Climate Change Vulnerability Assessment of Michigan's Fish and Wildlife

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Adaptation in the Great Lakes Region

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Michigan Natural Features Inventory

MICHIGAN STATE UNIVERSITY EXTENSION

DEPARTMENT OF NATURAL RESOURCES · DNR · MICHIGAN

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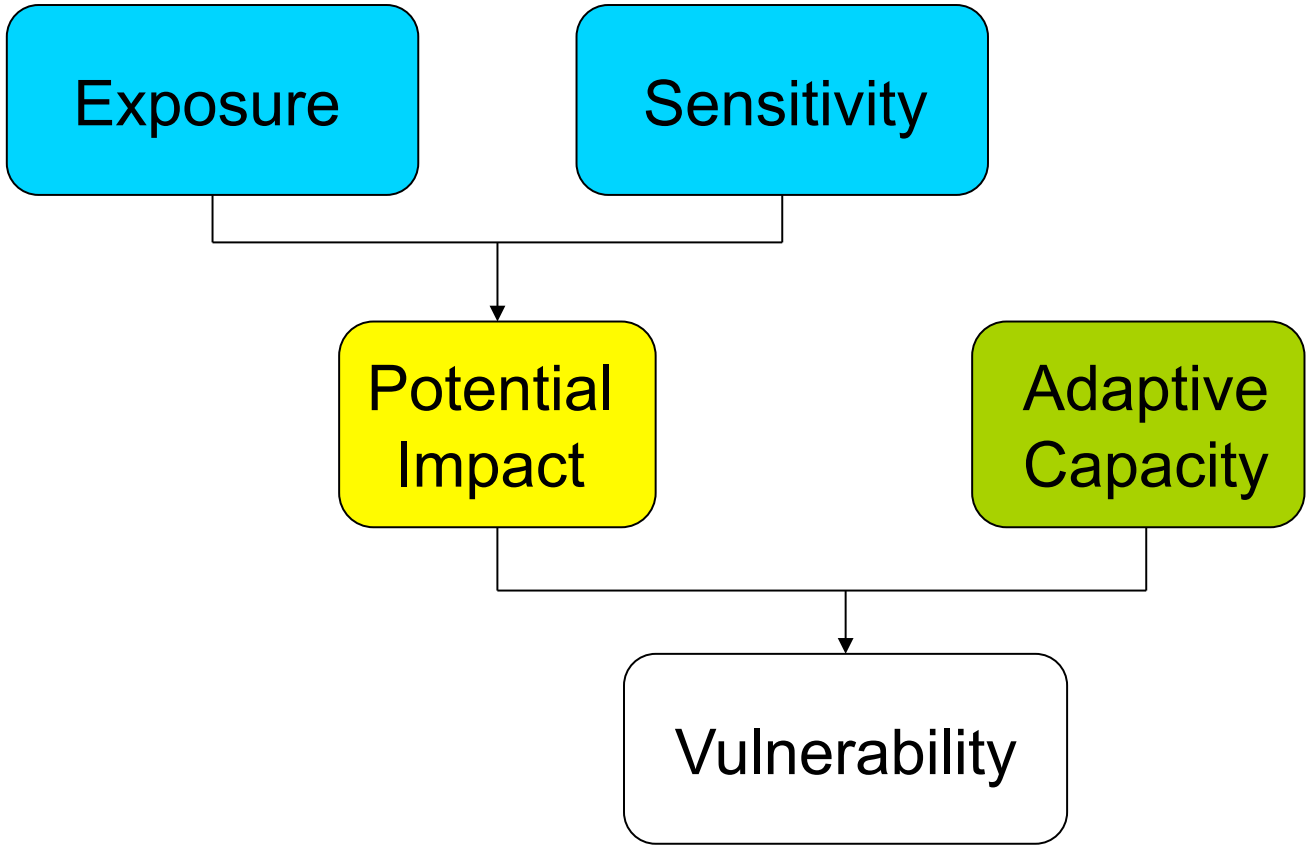
Vulnerability Assessment

- 400 species total
  - Species of Greatest Conservation Need
  - Game species
  - Associated with coastal zone
  - May be vulnerable to climate change
  - Available information

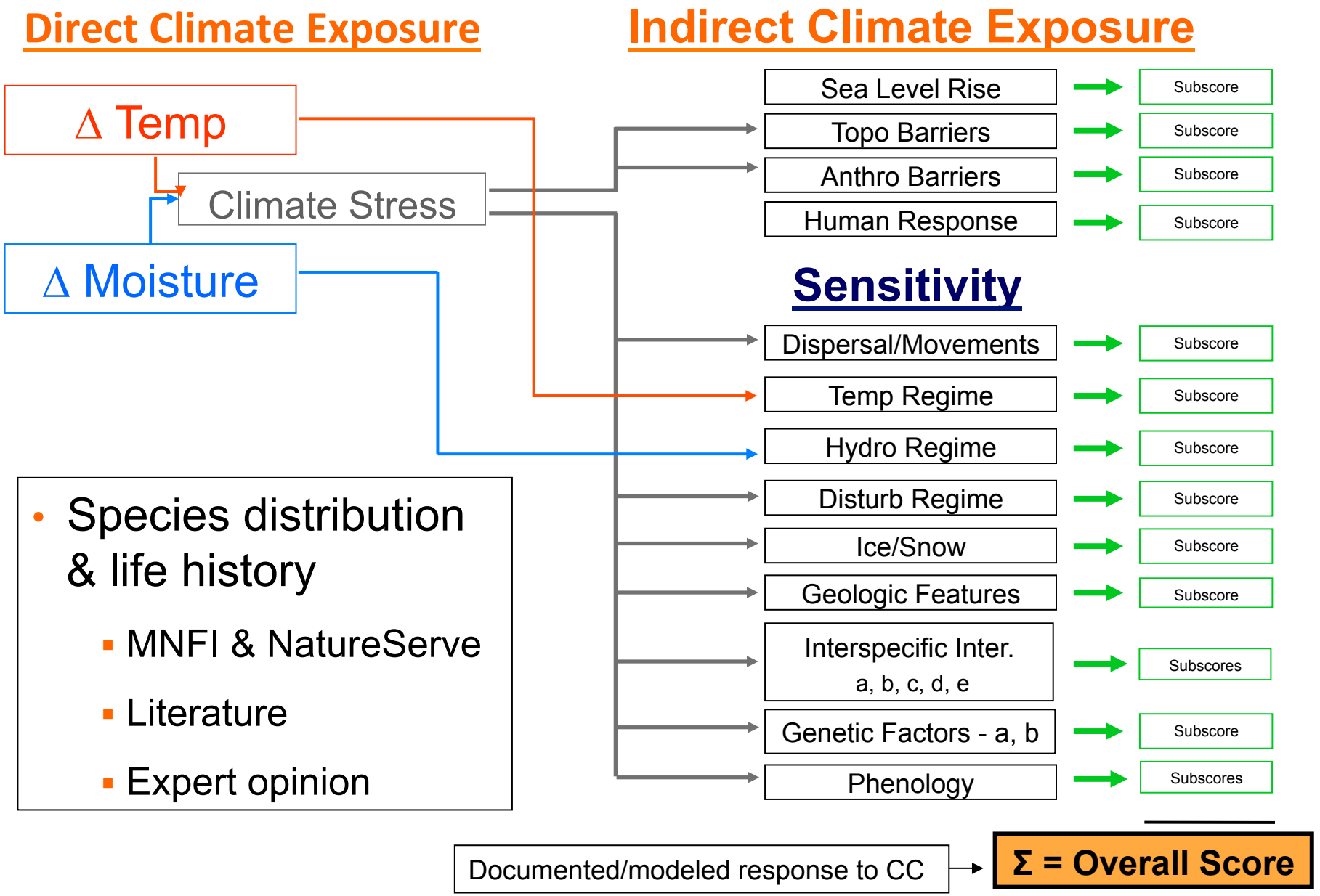
Components of Vulnerability



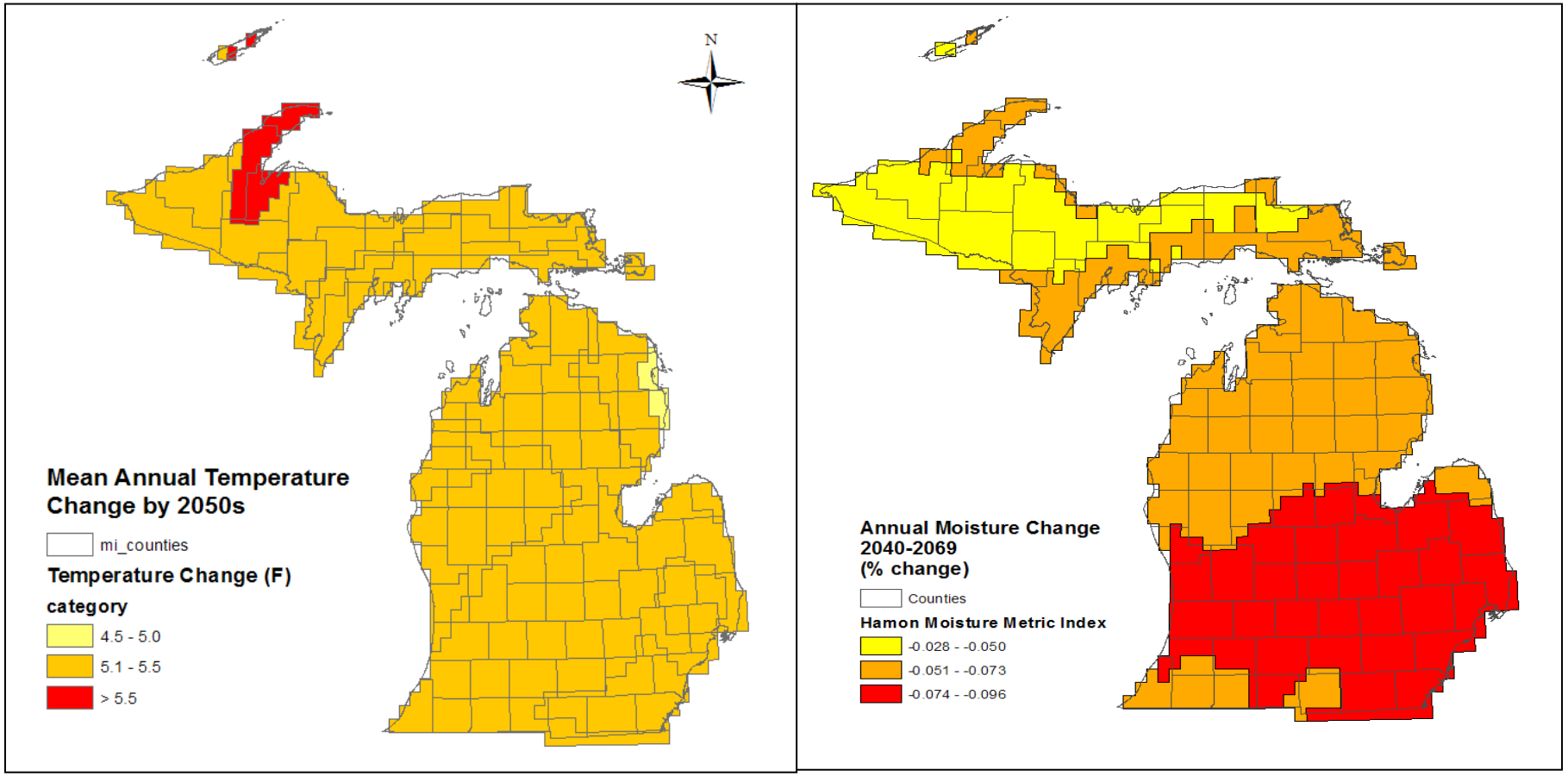
From: Glick et al. 2011 Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment

Vulnerability Assessment

- NatureServe Climate Change Vulnerability Index (CCVI)
  - Easy, (relatively) quick, systematic, qualitative
  - Predicts species vulnerability/whether species will decline, remain stable or increase by 2050
  - Highlights factors that contribute to vulnerability


Direct Climate Exposure
Indirect Climate Exposure
Δ Temp
Climate Stress
Δ Moisture
Sea Level Rise
Topo Barriers
Anthro Barriers
Human Response
Subscore
Subscore
Subscore
Subscore
Sensitivity
Dispersal/Movements
Temp Regime
Hydro Regime
Disturb Regime
Ice/Snow
Geologic Features
Interspecific Inter.
a, b, c, d, e
Genetic Factors - a, b
Phenology
Subscore
Subscore
Subscore
Subscore
Subscore
Subscores
Subscore
Subscores
• Species distribution & life history
▪ MNFI & NatureServe
▪ Literature
▪ Expert opinion
Documented/modeled response to CC
Σ = Overall Score

Exposure Data: ClimateWizard



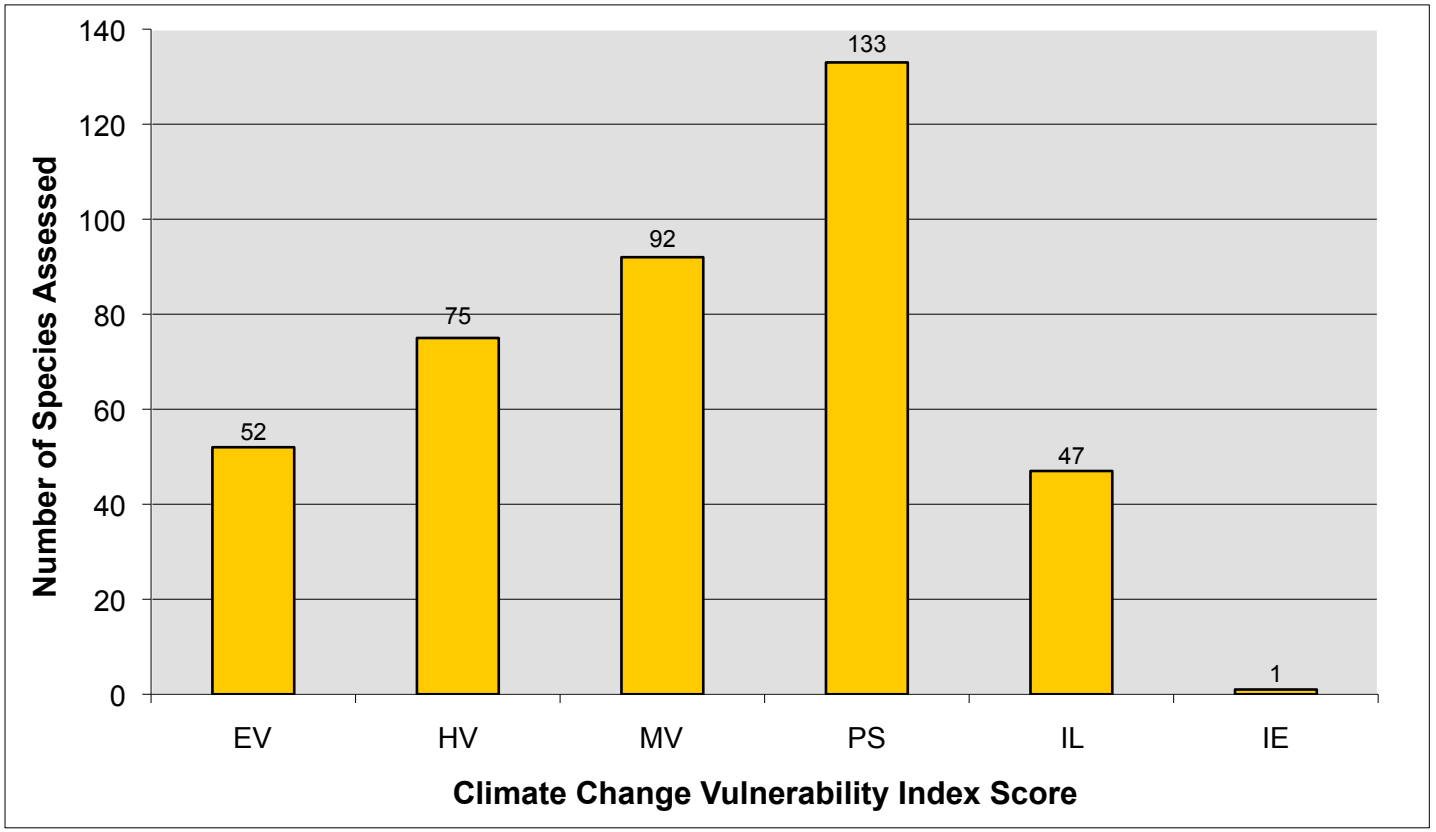
www.climatewizard.org

Index Scores

↓↓↓	Extremely Vulnerable
↓↓	Highly Vulnerable
↓	Moderately Vulnerable
≈	Not Vulnerable/Presumed Stable
↑	Not Vulnerable/Increase Likely
?	Insufficient Evidence

*Confidence Score – L, M, H, VH

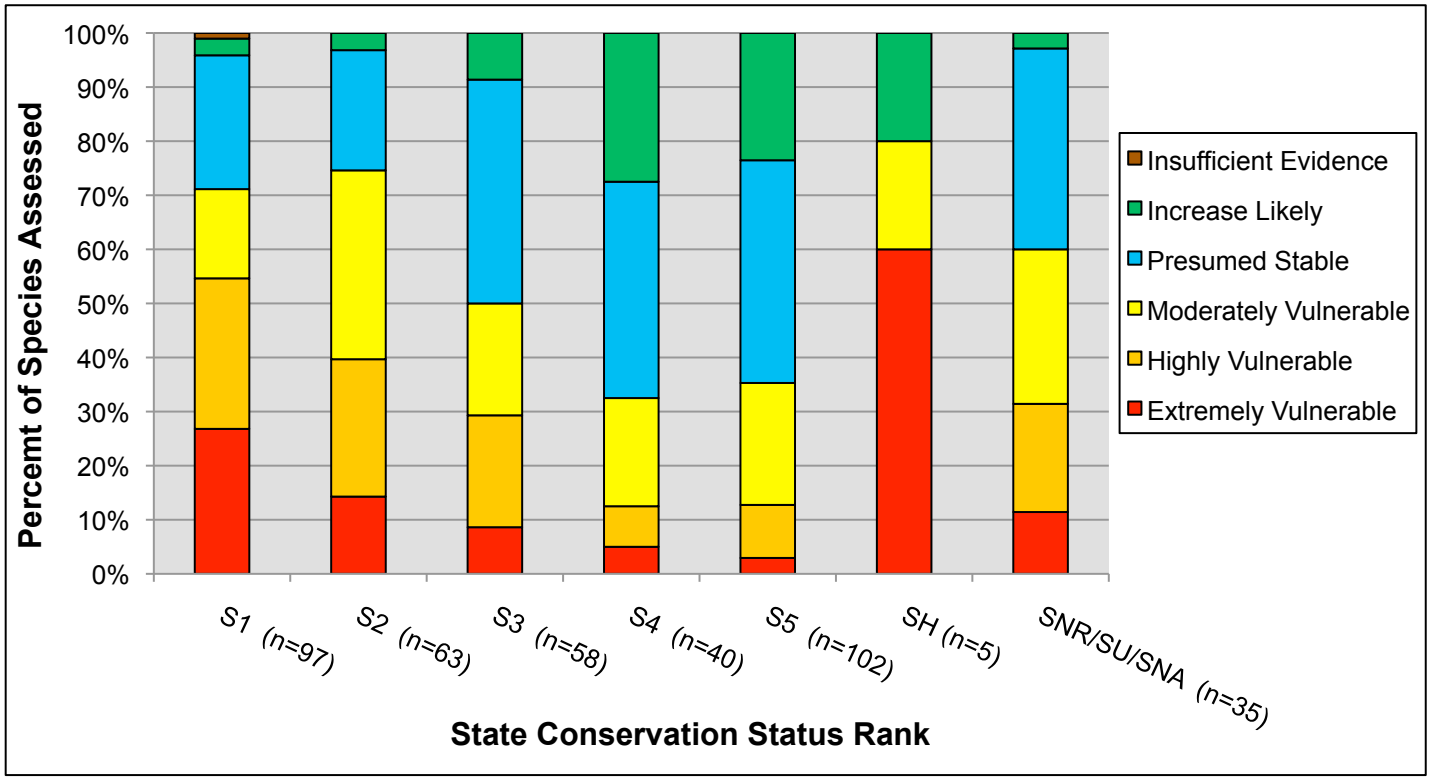
CCVI Results - Overall



Vulnerable (EV, HV, MV)

- 219 (55%) of the 400 animals

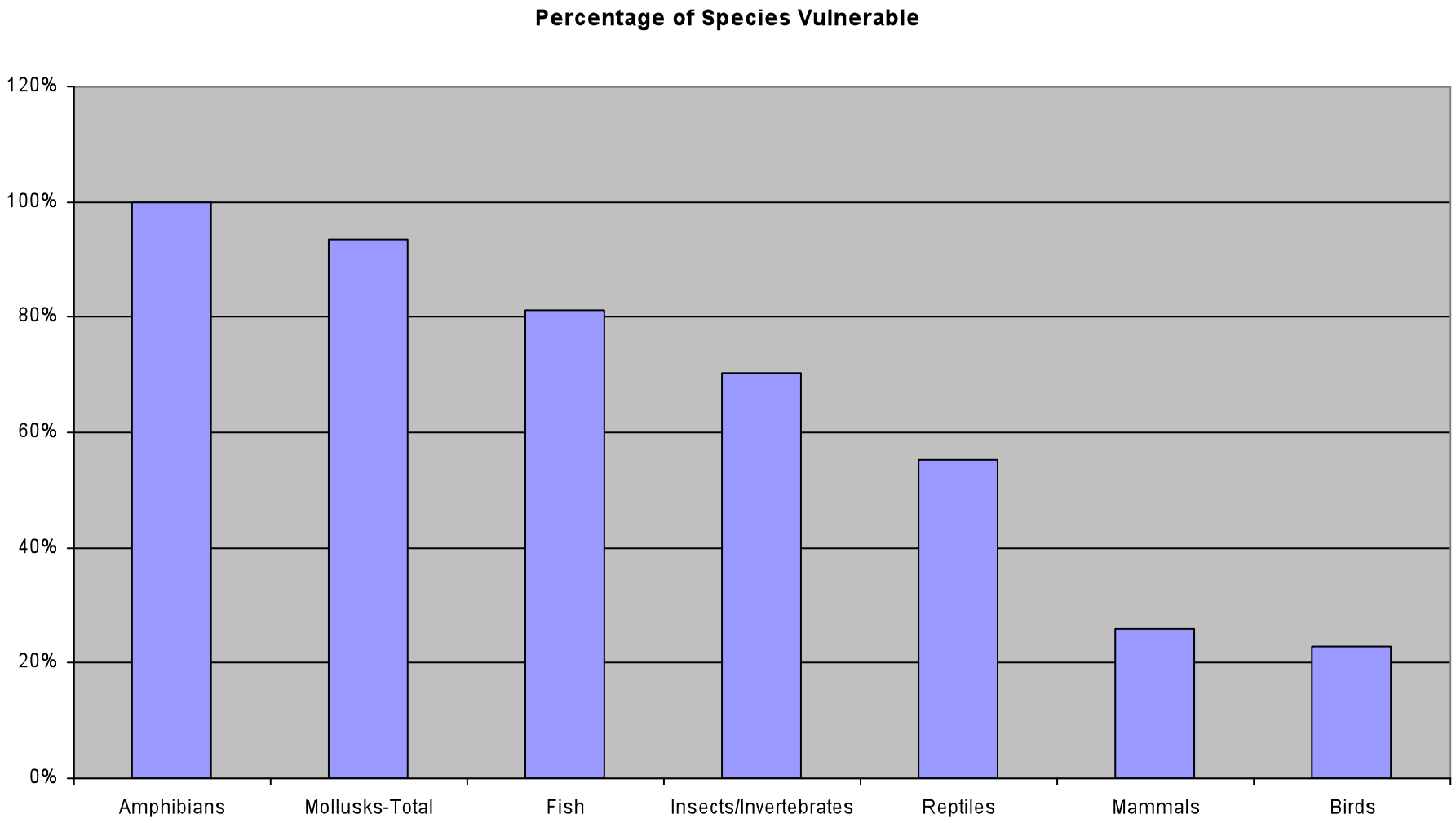
Results - State Status



Vulnerable (EV, HV, MV)

- 67% of rare/S1-S3 species
- 35% of common/S4-S5 species
- 17% of game species

Results – Animal Taxa



- Climate vulnerable and likely to decrease in Michigan
  - Rare Species
    - Common loon
    - Hine's emerald dragonfly
    - Karner blue butterfly
    - Canada lynx
  - Common Species
    - Moose
    - Snowshoe hare
    - Northern flying squirrel

- Climate stable or likely to increase in Michigan
  - Rare Species
    - Kirtland's warbler
    - Prairie vole
    - Gray [black] ratsnake
  - Common Species
    - Virginia opossum
    - Turkey
    - Southern flying squirrel

Support for Results

- Actual changes seen in Michigan
  - Southern species moving north
  - Northern species decreasing
    - Southern flying squirrel and northern flying squirrel
    - Blanchard's cricket frog??
- Other assessments
  - Eastern Massasauga – Lars et al. 2013

Contributing Factors

- Historical hydrological niche
  - Exposure to past variations in precipitation
- Physiological hydrological niche
  - Narrowly defined, specific habitats, local conditions
- Natural and anthropogenic barriers
- Land use changes due to climate change mitigation

Implications for Adaptation

- Focus on species that are climate vulnerable
- Address factors that contribute to vulnerability
  - Barriers
    - Provide connectivity / dispersal corridors
    - Assisted dispersal / migration
  - Reduce current stressors
    - Invasive species control
    - Habitat manipulation (e.g., maintain hydrology)

Caveats and Considerations

- Iterative process
  - Revisit with new information (e.g., downscaled MI climate models)
- High degree of uncertainty
  - Climate change (precip, moisture, GL water levels)
  - Limited species information

Caveats and Considerations

- Species Vulnerability Assessments
  - CCVI – strengths and weaknesses
  - Training your brain
- Use climate change vulnerability in conjunction with conservation status and other goals/values to develop management priorities

Questions?

Full report online at: http://www.michigan.gov/documents/dnr/3564_Climate_Vulnerability_Division_Report_4.24.13_418644_7.pdf

For more information, please contact:

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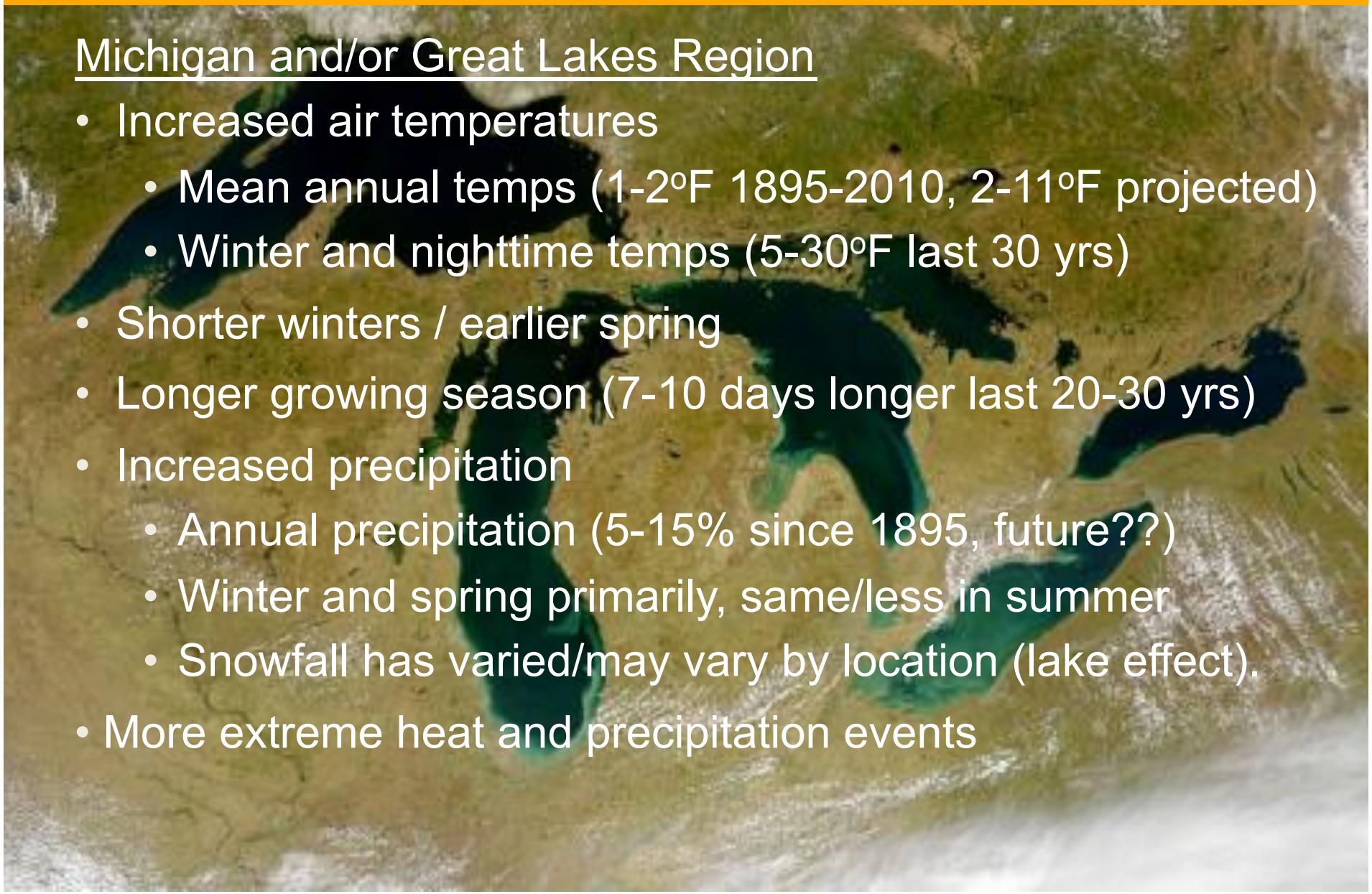
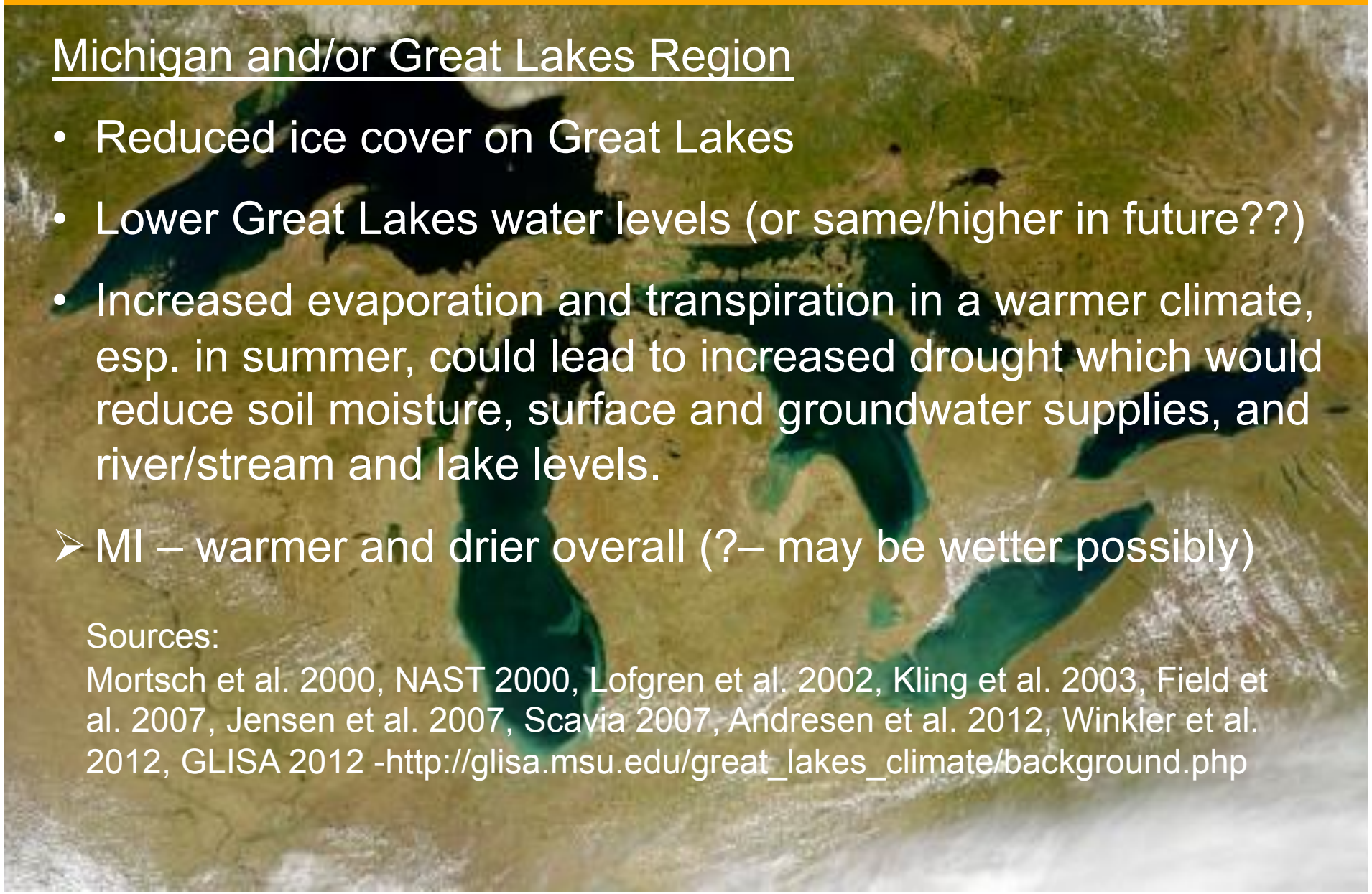
Climate Change in the Great Lakes



Michigan and/or Great Lakes Region

- Increased air temperatures
  - Mean annual temps (1-2^{o}F 1895-2010, 2-11^{o}F projected)
  - Winter and nighttime temps (5-30^{o}F last 30 yrs)
- Shorter winters / earlier spring
- Longer growing season (7-10 days longer last 20-30 yrs)
- Increased precipitation
  - Annual precipitation (5-15% since 1895, future??)
  - Winter and spring primarily, same/less in summer
  - Snowfall has varied/may vary by location (lake effect).
- More extreme heat and precipitation events

Climate Change in the Great Lakes



Michigan and/or Great Lakes Region

- Reduced ice cover on Great Lakes
- Lower Great Lakes water levels (or same/higher in future??)
- Increased evaporation and transpiration in a warmer climate, esp. in summer, could lead to increased drought which would reduce soil moisture, surface and groundwater supplies, and river/stream and lake levels.

➢ MI – warmer and drier overall (?– may be wetter possibly)

Sources:
Mortsch et al. 2000, NAST 2000, Lofgren et al. 2002, Kling et al. 2003, Field et al. 2007, Jensen et al. 2007, Scavia 2007, Andresen et al. 2012, Winkler et al. 2012, GLISA 2012 -http://glisa.msu.edu/great_lakes_climate/background.php

Vulnerability Assessments

- Climate change impacts on species, habitats, or ecosystems
- *Which* are vulnerable to climate change
- *Why* they are vulnerable
- *Where* vulnerable in some cases

Climate Change Adaptation

- Some species/systems will be vulnerable to or impacted by climate change; others may benefit.
- Adaptation - actions designed to reduce vulnerability and help species/systems cope with or recover from climate change impacts.
- Different from mitigation – actions to reduce climate change (e.g., reduce greenhouse gases)
- Vulnerability assessments – key to adaptation efforts

Vulnerability

- “the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change” (IPCC, Füssel and Klein, 2006)
- The likelihood that climate-induced shifts will have an adverse impact on a given species, habitat, or ecosystem (Stein 2010).

Species Vulnerability Assessment

- MDNR Wildlife Division – similar vulnerability assessment
- 280 animals – Other SGCN and species of interest (e.g., game)
  - Some duplicates with MNFI
- Total (MNFI+MDNR) - 456 species
  - 395 animals
  - 61 plants

Actual Changes Seen in Michigan

Southern Species Moving North

- White-footed Mouse
- Eastern Chipmunk
- Southern Flying Squirrel
- Opossum

Northern Species Decreasing

- Woodland Deer Mice
- Least Chipmunk
- Northern Flying Squirrel
- Southern Red-backed Vole
- Woodland Jumping Mouse

Contributing Factors

- Mussels
  - Dependence on other species for propagule dispersal
- Mammals
  - Dependence on ice/snow cover
- Plants
  - Restriction to uncommon geological features
  - Reliance on interspecific interactions - fungi