



APPALACHIAN LCC

Appalachian LCC Workshop

November 29-30, 2011

December 1 (Writing Team)

Blacksburg, VA

Draft Synthesis Report

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Priority Conservation Science Needs Workshop

November 29-30, 2011; Inn at Virginia Tech

Synthesis Report

Overview and Process

The Appalachian Landscape Conservation Cooperative (LCC) is a partnership working to improve science products supporting conservation of natural resources. For more information about the Appalachian LCC, visit the website at: <http://www.applcc.org>

Purpose and process of the workshop

The workshop assembled researchers, biologists and managers from across the Appalachian region to identify a Portfolio of science needs addressing conservation challenges and opportunities across the landscape. The Portfolio will serve as a critical guiding framework to help facilitate and support the conservation planning, delivery, and applied research and monitoring efforts across the region.

Attendees identified the longer-term, comprehensive Portfolio of science needs, but were also charged with ranking top science needs for potential funding support. Prior to the November workshop, foundational materials, including webinars, were distributed to attendees to provide crucial guidance and background for participation. Appendix A contains the workshop agenda.

Products of the workshop will be:

- A Synthesis Report outlining the Portfolio of Science Needs that reflect conservation priorities across the region, and recommendations of the top ranked projects that the decision-making body may wish to consider immediately;
- The full, Final Science Needs Report of broader workshop discussions including the Portfolio of science needs that will serve as guidance to inform future conservation and science-support funding through the Cooperative.

Workshop coordinators: Dr. Jean Brennan and Bridgett Costanzo (USFWS), and Dr. Rachel Muir (USGS).

Workshop Planning Team, Facilitators, Note Takers, and Support Staff:

Bridgett Costanzo (AppLCC)	Dr. Todd Fearer (AMJV)
Dr. Rob Baldwin (Clemson University)	Dr. Mary Foley (NPS)
Danna Baxley (KY Dept of Fish and Wildlife Resources)	Lindsay Gardner (SARP)
Rick Bennett (USFWS)	Dave Hartos (OSM)
Hugh Bevans (USGS)	Linda May (GA Dept of Natural Resources)
Dr. Gwen Brewer (MD DNR)	Thomas Minney (TNC)
Chris Burkett (VA Dept Game and Inland Fisheries)	Callie McMunigal (EBTJV)
Tai-Ming Chang (EPA)	Patrick Pitts (USFWS)
David Day (PA Fish and Boat Commission)	Dr. Brian Smith (AMJV)

Workshop logistics and facilitation:

Sarah Hughes, Project Manager / Logistics, DJ Case & Associates, sarah@djcase.com

Gwen White, Facilitator / Note Taker, DJ Case & Associates, gwen@djcase.com

Participant characterization

Workshop planners knew there were many more experts in the region than the 80 participant maximum that was originally planned for the workshop. Given the unique partnership represented by the LCC, the Workshop Planning Team (WPT) wanted to ensure that the final list of attendees reflected a representative balance of technical or subject-matter expertise, across taxa and systems, regional or sub-regional expertise, a sectoral diversity across the Cooperative membership, and included a balance of both researchers and managers. Therefore, the WPT solicited names and contact information for prospective participants until October 28, 2011.

Due to the overwhelming interest in the workshop and opportunity to gather input from a broader set of constituents, workshop planners selected a larger number of participants than originally intended, accommodating up to 150 participants and expanding the number of breakout work groups to seven on the first day and six on the second.

Classification of workshop participants was:

<u>Total</u>	<u>Profession</u>	<u>Percent</u>
72	Managers	52%
67	Researchers	48%

<u>Sector</u>	<u>Percent</u>
Federal	43%
State (incl. coop, CESU)	28%
Other (incl. NGO, university, business)	28%

<u>Total</u>	<u>Expertise</u>	<u>Total</u>	<u>North</u>	<u>South</u>
44	Aquatic – Manager	26	11	15
	Aquatic - Researcher	18	11	7
42	Terrestrial - Manager	23	13	10
	Terrestrial - Researcher	19	8	11
14	Climate Change - Manager	6	3	3
	Climate Change - Researcher	8	4	4
25	Human Dimensions - Manager	12	7	5
	Human Dimensions - Researcher	13	10	3
14	IT/Information Management - Manager	5	3	2
	IT/Information Management – Researcher	9	4	5
	Totals	139	74	65

The Appalachian LCC also invited participants to attend portions of the workshop remotely via the website: <http://applcc.org/page/workshop2011>. At the website viewers could:

- View recorded presentations about landscape level science from regional conservation leaders; Read the agenda and read each day's summary notes of workshop results; and Watch live broadcasts (these will also be archived) of the workshop plenary sessions.

Process for Ranking Top Science Needs

Common terms are used in very specific way to organize the extensive list of Science Needs produced during the year as a result of the LCC Coordinator's communications with partners across the Appalachian LCC region. Attendees identified the longer-term, comprehensive Portfolio of science needs, but were also charged with ranking top science needs for potential funding support as described below.

Definition of terms

Term: Portfolio

- Roughly equivalent to a Strategic Plan
- Provides a vision of research gaps and desired environmental conditions
- Limited spatially by bounds of AppLCC

Term: Theme

- Broad organizational structure for Portfolio (e.g. Ecosystem Services)
- Fundamental aspects of the landscape or tools used to understand these landscape components
- Equivalent to an Objective w/in a State Strategic Plan.

Term: Program

- Subthemes that further organize the Science Needs Portfolio
- Consists of research topics (e.g. Water Quality)
- Equivalent to a Program w/in a State Strategic Plan
- Multiple Themes may share same Program(s).

Term: Science Need

- Specific research or conservation planning/design action needed to improve scientific understanding and support sound conservation management decisions under a given Program

Ranking: Writing Team members worked on Day-3, following the large-group workshop, to rank each of the top needs identified during the workshop as a 1, 2 or 3 from highest to lowest. They were instructed to vote to represent their individual workgroup discussions on Day 1 and 2 of the workshop. The Workgroups were also asked to provide a "goal" statement for each thematic area represented in the Portfolio, and Goals were then adjusted accordingly in the Portfolio.

Workgroup Facilitators (F) and Note Takers (N) on the Synthesis/Writing Team included:

GIS/InfoMgmt: (F) Rose Hessmiller (Contractor), (N) Ed Laurent (ABC)
Climate Change: (F) Chris Burkett (VA), (N) Jen Krstolic (USGS)
Human Dimensions: (F) Steve Faulkner (USGS), (N) Lindsay Gardner (SARP)
Northern Terrestrial: (F) Linda May (GA), (N) Todd Fearer (AMJV)
Southern Terrestrial: (F) Dana Baxley (KY), (N) Brian Smith (AMJV)
Northern Aquatics: (F) Anita Goetz (USFWS), (N) Angie Rodgers (NC-DENR)
Southern Aquatics: (F) Patrick Pitts (USFWS), (N) Callie McMunigal (EBTJV)

Top Ranked Science Needs

Appalachian LCC Science Needs Portfolio – Top Ranked Science Needs - 2011

I. Top (5) Ranked (Day-3: Synthesis/Writing Team Ranking) Needs

Thematic-Area (2) Aquatic

GOAL: Quantitatively describe current and future hydrologic and structural habitat conditions and aquatic population trends, and set conservation goals for both, in order to maintain native habitats and endemic aquatic species in their current locations or support these as they migrate with land use and climate changes in the future.

Ranked #1. [Ecological flows, Species-Habitat Relationships at Multiple Scales & Effects of Alterations] (Assemble the necessary scientific information or conduct the necessary studies required to develop a) (r)igorous understanding of the relationships among ecological flows and hydrology (discharge, seasonal, etc.), habitat (temp, geology, physical space, etc.), and aquatic biota/communities (in order) to assess how alterations to systems will affect their sustainability.

Thematic-Area (7) Human Dominated / Economic Lands (Urban, Ag, Energy)

GOAL: Collaboratively (identify ways and opportunities to) meet economic development and conservation management goals through the understanding of potential land use changes, economic impacts and pressures on the resources of the AppLCC region to improve decision-making and management.

Ranked #2. [Resource extraction & demands for energy] (Using a suite of analytical tools,) forecast future spatial footprint of energy production, mineral extraction, and associated infrastructure/transmission/transportation in coming decades (in 20 years) in light of changes to demand, technology, policy, and regulation, including econometric models to better understand the impacts on resources (species and habitats).

Thematic-Area (1) GIS / Information Management

GOAL: Develop a GIS and content management system/ IT architecture that facilitates the development of community networks, supports landscape planning and systems modeling, enables exchange of information and tools to gather and disseminate data.

[Backend infrastructure and functionality to include: a geospatial web-based platform in collaboration with LCC members and neighboring LCCs, calendar/event planning function, web services, large files transfer, projects and people database, group work flow, public commenting, hardware/software inventory, geo-referencing, mobile applications, and federated search *(reworded).*]

Ranked #3. [GIS/IT Capacity] – (Based on the input provided by a GIS/IT Working group assembled by the LCC): design pilot study or use case studies (1) to define the necessary architecture (to support the work and products of the LCC community); (2) identify hardware, software, functionality and staffing needs; and (3) makes recommendations to steering committee for allocating resources for architecture needs.

[(The Workshop Participants offered the follow-up process to utilize the advisory Work Group to support LCC staff efforts to) oversee the development of architecture; makes recommendations for governance, data access and security rules to steering committee; design education and (outreach) approaches to engage stakeholder use; outline methodology for assessment and monitoring of use.]

Thematic-Area (5) Terrestrial – Forests (original)

GOAL: (Assemble the necessary information or conduct studies necessary to) (d)velop and implement comprehensive regional strategies to conserve and manage forest/working forest communities across jurisdictions by inventorying significant regional forest communities, evaluating the condition, importance, and regional threats impacting these communities (*reworded*).

Ranked #4. (repeated) [**Species/habitat distribution trends (includes all terrestrial habitats = forests, open land and wetlands)**] Understanding representative/priority/focal species and population distributions (all terrestrial – forests, open land and wetlands) across the region, their habitat relationships, and effective movement/dispersal linkages. [Recommendation/Approach: find representative species for habitat and migratory relationships - can't do every species (ex. amphibians as potential representative species)]

Thematic-Area (4) Terrestrial – Wetlands

GOAL: (I)ventory significant regional wetland habitats, evaluate the condition and importance of these habitats, and identify regional threats impacting those resources so that LCC partners and stakeholders can develop and implement cohesive regional management strategies to protect and manage wetlands across jurisdictions.

Ranked #4. (repeated) [**Species/habitat distribution trends (includes all terrestrial habitats = forests, open land and wetlands)**]

Thematic-Area (6) Terrestrial - Open-land Natural Community (grasslands, meadows, balds, shale barrens)

GOAL: (I)ventory significant regional grassland/open-land communities and evaluating the condition, importance, and regional threats impacting these communities (to) (d)velop and implement comprehensive regional strategies to conserve and manage natural and non-natural (e.g. restored minelands) grassland/open-land communities across jurisdictions.

Ranked #4. (repeated) [**Species/habitat distribution trends (includes all terrestrial habitats = forests, open land and wetlands)**]

Thematic-Area (9) Climate Change - Impacts, Downscale/Coupled Modeling, Adaptation

GOAL: Work with partners and stakeholders to determine climate change adaptation and mitigation strategies that can be implemented and coordinated across multiple scales (by apply(ing) the best available (projections) of how the regional climate will change (and) estimates (of) the impacts those changes will have on the region's natural and cultural resources.

Ranked #5. [Vulnerability assessments (climate and non-climate stressors)] Support multi-scale vulnerability assessments (that incorporate species-specific physiological data) to identify habitats and species that would be most vulnerable to climate change in the LCC, especially range-limited/endemic species. [Collate/compile 'meta-analysis' of vulnerability assessments done by states and other partners. (Do not) reinvent wheel. Learn from what has been done, what can be improved on, gaps filled, build on existing foundation (e.g., how to adjust populations models.) USFWS has done some of this meta-analysis, but focused more on T&E. Making sure it is heavily coordinated with Climate Science Centers (*reworded*).]

Day 3: Synthesis/Writing Team [Each voted top 3 in ranked order (1=top, 2, 3). Vote to represent their individual workgroup discussions.]

GIS/InfoMgmt: Rose Hessmiller (Contractor), Ed Laurent (ABC)
Climate Change: Chris Burkett (VA), Jen Krstolic (USGS)
Human Dimensions: Steve Faulkner (USGS), Lindsay Gardner (SARP)
Northern Terrestrial: Linda May (GA), Todd Fearer (AMJV)
Southern Terrestrial: Dana Baxley (KY), Brian Smith (AMJV)
Northern Aquatics: Anita Goetz (USFWS), Angie Rodgers (NC-DENR)
Southern Aquatics: Patrick Pitts (USFWS)*Proxy Leroy Koch (USFWS),
Callie McMunigal (EBTJV)*Proxy Rachel Muir (USGS)

II. Remaining (below top-5 ranked) Needs: (Compiled Day-3 Synthesis Team)

Thematic-Area (2) Aquatic

GOAL: Be able to quantitatively describe current and future hydrologic and structural habitat conditions and aquatic population trends, and set conservation goals for both, in order to maintain native habitats and endemic aquatic species in their current locations or support these as they migrate with land use and climate changes in the future.

(1 vote). [**Social/economic barriers to address known stressors**] For aquatic systems, conduct a social science research study to identify social or economic barriers and develop culturally feasible solutions to address sensitive issues related to known stressors (agriculture, forestry, urban growth, mining, untreated sewage, etc) across the landscape and develop tools for communicating those solutions

(0 Vote): [**Ecological flows, Species-Habitat Relationships at Multiple Scales & Effects of Alterations**] Need to understand the impact of precipitation and temperature change (related to climate change) on surface-water and groundwater hydrology in the context of regional characteristics such as land use, water use, recreation, industrial use, municipal use, aquatic biology, agriculture, geology, and changes in air pollution.
[Incorporate biological response]

Thematic-Area (3) Terrestrial - Cave/Karst/Mines / (incl. Groundwater)

GOAL: (Assemble the necessary information or conduct studies necessary to) (d)velop and implement comprehensive regional strategies to conserve and manage cave/karst/mine (CKM) communities across jurisdictions by inventorying significant regional CKM communities and evaluating the condition, importance, and regional threats impacting these communities.

(1 vote). [**Geospatial data tools for planning & future condition scenarios (inventory caves)**] Downscaling and calibrating/revisiting tools necessary for spatial data planning and future condition scenarios of vegetation (all terrestrial – forests, open land and wetland) specific to the LCC (e.g. ecological land units, LandFire, LIDAR, Enhanced Conservation Action Planning). Understanding historical vegetation distributions and disturbance regimes in the landscape and the extent to which they can be replicated/restored under changing conditions.

(0 Vote) [**Geospatial data tools for planning & future condition scenarios (inventory caves)**] Develop a classification (biological and geophysical) scheme for karst, inventory and mapping of cave, karsts, mines, karst related springs, and ground water. Compile existing karst geospatial datasets and analyze to (1) create datasets on karst springs, cave passage/entrance density, cave obligate/dependent species distributions, and subterranean biodiversity maps, and (2) identify data gaps that are barriers to conservation planning.

(0 Vote) [**Geospatial data tools for planning & future condition scenarios (inventory caves)**] Understand species and community distributions, their habitat relationships, and linkages across systems.

Thematic-Area (5) Terrestrial – Forests (original)

GOAL: (A)ssemble the necessary information or conduct studies necessary to) (d)evelop and implement comprehensive regional strategies to conserve and manage forest/working forest communities across jurisdictions by inventorying significant regional forest communities, evaluating the condition, importance, and regional threats impacting these communities (*reworded*).

(2 votes) [**Geospatial data tools for planning & future condition scenarios (inventory forest network)**] Identify a connected and resilient network of forest ecosystems in the Appalachian LCC.

Thematic-Area (6) Terrestrial - Open-land Natural Community (grasslands, meadows, balds, shale barrens)

GOAL: (I)nventry significant regional grassland/open-land communities and evaluating the condition, importance, and regional threats impacting these communities (to) (d)evelop and implement comprehensive regional strategies to conserve and manage natural and non-natural (e.g. restored minelands) grassland/open-land communities across jurisdictions.

(1 vote) Understanding historical vegetation distributions and historical disturbance regimes in the landscape (specifically natural open lands communities) and the extent to which they can be replicated given existing and potential future conditions. Develop conservation strategies to replicate reference conditions. (Note: could be part of a support project to ECAP, Landfire, etc.)

Thematic-Area (7) Human Dominated / Economic Lands (Urban, Ag, Energy)

GOAL: (C)ollaboratively (identify ways and opportunities to) meet economic development and conservation management goals through the understanding of potential land use changes, economic impacts and pressures on the resources of the AppLCC region to improve decision-making and management.

(2 votes) [**Resource extraction & demands for energy**] Effects of resource extraction – related to energy development and resource (energy) extraction; sitings; physical landscape; effects of fragmentation, sedimentation (e.g. Vulnerability of aquatic species and communities to Marcellus shale development in Appalachia.)

Thematic-Area (8) Human Dimensions - Environmental Benefits, Ecosystem Services, Social Expectations

GOAL: To (assemble the necessary information required to help) meet public and local resident needs/preferences and conservation goals through better understanding, valuation and management of ecosystem services.

(0 Votes) [**Ecosystem services at landscape scales**] Map, model and measure ecosystem services at appropriate landscape scales, including: biophysical production functions/understanding of metrics; mapping beneficiaries (i.e., benefits realized outside the AppLCC boundary or by visitors to Appalachian region); Assessment of preferences (could really help us target efforts to what people value most, and build constituency); Priority of services; and Cumulative impacts.

Thematic-Area (9) Climate Change - Impacts, Downscale/Coupled Modeling, Adaptation

GOAL: Work with partners and stakeholders to determine climate change adaptation and mitigation strategies that can be implemented and coordinated across multiple scales (by apply(ing) the best available (projections) of how the regional climate will change (and) estimates (of) the impacts those changes will have on the region's natural and cultural resources.

(2 votes). [**Adaptation strategies (stressor interactions, disturbance regimes)**] Evaluate the interaction among land use, climate change, invasive species, and/or other environmental stressors to develop guidelines and principles for adaptation strategies. [Strategies: human interactions, biological augmentation, genetic banking, restoration efforts.] [Nat'l LCC Network]

Thematic-Area (10) Social science research

GOAL: Identify the social science research needed to achieve affective communications and stakeholder outreach and the specific audiences associated with that information need. Not outreach and communications activities but the science that supports those efforts.

APPENDIX I.

Workshop Preparation materials

Materials to prepare participants were placed a few days in advance of the workshop on the website at: <http://applcc.org/page/november-science-needs-workshop-resource-materials>

The WPT recommended that participants prioritize their reading in the following order:

- 1) Agenda – review the times and note that lunch was provided.
- 2) Mission & Vision and Map of the LCC – set the boundaries for discussion.
- 3) Portfolio Schematic – set the context for the process of reviewing programmatic needs and provided consistent understanding of some terms of art that were used.
- 4) Science Needs – participants worked intensively with this list in facilitated sessions, refining program descriptions and identifying highest priority immediate needs, starting with the list that matches their expertise. Participants were in a breakout with others from their region and discipline on the first day. On the second day, groups were mixed and participants were reviewing other sets of needs.
- 5) Webinars – no more than 20 minutes each, review recorded presentations for topics that most closely matched their expertise or for those which they need a refresher.

Complete participant lists and room assignments for rotating breakouts were available at registration at The Inn on the Virginia Tech Campus, Blacksburg, VA.

Webinars

In preparation for the workshop, coordinators assembled a suite of Resource Materials. These were presented as short video presentations (~20 min.) to give a broad introduction to the products, tools, and planning framework and initiatives that have been initiated by Cooperative members, partners, and neighboring LCC communities. Participants were encouraged to take the time to review the materials that will introduce them to:

- How LCCs fit within the [Regional Conservation Framework](#) (illustrative example of the work from the North Eastern states and North Atlantic LCC; presented by Ken Elowe, USFWS NE Region) and the role of LCCs as we enter a new era in conservation, and the [SE Conservation Adaptation Strategy](#) (presented by Bill Uihlein, USFWS SE Region);
- Overview of the various [landscape planning tools](#) (Rob Baldwin, Clemson University) and the tools and approaches being developed by neighboring LCCs (North Atlantic LCC; Andrew Milliken presenting [Representative Species approach](#) and Designing Sustainable Landscapes tool) (Gulf Coast Plains and Ozark; John Tirpak presenting the [Conservation Planning Atlas](#)) (South Atlantic LCC, Rua Mordicai presenting the [Optimal Conservation Strategy](#) decision support model) (Upper Mid-West and Great Lakes LCC; presented by Olivia LeDee on the [Vulnerability Assessment and Interactive Workshop](#)) and (Peninsular Florida LCC; presentation by Juan Carlos Vargas on the [South Florida planning model](#) developed in collaboration with MIT and partners involved with Everglade conservation);

- Threats assessments and how to models to help inform and guide future land-use decisions as they relate to [energy development](#) (Nels Johnson and Tamara Gagnolet, TNC-PA) and [urbanization](#) (Todd Jones-Farrand, ABC); and
- Efforts at the [federal level to coordinate among all the agencies across the Southeast](#) with program being implemented in overlapping areas to better plan and to be more efficient and effective manner (by Rick Durbrow, EPA-Region 4.)

Two additional webinars may be recorded for future reference.

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APPENDIX II. Guidance on Ranking Criteria

Participants were asked to consider the follow points as guidance in evaluating the adequacy of each potential activity or research investigation as they identified and built the Portfolio elements. (This list is not presented in order of importance or priority, nor does it imply that all points must be satisfied to be included within the Portfolio.)

1. MEETS BASIC TENET OF LCC PURPOSE - Science Need represents big picture thinking (large scale and/or long-term and multi-taxa) inherent to the LCC vision.

ADDRESSES LANDSCAPE SCALE (LCC) ISSUES - The activities or research contribute toward addressing global or regional threats which require a landscape-level (LCC-scale) spatial approach in order to formulate a coordinated response or investigation (*“No single entity has the capacity or resources to address the issue alone”*).

2a. IMPROVES RESEARCH OR SCIENCE KNOWLEDGE BASE - Science Need reduces uncertainty in one of 3 ways:

- i. **ENHANCE RISK MANAGEMENT** - Activity or research investigation helps remove or resolve some uncertainty that is currently an impediment to the conservation community in planning, prioritizing, and taking action but must be integrated to manage risk to valued resources.
- ii. **TEST PROMISING PROOF OF CONCEPT** - Supporting the deployment of larger-scale/wider ranging system of experimental treatment or manipulation that reflect the application of promising result from a more narrow pilot study or demonstration activity.
- iii. **SYNTHESIS AND EVALUATION** - Activities or research support strategic review, evaluation, and synthesis describing the relative merits, proper application, and bounds of uncertainty of tools, methodologies, and strategies currently being applied with the intent of providing guidance to land and resource managers across the Appalachian LCC.

2b. ENHANCES CONSERVATION PROGRAM MANAGEMENT - Science Need improves our conservation efforts in terms of better decision-making and increased effectiveness by either:

- iv. **ENHANCE CONSERVATION PLANNING AND DECISION-MAKING TO ENHANCE DELIVERY** - Production of a broad landscape-planning analytical or decision support tool or integration of existing data to standardize and link across administrative or state boundaries and serve the needs of multiple conservation delivery members across the LCC.

- v. **SUPPORTS ADAPTIVE MANAGEMENT** - Activity or research advances LCC joint efforts to identify and incorporate effectiveness measures into landscape-level conservation planning, design, delivery, or monitoring and helps establish conservation targets.

3. GETS THE TIMING RIGHT - Science Need represents the next logical step in a sequence.

EXECUTES A BUILDING BLOCK FOR THE PORTFOLIO - Identified activity or research investigation fits within the broader Appalachian LCC Conservation Priorities Science Needs Portfolio, both in terms of outcomes, products, timeline and sequence (i.e., a foundational elements or components already in place and this represents the next integrative step).

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APPENDIX III.

Suggestions for selection and funding process from workshop participants

Working groups discussed the ranking criteria and identified several areas where they would suggest modifications or recommendations for implementing a funding process:

- *Create user groups / teams for each funded science need* - This team should be involved from the RFP development (to refine science need because they are so broad) through completion of the project. The team should be composed of representatives from the user community that will benefit from the research.
- *Narrow topics for RFP development* - There was concern that many of the science needs are very broad—too broad to immediately go to RFP process. The working group hopes that the ISC will be involved in narrowing down these broad needs before they are funded.
- *Sequence of Needs* – Some needs must be addressed to lay a foundation for action on other needs. For example, adaptation strategies should be done after vulnerability assessments. Determine whether to start with system or species level approach first.
- *Balance multiple scales and organismal and habitat funding at the landscape level* - The hierarchy [of themes, programs, needs] doesn't restrict the thinking of research needs but is merely an umbrella for administrative record keeping. Emphasize regional and local scales and the need to be able to scale from local to regional. Capture species interdependence and interactions. Address protection of healthy ecosystems (e.g., refugia) along with restoration approaches. Define “historical” baseline or targets.
- *Climate change mitigation created a gap* - Assumption made that the Appalachian LCC wouldn't address mitigation may have resulted in a gap.
- *Consider the human/political aspects* - Differentiate between science needs and advocacy (how the science will be used). Concern over limiting public audience to that within the LCC boundary (who will benefit from ecosystem services) and losing the local perspective on conservation needs. Clearly define trade-offs.
- *Incorporate social science research* – Need social science to examine policy options, legal aspects, and natural resource impacts given a particular policy direction, including scenario models on urbanization, current and future water and energy demand, land ownership shifts (public/private), cultural resources, ecosystem services, and decision-support tools for human population growth and economics assessments.
- *Add an outreach/communications program* (stakeholder identification and engagement) -. Outreach and engagement are key to collaboration and decision-making process. Need to understand people's/group's motivations, public desires for conservation (values), working with partners, conflict resolution between user groups, and consensus-building.
- *Use evaluation techniques to measure outcomes* – A resilient network is not static. Be adaptive and iterative by including research and monitoring, including standard protocol for status and long-term trends, classification of habitats, available surrogates from state databases, use of probabilistic survey data, and strict criteria for intertwining reference conditions. Need to have an integrated approach to the suite of models and tools so that states can communicate with each other.

- *Product accessibility and coordination* – Products of the LCC activities must be available to be used (open access) to ensure greater credibility, transparency and speed in decision making, save money, and increase efficiency. Complement approaches and products among partners and states. Address differences between states (e.g., regulations, models/tools, standard protocols) and coordinate management plans/treatments across jurisdictional and ownership boundaries to achieve broader conservation goals (e.g., regional connectivity).

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