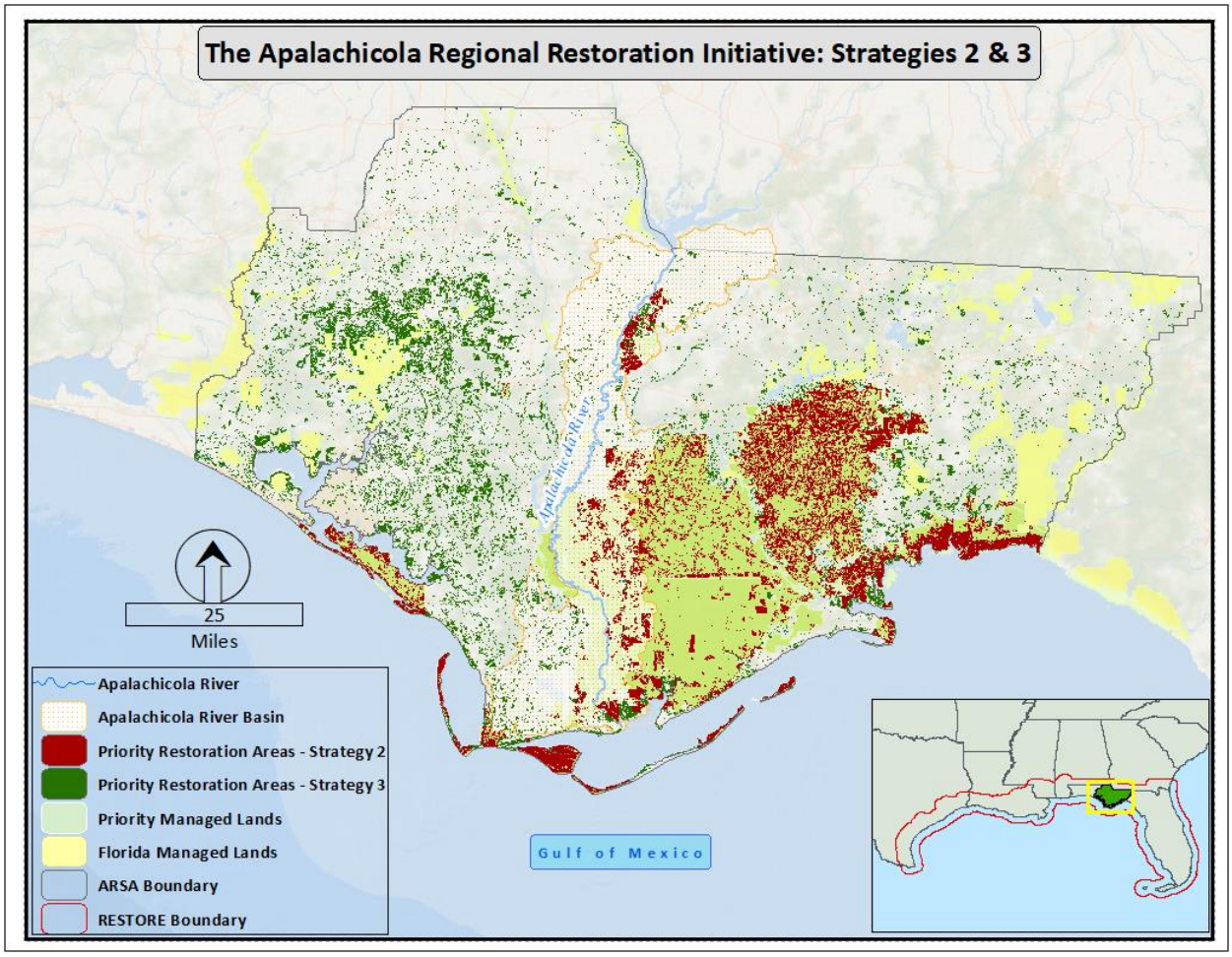

Figure 3. ARRI Strategies 2 and 3 priority restoration areas on public and private lands developed from remote-sensing derived basal area estimates [40], landcover [44], imagery, vegetation and natural communities [43] data for the Apalachicola region.

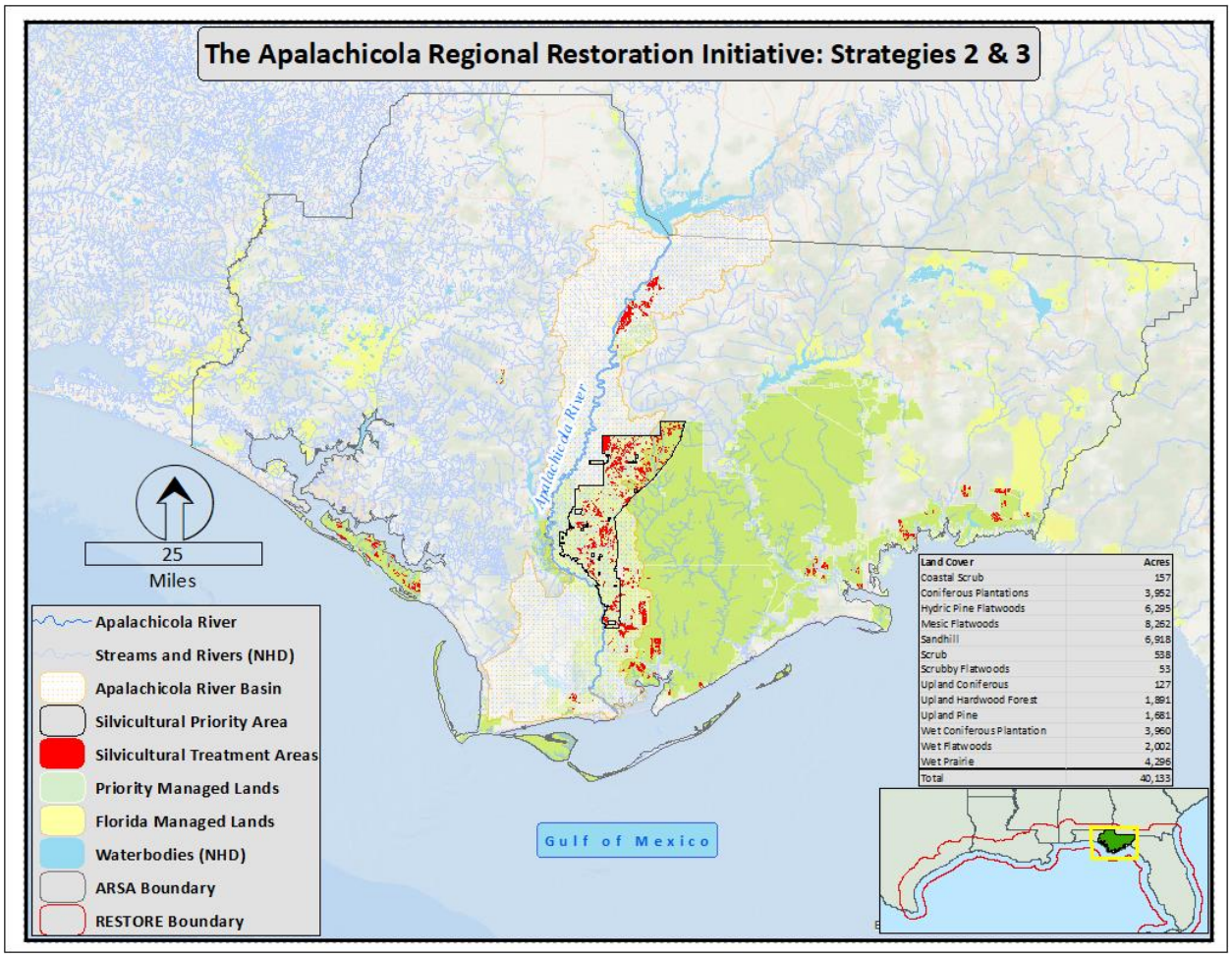

Figure 4. Silvicultural treatment areas on regional priority managed lands developed from remote-sensing derived basal area estimates [40], landcover [44], imagery, vegetation and natural communities [43] data for the Apalachicola region. Embedded table shows breakdown of landcover types with acreages used to help prioritize restoration goals.

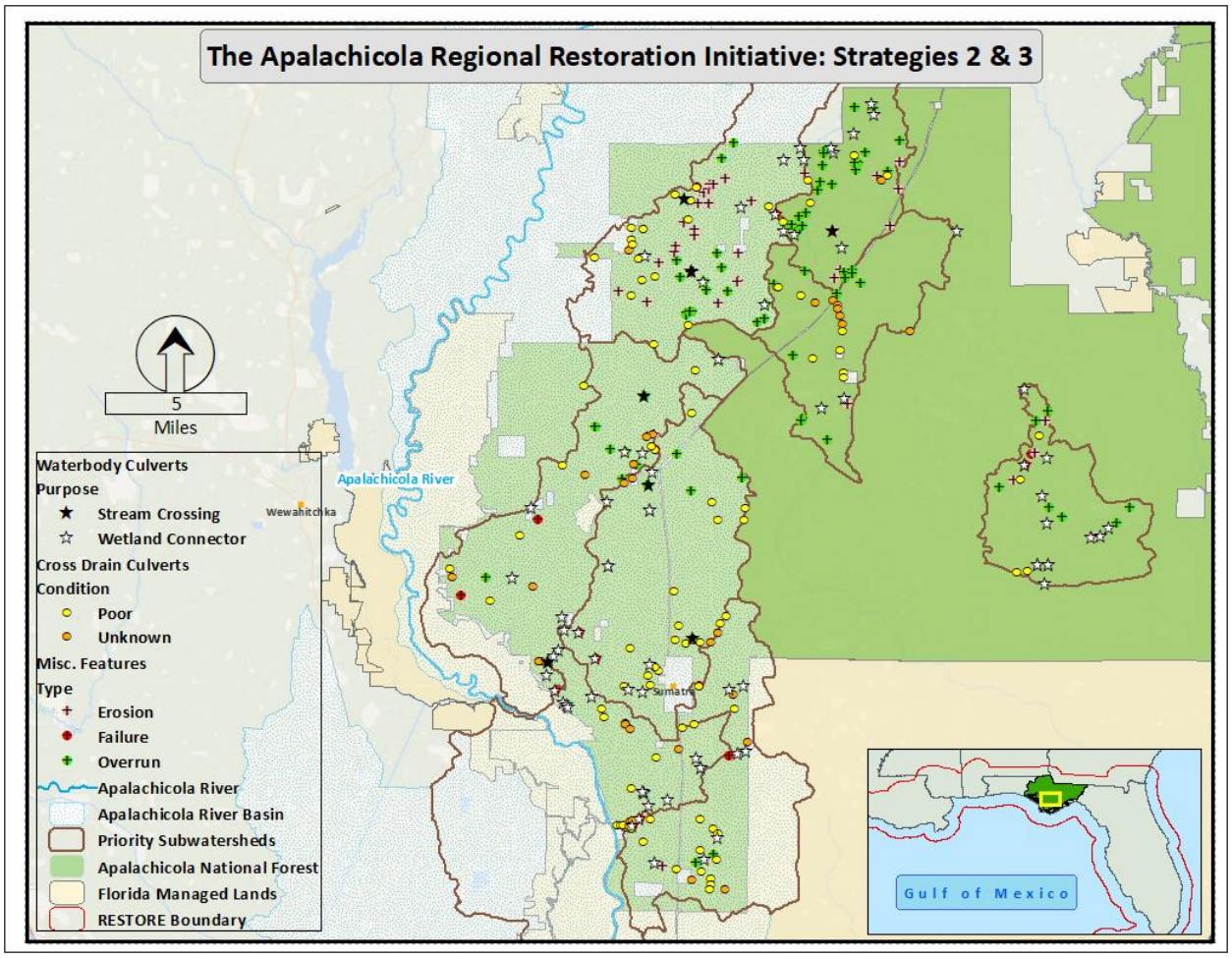

Figure 5. Priority hydrological infrastructure on the Apalachicola National Forest (ANF) for installation, repair, replacement, or modification. Selection was based on five factors: 1) number of high priority waterbody culvert replacements, 2) number of cross drains in poor or unknown condition, 3) number of erosion events, significant failures, or overrun road points, 4) drainage bay, 5) percent of sub watershed on the ANF (all hydrologic assessment field data collected through Tate's Hell Strategy 1 project).

ARRI Tables

Restoration Activities / Treatments	Examples
Forest establishment	Planting - Longleaf
Native understory establishment	Planting - Wiregrass, Seed collection/sowing
Timber (forest) stand improvement	Thinning - reduce stand density, Mid-story hardwood treatment
Prescribed fire	Broadcast burning - hand or aerial ignition
Fuels treatments	Mechanical - mulching, mowing, chipping, compacting
Control nonnative invasive species (NNIS)	Herbicide, Mechanical treatments

Table 1. ARRI Strategies 2 and 3 proposed restoration activities.

Restoration Category	Proposed Restoration Activities / Treatments	Approx. Acres
Silvicultural	Forest, native understory establishment, Timber (forest) stand improvement	18,000
Private Forest Management	Enroll PFLO in management plan – plan includes all treatment options	25,000
Fire / Fuels	Prescribed fire, Fuels treatments	201,450
Hydrologic	Improve hydrologic connectivity	5,000
NNIS	Control non-native invasive plants	500
Wetlands	Imperiled wetlands restoration	50

Table 2. ARRI Strategies 2 and 3 restoration categories, proposed activities, and acreages to be treated. **250,000**

Florida Agricultural and Mechanical University
TALLAHASSEE, FLORIDA 32307-3100

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OFFICE OF THE PRESIDENT

TELEPHONE: (850) 599-3225
FAX: (850) 561-2152

April 13, 2020

RESTORE Council Members
c/o Administrator Andrew Wheeler
US EPA Headquarters
1200 Pennsylvania Avenue, N. W., Mail Code: 1101A
Washington, DC 20460

Dear Mr. Wheeler and Members of the RESTORE Council,

Please accept this letter as my statement of support for the USDA-led proposal "Apalachicola Regional Restoration Initiative: Strategies 2 and 3." Florida Agricultural and Mechanical University (FAMU) has worked closely with USDA for many years through the 1890 National Scholars Program, the Florida Forest Watershed Research Program (USDA Forest Service Southern Research Station), and more recently to establish the Center for Spatial Ecology and Restoration (CSER).

CSER was created through a partnership agreement between USDA and FAMU using funding from the Gulf Coast Ecosystem Restoration Council via an interagency agreement with the USDA Forest Service (17-IA-11083150-001) for the Apalachicola Tate's Hell Strategy 1 project as well as significant contributions from FAMU. CSER is playing an important role in the development of deliverables for the Planning component of Tate's Hell Strategy 1 including a landscape scale hydrologic assessment, a regional restoration decision support system and a comprehensive hydrologic assessment and restoration plan. CSER has already utilized draft versions of these deliverables to identify high priority restoration sites for the Apalachicola Regional Restoration Initiative: Strategies 2 and 3. If funded, Strategies 2 and 3 will continue to support CSER staff and students who will play a vital role in guiding the implementation of restoration activities, monitoring effectiveness of activities and providing feedback to the USDA and their partners in an adaptive management framework.

In addition to the support of RESTORE funded activities, CSER is helping to educate and train the next generation of geospatial professionals, land managers and environmental scientists. Several undergraduate and graduate students have already worked on the Tate's Hill Strategy 1 project, including students in the School of the Environment, the College of Science and Technology and the FAMU-FSU College of Engineering. The research and hands-on work that these students are doing related to this project not only contributes to the deliverables, but also provides invaluable real-world experience related to environmental restoration and management.

In closing, I enthusiastically support the proposal "Apalachicola Regional Restoration Initiative: Strategies 2 and 3." If funded, FAMU is committed to working closely with the USDA, the Nature Conservancy and other partners in the Apalachicola and Tate's Hell region to ensure that this project is successful.

Sincerely,

Larry Robinson, Ph.D.
President

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 Apalachicola Regional Restoration Initiative (ARRI) is an extension of the Tate's Hell Strategy 1 project that was funded in FPL1. ARRI Strategies 2 & 3 are collaborative, landscape-level projects focused on restoring longleaf pine, coastal ecosystems, and hydrology within the Apalachicola Region of Florida. Major elements include improvement to water quality and quantity, outreach to public landowners, monitoring, and targeted education to minority students.

Strategy 2 — Under Strategy 2, the USDA Forest Service, The Nature Conservancy, Apalachicola Regional Stewardship Alliance, Florida A&M University, University of Florida, and Center for Spatial Ecology & Restoration will partner to implement ecological restoration activities including: 1) region-wide restoration for approximately 250,000 acres of longleaf habitat, 2) targeted silvicultural treatments for about 18,000 acres of dense pine forests, 3) hydrologic restoration for around 5,000 acres to reconnect freshwater habitat in high priority watersheds, 4) increased regional prescribed fire, 5) invasive species treatments, and 6) imperiled wetland restoration.

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 Strategy 2 & 3 restoration efforts will help restore and conserve critical habitat, water quantity and quality, and benefit the economy.

FPL Category: Cat1: Implementation Only

Activity Type: Program

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

Co-sponsoring Agency(ies):
FL

Is this a construction project?: No

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 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 Florida Forest Service's (FFS's) 10-year management plan for Tate's Hell State Forest (SF), Florida Wildlife Commission's (FWC's) Florida's Freshwater Priority Resources and Northwest Florida Water Management District's Surface Water Improvement Plan for Apalachicola River and Bay. 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 Florida Forest Service 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 the 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 hydrological conditions in near-shore coastal systems, and thus the biological communities that inhabit them. Timing, quantity, and quality of freshwater flows from forests [5] change salinity, and total suspended solid levels which directly impacts riverine and estuarine productivity, distribution of species, and phenology [6], [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 1). 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. 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].

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 U.S. [20], and more water than runoff [15], [19]. 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 United States [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].

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, Apalachicola Regional Stewardship Alliance (ARSA), Florida Forest Service, Florida A&M University, University of Florida, 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 including: 1) silvicultural treatments applied to approximately 18,000 acres of dense pine forests to restore longleaf pine habitat, and contribute substantially to America's Longleaf Restoration Initiative, 2) infrastructure and hydrologic feature restoration by replacement of failing culverts, wing ditches, ditch plugs, and low water crossings within approximately 5,000 acres of reconnected freshwater habitat in high priority watersheds, 3) increased prescribed fire, 4) control and eradication of invasive species, 5) restoration of at-risk wetlands, particularly those inhabited by the imperiled frosted flatwoods salamander, 6) forest management and restoration activities conducted with private landowners (public engagement) in support of longleaf restoration, forest health, fuels reduction and community resilience - ARRI Strategy 3. The impacts of these restoration activities will be measured through a robust drone-based 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 Florida A&M University. Results will be delivered to regional and Gulf-wide restoration partners through peer-reviewed publications, technical reports, and web-based mapping tools.

This project closely aligns with several goals, objectives, and commitments of the Gulf Coast Ecosystem Restoration Council Comprehensive Plan 2016 update [32]. 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) as well as science-based decision support tools that have been developed for this project [33]. 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. Finally, this project will leverage spatial decision support tools from Tate's Hell Strategy 1 and

will add a robust drone-based monitoring program to provide an advanced science-based decision making and adaptive management framework which will help guide future ARRI and Gulf-wide restoration efforts.

Proposed Methods :

Increased water availability and improved water quality are primary objectives of ARRI Strategy 2. Specifically, the goal is to effect 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. By distributing treatments in multiple habitat types and conditions, operations can continue year-round to mitigate risk. Potential target treatment locations (Figures 2 & 3) are based on products developed by CSER to estimate forest damage following Hurricane Michael [33], current hydrological conditions, FNAI High Priority Natural Communities [34], past land management activities, and years of professional restoration experience across the region. All restoration treatments are proven methodologies for forest land management with reliable, repeatable results. Details of individual practice methods are withheld in lieu of descriptive figures based on remote sensing analysis of where activities should be deployed.

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, and modified natural fire regimes. Thus, we propose to work through established partnerships using a mixture of traditional restoration methods and advanced geospatial techniques to implement verified land management activities and improve structure, composition, function, and connectivity of the Apalachicola landscape.

Successful restoration requires understanding the distribution of historic 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 leverage, CSER has used FNAI historic natural community [35], land cover [36], imagery, and recent high-resolution LiDAR data to help identify target conditions for restoration 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 conditions. Based on the detailed ecological condition assessments of multiple natural communities on the Apalachicola National Forest [37], 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.

For example, many project areas have been formerly logged and planted with off-site slash pine or sand pine rather than site-appropriate longleaf. Project partners have developed effective restoration techniques for a range of current conditions, and we are 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. By applying a regional ecological condition framework, utilizing decision support tools developed through Tate's Hell Strategy 1, 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 hydrological conditions in Apalachicola's watersheds.

As leveraging, CSER has developed remotely-sensed ET estimates throughout the Apalachicola Region. Further, derived ET estimates will be compared with calculated ET estimates using the modified Penman-Monteith equation [38] 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.

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 [39]. 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 [40]. 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.

In addition, 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., phosphorus). Where appropriate, ditch plugs may be installed to restore wetlands or hydrologic connectivity. As leveraging, a detailed analysis of infrastructure and hydrologic connectivity has been conducted to show target locations for infrastructure improvements on the Apalachicola National Forest (Figure 4).

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 [41] and pivotal to the conservation and restoration of longleaf and hydrologic resources. Specifically, the Florida Forest Service will lead the effort to engage and advise private forest landowners in active management and restoration of their lands (Figure 2). 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. 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. These activities will increase the quantity of private forestlands being actively managed with several different objectives including invasive species control, timber stand improvement, site preparation, hydrological restoration, prescribed fire, and

establishment of 5,000 forested acres with native species. The “on-the-ground” efforts will be directed by the Florida Forest Service with assistance from the Florida Fish & Wildlife Conservation Commission, NRCS, and other restoration team partners (leveraging).

Environmental Benefits:

Increased water availability and improved water quality are primary objectives of ARRI Strategy 2 and 3. Specifically, the goal is to effect water recharge by reducing forest biomass and thus, evapotranspiration (ET) via targeted forest management implemented throughout the Apalachicola region. 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].

Targeted hydrologic restoration will restore natural sheet flow and improve water quality by increasing sediment retention and nutrient assimilation on up to 5,000 acres. Simple low-water crossings are less likely to cause ?ow diversions or accelerations which can worsen channel instability and are 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. Where appropriate ditch plugs may be installed to restore hydrologic connectivity and to reduce transport of sediment, nutrients, and pollutants from adjacent lands.

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 also provide critical habitat to several state and federally listed species including red-cockaded woodpecker and frosted flatwoods salamander. Recent work has shown that as much as half of the ecosystems in this area are in poor ecological condition and need ecological restoration [42].

ARRI Strategies 2 and 3 leverage resources and partnerships from the Tate’s Hell Strategy 1 RESTORE project including ecosystem-based decision support tools that have been developed [38] to prioritize critical habitats where current ecological conditions depart from historic reference conditions (Figures 2-3). Over the 5-year ARRI timeline, region-wide ecological restoration activities will be implemented on more than 250,000 acres of federal, state, and private lands. 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.

Progress towards improved habitat conditions will be monitored by CSER using existing field plots and remotely sensed data from drones and satellites. This monitoring work will inform ARSA land managers (adaptive management) and will be used to update ecological conditions in decision support tools through time. By using this regional ecological approach to prioritize restoration efforts for maximum benefit, and leveraging knowledge and resources among partners, we will substantially increase the pace and scale of habitat restoration and will also reduce wildfire risks to communities. This approach and other methodologies used in ARRI are also transportable to other Gulf-wide restoration efforts.

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 [46] and are pivotal to longleaf conservation and hydrologic restoration. Outreach will consist of micro-targeting to

engage priority landowners, educational 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. The course 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.

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 practice implementation.

Metrics:

Metric Title: HR004 : Habitat restoration - Acres restored : Habitat Restoration
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 once occupying project site in question 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 [46] and A Desk Guide to the 3 Step Trigger System for Longleaf Pine Restoration- Guidance on the Path Towards Restoration [47].

Metric Title: HR009 : Restoring hydrology - Acres with restored hydrology : Habitat Restoration
Target: 5,000
Narrative: Install 15 low water crossings and repair, replace 12 road crossing structures (including 2 box culverts).

Metric Title: HM005 : Agricultural BMPs - acres under contracts/agreements : Habitat Management
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 forestlands being actively managed with several different objectives including invasive species control, timber stand improvement, site preparation, hydrological restoration, prescribed fire, and establishment of native species.

Metric Title: HM006 : Habitat management and stewardship - Acres under improved management : Habitat 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 put many more areas on the path to restoration as defined in the USDA Forest Service Southern Region Longleaf Pine Restoration Strategy [46] and A Desk Guide to the 3 Step Trigger System for Longleaf Pine Restoration- Guidance on the Path Towards Restoration [47].

Risk and Uncertainties:

Incorporating risk and uncertainty analysis into environmental and hydrologic restoration is undoubtedly a means of improving decision-making quality. In ARRI strategies 2 and 3, there are broad types of uncertainty that apply, but specific empirical uncertainty is complex to address at the proposed scale. However, this project has a distinct advantage in that it employs the best available data, science, and technology to spatially classify and quantify restoration targets before proven traditional ground-based restoration activities begin. Adequate high-priority targets have already been identified and characterized

to compensate for uncertainty associated with where to conduct restoration activities and on what habitat types. Because all of this has been captured through the lens of remote sensing within the context of the landscape, 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 on Tate's Hell Strategy 1 and provided in this proposal with analytical results and figures depicting prioritized restoration targets throughout the region.

The scope and scale of ARRI alone introduces inherent risk, but in general terms the risks associated with this project are comparatively low. In fact, the risk of not doing ARRI may create greater long-term peril to terrestrial environments, native plants and animals and hydrologic resources resulting in significant negative near and long-term downstream impacts, wildfire, insect/disease, and degraded natural community resilience. Therefore, a relatively low risk/reward ratio is a noteworthy positive benefit of ARRI, particularly when factoring for potential economic benefit and future climate change.

Detailed analysis of potential effects of climate change on forest resources, or the effects of forest management activities on climate are impractical at 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. As such, the consideration of climate change for this project is limited to the general 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 [48, 49]. When longleaf pines are harvested, they will primarily produce sawtimber products rather than pulp [50], 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 [51], 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 CO2 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 [54]. 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 disease, catastrophic wildfire and increase resilience to extreme weather events [49, 52]. In the context of climate change, the proposed activities will undoubtedly increase forest health and resilience to climate-related perturbation, whereas the no action decision will produce forests that are less resistant and resilient to drought, disease, hurricanes, and insect damage. Again, ARRI has a relatively low risk/reward ratio which is supported by science, data and decades or restoration experience.

Short-term risks from operational inefficiencies and uncertainty are important issues when considering the 5-year time horizon of ARRI. Mitigating factors to operational risk have already been considered in the pre-proposal analysis in that activities can be distributed across the ARRI landscape among wet and dry, public and private locations among multiple habitat types while simultaneously considering value and

impact to hydrologic resources all prioritized within a high-resolution spatial framework. 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, i.e., lower chance of work stoppage. 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.

Since there will be some small-scale construction contracting for hydrologic infrastructure improvements on the Apalachicola National Forest, there is some risk associated with construction 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 hydrological infrastructure for restoration on the ANF provides many options within high-priority watersheds (Figure 4). 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. In ARRI Strategy 3, there is risk associated with non-participation from private landowners and the potential conversion of forest lands to other land uses including non-traditional uses (e.g., hemp, solar). Conversely, there is a much greater risk from a no-action decision simply because there will be fewer incentives for private landowners to maintain their lands in forest. Additionally, given recent unforeseen economic events associated with the coronavirus pandemic, landowners may be forced to opt for more lucrative use options, or perhaps even be forced to sell to remain financially viable. By providing forest landowners with technical and financial 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.

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 [53]. 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 [54, 55], 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.

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. Accomplishments will be tracked in TNC's Conservation Activity Tracking Database, and USDA's Forest Activity Tracking System. Hydrological and wetland restoration targets will be monitored before, during and after renewal. Monitoring activities will include site visits and use protocols developed by the 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 [42]. A subset of hydrologic restoration sites will be more intensively monitored, and high-resolution drone-borne multispectral image sensors may be used to map changing conditions (e.g., water levels, vegetation). Internet of Things (IoT) sensors may be deployed to remotely 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). Existing USDA standard operating procedures will be followed for monitoring prescribed fire [43], and silvicultural treatment effectiveness [44, 45].

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. 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. Results will be shared through technical reports, peer-reviewed publications, Webmaps, and social media.

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 USFS 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, spatial analysis, and large spatial dataset storage, CSER will use infrastructure assembled at FAMU including high-speed (10Gb) network storage arrays and Microsoft's AZURE cloud computing framework. CSER has been storing and analyzing data by leveraging the power of the distributed cloud and frequently uses Microsoft Azure Storage Explorer to access the AZURE environment. The same processes will be utilized for ARRI Strategy 2. 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 Regional Restoration Decision Support System which will be leveraged for ARRI data analysis and distribution along with ESRI's ArcGIS Online.

Collaboration:

ARRI Strategies 2 & 3 reestablish proven partnerships that precede Tate's Hell Strategy 1 (THS1). Strategy 2 partnerships include the USDA Forest Service, The Nature Conservancy, ARSA, Florida Forest Service, FAMU, UF, and CSER at FAMU. The National Forests in Florida has been working with our TNC partners for years and have a demonstrated record of conservation and restoration achievements within the Apalachicola Region. CSER at FAMU is a partnership that developed from THS1 and serves as a model for government/academic/industry partnerships. Strategy 3 also builds upon projects predating THS1. The Florida Forest Service 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. Industry partners (Microsoft, Davis Instruments, Certified Ag Resources, SenseFly) have also provided generous in-kind support.

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, and FFS
    - 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 story maps shared through ArcGIS Online.

Additionally, the Apalachicola Regional Stewardship Alliance (ARSA) and planned Shared Stewardship Coordinator position will play vital roles in coordinating treatments across managed lands and focal public restoration areas (Figures 2 and 3). Proposed treatments will be finalized at ARSA quarterly meetings and additional leveraging opportunities will be explored. Florida Forest Service 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%.

Funds: $1,321,296.00
Type: Co-funding
Status: Committed
Source Type: State
Description: TNC has committed a minimum of 20% match to a new 5-year participating agreement. Most of this match will be from 3rd party funding for TNC crews to work on public and private lands within the same watersheds that will be treated through this project. This may include funding from Florida Fish and Wildlife Conservation Commission, Florida Forest Service, Northwest Florida Water Management District, US Fish and Wildlife Service and other partners within the Apalachicola Regional Stewardship Alliance.

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 illustrated in Figure 1, 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 Conference 18, Tallahassee, FL, 1993.

[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] United States Geological Survey, *HA 730-G Ground Water Atlas of the United States-Alabama, Florida, Georgia and South Carolina*. U.S. Geological Survey Publications Warehouse, 1990. 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 runoff 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, 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, North Carolina: US Department of Agriculture 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] 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.

[20] 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: USGS Water-Supply Paper 2375, 1991, pp. 99-104.

[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: 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] 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

[33] J. St. Peter, C. Anderson, J. Drake, P. Medley, "Spatially quantifying forest loss at kandscape- scale following a major storm event," *Remote Sensing*, vol. 12, no. 7, Apr. 2020, Art. no. 1138, https://doi.org/10.3390/rs12071138.

[34] 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.

[35] 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.

[36] 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.

[37] 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.

[38] 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.

[39] 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.

[40] K. Clarkin, G. Keller, T. Warhol, and S. Hixson, *Low-water crossings: Geomorphic, biological, and engineering design considerations*, Washington D.C.: U.S. Department of Agriculture, Forest Service National Technology and Development Program Report 0625 1808—SDTDC, 2006.

[41] J. P. Bamett, A. E. Tiarks, and M. A. Sword, "Sustaining productivity of planted forests in the Gulf Coast Region," in: Z. H. Ning and K. K. Abdollahi, Eds. *Current stresses and potential vulnerabilities: Implications of global change for the Gulf Coast Region of the United States*. Baton Rouge, LA: Gulf Coast Regional Climate Change Assessment Program, 2000, pp 76-85.

[42] Center for Aquatic Technology Transfer (CATT), USDA Forest Service Southern Research Station, "Summary of aquatic organism passage surveys on the Apalachicola National Forest, Florida 2017-2019" Accessed: Mar. 24, 2020. [Online]. Available at: https://srs.fs.usda.gov/catt/pdf/aop/2017-2019_FL_CATT_AOP_report.pdf.

[43] 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: 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.

[44] 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.

[45] 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.

[46] USDA Forest Service Southern Region, "Longleaf Pine Restoration Strategy," Available in uploads section of proposal.

[47] 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.

[48] 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.

[49] 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

[50] 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.

[51] 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.

[52] 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.

[53] 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

[54] 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: P. Shafroth, C. Brown, and D. Merritt, Eds., *Saltcedar and Russian olive control demonstration act science assessment,* Ft. Collins, CO: U.S. Geological Survey Scientific Investigations Report 2009–5247, 2010. Accessed: April 1, 2020. [Online]. Available at: https://pubs.usgs.gov/sir/2009/5247/.

[55] 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.

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.

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 and 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	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 resources of concern.
Endangered Species 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 threatened and endangered species.
National Historic Preservation 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 cultural resources.
Magnuson-Stevens Act	N/A	Note not provided.
Fish and Wildlife Conservation Act	N/A	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

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

		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)	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 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	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 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	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 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

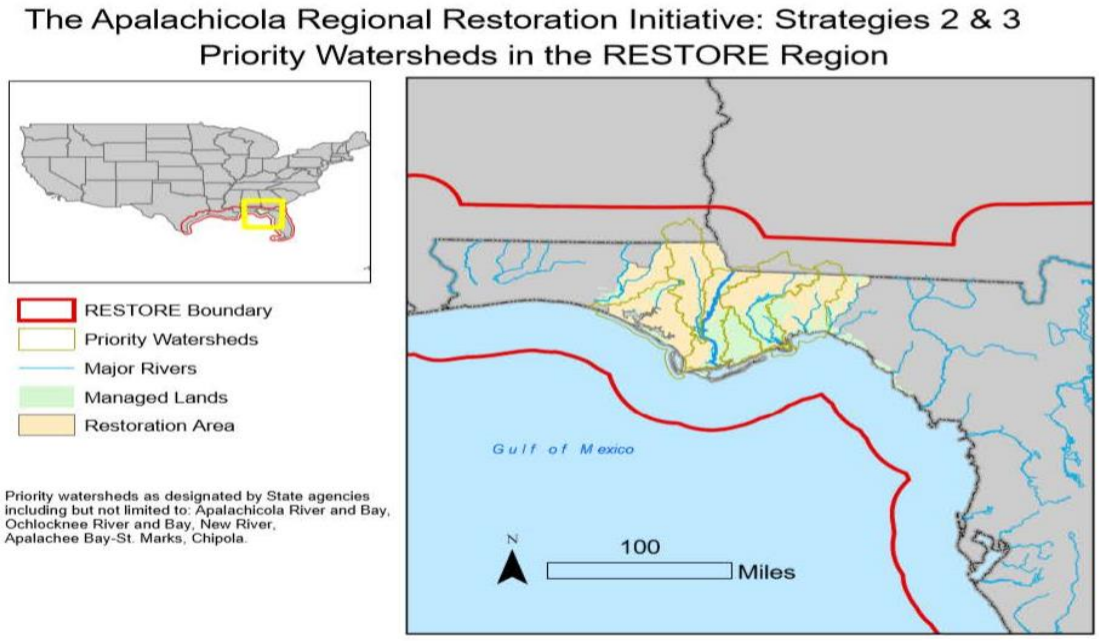

Figure 1: Project Location

Other Uploads

5_ARRI_Maps_Charts_Figures.pdf
Caption : Maps showing the Apalachicola Regional Restoration Initiative: Strategies 2 & 3
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/613/36

4_ARRI_Ref47_NFFLongleafDeskGuide.pdf
Caption : 2 page desk guide to the 3 step trigger system for longleaf pine restoration
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/614/36

3_ARRI_Ref46_R8LongleafStrategy.pdf
Caption : Southern Region National Forest System Longleaf Pine Restoration Strategy (20 page document)
Link to Download
http://www.restorethegulf.gov/apps/piper/web/Uploads/Download/proposal/615/36

FPL 3b Internal Staff Review of Proposal Submitted 4/24/2020

Project/Program	The Apalachicola Regional Restoration Initiative: Strategies 2 & 3		
Primary Reviewer	John Ettinger	Sponsor	USDA
EC Reviewer	John Ettinger	Co-Sponsor	

1. Is/Are the selected Priority Criteria supported by information in the proposal?	Yes
Notes	

2. Does the proposal meet the RESTORE Act geographic eligibility requirement?	Yes
Notes	

3. Are the Comprehensive Plan primary goal and primary objective supported by information in the proposal?	Yes
Notes	

4. Planning Framework: If the proposal is designed to align with the Planning Framework, does the proposal support the selected priority approaches, priority techniques, and/or geographic area?	More information needed
Notes	Overall, the proposal supports the selected priority techniques. However, based on the information provided, it seems that activities corresponding to the "Erosion and sediment control" technique are captured by the more inclusive "Agriculture and forest management" technique. If so, Council staff recommend revising the proposal to remove the "Erosion and sediment control" technique in order to avoid implying that additional types of erosion control activities will take place.

5. Does the proposal align with the applicable RESTORE Council definition of project or program?	Yes
Notes	

6. Does the budget narrative adequately describe the costs associated with the proposed activity?	More information needed
Notes	Since a portion of the requested funding would be put toward construction (e.g., hydrologic infrastructure improvements), Council staff recommend the sponsor revise the answer to the question "Is this a construction project?", from "no" to "yes". Some discussion of the risk, uncertainty and associated costs in hydrologic infrastructure improvements is included in the narrative. Council staff recommend

	including a statement in the budget narrative that the need for contingency cost will be considered as appropriate when developing individual project-specific budgets for construction activities. Finally, funds are not specifically requested for Project Management. Council staff recommend that the sponsor consider whether sufficient funding is incorporated into the request to cover management of the overall agreement, including any subrecipients or contractors, other general project management costs, agency overhead, and indirect costs for any subrecipients.

7. Are there any recommended revisions to the selected leveraged funding categories?			No
Notes			

8. Have three external BAS reviews been completed?	More information needed
Notes	Please see the external BAS review comments, and external reviews summary attached with these review comments.

9. Have appropriate metrics been proposed to support all primary and secondary goals?	More information needed
Notes	The sponsor has selected RESTORE Council metric HM006 - Acres under improved management; however, use of this metric has previously been reserved for land acquisition projects (and has been discontinued due to redundancy with other acquisition metrics). Council staff recommend revising the proposal to remove this metric. Instead, acres targeted for restoration and management should be counted under either metric "HR004 - Habitat restoration - acres restored" or "HM005 - Agricultural BMPs - acres under contracts/agreements." In order to avoid double-counting, the same acre should never be included under both HR004 and HM005. For consistency with previously funded projects and programs, Council staff also recommend the sponsor consider revising the proposal to include metric "COI003 - # people enrolled - BMPs", though this metric is not necessary to support the primary and secondary goals proposed.

10. Environmental compliance: If FPL Category 1 has been selected for the implementation component of the project or program, does the proposal include environmental compliance documentation that fully supports the selection of Category 1?	No
Notes	The sponsor provided the 2015 environmental compliance documentation used by the Council to approve the Gulf Coast Conservation Reserve Program in the Initial FPL, not the currently proposed phases of the Apalachicola Regional Restoration Initiative. Based on the environmental compliance discussion in the application, it appears the sponsor is proposing to use the same environmental compliance approach for this FPL 3b proposal as was used in 2015 for the earlier phases of the Apalachicola program. Council staff agrees with such an approach. To that end, the sponsor would need to provide

	documentation that demonstrates compliance with the environmental laws applicable to the proposed approval of funds for Strategies 2 and 3 of the Apalachicola Regional Restoration Initiative. Specifically, USDA will need to provide (1) USDA CE documentation that fully covers the activities proposed in Strategies 2 and 3; (2) documentation from USFWS regarding compliance with the Endangered Species Act for the proposed activities in Strategies 2 and 3; and (3) ensure that NHPA has been addressed for the program (as was done in the Initial FPL, this could be accomplished by referencing in the CE the programmatic approaches and commitments USDA will employ to ensure compliance with NHPA). Council staff also recommends revising the environmental compliance discussion to remove reference to the Council's 2015 findings, and replace it with a discussion of how USDA proposes to address NEPA and the other laws applicable to the FPL 3b proposal (in this case by using a USDA CE for Strategies 2 and 3.) As currently written, the proposal appears to indicate that the Council has already made a finding on the environmental compliance for Strategies 2 and 3, which is not the case.

11. Geospatial Compliance: Have the appropriate geospatial files and associated metadata been submitted along with a map of the proposed project/program area?	More information needed
Notes	Council staff recommends the sponsor add Lower Choctawhatchee and Lower Ochlockonee to the watersheds list.

FPL 3b BAS Review Summary
The Apalachicola Regional Restoration Initiative: Strategies 2 & 3
May, 2020

Overall the external Best Available Science reviews for *The Apalachicola Regional Restoration Initiative: Strategies 2 & 3* are positive. All reviewers agree that reasonable justification that the proposal is based on science that uses peer-reviewed data has been provided. Most reviewers feel that the scientific basis of this project is justified using science that maximizes the quality, objectivity, and integrity of information, though Reviewers 1 and 3 raise concerns over how outcomes will be measured (discussed below). Reviewer 3 asks what statistical considerations went into determining the size (41,000 acres) and concentrated spatial arrangement of treatment areas, and whether environmental benefits can be reasonably expected to be achieved for the management region described (250,000 acres) given the scale over which natural processes operate and the need for landscape or watershed connectivity.

Reviewers agree that the project has clearly defined goals and objectives, though Reviewer 2 requests clarification on whether acres being treated and acres being managed overlap and are "double-counted" between metrics. Reviewers also agree that measures of success aligning with the primary project goal are identified. Generally the reviewers found the methods for the proposed project to be clearly defined with appropriate justification; however, Reviewer 3 requests that methodological information be moved to the Proposed Methods section from elsewhere in the proposal, and that details be added describing the basis for the target number of private acres to get under contract, and the target number of landowners to reach in order to do so. Reviewer 2 highlights the well-described alignment between the techniques that will be used and the benefits to water quality.

Generally, reviewers feel the proposal objectives and methods are justified using peer reviewed literature and publicly available information. Although Reviewer 1 points out that there is a substantial body of work on restoration in Tate's Hell that could be cited, reviewers agree that the methods are well-supported and appropriate for this geographic area. Reviewer 1 asks for clarification on whether silvicultural management will be done in compliance with Florida's silviculture BMP program and manual.

Concerns are raised about whether the proposal identifies a monitoring strategy that will support the measurement of project success in terms of metrics. While Reviewer 2 is satisfied that drones and multi-spectral sensors can track water levels and vegetation changes, and will facilitate adaptive management of prescribed burns, Reviewer 3 does not see how the adaptive management plan will be linked to monitoring. Reviewer 1 also asks for more information in general on how monitoring will be linked to success, and suggests a need for direct measurement of water quantity and water quality parameters. However, it should be noted that detailed monitoring strategies are not required at the proposal stage. While Reviewer 3 requests a data management plan, this too is not required at the proposal stage, and Reviewer 2 points out that the proposal outlines data collection protocols that take advantage of existing tracking databases.

All reviewers agree that all literature sources used to support the proposal are accurately and completely cited, and represented in a fair and unbiased manner. Reviewers feel that the information discussed and used for project justification is recent and relevant to the proposed activity.

The reviewers agree the proposal evaluates uncertainties and risks in achieving its objectives over time, including both short- and long-term risks, but suggest that additional risks to consider should include short-term uncertainty inherent in working with private landowners and changes in the timber market (e.g., declines in timber value, conversion from timber to hemp), and long-term risks from sea level rise. Reviewers 2 and 3 indicate risk mitigation strategies should also be discussed. Nonetheless, reviewers feel the proposal provides reasonable justification that the risks and uncertainties of the scientific basis for such projects are clearly documented and communicated. Reviewer 3 raises the need for a risk analysis of different management alternatives and mitigation plans, however, this information is not required as part of a proposal. Reviewer 2 also notes that long-term risks to the ecosystems are greater from taking no action than taking the proposed actions, and that the risks identified are likely minimal or can be mitigated due to the scale of the proposed work.

In general, reviewers believe the environmental benefits of the proposed activity are clearly defined within the project proposal, although Reviewer 2 requests clarification on the relationship between benefits and underlying stressors. Reviewer 2 also requests clarification on how management activities will be implemented such that they can achieve benefits at the scale of 250,000 acres.

All reviewers believe the proposal adequately evaluates the successes and failures of similar restoration efforts, and that the sponsor and project partners have demonstrated experience in implementing projects similar to the one being proposed.

Reviewer 2 provides the following final comment: “This ARRI proposal is well-constructed, ambitious and consistent with the RESTORE Act. It includes relevant research and particularly good discussion of the science supporting the relationship between water and forest management. While ambitious in its acreage goals there is nothing that has not been tried in other locations and with success. The risks to the RESTORE program, if it chooses to fund this project, are minimal while the gains for the recovery of these ecosystems within the Apalachicola region could be substantial.”

RESTORE Council FPL 3b Best Available Science Review

The Apalachicola Regional Restoration Incentive: Strategies 2 & 3

USDA was pleased to receive the feedback from the Best Available Science review of the Apalachicola Regional Restoration Initiative project proposal. This process will serve to provide the public with greater transparency relative to how the program will be administered and how the proposed outcomes will be achieved. The comments and USDA's response to the comments provide additional information as suggested by reviewers. The proposal seeks to build upon similar and synergistic Gulf restoration activities to address water quality. The following responses to BAS Review comments are provided to address information gaps identified by the reviewers as it relates to the Apalachicola Regional Restoration Initiative proposal.

Best Available Science: These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1. Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?

Comment Reviewer 1: Given the amount of restoration work that already has been done in Tate's Hell by the State of Florida/NWFWMD, it is disappointing that few of the project reports or papers associated with the completion and evaluation of these projects were included in the literature cited. Most of the references are for work outside this region.

Comment Reviewer 2: Yes, the proposal provides justification for the restoration work and cites literature supporting the rationale for water quality/quantity benefits and secondarily habitat benefits.

Comment Reviewer 3: NA

USDA Response: We heartily agree with reviewers' comments regarding hydrologic restoration work in THSF. Indeed, there has been considerable high-quality restoration work done in this area, particularly on THSF. This was an oversight and has been corrected. To clarify, originally, much of the literature cited in the narrative was used to build the case for upland restoration as it pertains to water quantity improvements and the resultant water quality impacts gained through silvicultural activities, evapotranspiration, etc.

Question 2. If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?

Comment Reviewer 1: As discussed above, the majority of the literature cited is for work outside of the Gulf Coast region. However, based on past work in Tate's Hell, the proposal's methods are adaptable to this region.

Comment Reviewer 2: The supporting information applies to the same or similar coastal and forest ecosystems found in the region and builds on previous restoration work with these systems in the same general area.

Comment Reviewer 3: NA

USDA Response: Respectfully, we disagree with Reviewer 1's comments regarding most literature citations being outside the Gulf Coast region. The information that was provided drew from a substantial body of research with direct applications to work within the region. Above 60% of the literature originally cited was locally (Florida and/or Gulf) or regionally-specific, or contained information within the reference about the project locale. Other references included in the Bibliography contained information that was site-independent but applied to this case study. This is particularly the situation with evapotranspiration equations, but we also cited Florida and even panhandle-specific open pine forest examples. Again, literature originally cited in the narrative was used to build the case for upland restoration as it relates to evapotranspiration, water quantity improvements and the resultant water quality impacts and not specifically hydrologic feature modification as has been done in this immediate vicinity. In the original Bibliography, there were 55 references. There are now 68 references including several that are in the location of the project site. Hopefully, this will be satisfactory.

Question 3. Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: Yes, the proposal narrative uses current scientific literature appropriately in support of the project activities.

Comment Reviewer 3: There are some typos in the citations.

USDA Response: We have added a few more references that were relevant to reviewers' comments (e.g., documents related to hydrologic restoration on Tate's Hell SF). We have also attempted to fix all typos in the citations and the Bibliography.

Question 4. Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)

Comment Reviewer 1: It is good the proposal recognizes and discusses the potential impacts of the coronavirus. However, they did not discuss the potential uncertainties and risk associated with the extensive damage to timber resources from Hurricane Michael and the associated drop in prices for timber. Since this proposal seeks to increase long leaf pine production, which

is a very long-term investment, the project may also want to evaluate risks associated with changes in crop – from timber to hemp, for example.

Comment Reviewer 2: The proposal discusses the risks and uncertainties associated with the project activities and the project area. Long-term risks to the ecosystems are likely greater from taking no action than taking the proposed actions. The risks identified are likely minimal or can be mitigated due to the scale of the proposed work. Two areas could benefit from more discussion and mitigation: In the near term, the inherent uncertainty surrounding work with private forest landowners and their adoption of forest management. In the long-term, the risk to parts of the project area from sea level rise.

Comment Reviewer 3: NA

USDA Response: We fully acknowledge that there are risks associated with ARRI. To the best of our abilities, and given the character limitations, we have done a major rewrite of the Risks and Uncertainties section to address the issues raised by the reviewers. We have added a discussion related to risks pertaining to the timber market following Hurricane Michael, and conversion of forest land to other uses (hemp, solar). We have also added more discussion related to risks associated with climate change. However, we would also like to note that a full assessment of these risks would be better suited to a Gulf-wide analysis rather than at a project level.

Based on the answers to the previous 4 questions, and giving deference to the sponsor to provide within reason the use of best available science, the following three questions can be answered:

Question A. Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: Yes, the applicant provides reasonable justification for the restoration activities proposed and cites appropriate literature.

Comment Reviewer 3: The proposal narratives were well written. Generally speaking, both proposal objectives and proposed methods are well justified, irregardless of the anticipated shifts and trends of related natural processes and ecosystem patterns. Some statements need literature supports (see below)

USDA Response: We have added additional literature support where applicable. More detailed comments addressed below.

Question B. Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?

Comment Reviewer 1: Needs to do a better job of quantifying actual water quantity and water quality changes from the project.

Comment Reviewer 2: The proposal contains good references and discussion of the relationship between water availability and forest management and uses that empirical information to guide the scope of proposed restoration treatments.

Comment Reviewer 3: For strategy 2, the total area to be treated directly is about 23,000 ac (silvicultural treatments applied on 18,000 ac, infrastructure implementation and restoration on 5,000 ac), less than 10% of a total of 250,000+ ac for the entire region. It is not clear how much environmental benefits can be achieved? Statistically, what are the considerations to select the size of treated areas? Moreover, the treated areas are concentrated in a few large blocks, rather than multiple areas across the whole region. Will this design or treatment plan consider the connectivity between landscapes or watersheds, and the spatial scales on which natural processes operate? For a large-scale restoration project, a statistically sound treatment plan including the size of treated areas. blocks and their spatial arrangements in the entire study region needs to be addressed clearly. There is little relevant information in the narratives.

USDA Response: We have rewritten several sections related to the impacts of project activities on water quantity and water quality. This includes more information in the Introduction and Methods, a more detailed explanation of site/project level monitoring, a more detailed explanation of landscape scale monitoring using remote sensing and discussion about incorporation of hydrologic models (e.g., SWAT and BASINS) to help better understand landscape scale impacts. We disagree with reviewer 3's comment that only 23,000 ac will be treated. We have tried to more clearly illustrate the acreages (Table 2 and methods) that will be treated by silvicultural activities (18,000 ac), hydrologic activities (5,000 ac), improved private land management (25,000 ac), NNIS treatments (500 ac) and wetland restoration (50 ac). Additionally, the prescribed fire and fuels treatments on approximately 218,000 ac will indeed have a direct impact on these coastal upland and wetland ecosystems. TNC restoration crews are highly trained and will use fire and fuels treatments for maximum environmental benefits (e.g., to reduce woody shrub cover and increase cover of natural pyrogenic herbaceous cover). CSER will use an innovative drone-based prescribed fire monitoring program to better capture the fine scale ecological impacts of prescribed fire and to adapt these techniques through time when compared with in situ data collected at a small subset of sites pre-fire (e.g., in USFS fuels plots) and during the fire (e.g., weather stations capturing changes in temperature, humidity and wind). Furthermore, hydrologic models will incorporate monitoring/accomplishment data to estimate watershed- and landscape-level impacts to water quantity and quality. Ecological condition models will be updated annually with monitoring/accomplishment data to track improvements to ecological conditions and to adapt/prioritize future treatments. Regarding

reviewer 3's comments about the selection of treatment sites, this is more clearly described in the methods and in Figures 3 and 4. As discussed in Methods, sites were selected based on a variety of spatial datasets (e.g., high priority natural communities from FNAI, estimated impacts from Hurricane Michael, past land management activities, etc.), and information from ARSA staff as to where priority restoration is needed.

Question C. Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?

Comment Reviewer 1: It is good the proposal recognizes and discusses the potential impacts of the coronavirus. However, they did not discuss the potential uncertainties and risk associated with the extensive damage to timber resources from Hurricane Michael and the associated drop in prices for timber. Since this proposal seeks to increase long leaf pine production, which is a very long-term investment, the project may also want to evaluate risks associated with changes in crop – from timber to hemp, for example.

Comment Reviewer 2: The applicant has made a reasonable effort to describe what scientific information can or cannot be used to evaluate the risks and uncertainties of the proposed project.

Comment Reviewer 3: NA

USDA Response: See response related to risks in Question 4 above, and Questions F&G below.

Science Context Evaluation:

Question A. Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?

Comment Reviewer 1: Click here to enter text

Comment Reviewer 2: Yes, the previous work through the RESTORE Tate's Hell Strategy 1. All the partners have experience with aspects of the proposed work. All of the restoration techniques proposed have been used elsewhere.

Comment Reviewer 3: NA

USDA Response: We have added additional text about the Apalachicola Regional Stewardship Alliance (ARSA) and references to the original FPL (2015) text on Tate's Hell Strategy 1, and references to Tate's Hell Strategy 1 products that were recently published (Hogland et al. 2020) or are currently in preparation (e.g., Crandall et al., St. Peter et al.).

Question B. Does the project/program have clearly defined goals objectives?

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: Yes, each of the individual project components are well-defined. It would help to understand how the pieces fit together. For example, is the 25,000 acres of private forest land to be treated under the Agricultural BMP metric (Strategy 3) contained within the 250,000 acres of habitat management metric (Strategy 2). Is the total acreage of impact for the project 250,000 acres or 298,000? Clarity on the metrics for reporting purposes would help to avoid double-counting. That said, the proposed project would clearly operate at a landscape scale and is expected to have positive impact for these ecosystems.

Comment Reviewer 3: NA

USDA Response: We agree that the acreages were not clear, so we have rewritten the Methods, added a new table (Table 2) and have updated the Metrics to avoid double counting.

Question C. Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: All the restoration techniques proposed have been used previously in similar contexts and even within the same geographic area. The alignment between these techniques and benefits to water availability are described well. The partners have experience with their implementation and cost-effectiveness.

Comment Reviewer 3: The method section has a detailed description on the scientific base and multiple data sources used for the proposed methods, but the proposed methods or treatments were placed in the introduction/overview section and Table 1. It reads a bit awkward logically. Products developed by the CSER and used for designing proposed methods and/or data analysis such as ET estimates for the Apalachicola region should be cited in the text. For strategy 3 to work with NIPF, the proposal aims to reach out 300+ landowners covering 25,000 acres. What is the base for these figures? What is the proportion of landowners to be reached in the entire region? Whether successful or not, the cost effectiveness ratios of the restoration project depends on not only the soundness of the proposed methods and techniques, but also the treated areas covered and the number of landowners who will participate in this program. An appropriate justification on this point is needed.

USDA Response: We agree that the placement of Methods in the Introduction section was a bit awkward and have rewritten portions of both the Introduction and the Methods to address this. In addition to the CSER references which were included in the original draft (e.g., Jenkins 2018, St. Peter et al. 2020, Center for Aquatic Technology Transfer 2019), we added 3 more CSER references (Hogland et al. 2020, Crandall et al. and St. Peter et al., in prep). We added a statement to the methods regarding the NIPF numbers (# of landowners and acres). These numbers come from Florida Forest Service's extensive experience with their Longleaf Pine Private Landowner Incentive Program.

Question D. Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: Yes, the proposal provides a good discussion of the benefits to water quality and quantity in particular (Primary Comprehensive Plan goal) but also to habitats and associated at-risk species. The proposal discusses benefits to the long-term security of the regional water supply and the threats to that supply over time. It also discusses the importance of long-term stewardship of forests resources and building capacity among natural resource professionals to maintain those forest conditions to support water supply and native habitats through prescribed fire and invasive species management.

Comment Reviewer 3: The environmental benefits should be addressed specifically in an order like ecosystem/habitat types and acreage-restoration activities to be implemented - major environmental stressors – environmental benefits to be achieved. Over a 5-year timeline, will restoration activities be treated or implemented on all the 250,000+ acres? This is mentioned for the first time in the proposal. In previous sections, only <10% lands will be treated. If the proposal will treat all lands, Please specify the exact activities to be implemented. How? Especially on private lands, how will treatments be implemented on such a large scale?

USDA Response: We have almost completely rewritten the Environmental Benefits section. We have strengthened the linkages between environmental benefits and their underlying stressors. Acreages to be treated are defined in the Methods section, Table 2 and in Metrics. A breakdown of priority acres by habitat type is included in Figure 4.

Question E. Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: Yes, the proposal has metrics that align with the Comprehensive Plan and are consistent with the RESTORE Act. Specific metrics are proposed for Habitat restoration and Restoring hydrology (Habitat Restoration) as well as Agricultural BMPs and Habitat management and stewardship (Habitat Management) including quantitative targets.

Comment Reviewer 3: NA

USDA Response: We concur with reviewer 2's comments. As mentioned above we did update the Metrics section to remove any possible double counting. Progress towards metric goals will be tracked in TNC and USFS databases.

Question F. Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: This proposed work is part of a long-term multi-generational effort. It is designed with these long- term environmental benefits and risks in mind. Although future extreme weather events like hurricanes may be difficult to predict, sea level rise is more predictable. Because many acres of the project area are right along the coast (Figures 2 and 3) a discussion of sea level rise and how it may or may not affect the long-term impacts of the project seems prudent. Longleaf ecosystems are expected to be resilient to changing climate conditions, but sea level rise may change habitat types entirely. These changes can be mitigated and could be discussed.

Comment Reviewer 3: NA

USDA Response: To the best of our abilities, we have done a major rewrite of the Risks and Uncertainties section to address the issues raised by the reviewers. We have also added more discussion related to risks associated with climate change, including a discussion on the resilience of longleaf to climate change and on the benefits of longleaf for long-term carbon sequestration. As noted above, a thorough assessment of risks from sea level rise would be better suited to a Gulf-wide analysis rather than at a specific project level.

Question G. Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socioeconomic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)

Comment Reviewer 1: This section could be improved, see previous comment above about potential changes in crop from forestry to hemp production. This could affect success in Strategy #

Comment Reviewer 2: The proposal discusses short term risks and uncertainties. Due to the nature of the proposed work, these risks are minimal and there is flexibility and time within the project area and timeline to mitigate these risks. One part that is discussed but could be strengthened is the inherent uncertainty surrounding work with private landowners. This is a key component of the proposal affecting 25,000 acres (Strategy 3). The proposal could make clear how to mitigate this uncertainty through outreach to many more landowners than are needed to achieve their goal in the event that the 100 landowners who agree to a visit from a forester may not all adopt new forest management on their lands. It is also worth noting that failure to achieve the 25,000 acre goal for private forest management may only impact approximately 10% of their proposed treatment acres.

Comment Reviewer 3: The applicants claimed the risks with the project are comparatively low, but did not gave a justification. What is the reference? To quantify potential risks and uncertainties, an efficient way may be using a conceptual model or framework by identifying the sources of risks and uncertainties associated with management activities and environmental stresses including climate change, hurricanes and wildfires, etc. Also, a risk analysis of different management alternatives and mitigation plans is necessary. The proposed treatments should be a tradeoff between multiple constraints. Also, the risk may differ with ownerships such as federal vs private lands. And risks may also change with treatment times. This should be dealt explicitly in the proposal. No action is an extreme case, and a less conservative plan should be used and will be more meaningful to compare or quantify risks and uncertainties of the proposed activities and treatments.

USDA Response: We agree with reveiwer's comments that this section was lacking. Original character limits required a number of compromises in content and flow throughout the document that have been addressed to the best of our ability. We believe the apprehensions about land conversion have now been sufficiently covered. While hemp and solar may be appealing at first glance, a careful analysis reveals the risks associated with either of these options is likely greater than keeping existing forest land in forest. As well, it is probable that the USDA Farm Service Agency's Emergency Forest Restoration Program will help allay some concerns and buffer from economic impacts associated with Hurricane Michael and slumping timber markets. Payments from EFRP are imminent. Regarding risk associated with lack of participation from PFLOs in Strategy 3, we feel that Hurricane Michael might actually work in our favor. FFS's involvement in timber damage documentation related to EFRP will provide ample opportunity to inform PFLOs and enroll them in approved management plans thus ensuring maximum participation. Concerning risk related to mega-factors, we feel that having the array of spatial locations to operate as exhibited in our pre-proposal spatial analysis will allow for adaptive management and give restoration teams the opportunity to conduct

activities somewhere within the region at any given time resulting in lower chance of work stoppage. While the probability is high that there will be some wildfires or extreme weather events, it is improbable these will occur region-wide. Regarding climate change, and the impacts of sea-level rise, many of the areas we are proposing to work in are upland to the areas where sea-level rise will have the most impact. Also, the fact that we are attempting to return more freshwater to the system could offset some of the saltwater intrusion associated with sea-level rise. As well, if no action is taken, upland and aquatic ecosystems will not be as resilient in the face of catastrophic mega-events or the long-term effects of climate change. That said, we feel that a full assessment of these risks is a very big undertaking at this stage and would be better suited to a Gulf-wide analysis examining the impacts on all coastal RESTORE projects versus individual project level analyses. We fully acknowledge that there are multiple risks associated with ARRI. In this version, with expanded character limitations, we have attempted to tackle the reviewer's concerns, but in light of all the information presented, we feel that the risk/reward ratio is acceptable. The restoration techniques are proven, work is spread across the region, and managers can make timely decisions on where and when to conduct specific restoration activities.

Question H. Does the project/program consider recent and/or relevant information in discussing the elements above?

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: The proposal makes use of current peer-reviewed literature on forests and water and other topics germane to this project as well as other plans and relevant information including the expertise of partner agencies, universities and others. It uses this information to explain its selection of restoration techniques and the risks and uncertainties associated with working at their proposed landscape scale.

Comment Reviewer 3: Click here to enter text.

USDA Response: We concur with reviewer's comments.

Question I. Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)

Comment Reviewer 1: Click here to enter text.

Comment Reviewer 2: The proposed work is based on the experience of several project partners as well as published guides to restoration methods which have been vetted and proven successful. There is nothing being proposed that has not been tried.

Comment Reviewer 3: Click here to enter text.

USDA Response: We concur with reviewer's comments.

Question J. Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)

Comment Reviewer 1: The description of the monitoring effort is very general. Appears that much of the monitoring is indirect measurements via a drone. See very little meaningful actual monitoring of either water quantity or water quality parameters, making it difficult to understand how the proposed monitoring will be used to assess environmental success.

Please summarize any additional information needed below:

More thorough description of the monitoring proposed and how it will actually measure changes in water quantity or water quality. Need clarification to ensure that all silviculture activities will be done in compliance with Florida's silviculture BMP program and manual, not just the USDA BMPs listed in references 44 and 45. Florida's silviculture BMPs are more extensive than the USDA ones and they are based on Florida conditions and BMP monitoring results.

Comment Reviewer 2: The monitoring component is justified and embraces adaptive management principles. Some of the hydrologic restoration sites will be more intensely monitored using drone technology and multi-spectral sensors to examine water levels and vegetation changes. Drones will also be used to evaluate the efficiency of prescribed fire treatments. Multi-spectral imaging can be compared to pre and post fire plot data and used to improve fire management which will be an ongoing stewardship activity. The proposal has also outlined a data collection protocol that takes advantage of existing tracking databases.

Please summarize any additional information needed below:

This ARRI proposal is well-constructed, ambitious and consistent with the RESTORE Act. It includes relevant research and particularly good discussion of the science supporting the relationship between water and forest management. While ambitious in its acreage goals there is nothing that has not been tried in other locations and with success. The risks to the RESTORE program, if it chooses to fund this project, are minimal while the gains for the recovery of these ecosystems within the Apalachicola region could be substantial.

Comment Reviewer 3: Data are invaluable. A detailed data management plan is needed and information such as data types involved, storage and backup, data access and repository,

quality assurance, metadata for long-term management should be described in the data management plan. A monitoring program with new techniques such as drone applications was proposed. But how the adaptive management plan is linked with monitoring programs and findings was not discussed.

Please summarize any additional information needed below:

The applicants have the expertise and are knowledgeable to conduct the proposed work. The proposal also articulates clear objectives, goals, and tasks. A weakness is that the proposal lacks a sold spatial framework to integrate proposed methods and potential risks and benefits. As a five-year restoration project, a detailed plan specifying how to implement relevant tasks or restoration activities over space and across times should be included. Overall, the proposal lacks some statistical and experimental details. As a science-based, large-scale study, a well-designed treatment plan is necessary for data analysis and summary and quantifying risks and uncertainties associated with the proposed tasks.

USDA Response: We agree the Monitoring and Adaptive Management section was too general (somewhat due to previous space limitations). We have completely rewritten this section to include more information about 1) field, site-level monitoring, 2) adherence to Florida Silviculture BMPs (which was added as a reference), 3) hydrology monitoring, including seeking additional extramural funding to do more site-level water quality monitoring through CSER and FAMU SOE/COE, and 4) landscape-level monitoring via remotely-sensed imagery and products. We also included a discussion of how all monitoring/accomplishment data will be used to update ecological condition models and the spatially-explicit Regional Restoration Decision Support System (RRDSS), and to deploy hydrologic models (e.g., SWAT) to help understand impacts to water quality and quantity. We also provided a discussion of how monitoring results will be used to adapt management as needed (e.g., shared at quarterly ARSA meetings, technical reports, peer-reviewed papers).

Further, we have added supplementary details to the Data Management section related to existing data storage infrastructure developed by CSER at FAMU, archiving and incorporation of data into databases, and the RRDSS. We disagree with Reviewer 3's comment that the proposal lacks a solid spatial framework. ARRI is founded on novel spatial data, tools and expertise that have taken years to develop through many creative partnerships. We have included more information throughout the proposal related to the spatially-explicit nature of all ARRI data and tools as well as more references to these datasets. As mentioned in the response to Question B (pg. 4), and elaborated on in the Methods section and Figures 3 and 4, sites were selected based on a variety of spatial and tabular datasets (e.g., high priority natural communities from FNAI, estimated impacts from Hurricane Michael, past land management activities, etc.) as well as from information provided by ARSA leadership as to where priority restoration is needed. Sites are also distributed widely across public and private ownership and across different

natural community types to ensure opportunities to conduct activities somewhere within the region at any given time resulting in lower chance of work stoppage.

Gulf Coast Ecosystem Restoration Council

FPL 3b Internal Best Available Science Review Panel Summary

July 2020

Introduction

On Tuesday, June 30, and Wednesday July 1, 2020 the RESTORE Council convened the Funded Priorities List (FPL) 3b Internal Best Available Science (BAS) Review Panel. The purpose of this internal panel was to use Council member-agency expertise to address external BAS review comments provided for FPL 3b submitted project/program proposals, and potentially identify project/program synergies not identified prior to proposal submission. The ultimate goal of the panel was to provide Council members with substantive best available science content to inform their decision-making.

The internal panel was convened via webinar with representatives from each of the Council's eleven member agencies present. Each BAS Panel member was provided the following:

1) Full FPL 3b proposals
2) 3 external BAS reviews for each proposal
3) Summary of external BAS reviews for each proposal
4) Proposal Sponsor's response to the BAS reviews summary
5) Any proposed revisions to the proposal

Proposal sponsors provided a brief synopsis of their proposal to the panel, a summary of comments made in external reviews, and discussed their proposed response to the external reviews. Council staff then solicited feedback from the panel on the proposal sponsor's presentation of comments and responses to those comments, and any additional BAS concerns. Council staff also solicited feedback on any existing or future synergies with other Gulf restoration activities. The proceedings of the meeting for this proposal are summarized below.

Sponsor: USDA

Apalachicola Regional Restoration Initiative

Feedback from the panel on the proposal sponsor's presentation of comments and responses to those comments, and any additional BAS concerns:

Tracking success: Concerns are raised about whether the proposal identifies a monitoring strategy that will support the measurement of project success and prevent double counting.

- The BAS Panel agrees that USDA has appropriately addressed this comment.

Tracking success: Concerns are raised over how outcomes will be measured.

- The BAS Panel agrees that USDA has appropriately addressed this comment.

Environmental benefits: Clarification is requested on how management activities will be implemented such that they can achieve benefits at the scale of 250,000 acres.

- The BAS Panel agrees that USDA has appropriately addressed this comment.

Risks and uncertainty: Address short-term uncertainty inherent in working with private landowners and changes in the timber market (e.g., declines in timber value, conversion from timber to hemp), and long-term risks from sea level rise.

- The BAS Panel agrees that USDA has appropriately addressed this comment.

Panel comments on existing or future synergies with proposed activity:
Implementation of this proposal would create synergies with $60 million worth of NFWF GEBF investments in land acquisition, oyster restoration, and hydrological restoration in this watershed.

SCIENCE EVALUATION

Bucket 2: Comprehensive Plan Component

Proposal Title: The Apalachicola Regional Restoration Initiative: Strategies 2 & 3
Location (If Applicable): Florida
Council Member Bureau or Agency: U.S. Department of Agriculture
Type of Funding Requested: Implementation

Reviewed by: Reviewer 1
Date of Review: May 4, 2020

Best Available Science:

These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1.	
Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?	Yes
Comments:	
Given the amount of restoration work that already has been done in Tates Hell by the State of Florida/NWFWMD, it is disappointing that few of the project reports or papers associated with the completion and evaluation of these projects were included in the literature cited. Most of the references are for work outside this region.	

Question 2.	
If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?	Yes
Comments:	
As discussed above, the majority of the literature cited is for work outside of the Gulf Coast region. However, based on past work in Tates Hell, the proposal's methods are adadptable to this region.	

Question 3.	
Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?	Yes
Comments:	
Click here to enter text.	

Question 4.	
Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)	Yes
Comments:	
It is good the proposal recognizes and discusses the potential impacts of the coronavirus. However, they did not discuss the potential uncertainties and risk associated with the extensive damage to timber resources from Hurricane Michael and the associated drop in prices for timber. Since this proposal seeks to increase long leaf pine production, which is a very long term investment, the project may also want to evaluate risks associated with changes in crop – from timber to hemp, for example.	

Based on the answers to the previous 4 questions, and *giving deference to the sponsor to provide within reason the use of best available science,* the following three questions can be answered:

Question A	
Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?	Yes
Comments:	
Click here to enter text.	

Question B	
Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?	Yes
Comments:	
Needs to do a better job of quantifying actual water quantity and water quality changes from the project.	

Question C	
Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?	Yes
Comments:	
It is good the proposal recognizes and discusses the potential impacts of the coronavirus. However, they did not discuss the potential uncertainties and risk associated with the extensive damage to timber resources from Hurricane Michael and the associated drop in prices for timber. Since this proposal seeks to increase long leaf pine production, which is a very long term investment, the project may also want to evaluate risks associated with changes in crop – from timber to hemp, for example.	

Science Context Evaluation:

Question A	
Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?	Yes
Comments:	
Click here to enter text.	

Question B	
Does the project/program have clearly defined goals objectives?	Yes
Comments:	
Click here to enter text.	

Question C	
Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?	Yes
Comments:	
Click here to enter text.	

Question D	
Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?	Yes
Comments:	
Click here to enter text.	

Question E	
Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)	Yes
Comments:	
Click here to enter text.	

Question F	
Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)	Yes
Comments:	
Click here to enter text.	

Question G	
Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socio-economic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)	Yes
Comments:	
This section could be improved, aee previous comment above about potential changes in crop from forestry to hemp production. This could affect success in Strategy #	

Question H	
Does the project/program consider recent and/or relevant information in discussing the elements above?	Yes
Comments:	
Click here to enter text.	

Question I	
Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)	Yes
Comments:	
Click here to enter text.	

Question J	
Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)	Need more information

Comments:

The description of the monitoring effort is very general. Appears that much of the monitoring is indirect measurements via a drone. See very little meaningful actual monitoring of either water quantity or water quality parameters, making it difficult to understand how the proposed monitoring will be used to assess environmental success.

Please summarize any additional information needed below:

More thorough description of the monitoring proposed and how it will actually measure changes in water quantity or water quality. Need clarification to ensure that all silviculture activities will be done in compliance with Florida's silviculture BMP program and manual, not just the USDA BMPs listed in references 44 and 45. Florida's silviculture BMPs are more extensive than the USDA ones and they are based on Florida conditions and BMP monitoring results.

SCIENCE EVALUATION

Bucket 2: Comprehensive Plan Component

Proposal Title: The Apalachicola Regional Restoration Initiative: Strategies 2 & 3
Location (If Applicable): Florida
Council Member Bureau or Agency: U.S. Department of Agriculture
Type of Funding Requested: Implementation

Reviewed by: Reviewer 2
Date of Review: May 8, 2020

Best Available Science:

These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1.	
Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?	Yes
Comments:	
Yes, the proposal provides justification for the restoration work and cites literature supporting the rationale for water quality/quantity benefits and secondarily habitat benefits.	

Question 2.	
If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?	Yes
Comments:	
The supporting information applies to the same or similar coastal and forest ecosystems found in the region and builds on previous restoration work with these systems in the same general area.	

Question 3.	
Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?	Yes
Comments:	
Yes, the proposal narrative uses current scientific literature appropriately in support of the project activities.	

Question 4.	
Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)	Yes
Comments:	
The proposal discusses the risks and uncertainties associated with the project activities and the project area. Long term risks to the ecosystems are greater from taking no action than taking the proposed actions. The risks identified are likely minimal or can be mitigated due to the scale of the proposed work. Two areas could benefit from more discussion and mitigation: In the near term, the inherent uncertainty surrounding work with private forest landowners and their adoption of forest management. In the long-term, the risk to parts of the project area from sea level rise.	

Based on the answers to the previous 4 questions, and *giving deference to the sponsor to provide within reason the use of best available science,* the following three questions can be answered:

Question A	
Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?	Yes
Comments:	
Yes, the applicant provides reasonable justification for the restoration activities proposed and cites appropriate literature.	

Question B	
Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?	Yes
Comments:	
The proposal contains good references and discussion of the relationship between water availability and forest management and uses that empirical information to guide the scope of proposed restoration treatments.	

Question C	
Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?	Yes
Comments:	

The applicant has made a reasonable effort to describe what scientific information can or cannot be used to evaluate the risks and uncertainties of the proposed project.

Science Context Evaluation:

Question A	
Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?	Yes
Comments:	
Yes, the previous work through the RESTORE Tate's Hell Strategy 1. All the partners have experience with aspects of the proposed work. All of the restoration techniques proposed have been used elsewhere.	

Question B	
Does the project/program have clearly defined goals objectives?	Yes
Comments:	
Yes, each of the individual project components are well-defined. It would help to understand how the pieces fit together. For example, is the 25,000 acres of private forest land to be treated under the Agricultural BMP metric (Strategy 3) contained within the 250,000 acres of habitat management metric (Strategy 2). Is the total acreage of impact for the project 250,000 acres or 298,000? Clarity on the metrics for reporting purposes would help to avoid double-counting. That said, the proposed project would clearly operate at a landscape scale and is expected to have positive impact for these ecosystems.	

Question C

Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?	Yes

Comments:

All the restoration techniques proposed have been used previously in similar contexts and even within the same geographic area. The alignment between these techniques and benefits to water availability are described well. The partners have experience with their implementation and cost-effectiveness.

Question D

Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?	Yes

Comments:

Yes, the proposal provides a good discussion of the benefits to water quality and quantity in particular (Primary Comprehensive Plan goal) but also to habitats and associated at-risk species. The proposal discusses benefits to the long-term security of the regional water supply and the threats to that supply over time. It also discusses the importance of long-term stewardship of forests resources and building capacity among natural resource professionals to maintain those forest conditions to support water supply and native habitats through prescribed fire and invasive species management.

Question E

Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)	Yes

Comments:

Yes, the proposal has metrics that align with the Comprehensive Plan and are consistent with the RESTORE Act. Specific metrics are proposed for Habitat restoration and Restoring hydrology (Habitat Restoration) as well as Agricultural BMPs and Habitat management and stewardship (Habitat Management) including quantitative targets.

Question F	
Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)	Need more information
Comments:	
This proposed work is part of a long-term multi-generational effort. It is designed with these long term environmental benefits and risks in mind. Although future extreme weather events like hurricanes may be difficult to predict, sea level rise is more predictable. Because many acres of the project area are right along the coast (Figures 2 and 3) a discussion of sea level rise and how it may or may not affect the long-term impacts of the project seems prudent. Longleaf ecosystems are expected to be resilient to changing climate conditions, but sea level rise may change habitat types entirely. These changes can be mitigated and could be discussed.	

Question G	
Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socio-economic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)	Yes
Comments:	
The proposal discusses short term risks and uncertainties. Due to the nature of the proposed work, these risks are minimal and there is flexibility and time within the project area and timeline to mitigate these risks. One part that is discussed but could be strengthened is the inherent uncertainty surrounding work with private landowners. This is a key component of the proposal affecting 25,000 acres (Strategy 3). The proposal could make clear how to mitigate this uncertainty through outreach to many more landowners than are needed to achieve their goal in the event that the 100 landowners who agree to a visit from a forester may not all adopt new forest management on their lands. It is also worth noting that failure to achieve the 25,000 acre goal for private forest management may only impact approximately 10% of their proposed treatment acres.	

Question H	
Does the project/program consider recent and/or relevant information in discussing the elements above?	Yes
Comments:	
The proposal makes use of current peer-reviewed literature on forests and water and other topics germane to this project as well as other plans and relevant information including the expertise of partner agencies, universities and others. It uses this information to explain its selection of restoration techniques and the risks and uncertainties associated with working at their proposed landscape scale.	

Question I	
Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)	Yes
Comments:	
The proposed work is based on the experience of several project partners as well as published guides to restoration methods which have been vetted and proven successful. There is nothing being proposed that has not been tried.	

Question J	
Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)	Yes
Comments:	
The monitoring component is justified and embraces adaptive management principles. Some of the hydrologic restoration sites will be more intensely monitored using drone technology and multi-spectral sensors to examine water levels and vegetation changes. Drones will also be used to evaluate the efficiency of prescribed fire treatments. Multi-spectral imaging can be compared to pre and post fire plot data and used to improve fire management which will be an ongoing stewardship activity. The proposal has also outlined a data collection protocol that takes advantage of existing tracking databases.	

Please summarize any additional information needed below:
This ARRI proposal is well-constructed, ambitious and consistent with the RESTORE Act. It includes relevant research and particularly good discussion of the science supporting the relationship between water and forest management. While ambitious in its acreage goals there is nothing that has not been tried in other locations and with success. The risks to the RESTORE program, if it chooses to fund this project, are minimal while the gains for the recovery of these ecosystems within the Apalachicola region could be substantial.

SCIENCE EVALUATION

Bucket 2: Comprehensive Plan Component

Proposal Title: The Apalachicola Regional Restoration Initiative: Strategies 2 & 3
Location (If Applicable): Florida
Council Member Bureau or Agency: U.S. Department of Agriculture
Type of Funding Requested: Implementation

Reviewed by: Reviewer 3
Date of Review: Click here to enter text.

Best Available Science:

These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1.	
Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?	Yes
Comments:	
NA	

Question 2.	
If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?	Yes
Comments:	
NA	

Question 3.	
Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?	Choose an item.
Comments:	
There are some typos in the citations.	

Question 4.	
Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)	Yes
Comments:	
NA	

Based on the answers to the previous 4 questions, and *giving deference to the sponsor to provide within reason the use of best available science,* the following three questions can be answered:

Question A	
Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?	Yes
Comments:	
The proposal narratives were well written. Generally speaking, both proposal objectives and proposed methods are well justified, irregardless of the anticipated shifts and trends of related natural processes and ecosystem patterns. Some statements need literature supports (see below)	

Question B	
Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?	Need more information
Comments:	
For strategy 2, the total area to be treated directly is about 23,000 ac (sivicultural treatments applied on 18,000 ac, infrastructure implementation and restoration on 5,000 ac), less than 10% of a total of 250,000+ ac for the entire region. It is not clear how much environmental benefits can be achieved? Statistically, what are the considerations to select the size of treated areas? Moreover, the treated areas are concentrated in a few large blocks, rather than multiple areas across the whole region. Will this design or treatment plan consider the connectivity between landscapes or watersheds, and the spatial scales on which natural processes operate? For a large-scale restoration project, a staitically sound treatment plan including the size of treated areas.blocks and their spatial arrangements in the entire study region needs to be addressed clearly. There is little relevant information in the narratives.	

Question C	
Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?	Yes
Comments:	

NA

Science Context Evaluation:

Question A	
Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?	Yes
Comments:	
NA	

Question B	
Does the project/program have clearly defined goals objectives?	Yes
Comments:	
NA	

Question C

Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?	Need more information

Comments:

The method section has a detailed description on the scientific base and multiple data sources used for the proposed methods, but the proposed methods or treatments were placed in the introduction/overview section and Table 1. It reads a bit awkward logically. Products developed by the CSER and used for designing proposed methods and/or data analysis such as ET estimates for the Apalachcola region should be cited in the text. For strategy 3 to work with NIPF, the proposal aims to reach out 300+ landowners covering 25,000 acres. What is the base for these figures? What is the proportion of landowners to be reached in the entire region? Whether successful or not, the cost-effectiveness ratios of the restoration project depends on not only the soundness of the proposed methods and techniques, but also the treated areas covered and the number of landowners who will participate in this program. An appropriate justification on this point is needed.

Question D

Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?	Need more information

Comments:

The environmental benefits should be addressed specifically in an order like ecosystem/habitat types and acreage-restoration activities to be implemented - major environmental stressors – environmental benefits to be achieved. Over a 5-year timeline, will restoration activities be treated or implementd on all the 250,000+ acres? This is mentioned for the first time in the proposal. In previous sections, ony <10% lands will be treated. If the proposal will treat all lands, Please speficy the exact activities to be implemented. How? Especially on private lands, how will treatments be implemented on such a large scale?

Question E

Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)	Yes

Comments:

NA

Question F	
Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)	Yes
Comments:	
NA	

Question G	
Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socio-economic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)	Need more information
Comments:	
The applicants claimed the risks with the project are comparatively low, but did not gave a justification. What is the reference? To quantify potential risks and uncertainties, an efficient way may be using a conceptual model or framework by identifying the sources of risks and uncertainties associated with management activites and environmental stresses including climate change, hurricanes and wildfires, etc. Also, a risk analysis of different management alternatives and mitigation plans is necessary. The proposed treatments should be a tradeoff between multiple constraints. Also, the risk may differ with ownerships such as federal vs private lands. And risks may also change with treatment times. This should be dealt explicitly in the proposal. No action is an extreme case, and a less conservative plan should be used and will be more meaningful to compare or quantify risks and uncertainties of the proposed activies and treatments.	

Question H	
Does the project/program consider recent and/or relevant information in discussing the elements above?	Yes
Comments:	
Click here to enter text.	

Question I	
Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)	Yes
Comments:	
Click here to enter text.	

Question J	
Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)	Need more information
Comments:	
Data are invaluable. A detailed data management plan is needed and information such as data types involved, storage and backup, data access and repository, quality assurance, metadata for long-term management should be described in the data management plan. A montoring program with new techniques such as drone applications was proposed. But how the adaptive management plan is linked with monitoring programs and findings was not discussed.	

Please summarize any additional information needed below:
The applicants have the expertise and are knowledgeable to conduct the proposed work. The proposal also articulates clear objectives, goals, and tasks. A weakness is that the proposal lacks a sold spatial framework to integrate proposed methods and potential risks and benefits. As a five-year restoration project, a detailed plan specifying how to implent relevant tasks or restoration activites over space and across times should be included. Overall, the proposal lacks some statistical and experimental details. As a science-based, large-scale study, a well designed treatment plan is necessary for data analysis and summary and quantifying risks and uncertainties associated with the proposed tasks.