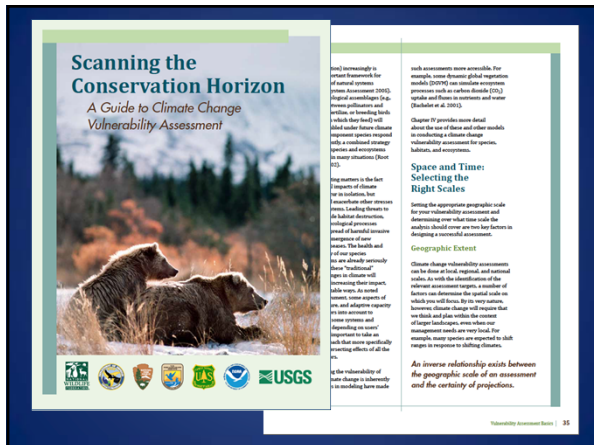
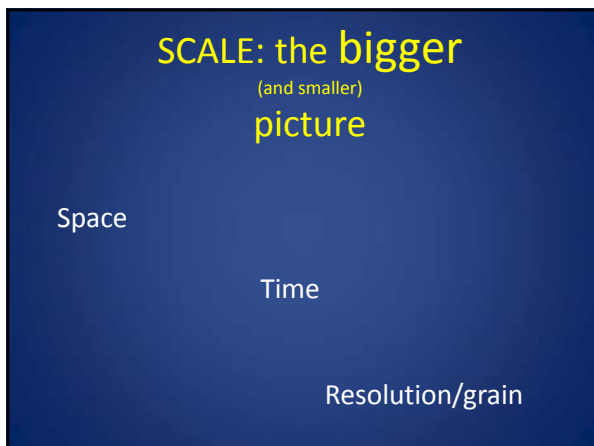


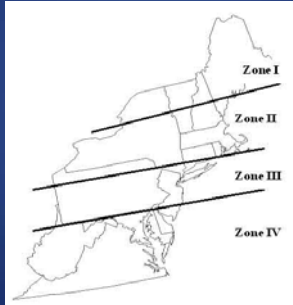






SPACE: Habitats/communities

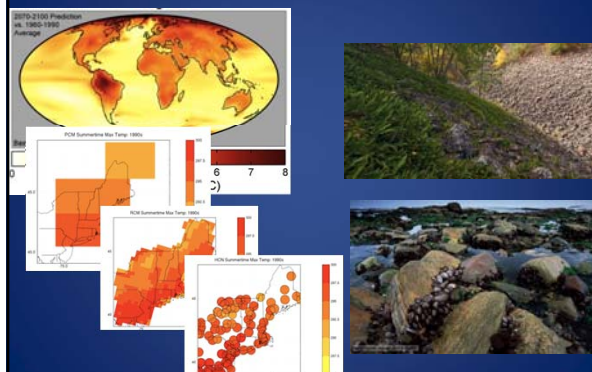
NEAFWA zones



Habitat Vulnerability Across Zones

	Zone I	Zone II	Zone III	Zone IV
Acadian-Appalachian Alpine Tundra	Highly Vulnerable			
Acadian-Appalachian Montane Spruce-Fir Forest	Vulnerable	Critically Vulnerable		
Laurentian-Acadian Northern Hardwood Forest	Less Vulnerable	Vulnerable	Vulnerable	Critically Vulnerable
Central Mixed Oak-Pine Forests	Least Vulnerable	Least Vulnerable	Less Vulnerable	Vulnerable
Pitch Pine Barrens		Less Vulnerable	Less Vulnerable	Less Vulnerable
Northern Atlantic Coastal Plain Basin Peat Swamp		Less Vulnerable	Less Vulnerable	Less Vulnerable
Central and Southern Appalachian Spruce-Fir Forest				Critically Vulnerable
Boreal-Laurentian Bog	Highly Vulnerable	Highly Vulnerable		
Shrub Swamp	Vulnerable	Vulnerable	Vulnerable	Vulnerable
Emergent Marsh	Vulnerable	Vulnerable	Vulnerable	Vulnerable

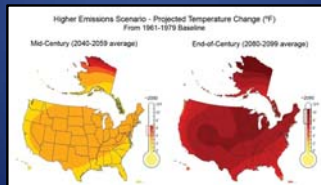
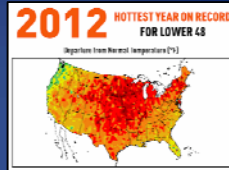
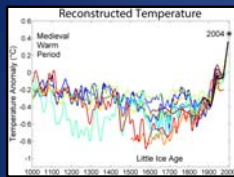
SPACE: Climate



TIME: species and habitats

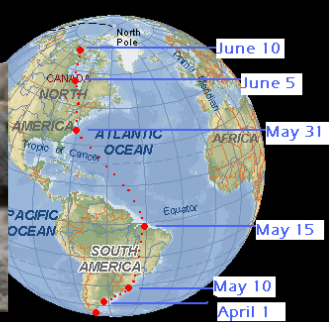


TIME: climate



SPACE and TIME: Migratory pathways

Red Knot



Scale of Implementation

- Relative scale of implementation vs. resource of interest
- Relative scale of implementation vs. effect of actions
- Type of implementation
 - Broad brush policy
 - Comprehensive use/management planning
 - Narrow site scale project design or regulation

Scale of Implementation

- Scales often mixed within the same landscape:
 - Federal region
 - State government
 - Local governments
 - Agency jurisdiction
 - Watershed management
 - Individual land owner
 - Project site

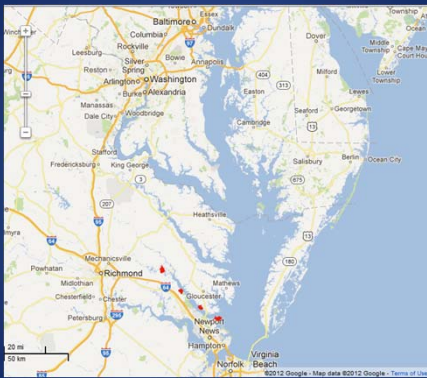
All in same planning area

YTIXE
COMP!

Everything should be made as simple as possible, but not simpler.

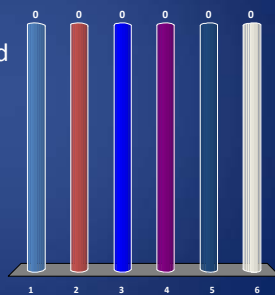
Conclusion

- Scale has large implications
- Can't have the ideal scale for all features
- Compromise is necessary



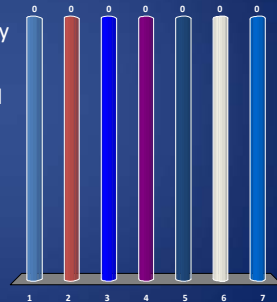
You are asked to do a VA for Chesapeake Bay-Virginia NERR. Do you assess exposure at the scale of:

1. CBNERR-VA
2. CBNERR-VA watershed
3. CBNERR-VA + MD
4. CBNERR-VA + MD and watersheds
5. The entire Bay
6. The entire Bay and its watershed



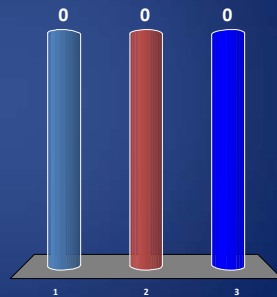
You work for CBNERR-VA & are asked to do a VA for the constructed oyster reef in the Goodwin Islands component. Do you assess exposure at the scale of:

1. The Goodwin Islands only
2. CBNERR-VA
3. CBNERR-VA & watershed
4. CBNERR-VA + MD
5. CBNERR-VA + MD and watersheds
6. The entire Bay
7. Bay & watershed



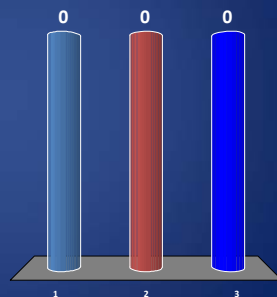
You work for CBNERR-VA & are asked to do a VA for loggerhead turtles to inform the Recovery Plan. Do you assess exposure at the scale of:

1. CBNERR-NA
2. Chesapeake Bay
3. Their entire range



You work for CBNERR-VA & are asked to do a VA for loggerhead turtles to inform Reserve management. Do you assess exposure at the scale of:

1. CBNERR-VA
2. Chesapeake Bay
3. Their entire range

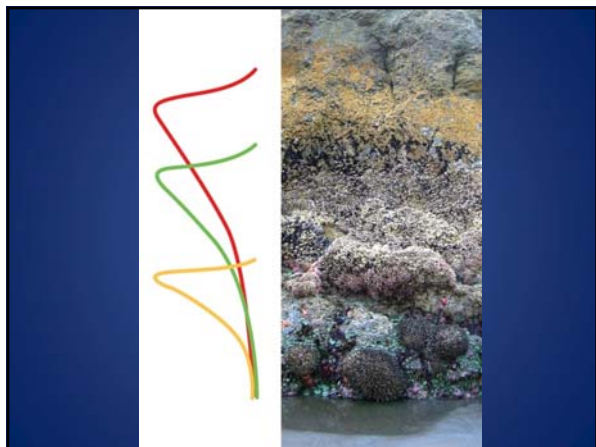


EXTRA SLIDES

Multiple Issues of Scale

- Species habitat and life history aspects
- Data scale/precision differences
- Land planning/management scales
- Time relative to effects, decisions, implementation





RESOLUTION: Grain of resource distribution

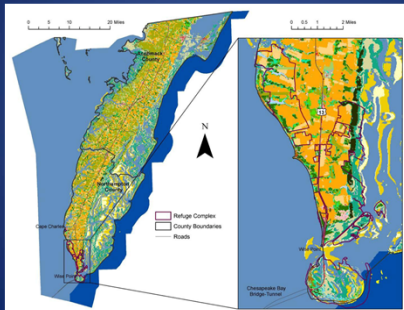
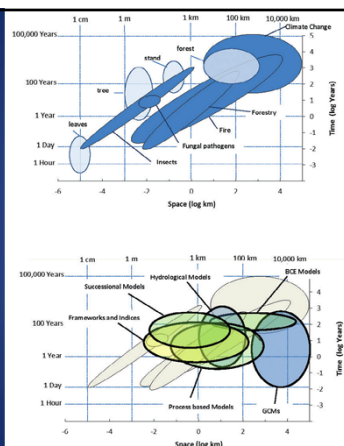
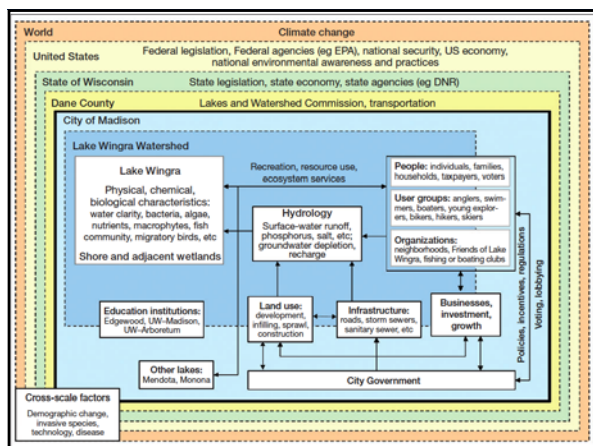
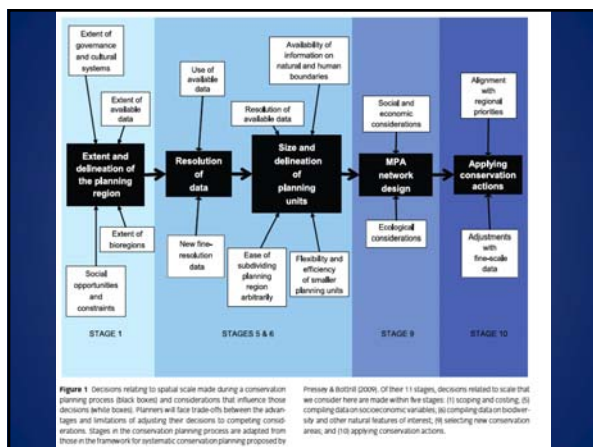


Table 1 The hierarchy theory model modified for sub-national vulnerability of the environmental and social system

Level	Environmental system	Social system
Macro-level dynamics	Climate change Transboundary pollution	Ageing of the population National and global economic prosperity, globalisation
Level of observation (here: counties)	Fragmentation of landscape Protection status Land management	Fragility, marginalisation, dependency, welfare, economic prosperity as a profile of the average of all residents within a county
Micro-level components	Soil composition Vegetation type Hydrological conditions	Human behaviour Risk perception Social networks, skills, resources and physical fitness as a profile of a person







	Spatial scale		
	Large ^a	Intermediate ^b	Small ^c
Availability of information on climate and climate change effects	High for future climate and general effects on vegetation and water	Moderate for river systems, vegetation, and animals	High for resource data, low for climate change
Accuracy of predictions of climate change effects	High	Moderate to high	High for temperature and water, low to moderate for other resources
Usefulness for specific projects	Generally not relevant	Relevant for forest density management, fuel treatment, wildlife, and fisheries	Can be useful if confident that information can be downscaled accurately
Usefulness for planning	High if collaboration across management units is effective	High for a wide range of applications	Low to moderate

^a More than 10,000 km² (e.g., basin, multiple National Forests)
^b 100 to 10,000 km² (e.g., subbasin, National Forest, Ranger Districts)
^c Less than 100 km² (e.g., watershed)

Vulnerabilities of Shorebirds to Climate Change

Hector Galbraith¹, Stephen Brown¹,
David W. DesRochers², J. Michael Reed³

¹Manomet Center for Conservation Sciences

²Dalton State College

³Tufts University

Our Approach

- Evaluates threats to shorebirds by species
- Works within the context of the Partners-in-Flight & U.S. Shorebird Conservation Plan risk systems
 - based on population size & trend, breeding & non-breeding distributions, threats to breeding & non-breeding sites



<http://www.outdooralabama.com/watchable-wildlife/what/birds/shorebirds/pitt.cfm>



Vulnerability Factors

- 1) Loss/gain in breeding habitat under climate change
- 2) Loss/gain in wintering habitat under climate change
- 3) Loss/gain in migration habitat under climate change
- 4) Degree of dependence on ecological synchronicities
- 5) Migration distance
- 6) Degree of breeding, wintering, or migration habitat specialization

<http://www.wildlifeaware.com/2008/01/>

Risk Factors

1) Loss/gain in breeding habitat under climate change:

	Score	Arrow
Major loss (>50%)	5	↑↑
Moderate loss (10-50%)	3	↑
Limited or no loss (-10-10%)	0	0
Moderate increase (10-50%)	-1	↓
Major increase (>50%)	-2	↓↓

Note: risk could decrease



Semipalmated Sandpiper

	Score	Arrow
1) Loss/gain in breeding habitat under climate change	3	↑
2) Loss/gain in wintering habitat under climate change	5	↑↑
3) Loss/gain in migration habitat under climate change	3	↑
4) Degree of dependence on ecological synchronicities	5	↑↑
5) Migration distance	4	↑
6) Degree of breeding, wintering, or migration habitat specialization	4	↑↑

Change in status from 'moderate concern' to 'highly imperiled'

<http://www.wildlifeaware.com/2008/05/>

Results for 50 North Am. Shorebirds

- 43 species (86%) predicted to ↑ risk level due to climate change
 - 34 increased by 1 level
 - 9 increased by 2 levels
- 3 species at lower risk
 - Solitary sandpiper – more breeding habitat
 - Bristle-thighed curlew – more breeding & wintering habitat
 - White-rumped sandpiper – more wintering habitat



<http://www.sevies.org/index.php?page=baibp&id=glenteye2>

U.S. Shorebird Conservation Plan

Risk Category	Current	Expected with climate change
Not at risk	0	0
Low concern	7	2
Moderate concern	15	7
High concern	23	13
Highly imperiled	4	17
Critical	–	10
