

THEMATIC AREA:

CAVE/KARST - MINELANDS

MISSION: *Conserve and manage cave/karst and restored mine land (CKM) communities across jurisdictions.*

[Science objective] Inventory significant regional subterranean/cave/karst systems and communities, evaluate the condition and importance of those communities, and identify regional threats impacting these (in order).

[Management objective] To develop and implement cohesive regional strategies to protect and manage those resources across jurisdictions.

A. HEADING: REGIONAL LEVEL

1. PROGRAM: Landscape-level Disturbances & System-level Response

Examines major disturbances (includes climate change) as well as the impacts associated with these, regardless of ecological organization (e.g., community, species, population).

PROGRAM DESCRIPTION: *Develop and compile data regarding the status and distribution of subterranean resources, threats impacting associated species, and work with partners to develop management strategies needed to address habitat threats and assist in the determination and recovery of threatened and endangered species. Examines major disturbances (includes climate change) as well as the impacts associated with these, regardless of ecological organization (e.g., community, species, population).*

(Grouping) – Foundational/Stock-taking Assessment/Classification System

- **Project Description:** Develop a classification system for karst systems in the Appalachian region (to help prioritize conservation strategies).
 - o **(related) Project Description:** Map of springs throughout karst region— characterization and identification. Age dating and watershed delineation of major springs. Establish long-term spring monitoring network. *[COP Comment: Spring and other hydrology analyses will connect cave/karst systems and their conservation to larger watersheds/landscapes.]*
 - o **(related) Project Description:** Compilation and integration of cave data, some of which is sensitive or ‘not owned’ by LCC partners.
 - o **(related) Project Description:** [S] Update and compile species information from each state into a centralized database across the region. Develop methodology for

ranking degree of imperilment and apply to species. Fund inventory efforts to verify continued existence of pre-1990 records. [COP Comment: Should this be a Project or the charge of a Steering Committee Work Group?]

(Grouping) – *Climate Change Science and Abiotic or Mechanical Aspects*

- **Project Description:** Model projected abiotic effects of Climate Change on cave/karst habitats. Continue/establish long-term temperature and oxygen isotope monitoring sites.

(Grouping) – *Climate Change Impacts on Ecological Function and Response to Changes*

(Grouping) – *Energy and Related Infrastructure and Roads*

- **Project Description:** What are the impacts of land use changes, management regimes (especially prescribed burning and timber harvest), and climate change on water/cave resources in karst areas?

(Grouping) – *Urbanization, Population Growth and (Domestic or Industrial) Water Demands*

(Grouping) – *Agricultural Expansion and (Ag-related) Water Demands*

(Grouping) – *Effects of Air Pollution*

(Grouping) – *Cumulative Impacts*

- **Project Description:** [N] Effects of stressors (human use, urbanization, energy development) on stability and functionality of CKM systems and associated species. Establish long term studies comparing systems receiving storm water runoff with systems with agricultural and forested watershed.
- **Project Description:** [S] Develop predictive models for cave/karst high-biodiversity systems. COP needs to elaborate and provide specific details. [COP Comment: Commenters participating in review of this document agreed this was too vague but did not remember what Southern experts at the Nov. 2011 Science Needs Workshop had intended for this SN.]

B. HEADING: HUMAN DIMENSIONS

2. PROGRAM: Social Component

(Grouping) – *Value/Ecosystem Services and Conflict*

(Grouping) – *Recreational, Commercial, Subsistence Use*

- **Project Description:** Conduct water value case study to show the ecological, economic, and human health importance of water coming through karst systems in the Apps. *[COP Comment: Approximately 25% of the US population depends on groundwater from karst systems and that number may be higher in the Appalachians. This could be a very powerful study which could lead to increased awareness, areas in need of priority management, increased funding potential, and much more. Managing karst is essentially managing water.]*

C. HEADING: SYSTEM LEVEL

3. PROGRAM: Ecological Functions of Managed/Human-Altered Systems

(Grouping) – *Foundational/Stock-taking Assessment/Classification System*

(Grouping) – *Dams/Instream Barriers*

(Grouping) – *Mitigating Ag and Forestry Impacts*

(Grouping) – *Protection & Restoration Approaches*

- **Project Description:** [N] Inventory and geo-referencing of restorable caves post-WNS and identify what Communities are expected to benefit.
- **Project Description:** Develop (or identify existing) BMPs that are appropriate/adequate to ensure protection of cave/karst ecosystems, based on existing science. *[COP Comment: Currently, there is no standard for karst buffers, etc. Forests across the US have buffers ranging from 50 feet to 500 meters with very little research to back up these distances. This is a vital need for land managers and could be shared with private entities including cities, etc.] [LCC Staff Comment: COP should review bird literature which finds that the wider the buffer, the better; most minimum buffer widths are policy decisions except those pertaining to water quality/filtering capacity (NRCS standards) which also look at vegetation type, slope, soil type, etc.]*

4. PROGRAM: Ecological Functions of Natural/Intact Systems

PROGRAM DESCRIPTION: Establishes how these systems are supposed to work, understanding the systems and their interrelatedness/interdependency.

(Grouping) – *Foundational/Stock-taking Assessment/Classification System*

(Grouping) – *Effects of Fire on Ecosystems*

(Grouping) – *Relationship/Ecological Flows and Nutrient Dynamics*

- **Project Description:** [N] Understanding of hydrology, recharge, and quality of ground water as it relates to cave/karst/mine systems. Establish long-term drip and cave stream water quality observatories.
- **Project Description:** Understanding of nutrient dynamics (in disturbed systems). *[COP Comment: This PD is much too vague to pursue without further definition.]*

(Grouping) – *Ecosystem Integrity/Resiliency*

- **Project Description:** [N] Linkages of above ground processes and management regimes to cave/karst/mine systems. *[COP Comment: This PD is much too vague to pursue without further definition; could be further clarified and combined with 2 bullets above.]*

D. HEADING: COMMUNITY LEVEL

5. Program: Community Level (Description and Function or Basic Community Ecology)

(Grouping) – *Basic Ecology/Ecological Relationships*

- **Project Description:** Determine species and community distributions, their habitat relationships, and linkages across systems.
- **Project Description:** [S] Biological inventory of animal communities. *[COP Comment: Much of this is occurring at the state or academic level and a regional inventory (as above) can collate that existing information.]*

E. HEADING: SPECIES/POPULATION LEVEL

6. PROGRAM: Basic Biological Understanding (Species-level)

[COP Comment: While I do think this is critical, many partners are on top of this right now and so the priority of the LCC should be to take that knowledge and make it widely available through the regional analysis and strategic thinking that comes with that.]

(Grouping) – *Basic Biological Information*

- **Project Description:** Conduct spring emergence studies for Indiana bats, northern long-eared bats, eastern small-footed bats, and tri-colored bats across the range to locate maternity colonies and identify possible spring migration routes. While we have a fairly good understanding of where Indiana bats hibernate, we still only know where less than 20% of the winter population occurs during the summer and we know even less for northern long-eared, small-footed

and tri-colored bats. These species have been affected by white-nose syndrome (WNS) and locating summer colonies can lead to a better understanding of where to focus mitigation efforts. These studies will be very useful for informing wind project siting decisions.

- **Project Description:** Conduct meta-analysis of previously collected acoustic data to look at bat population occurrences and trends over time. Multiple agencies in a large number of states have been collecting acoustic data via transects for several years; however, there is currently no repository for the data and no funding to conduct any analyses. This project would coordinate the collection, analysis, and summary of currently available acoustic transect data. This effort will also be very useful for informing wind project siting decisions and better understanding where to focus mitigation efforts.

(Grouping) – *At-Risk Species/Populations & Endemics*

(Grouping) – *Contaminants/Pollutants Effects on Species/Populations*

(Grouping) – *Invasive Organisms Effect on Species and Populations*

(Grouping) – *Effects of Disease (on a Species or Taxonomic Group)*

- **Project Description: [S]** Identify / understand of disease threats and their impacts on species of greatest conservation need.
 - o **(related) Project Description: [N]** Etiology, response, and management of WNS. *[COP Comment: Important, but probably already being addressed by many others.]*
 - o **(related) Project Description:** Inventory / monitoring and geo-referencing of caves with highest potential of supporting bat populations post-WNS. *[COP Comment: Most important WNS-related project for LCC pursuit.]*
- **Project Description: [S]** Develop process to prioritize taxonomic descriptions of described species (to understand their conservation status, population level).
- **Project Description: [S]** Develop sampling criteria to determine statistical likelihood of a species/genera presence/absence, and predictive models for cave species to assist with targeted monitoring efforts.

F. HEADING: “HOW (THE LCC) SHOULD DO BUSINESS”

- Need cave/karst training workshops for resource managers, citizens, developers, and consultants (e.g., provided by Karst Waters Institute). Need to get cave/karst coursework included in all regional state and private college and university curricula. *[COP Comment: The US Forest Service has a one week training session for resource managers that has already been developed and I believe there is some kind of training at NCTC. Is it possible to develop and support a small cadre of instructors to tweak this training and to host workshops across the AppLCC?]*
- Need BMPs that include a monitoring/evaluation component for cave/karst landscape based on existing science, particularly for stormwater management and nutrient application.
- There seems to be a lot of emphasis on bats and WNS in this list of priorities. While bats are an important aspect of cave and karst management, they are only one small component of that ecosystem. For example, there are approximately 26 bat species that use caves in America (for some part of the year) and over 1400 described species of invertebrate cave-obligate species. We should not prioritize projects that focus on bats or WNS over gathering basic data on the cave/karst ecosystem. Plus, there are other pots of money focused on this issue.
- Ensure USGS National Karst mapping products are available to AppLCC communities via web portal.
- A big push to protect summer roosts is the single most important thing we can do to encourage recovery from WNS impacts.