Appendix O. Climate Change Adaptation Technical Team Report

Prepared by Mary Pfaffko and Jon Ambrose

Technical Team Members

Team Leaders
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Invited but unable to participate in the meeting
Clark Alexander, Georgia Southern University
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Chris Craft, Indiana University
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Approach

As part of the 2015 revision of Georgia's State Wildlife Action Plan (SWAP), the SWAP Climate Change Adaptation Technical Team was assembled to address the impact of climate change on fish, wildlife, and habitat, and identify research and conservation needs to address it. Understanding and adapting to the impacts of climate change is a process inherent with uncertainty and therefore requires a multi-jurisdictional, regional, partnership approach. The team was comprised of representatives from government agencies, nongovernmental organizations, and universities.

Team communications occurred electronically and through one in-person meeting in January 2015. The format of the two-day meeting was presentations followed by two hours of general discussion on both days. Presentation topics included:

- Overview of the SWAP and Climate Change Adaptation Technical Team goals
- Effects of climate change on migratory birds
- Coastal vertebrate susceptibility to sea level rise
- Role of safeguarding in rare plant conservation
- Integrating uncertain futures into conservation management
- Landscape resilience
- SIVVA: a tool for assessing the synergistic impacts of climate change, land-use change, sea-level rise, and other factors on species prioritization and conservation
- Freshwater fish responses to climate change
- Amphibian and reptile climate change vulnerability assessment
- Incorporating temperature/precipitation predictions into models

Discussion topics included:

- What do we know right now at the species and ecosystem levels to help us respond to climate change and sea level rise?
- What do we need to know?
- Where should research be focused to inform our responses?
- Where and how should we focus conservation efforts?

The impact of climate change reaches beyond state boundaries, exacerbates existing threats to wildlife, and affects each species differently. Consequently, climate change warranted being addressed in the 2015 revision of the Georgia SWAP as an emerging issue in Section V. Below is a list of research and conservation needs for climate change adaptation identified by the Climate Change Adaptation Team. This is not intended to be a stand-alone "Climate Change Action Plan," but rather an acknowledgement of climate change as an important issue to be dealt with as part of the implementation of the SWAP, which includes continuing working with researchers, agencies, and organizations to elucidate potential impacts and implement climate smart conservation.

Research and Conservation Needs

Below is a compilation of research and conservation needs for addressing the impacts of climate change on wildlife. Projected climate changes in Georgia by 2070 that are likely to impact wildlife include:

- Increased average day and night temperature with extreme maximum of 40-70 days above 95F (Melillo, Richmond, & Yohe, 2014)
- Greater rates of evaporation and evapotranspiration (Melillo, Richmond, & Yohe, 2014)
- Uncertain frequency changes in precipitation but with greater flood amplitude and deeper and longer droughts (Melillo, Richmond, & Yohe, 2014)
- Fewer but larger hurricanes and major storms (Melillo, Richmond, & Yohe, 2014)
- Sea level rise, especially important in low-relief coastal zones (Parris et al., 2012)

Amphibian Responses to Climate Change

Identify priorities using models of amphibian response to climate change and structured decision making. Study the impacts of climate change on the flatwoods salamander and other species dependent on isolated wetland habitats. Use amphibian and reptile climate change vulnerability assessments to prioritize species, habitats, and sites. Identify protected areas that could provide management opportunities. This could be achieved by partnering with the University of Georgia and expert elicitation.

Analyzing Moving Boundaries Using R (AMBUR)

Use the AMBUR package for analyzing and visualizing historical shoreline change. The baseline and transect method is the primary technique used to quantify distances and rates of shoreline movement, and to detect classification changes across time. A forecasting function also allows estimation of the future location of the shoreline.

Coastal Incentive Grants

Apply for grants from the Coastal Resources Division for disaster resiliency and management to fund infrastructure and transportation on the coast.

Conservation Blueprint

Use the South Atlantic Landscape Conservation Cooperative Conservation Blueprint, which is a spatially-explicit plan that describes the places and actions needed for the regional conservation community to respond to climate change and other changes.

Freshwater Fish Response to Climate Change

Monitor water temperature to inform the understanding of freshwater fish response to climate change. Partner with Adopt a Stream, University of Georgia, Riverkeepers, and citizen science groups such as the Metro Atlanta Amphibian Monitoring Program. Develop a map of prioritized watersheds for temperature modeling. Start with Adopt-a-Stream areas, and then find gaps. Consult the Georgia River Network. Address this topic at the regional level to engage the Southeast Aquatic Resources Partnership (SARP), Landscape Conservation Cooperatives (LCCs), and Climate Science Centers (CSCs).

Guide Land Protection

Identify conservation corridors informed by sea level rise projections. Use land acquisition mechanisms including fee simple acquisition or easements, as well as voluntary set-asides and local ordinances. Work with local county governments.

Guide Policy

Inform wetland and salt marsh mitigation in the context of sea level rise. Provide policy guidance on how to protect future conditions. Partner with the NOAA Natural Resource Damage Assessment.

Identify Species that May Lose Habitat to Increased Temperatures

Species particularly at risk from high temperatures include those restricted to high elevation micro-habitats (e.g., blue-winged warbler, rock outcrop plant relicts). High elevation cove and boulderfield forest species (e.g., long-tailed shrew, red squirrel, southern bog lemming, and water shrew) that have well-established populations in more northern states may require a triage decision and receive low-priority status.

Migratory Species Response to Climate Change

For some species (e.g., painted bunting and ruby-throated hummingbird), Georgia may be their first significant landfall during spring migration. Georgia may contribute to rebuilding the monarch butterfly population, which is being considered for federal listing at the time of this writing. Conduct research and habitat management for transmission rights-of-ways (ROWs), which can provide a corridor of habitat that could accommodate major shifts in climate. Conduct pilot projects in partnership with University of Georgia (UGA) and Georgia Power Company to assess the feasibility of low-cost, low-maintenance Safe Passage management on ROWs. The two pilot projects include creating detention ponds and plantings in ROWs near UGA/Oconee River. Habitat would be managed and wildlife would be monitored by students. If the pilot projects are successful and effective, this action could be expanded to include other ROWs owned by the GA Power Company.

Safeguard Rare Plant Species

The Safeguarding Database is a centralized, standardized, and updated repository for data pertaining to collaborative plant conservation projects. The database is a tool for tracking rare species in safeguarding and landscape management, and for communicating successes, methods, threats, and needs. Safeguarding sites are correlated to Element Occurrences (EO) so the database can be used to update the Biotics database, which is used by state natural heritage programs to track sensitive species and conservation actions. Reports (e.g., prescribed fire habitat management report) can be generated to facilitate communication across high-profile restoration and recovery projects. Safeguarding can help rare plants species cope with the effects of landscape change. The database provides details relevant to habitats that can serve as indicators for responses to climate change. The Georgia Plant Conservation Alliance (GPCA) keeps genetic material for rare plants should assisted migration become necessary. The database was developed by Atlanta Botanical Garden in conjunction with the Georgia Department of Natural Resources, the State Botanical Garden of Georgia, and the Chattahoochee-Oconee National Forest. The GPCA has coordinated safeguarding efforts since 1995, and restores and

introduces rare species into native habitat. Member organizations establish and maintain collections for rare plant species that represent invaluable genetic resources.

Sea Level Rise Affecting Marshes Model (SLAMM) and Species Niche Modeling

The coast of Georgia has SLAMM models based on high accuracy, LiDAR-derived elevations. This dataset projects various scenarios of sea level rise over the next 100 years. Use SLAMM when considering coastal habitat response to sea level rise. While much of the coast of Georgia is well situated for the next 30 years due to the predominance of high elevations, the vast expanses of saltmarsh will begin fragmenting substantially over that period, and will be followed by marsh drowning on a large scale. (See the Ecosystems/Habitat Mapping Technical Team Report for more details).

Southeast Resilient Landscapes Model

The Southeast Resilient Landscapes Model, developed by the Nature Conservancy (TNC), identifies key places for conservation in the face of climate change and other factors. The model is based on conserving complex landscapes that increase diversity and resilience. An estimated resilience score is assigned based on scores of landscape diversity and local connectedness, and ranked relative to the geophysical setting and ecoregion. Landscape diversity refers to the number of landforms, the elevation range, and the wetland density. Topographic diversity buffers against the impacts of climate change by providing a variety of microclimates. Local connectedness refers to the number of barriers and the degree of fragmentation within a landscape. A highly permeable landscape promotes resilience by facilitating range shifts and the reorganization of communities.

Using Doris Duke Charitable Foundation funds, TNC plans to implement Resilience 2015: Southeast Resilient Landscapes Model with the purpose of identifying a network of resilient sites and linkages for the eastern U.S., and communicating the results to agencies and partners. The model provides regional context for conservation actions. Some of the data from this model has been incorporated into the GADNR draft "Greenways" map.

The current and revised products of the project may continue to inform climate change adaptation going forward. Connect TNC's models with niche models. Work with TNC and others to evaluate the model outputs and recommend improvements. Integrate uncertain futures into conservation management.

TNC invited the Georgia Department of Natural Resources (GADNR) to join the Steering Committee to identify resilient coastal areas impacted by Hurricane Sandy. Information from the project has been incorporated into the South Atlantic Landscape Conservation Cooperative's datasets. Information has also been incorporated into a land conservation funding project coordinated by the Open Space Institute and supported by the Doris Duke Charitable Foundation. The initiative is designed to help land trusts and public agencies focus their conservation efforts on climate priorities. The initiative includes priority areas within Georgia.

Standardized Index of Vulnerability and Value (SIVVA)

The Standardized Index of Vulnerability and Value (SIVVA) is a tool for assessing the synergistic impacts of climate change, land-use change, sea-level rise, and other factors on

species prioritization and conservation. It is a standardized system for assessing extinction risk, vulnerabilities to threats, and values. Potential partners include Valdosta State University (VSU) to modify SIVVA for application to ecosystems of Georgia. This would be modeled after the approach used by VSU, Florida Natural Areas Inventory, University of Central Florida, and the University of Florida to assess the conservation value and vulnerability of 300 species to interacting threats for the Florida SWAP (Reece et al. 2013).

Statewide Landcover Map

Develop a statewide landcover map. Fine-scale mapping facilitates habitat prioritization and conservation planning, as was demonstrated with the mapping of habitats of 11 coastal counties in the Southern Coastal Plain of Georgia. (See the Ecosystems/Habitat Mapping Technical Team Report for more details).

Statewide Light Detection and Ranging (LiDAR) Coverage

Obtain statewide LiDAR coverage to inform habitat mapping. LiDAR is a remote sensing method that generates precise, three-dimensional information about the shape of the Earth and its surface characteristics. LiDAR produces high resolution digital elevation data that supports landcover mapping needs through refining the vegetation mapping process. (See the Ecosystems/Habitat Mapping Technical Team Report for more details).

Statewide Map of Priority Habitats and Landscape Features

Develop a habitat data layer to provide a detailed picture of the status of habitats across the state and inform conservation actions at multiple scales. Update these data periodically to detect change. Full coverage of the Coastal Plain of Georgia is a priority for habitat mapping. The current map of 11 counties took three years to complete so the approach needs to be modified in order to achieve mapping goals over a reasonable timeframe. The current map has been used widely by local governments, conservation organizations, and private landowners. Over the longer term, the map would enable strategic conservation, and partners would apply for grants from public or private sources to assist with mapping. Create an ecosystems services spatial layer.

Trophic Asynchrony Models

Incorporate temperature and precipitation predictions into trophic asynchrony models. Incorporate phenology into existing monitoring efforts. Standardize phenology monitoring with partners over time. Identify a network of sampling sites to monitor phenology. Inform Atlanta Botanical Garden's monitoring program on what to monitor to capture climate change data in terms of phenology.

Urban Wildlife Conservation

Improve forage quality, minimize mortality due to predation and disease, and link stopover sites in cities to broader greenspace campaigns (e.g., Gwinnett County park easements, Atlanta Beltline) to provide food resources for migrants and reduce storm water runoff, and educate the public about keeping bird feeders clean. Build partnerships for urban wildlife conservation. Build on the existing urban conservation programs of the Nature Conservancy and the Georgia Forestry Commission. Build on existing Georgia Power Company programs such as 1) the Species Management Areas program which helps protect endangered birds, and 2) Power of

Flight. Partner with Atlanta Botanical Garden to work with Atlanta schools on urban pollinator gardens. Incorporate urban areas into the Georgia SWAP. Include urban areas when modelling potential habitat. Urban areas may be on migration corridors, and are home to voters and potential citizen scientists and rain gardens. Revitalize the Georgia Department of Natural Resources backyard habitat program or collaborate with other organizations that can help in this effort, such as the Georgia Wildlife Federation and garden clubs. Implement public education programs. Provide easy access to a list of recommended nurseries for native plants. Understand habitat connectivity; model the aggregate impact of smaller greenspaces that could enhance the impact of larger greenspaces. Address fish passage in urban areas. Encourage use of the SWAP to guide grants to do urban conservation work. Work with local governments to establish recreational corridors that also provide wildlife habitat. Include urban areas in a statewide landscape resiliency to engage city dwellers. Use the SLEUTH Projected Urban Growth mapping to present data that represent the extent of urbanization predicted by the model.

Vulnerability Assessments and Potential Societal Impacts

Evaluate existing vulnerability assessment tools to determine potential priorities for wildlife conservation as well as potential societal impacts. Measures of climate change vulnerability can include exposure to environmental events (e.g., droughts, floods), sensitivity to factors affecting society, and capacity to adapt to changing physical conditions. Binita, Shepherd, and Gaither (2015) performed a county-based vulnerability assessment for the state of Georgia. Climatic, social, land cover, and hydrological components were combined to capture long-term and hydroclimatic events. An overall trend toward drying and warming was observed. Climate vulnerability was found to be highest in some metropolitan Atlanta and coastal counties, as well as part of the rural Black Belt region in southwestern Georgia.

Wildlife Conservation on Private Lands

Work with private landowners to make better use of funds from Farm Bill conservation programs (e.g., Working Lands for Wildlife for Gopher Tortoise).