Crosswalk between the Appalachian LCC Objectives, Actions/Tasks, and Funded Research as addressed in 5-Year Work Plan and the National Fish, Wildlife and Plant Climate Adaptation Strategy

NFWPCAS GOAL 1: Conserve habitat to support healthy fish, wildlife and plant (FWP) populations and ecosystem functions in a changing climate.

> **Strategy 1.1:** Identify areas for an ecologically-connected network of terrestrial, freshwater, coastal, and marine conservation areas that are likely to be resilient to climate change (CC) and to support a broad range of FWP under changed conditions.
>
> **Strategy 1.2:** Secure appropriate conservation status on areas identified in Strategy 1.1 to complete an ecologically-connected network of public and private conservation areas that will be resilient to climate change and support a broad range of species under changed conditions.
>
> **Strategy 1.4:** Conserve, restore, and as appropriate and practicable, establish new ecological connections among conservation areas to facilitate fish, wildlife, and plant migration, range shifts, and other transitions caused by CC.

Appalachian LCC Work Plan

AppLCC Objective 2 General Principal: Ranking and prioritizing the conservation planning components and actions necessary for understanding resiliency and/or facilitating adaption through the restoration, establishment, and enhancement of key components and system functions are paramount. Emphasis will be placed on ensuring a feedback loop is established to assess the effectiveness of the AppLCC planning and on-the-ground efforts.

> **Objective 2.3:** Identify promising opportunities to safeguard the "best of the best" fish and wildlife habitat and plant communities or ecosystems
> - Action/Task 2.3.1 Identify current or promising management investment opportunities that reflect conservation of the "best of the best" resilient habitat for fish, wildlife and plant communities, including opportunities to contribute to cultural preservation priorities and to reinforce the conservation of other social resources.

> **Objective 2.6:** Based on the underpinnings of resiliency, identify the management approaches to achieve, restore or enhance system integrity, function, and reflect the conservation prioritization and relative ranking of the systems
> - Action/Task 2.6.2: Identify the components, function, and relationships that define resiliency and management approaches to achieve, restore, or enhance system function.
> - Action/Task 2.6.3: Identify and rank the core areas, components, and interrelationships that help and reinforce resilience. Continuously refine the details and status describing those areas based on threats and opportunities to help facilitate coordination and planning

> **Objective 2.8:** Project future landscape conditions cumulatively/over time, based on best available science/scenarios, indicating probable patterns and changes
> - Action/Task 2.8.4: Identify landscape-level models and articulate potential scenarios.

> **Objective 2.9:** Provide Guidance on how much habitat is necessary for sustainable/resilient (healthy ecosystem outcomes).

o Action/Task 2.9.1: Define and offer recommendations on what type and how much habitat is necessary for sustainable/resilient (healthy) outcomes and to achieve conservation targets.

Appalachian LCC Funded Research:

Project Title: *"Web-Based Tool for Riparian Restoration Prioritization to Promote Climate Change Resilience in Eastern US Streams."*
This research will develop and implement a user-friendly web-based tool to identify priority areas for riparian restoration in the context of predicted climate change at the appropriate scale needed by practitioners. The research will then link directly to ongoing and future stream flow, temperature, and biological response modeling projects and decision support tools.
- URL: http://applcc.org/research/dst-restoration-under-climate-change-team

Project Title: *"Stream Classification System for the Appalachian Landscape Conservation Cooperative"*
This research will develop a hierarchical classification for stream and river systems and a GIS map for aquatic ecosystems within the Appalachian LCC. The study will include a report describing the methods used to evaluate and develop the classification system, a literature review of existing stream classifications, and a GIS stream data set.
- URL: http://applcc.org/research/aquatic-habitat-classification

NFWPCAS GOAL 2: Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.

Strategy 2.1: Update current or develop new species, habitat, and land and water management plans, programs and practices to consider CC and support adaptation.
Strategy 2.2: Develop and apply species-specific management approaches to address critical climate change impacts where necessary.

Appalachian LCC Work Plan:

AppLCC Objective 3 General Principal: Our conservation dialogue is multi-dimensional, fosters cooperation, understanding and relies upon joint decision making for communication and utilization. It is important to demonstrate our work is not outside of society, but directly benefits the things that are important to society – jobs, outdoor recreation, quality of life, preservation of heritage, and a clean and healthy environment. We will improve understanding of how to effectively target and connect with identified audiences and communicate the importance and collective benefit of our work.

Objective 3.4: Communicate the human dimension benefits of landscape conservation in terms relative to human dimensions and values.
- Action/Task 3.4.1: Conduct a survey to identify key audiences and develop messages of concern to those groups (e.g., specific messages related to jobs, health, clean water, ecosystem services and cultural components, etc.)
- Action/Task 3.4.2: Communicate the impacts of major land use changes due to energy extraction, urban sprawl, and climate change.

AppLCC Objective 4 General Principal: By acting as facilitator/coordinator, the Cooperative will help partners align approaches and address landscape level challenges that achieve greater conservation efficiency and effectiveness at a local level. We will always seek to foster a two-way, cooperative relationship with our partners and focus interactions on mutual benefits.

> **Objective 4.4:** Assist, support, and utilize State Wildlife Action Plans (SWAPs) and other planning documents to assist with landscape level integration.
> - o Action/Task 4.4.1: Appoint a Work Group, drawn from the SC Members, to identify relevant information and opportunities to integrate information from the State Wildlife Action Plans (SWAPs) and other planning document into landscape-level plans, models, and efforts to set conservation targets. [The work of the Work Group may be informed by the guidance provided in "SWAP Best Practices" produced by AFWA.]

> **Objective 4.10:** SC Members provide leadership and guidance to the broader Cooperative and Members to proactively engage communities of practice.
> - o Action/Task 4.10.1: Establish an SC Work Group to identify and encourage organizational representation and engagement of subject-matter experts (communities of practice) to participate in and assume membership-specific actions/tasks.

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> **Objective 2.7:** Facilitate the use of natural resource indicators and surrogate species to inform landscape-level planning, identify and establish data needs and monitoring design that reflect management objectives and conservation targets.
> - o Action/Task 2.7.6: Develop species-habitat models to fully operationalize the integration of natural resource indicators and use of surrogate species measures across the AppLCC landscape-level planning, monitoring, and assessment.

NFWPCAS GOAL 3: Enhance capacity for effective management in a changing climate.

> **Strategy 3.1:** Increase the CC awareness and capacity of natural resource managers and enhance their professional capacity to design, implement, and evaluate FWP adaptation programs.
> **Strategy 3.2:** Facilitate a coordinated response to CC at landscape, regional, national, and international scales across state, federal, and tribal natural resource agencies and private conservation organizations.
> **Strategy 3.3:** Review existing federal, state, and tribal legal, regulatory, and policy frameworks that provide the jurisdictional framework for conservation of fish, wildlife, and plants to identify opportunities to improve, where appropriate, their usefulness in addressing climate change

Appalachian LCC Work Plan:

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> **Objective 2.1:** Conduct an overall threat assessment
> - Action/Task 2.1.2: Initiate threats assessment by impact [energy, urbanization and infrastructure, and climate change, etc.] that will be required to be combined and integrated to generate an overall threats assessment.
>
> **Objective 2.5:** Establish a structured decision-making process for the ongoing integration of existing partner plans to deliver landscape-level conservation planning
> - Action/Task 2.5.3: Review and synthesize key information from existing conservation, land and resource management plans.

AppLCC Objective 3 General Principal: Our conservation dialogue is multi-dimensional, fosters cooperation, understanding and relies upon joint decision making for communication and utilization. It is important to demonstrate our work is not outside of society, but directly benefits the things that are important to society – jobs, outdoor recreation, quality of life, preservation of heritage, and a clean and healthy environment. We will improve understanding of how to effectively target and connect with identified audiences and communicate the importance and collective benefit of our work.

> **Objective 3.4:** Communicate the human dimension benefits of landscape conservation in terms relative to human dimensions and values
> - Action/Task 3.4.2: Communicate the impacts of major land use changes due to energy extraction, urban sprawl, and climate change.

Appalachian LCC Funded Research:

Project Title: *"Support for Understanding Land Use and Climate Change in the Appalachian Landscape"*
> This research will compile climate change vulnerability assessments and other relevant information on vulnerable species and habitats, discern the various methodologies and criteria used in these assessments, and use a team of exert peer reviewers to recommend the most efficient, effective, and appropriate methods for adoption by the Appalachian LCC for conservation and adaptation planning.
> - URL: http://applcc.org/research/climate-change-vulnerability-assessment

NFWPCAS GOAL 4: Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.

> **Strategy 4.1:** Support, coordinate, and develop distributed but integrated inventory, monitoring, observation, and information systems to detect and describe climate impacts on FWP and ecosystems.

Strategy 4.2: Identify, develop, and employ decision support tools for managing under uncertainty (e.g., vulnerability and risk assessments, scenario planning, strategic habitat conservation approaches, and adaptive management evaluation systems) via dialogue with scientists, managers (of natural resources and other sectors), and stakeholders.

Appalachian LCC Work Plan:

AppLCC Objective 2 General Principal: Ranking and prioritizing the conservation planning components and actions necessary for understanding resiliency and/or facilitating adaption through the restoration, establishment, and enhancement of key components and system functions are paramount. Emphasis will be placed on ensuring a feedback loop is established to assess the effectiveness of the AppLCC planning and on-the-ground efforts.

Objective 2.3: Identify promising opportunities to safeguard the "best of the best" fish and wildlife habitat and plant communities or ecosystems
- o Action/Task 2.3.2: Develop a "dashboard decision support tool" that portrays these "best of the best" areas and opportunities to help Members maximize their conservation and resource investments.

Objective 2.5: Establish a structured decision-making process for the ongoing integration of existing partner plans to deliver landscape-level conservation planning
- o Action/Task 2.5.1: Determine which of the currently recognized structured decision/scenario planning/strategic prioritization process to be used and engage

Objective 2.8: Project future landscape conditions cumulatively/over time, based on best available science/scenarios, indicating probable patterns and changes
- o Action/Task 2.8.5: Deliver freely accessible (open source) data outputs and products that will feed to desktop decision-support tool (e.g. focus on landscape level habitat/species mitigation opportunities).

NFWPCAS GOAL 5: Increase knowledge and information on impacts and responses of fish, wildlife and plants to a changing climate.

Strategy 5.1: Identify knowledge gaps and define research priorities via a collaborative process among federal, state, and tribal resource managers and research scientists working with the National Science Foundation (NSF), USGCRP, NCA, USDA Extension, Cooperative Ecosystem Study Units (CESUs), CSCs, LCCs, JVs, and RISAs.
Strategy 5.3: Advance understanding of CC impacts and species and ecosystem responses through modeling.

Appalachian LCC Work Plan:

AppLCC Objective 1 General Principal: Utilize open source model programming and/or data and ensure open access to the information created. Data sharing policies will guide our efforts to obtained and integrate relevant data into landscape-level modeling efforts. (Acknowledge that some sources of data will need to be controlled and may not be publically available as source data due to sensitivity of the data.)

Objective 1.1: Conduct AppLCC data needs assessment:
- o Action/Task 1.1.9: Formalize a strategy and timeline to address gaps based on data needs assessment. Actions to address these gaps will be added after identification.

AppLCC Objective 2 General Principals: Ranking and prioritizing the conservation planning components and actions necessary for understanding resiliency and/or facilitating adaption through the restoration, establishment, and enhancement of key components and system functions are paramount. Emphasis will be placed on ensuring a feedback loop is established to assess the effectiveness of the AppLCC planning and on-the-ground efforts.

Objective 2.8: Project future landscape conditions cumulatively/over time, based on best available science/scenarios, indicating probable patterns and changes.
- o Action/Task 2.8.3: Develop the Charter to guide the Integrated Planning Team (with expertise in landscape-level planning and modeling) to support the work of Staff and facilitation of consultation and integration of assessments and recommendations from the various COPs.
- o Action/Task 2.8.6: Assess data gaps and define an ongoing "futuring" process to fill knowledge gaps, monitor emerging trends, and adapt existing efforts.

Appalachian LCC Funded Research:

Project Title: "*Data Needs Assessment and Data Management Architecture*"
This research will produce an analysis of tools, data, and processes to deliver usable, open-source data products for the LCC. In addition, it will review conservation planning tools, data needs, and provide packages of available data, as well as interpretive text. Finally, it will review the Interim Steering Committee conservation planning goals and based on those, prioritize and justify gaps that need to be filled.
- URL: http://applcc.org/research/data-needs-and-gis-team/data-needs-assessment

Project Title: "*Assessing Future Impacts of Energy Extraction in the Appalachian Mountains*"
Maps of wind, oil and gas, and coal development potential for the entire study area will be created. These maps and published projections from federal and state land management agencies will be used to model future build-out scenarios. Impacts of the build-out scenarios will be measured regarding habitat fragmentation of forest resources with a focus on the effects to biodiversity and water production for human populations. The study will also create a probability surface for land disturbance associated with large area surface coal mining and create a public web-based map server.
- URL: http://applcc.org/research/energy-forecasts

NFWPCAS GOAL 6: Increase awareness and motivate action to safeguard FWP in a changing climate.

Strategy 6.1: Increase public awareness and understanding of climate impacts to natural resources and ecosystem services and the principals of climate adaptation at regionally and culturally appropriate scales.

Strategy 6.2: Engage the public through targeted education and outreach efforts and stewardship opportunities.

Appalachian LCC Work Plan:

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> **Objective 2.2:** Identify the requirements to address human dimension components of land-use change, including preservation of cultural resources.
> - Action/Task 2.2.1: Identify relevant information to portray the human dimensions (cultural and social resources) in landscape-level planning.

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> **Objective 3.4:** Communicate the human dimension benefits of landscape conservation in terms relative to human dimensions and values.
> - Action/Task 3.4.1: Conduct a survey to identify key audiences and develop messages of concern to those groups (e.g., specific messages related to jobs, health, clean water, ecosystem services and cultural components, etc.)
>
> - Action/Task 3.4.3: Utilizing appropriate social science tools and surveys, determine attitudes/values of target audiences and the most effective means to communicate with and engage those groups.

NFWPCAS GOAL 7: Reduce non-climate stressors to help FWP and ecosystems adapt to a changing climate.

> **Strategy 7.1:** Slow and reverse habitat loss and fragmentation.
> **Strategy 7.2:** Slow, mitigate, and reverse where feasible ecosystem degradation from anthropogenic sources through land/ocean-use planning, water resource planning, pollution abatement, and the implementation of best management practices.

Appalachian LCC Work Plan:

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- o Action/Task 2.3.1 Identify current or promising management investment opportunities that reflect conservation of the "best of the best" resilient habitat for fish, wildlife and plant communities, including opportunities to contribute to cultural preservation priorities and to reinforce the conservation of other social resources.

Objective 2.6: Based on the underpinnings of resiliency, identify the management approaches to achieve, restore or enhance system integrity, function, and reflect the conservation prioritization and relative ranking of the systems
- o Action/Task 2.6.2: Identify the components, function, and relationships that define resiliency and management approaches to achieve, restore, or enhance system function.

Objective 2.7: Facilitate the use of natural resource indicators and surrogate species to inform landscape-level planning, identify and establish data needs and monitoring design that reflect management objectives and conservation targets.
- o Action/Task 2.7.5: Identify factors believed to be the most limiting to specific (surrogate species or targets) and identify monitoring efforts to track changes in these factors and response.
- o Action/Task 2.7.6: Develop species-habitat models to fully operationalize the integration of natural resource indicators and use of surrogate species measures across the AppLCC landscape-level planning, monitoring, and assessment.

Objective 2.9: Provide Guidance on how much habitat is necessary for sustainable/resilient (healthy ecosystem outcomes).
- o Action/Task 2.9.1: Define and offer recommendations on what type and how much habitat is necessary for sustainable/resilient (healthy) outcomes and to achieve conservation targets.

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- o Action/Task 3.4.2: Communicate the impacts of major land use changes due to energy extraction, urban sprawl, and climate change.

Appalachian LCC Funded Research:

Project Title: "*Development of a Hydrologic Foundation and Flow-ecology Relationships for Monitoring Riverine Resources in the Marcellus Shale Regions*"

> The emergence of hydraulic fracturing has led to the rapid expansion of natural gas drilling in the Marcellus Shale deposit in portions of Pennsylvania and West Virginia. Fracturing events will likely put a substantial strain on regional surface and ground water supplies, as well as lead to changes in stream flow that may alter available habitat for freshwater biodiversity and other ecological processes in adjacent freshwater ecosystems. This research will develop model(s) that predict ecological responses to flow alteration within the Marcellus Shale region of the Appalachian Landscape Conservation Cooperative (LCC).

- URL: http://applcc.org/research/technical-oversight-group/development-of-a-hydrologic-foundation-and-flow-ecology-relationships-for-monitoring-riverine-resources-in-the-marcellus-shale-region