Species and Habitat Selection for Climate Change Vulnerability Analysis in the Appalachian LCC

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Goal – select 50-75 species and 3-5 habitats for assessment

- **Selections should serve more than one purpose:**
  - Add value to existing body of work
  - Extrapolate results to other species and habitats where possible
  - Selected from diversity of habitats across the LCC
  - Analysis is representative of the entire LCC

Background

- **Expert panel met last January to assess diversity of CCVA methods, recommend approaches for AppLCC, and develop criteria for species / habitat selection**
- **Panel members:**
  - Kyle Barrett, Clemson University
  - John O'Leary, Massachusetts Department of Fish and Wildlife
  - Hector Galbraith, National Wildlife Federation
  - Patricia Butler, Michigan Technological University, Northern Institute of Applied Climate Science
  - Robert Cooper, University of Georgia
  - Kim Hall, The Nature Conservancy, Great Lakes
  - Healy Hamilton, Marine Conservation Institute (now VP of Science, NatureServe)

Criteria

- **Species:**
  - High conservation significance (SGCN, endemic to the region, T&E)
  - Importance to the ecological system (important food sources, ecosystem engineers, dominant)
  - Indicator species: climate change, particular ecological process)

  - **Habitats:**
  - Unique or endemic to the LCC
  - High connectivity
  - Dominant habitats

Existing Assessments

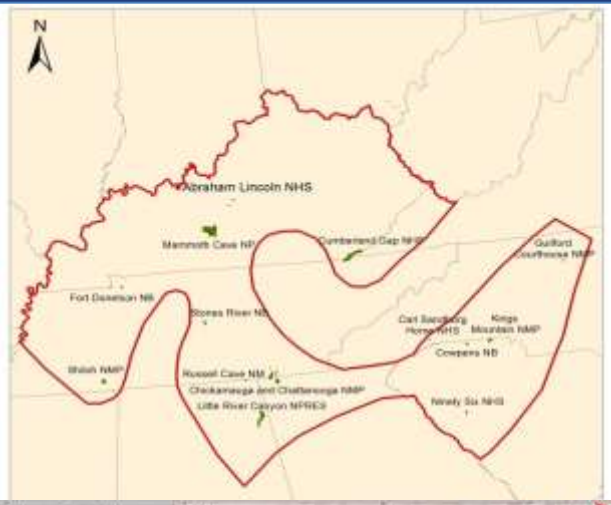
- Over 660 species assessed in all or part of the Appalachian LCC already in state-based analyses in WV, PA, NY, VA (2), IN, and in regional analyses (southern Appalachians or portions of the Interior Low Plateau)
- Six habitats already assessed in the Central Appalachian region

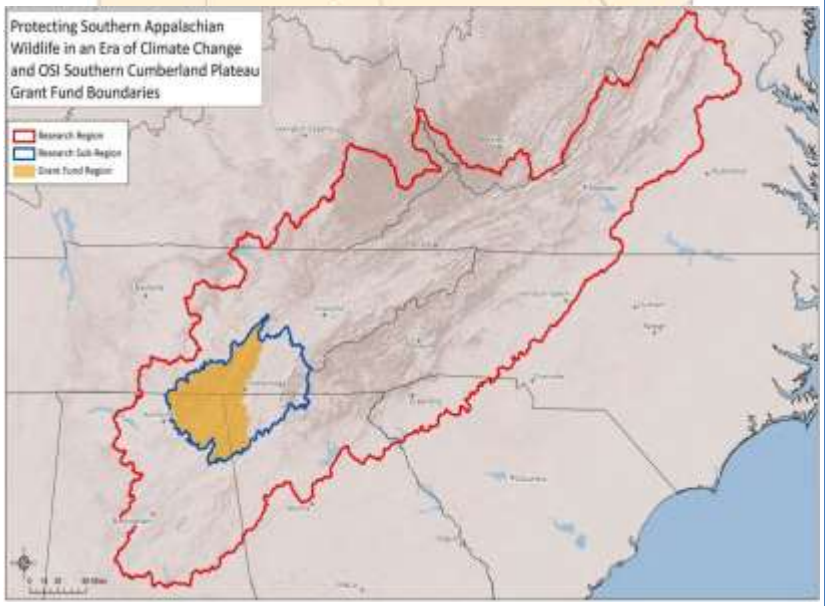
Species Data Sources

- Climate Change Vulnerability Index (CCVI) in NY, PA, WV, IL, VA
  - Vulnerability of At-risk Species to Climate Change in New York (Schlesinger et al. 2011)
  - Identifying Species in Pennsylvania Potentially Vulnerable to Climate Change (Furedi et al. 2011)
  - Climate Change Vulnerability Assessment of Species of Concern in West Virginia (Byers and Norris 2011)
  - Adapting Conservation to a Changing Climate: An Update to the Illinois Wildlife Action Plan (Walk et al. 2011)
  - Unpublished analysis of 40 species (Virginia Department of Natural Heritage 2010)
- One modeling study in VA
  - Virginia's Climate Modeling and Species Vulnerability Assessment (Kane et al. 2013)

More Species Data Sources

- Two regional analyses:
  - Cumberland / Piedmont Network (NPS) (Bruno et al. 2012)
  - Southern Appalachian region and subregion (Caroll et al. 2011)





Habitat Data Sources

- **Five habitats assessed in the northeastern states (Maine to Virginia) in two studies for the Northeast Association for Fish and Wildlife Agencies (NEAFWA) – Manomet Center for Conservation Sciences (2012)**
- **Assessment covered Central Appalachian portion of the Appalachian LCC (New York, Maryland, Virginia, West Virginia)**

CES202.593	Appalachian (Hemlock)-Northern Hardwood Forest	Highly Vulnerable
CES201.564	Laurentian-Acadian Northern Hardwood Forest	Vulnerable
CES202.592	Northeastern Interior Dry-Mesic Oak Forest	Less Vulnerable - Vulnerable
CES202.591	Central Appalachian Dry Oak-Pine Forest	Less Vulnerable - Vulnerable
CES202.028	Central and Southern Appalachian Spruce-Fir Forest	Critically Vulnerable
	Cold Water Fish Habitat	

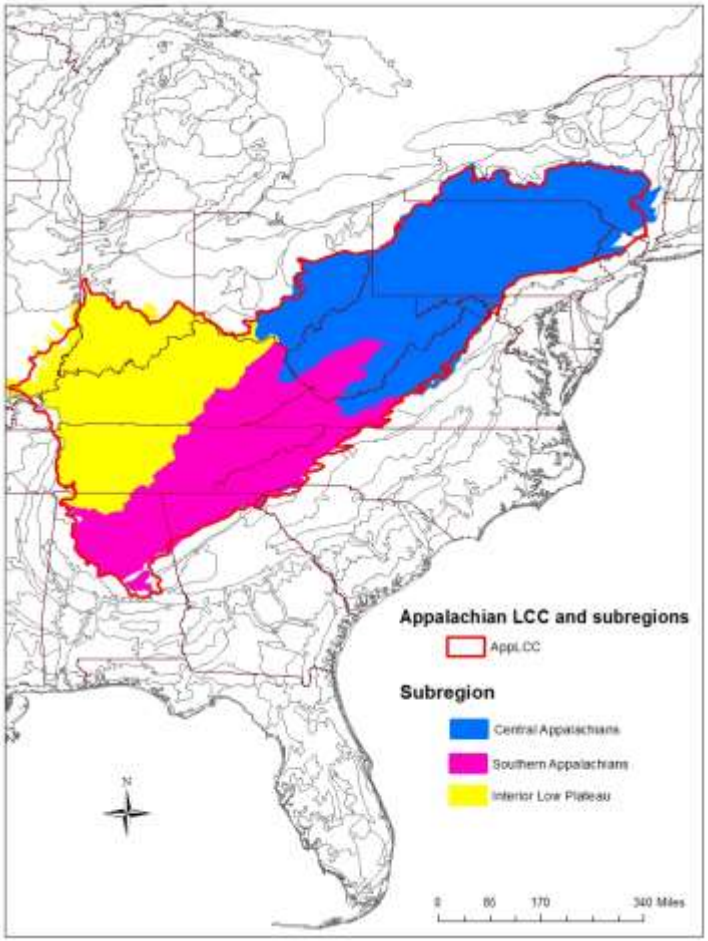
Appalachian LCC Subregions

How complete are these analyses in comparison to the LCC as whole?

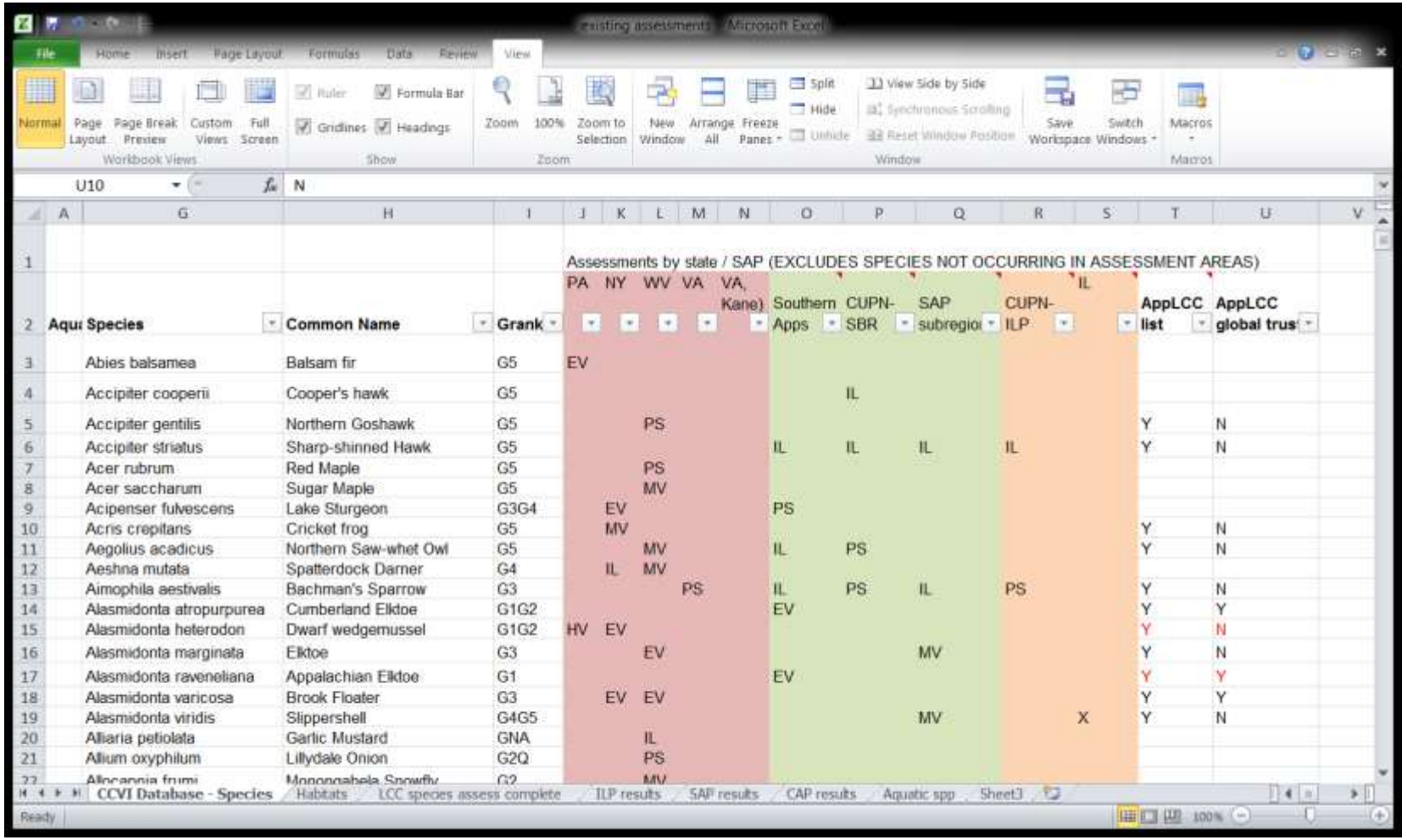
Much biophysical diversity in LCC region

Based on Forest Service Ecomap subsections:

- Central Appalachians
- Southern Appalachians and Cumberland Plateau
- Interior Low Plateau



Existing Assessments.xls



Assessments by state / SAP (EXCLUDES SPECIES NOT OCCURRING IN ASSESSMENT AREAS)

Aqua	Species	Common Name	Grank	PA	NY	WV	VA	VA, Kane)	Southern Apps	CUPN-SBR	SAP subregio	CUPN-ILP	IL	AppLCC list	AppLCC global trus
	Abies balsamea	Balsam fir	G5	EV											
	Accipiter cooperii	Cooper's hawk	G5							IL					
	Accipiter gentilis	Northern Goshawk	G5			PS								Y	N
	Accipiter striatus	Sharp-shinned Hawk	G5						IL	IL	IL	IL		Y	N
	Acer rubrum	Red Maple	G5			PS									
	Acer saccharum	Sugar Maple	G5			MV									
	Acipenser fulvescens	Lake Sturgeon	G3G4		EV				PS						
	Acris crepitans	Cricket frog	G5		MV									Y	N
	Aegolius acadicus	Northern Saw-whet Owl	G5			MV			IL	PS				Y	N
	Aeshna mutata	Spatterdock Darner	G4		IL	MV									
	Aimophila aestivalis	Bachman's Sparrow	G3				PS		IL	PS	IL	PS		Y	N
	Alasmidonta atropurpurea	Cumberland Elktoe	G1G2						EV					Y	Y
	Alasmidonta heterodon	Dwarf wedgemussel	G1G2	HV	EV									Y	N
	Alasmidonta marginata	Elktoe	G3			EV					MV			Y	N
	Alasmidonta raveneliana	Appalachian Elktoe	G1						EV					Y	Y
	Alasmidonta varicosa	Brook Floater	G3		EV	EV								Y	Y
	Alasmidonta viridis	Slippershell	G4G5								MV		X	Y	N
	Alliaria petiolata	Garlic Mustard	GNA			IL									
	Allium oxyphilum	Lillydale Onion	G2Q			PS									
	Allocapnia frumi	Monongahela Snowfly	G2			MV									

pink = Central Appalachians; green = southern Appalachians, peach = Interior Low Plateau

Existing assessments - results

D = does not occur

EV= extremely vulnerable

HV = highly vulnerable

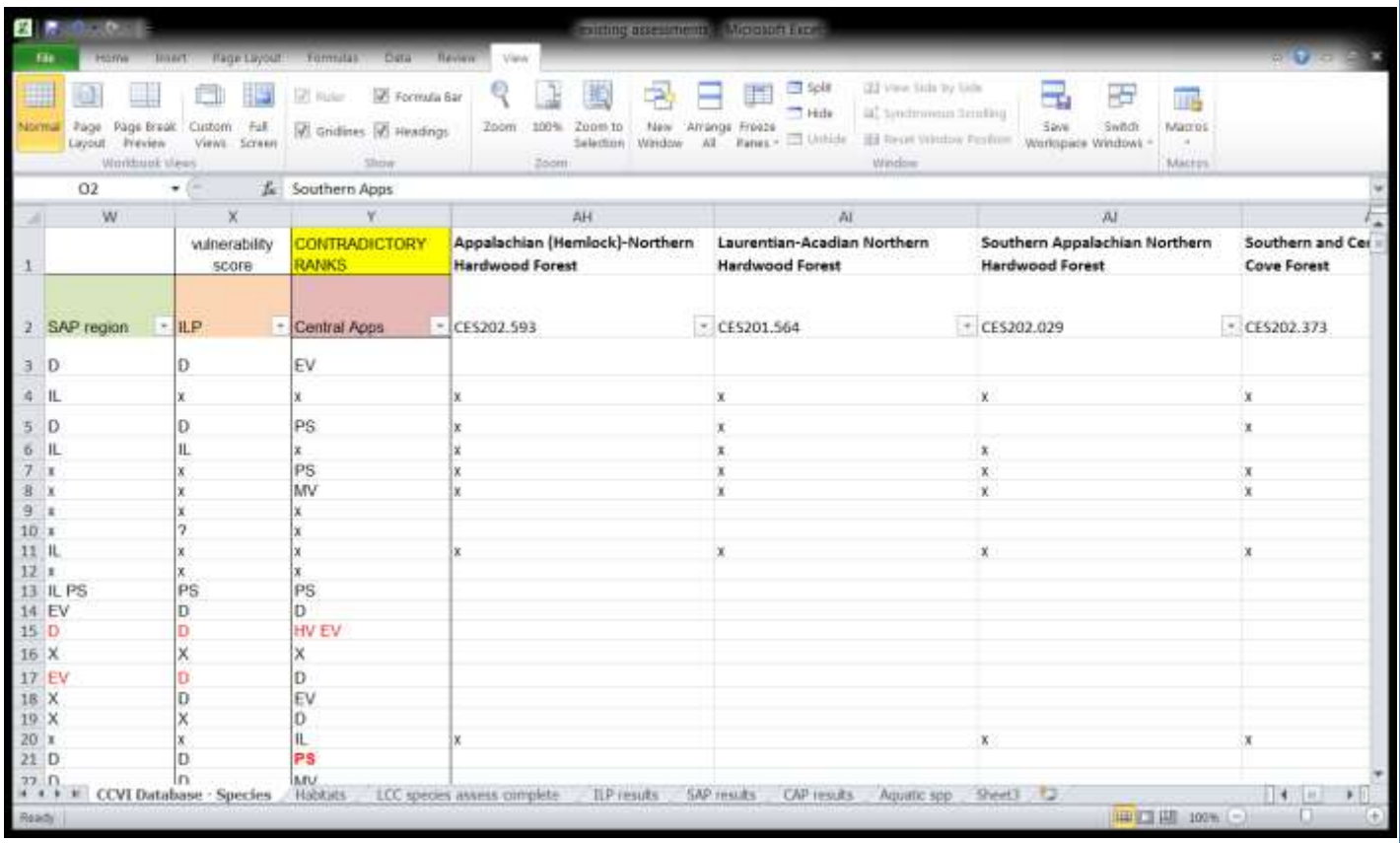
MV = moderately vulnerable

P = presumed stable

IL = increase likely

X = present in the region but not assessed there, or result not categorical

- 194 species completed
- >460 species have useful data compiled for further analysis



	W	X	Y	AH	AI	AJ	
1		vulnerability score	CONTRADICTORY RANKS	Appalachian (Hemlock)-Northern Hardwood Forest	Laurentian-Acadian Northern Hardwood Forest	Southern Appalachian Northern Hardwood Forest	Southern and Ce Cove Forest
2	SAP region	ILP	Central Apps	CES202.593	CES201.564	CES202.029	CES202.373
3	D	D	EV				
4	IL	x	x	x	x	x	x
5	D	D	PS	x	x		x
6	IL	IL	x	x	x	x	
7	x	x	PS	x	x	x	x
8	x	x	MV	x	x	x	x
9	x	x	x				
10	x	?	x				
11	IL	x	x	x	x	x	x
12	x	x	x				
13	IL PS	PS	PS				
14	EV	D	D				
15	D	D	HV EV				
16	X	X	X				
17	EV	D	D				
18	X	D	EV				
19	X	X	D				
20	x	x	IL	x		x	x
21	D	D	PS				
22	D	D	MV				

Systems and Habitats

- Select species from diversity of habitats
- No standard officially accepted habitat classification in LCC
- NatureServe map of systems – comprehensive for the US
- Use systems as proxy for habitats, based on North Atlantic LCC habitat classification and map

Major systems of Appalachian LCC

- Systems covering large geographic areas: Matrix (M) or Large Patch (LP)
- Important Wetlands: characteristic of the LCC region (floodplain, riparian, sinkhole ponds, fens, bogs)
- Unique: restricted to LCC; support large numbers of rare species adapted to unusual settings

Proposed Species (see spreadsheet)

					election justification: keystone or dominant (K); important food source (F); LCC restricted (L); suspected climate sensitive (CS); southern range limit (S); important wetland indicator (IW); rare [R]; northern range limit (N); important in many habitats (IH); AppLCC list (AL); Unique habitat indicator (U); actively monitored (M)	
FINAL LIST OF DE NOVO SPECIES						
Kingdom	Species	Common Name	Global Rank	AppLCC global trust?		TIER
Plantae	Actaea podocarpa	Mountain Bugbane	G4	N	L	1
Plantae	Apios priceana	Price's Potato-bean	G2	PROPOSE	L	1
Plantae	Arabis georgiana	Georgia rockcress	G1	N	L	1
Plantae	Asimina triloba	Pawpaw	G5	N	F, IH	2
Plantae	Astragalus tennesseensis	Tennessee Milk-vetch	G3	PROPOSE	L	1
Plantae	Baptisia australis	Blue Wild Indigo	G5	N	F, IW	1
Plantae	Bouteloua curtipendula	Sideoats Grama	G5	N	U	1
Plantae	Buckleya distichophylla	Piratebush	G3	PROPOSE	L	1
Plantae	Carya carolinae-septentrionalis	Southern Shagbark Hickory	G5	N	(K); N, F, L	1
Plantae	Castilleja coccinea	Indian paintbrush	G5	N	L	1
Animalia	Catocala marmorata	Marbled underwing	G3G4	N	L	1
Plantae	Chrysosplenium americanum	American Golden-saxifrage	G5	N	IW	2

Bottom Line

- Did the process make sense?
- Is there enough existing information on aquatic species?
- Are these the right habitats?
- Are there too many plants?
  - 14% of existing assessments were plants
  - 87% of proposed species are plants
  - Of assessments considered complete, 18% are plants
- If not, are these the correct ones?
- If so, what fauna should be substituted?