



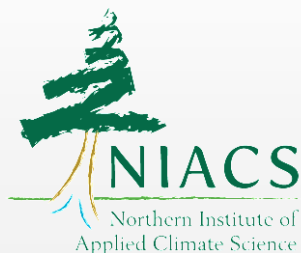
United States Department of Agriculture
Northern Forests Climate Hub

Adapting Forested Watersheds to Climate Change



Maria Janowiak & Danielle Shannon

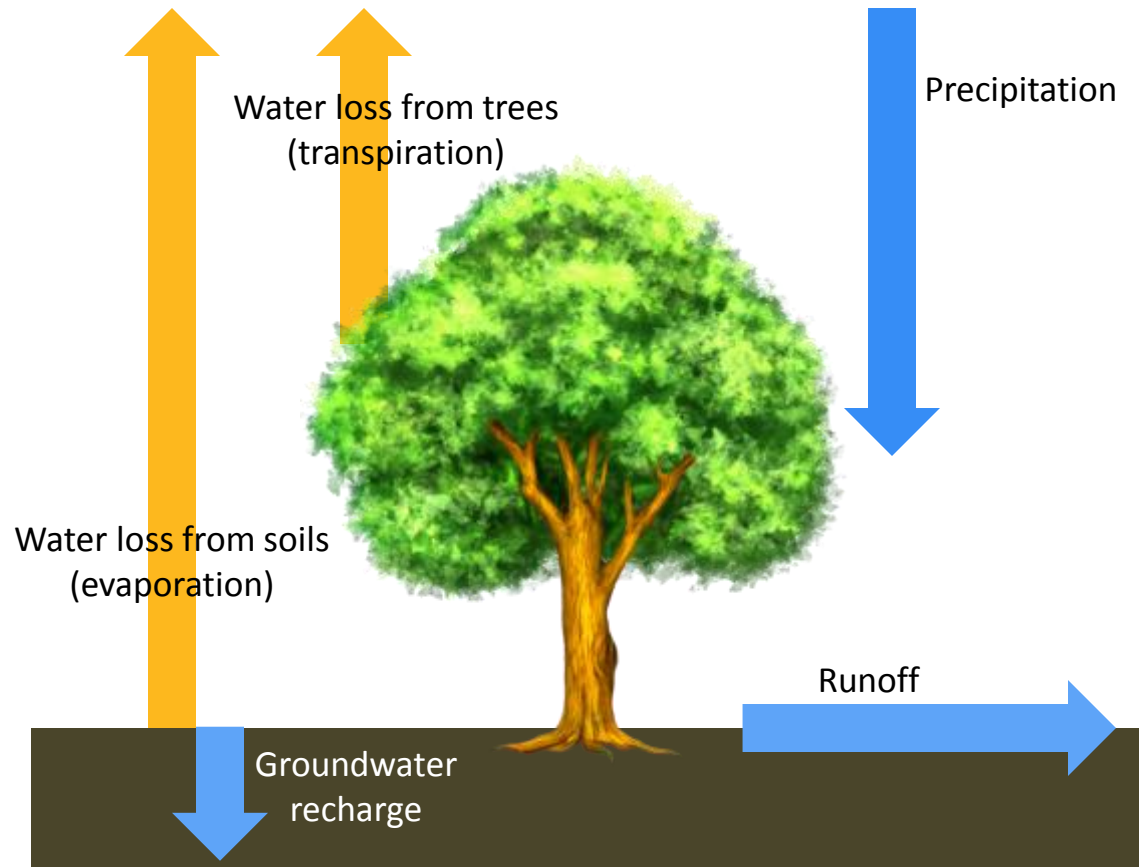
March 30, 2017



Michigan Society of American Foresters
spring meeting

Climate Change + Water

Weather & climate drive hydrology.

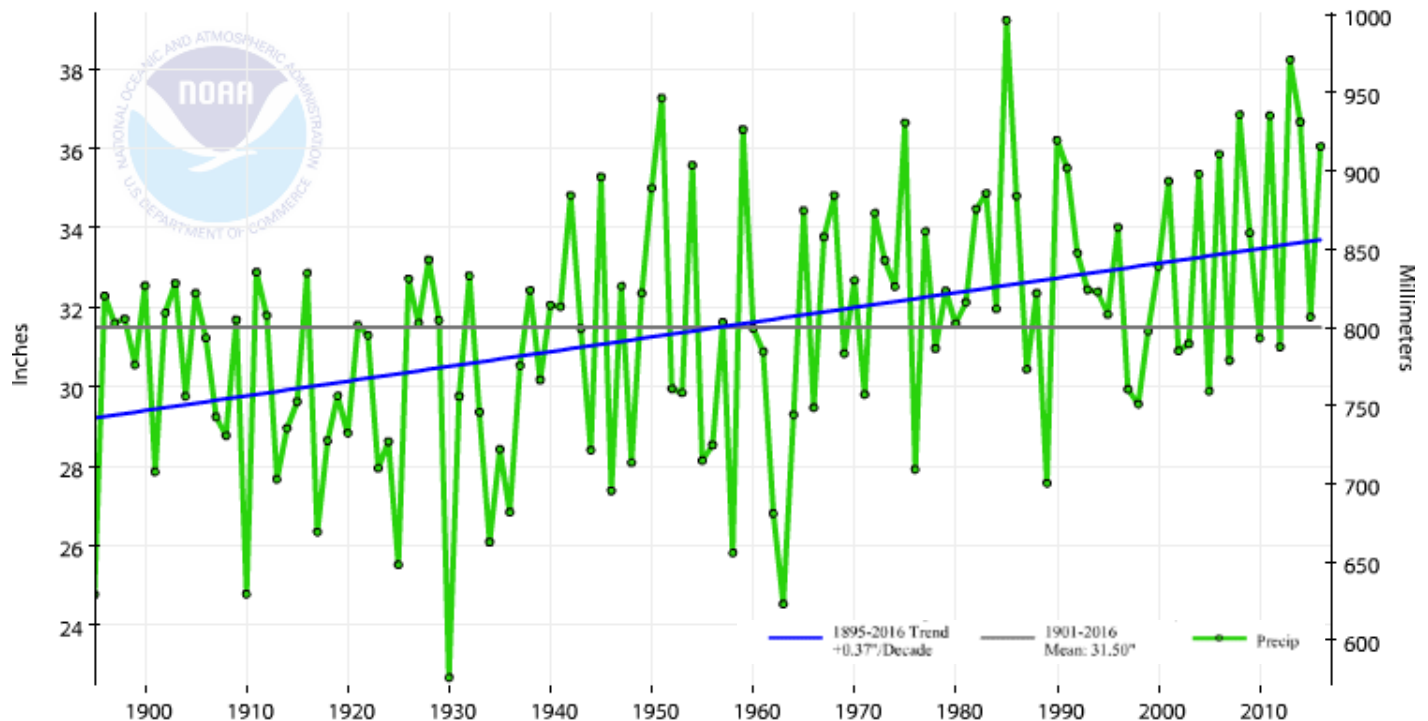


Climate Change + Water = Wetter

Observed:

- 4+ inches more annual precipitation

Michigan Annual Precipitation, 1885-2016



Climate Change + Water = Wetter

Observed:

- 4+ inches more annual precipitation
- More frequent extreme rain events

Future:

- Precip increases: annual, winter, spring, and fall
- More extreme events



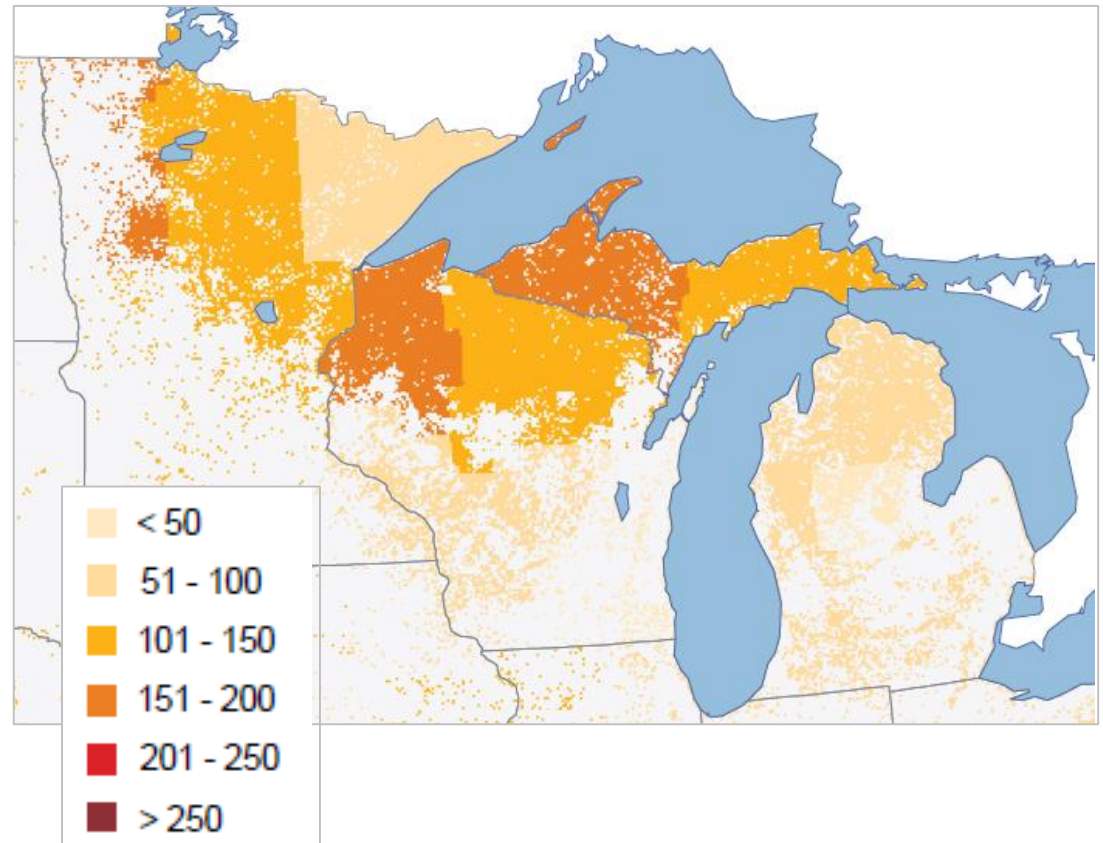
July 12, 2016
Northern Wisconsin

Climate Change + Water = **Wetter AND Drier**

Observed:

- Dry periods in some parts of Michigan

Cumulative Drought Severity Index, 1960-2013



Climate Change + Water = **Wetter AND Drier**

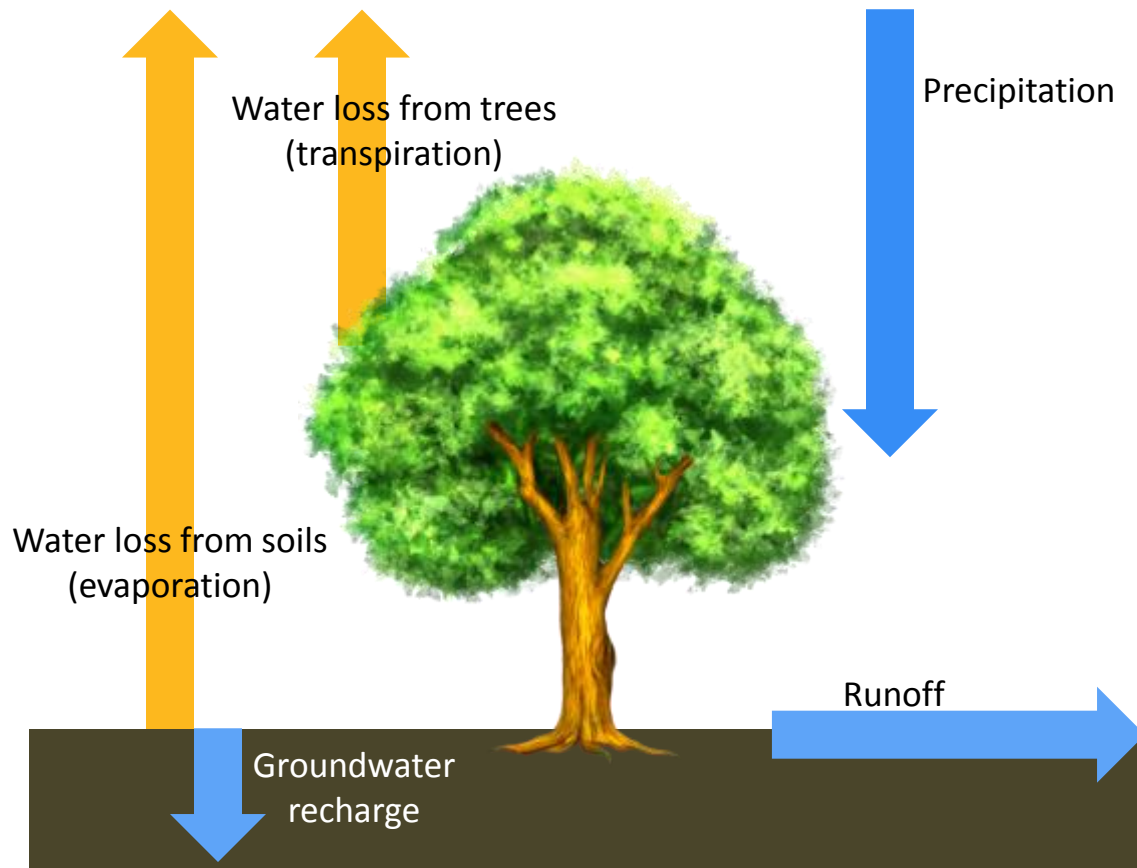
Observed:

- Dry periods in some parts of Michigan

Future

- Summer rainfall may not change much.
- Possibility of more consecutive dry days.

- Warmer temperatures dry air & soils



Climate Change + Water = **Wetter AND Drier**

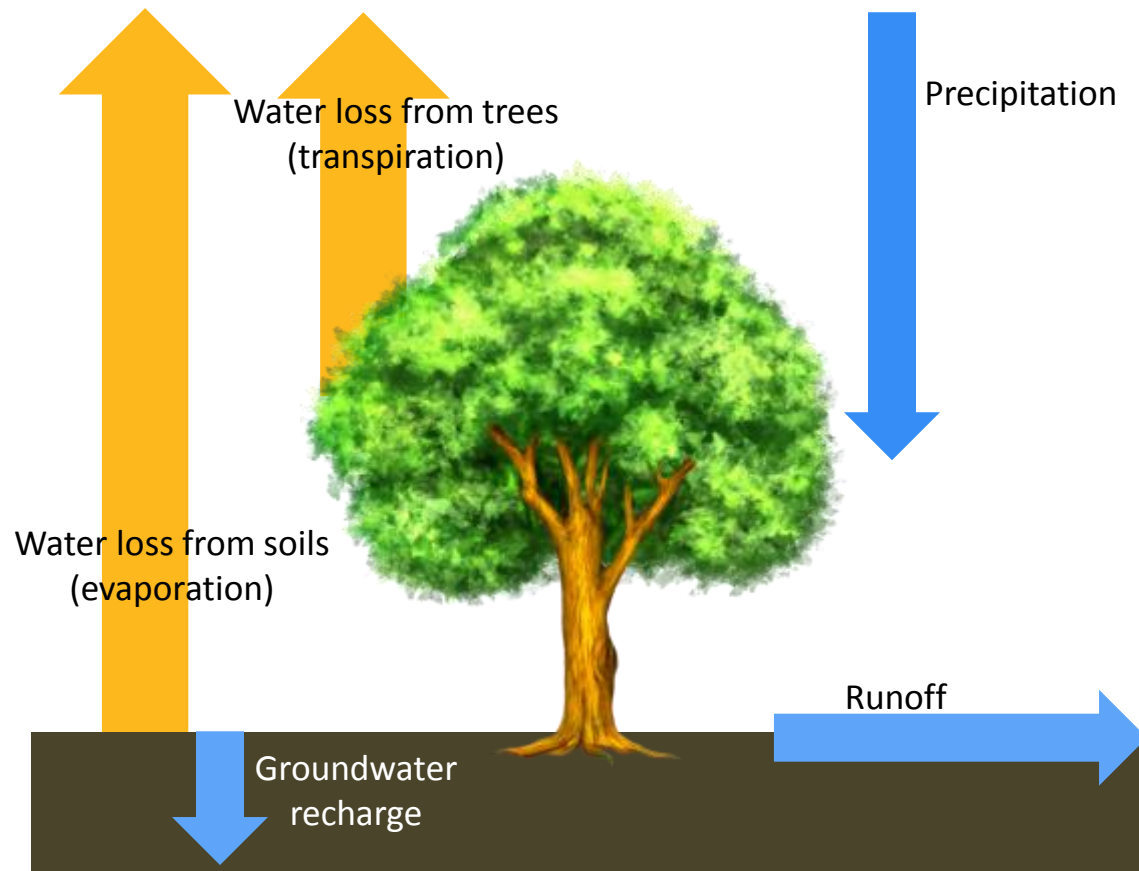
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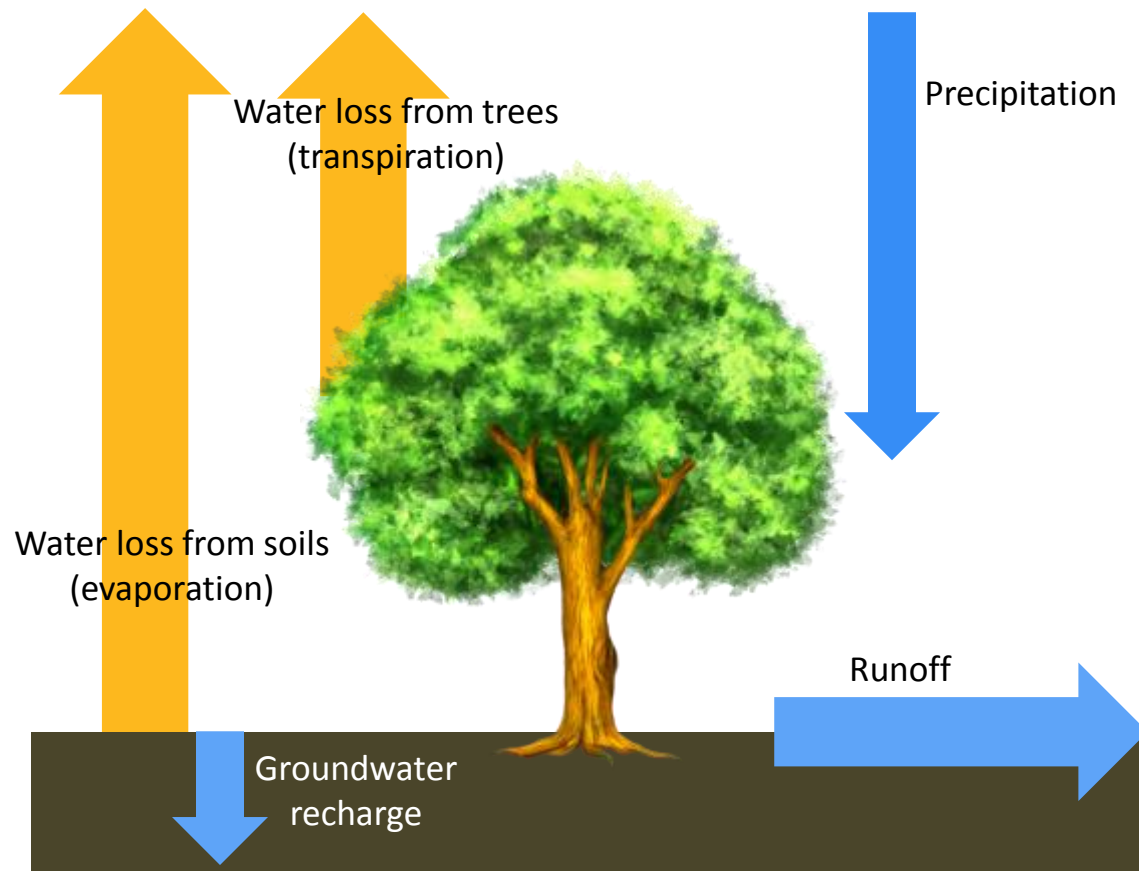
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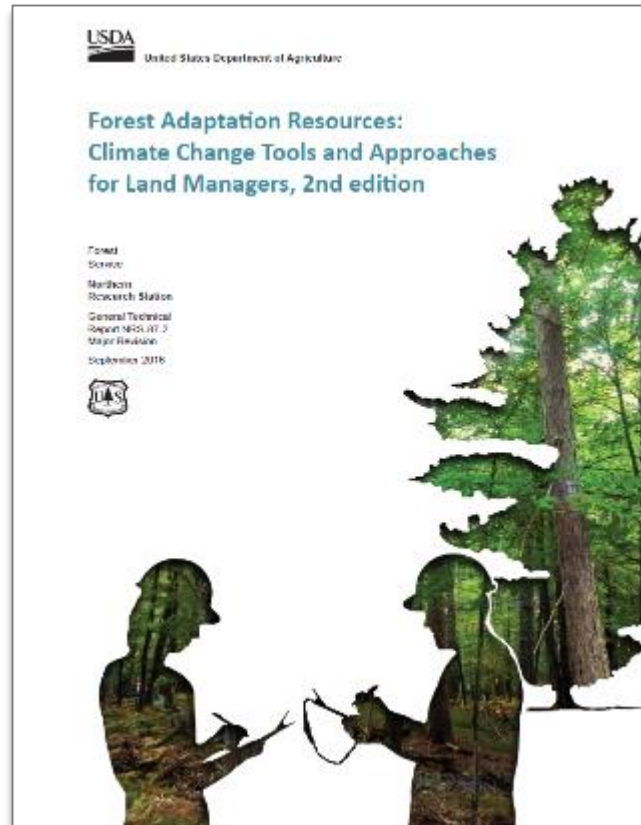
- Warmer temperatures dry air & soils
- Extreme events increase runoff

Result: Risk of moisture stress & drought



Responding to Climate Change

Creating new Adaptation Strategies and Approaches for forested watersheds



Order a copy at:
www.nrs.fs.fed.us/pubs/52760

Strategies & Approaches

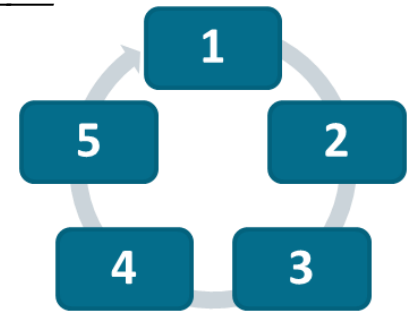
Menu of adaptation actions



Adaptation Workbook

Structured process to integrate climate change considerations into management.

- Workbook approach



Also online: AdaptationWorkbook.org

Responding to Climate Change

Creating new Adaptation Strategies and Approaches for forested watersheds

Translating **concepts** to **actions**

Options (concepts) = 3

- Resistance, Resilience, Transition

Strategies = 6

- Regionally specific conditions

Approaches = 30

- Actions for a specific ecosystem or forest type

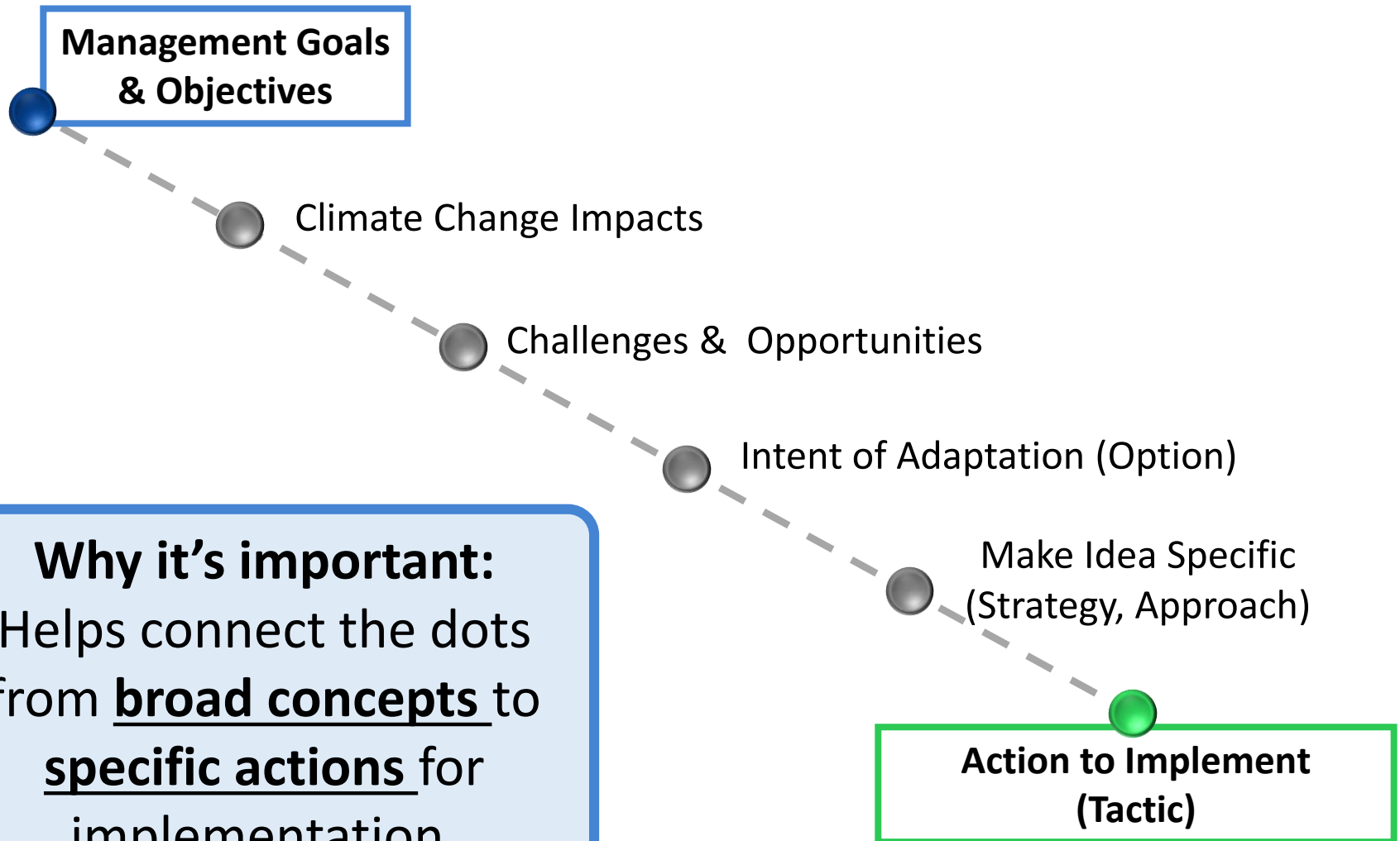
Tactics = infinite

- Prescriptions for local conditions and management objectives



Responding to Climate Change

Creating new Adaptation Strategies and Approaches for forested watersheds



Protect Soil and Water Resources

Use BMPs for Water Quality

- Maintain infiltration and water storage capacity of soils (1.1)
- Protect hydrologic function of forested wetlands (1.5)
- Reduce soil erosion and sediment loading (2.3)
- Reduce overland flows (5.5)
- Minimize road infrastructure on the landscape (6.2)

Impacts addressed:

- Altered precipitation
- Extreme precipitation
- Flooding



Restore Channel Connectivity

Improve Road Crossings

- Restore hydrologic connectivity (1.2)
- Moderate stream temperature increases (2.1)
- Restore stream channel form and function – mimics natural channel design (1.3)
- Reduce negative effects of flooding and extreme high flows (5.4)
- Stronger and more robust infrastructure (6.1)

Impacts addressed:

- Warmer air and water temperatures
- Altered precipitation
- Extreme precipitation
- Flooding
- Altered streamflows



Restore Natural Stream Channels

Improve Road Crossings – Removal

- Connectivity, natural flows *(1.2, 1.3)*
- Remove road infrastructure and readjust system *(6.4)*

Impacts addressed:

- Warmer air and water temperatures
- Altered precipitation
- Extreme precipitation
- Flooding
- Altered streamflows



Maintain Forest and Vegetative Cover

Ensure Vegetative Cover

- Maintain forest and vegetative cover in uplands, wetlands, and riparian areas (3.1)
- Revegetate areas after disturbance (3.2)
- Prevent invasive species establishment (3.3)
- Enhance species and structural diversity in forests (3.5)

Impacts addressed:

- Warmer temperatures
- Altered precipitation
- Altered streamflows
- Extreme events
- Changes in tree species distribution
- Enhanced forest stressors



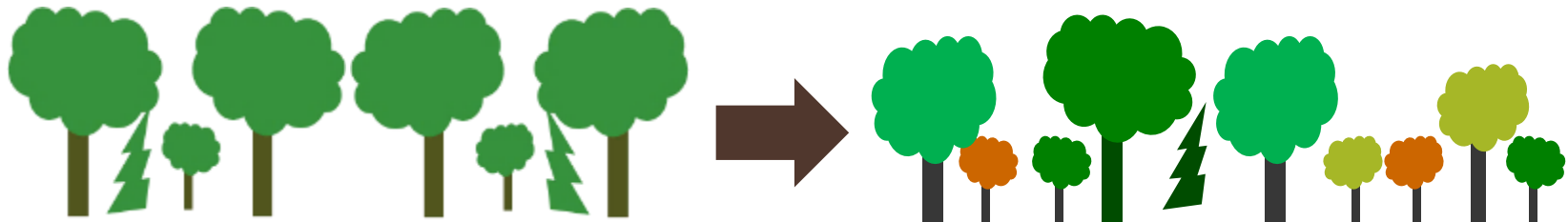
Promote Healthy Forests

Adapt Forests to Changing Conditions

- Favor native species expected to be adapted to future conditions (4.1)
- Encourage new mixes of native species (4.2)
- Disfavor species that are maladapted (4.3)
- Introduce species that are expected to be adapted to future conditions (4.5)

Impacts addressed:

- Warmer temperatures
- Altered precipitation
- Changes in tree species distribution
- Enhanced forest stressors



Promote Healthy Riparian Areas and Wetlands

Adjust Management to Changing Conditions

- Protect forested wetland function (1.5)
- Moderate stream temperature increases (2.1)
- Protect sensitive and unique habitats (3.4)
- Adapt forests to new or changing water levels (4.6)

Impacts addressed:

- Warmer air and water temperatures
- Altered precipitation
- Altered streamflows
- Extreme events
- Changes in tree species distribution
- Enhanced forest stressors



Promote Healthy Riparian Areas and Wetlands

Integrate Forest and Water Management

- Protect forested wetland function (1.5)
- Moderate stream temperature increases (2.1)
- Adapt forests to new or changing water levels (4.6)

Impacts addressed:

- Warmer air and water temperatures
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Promote Healthy Forest Wetlands

Integrate Forest and Water Management

- Protect forested wetland function (1.5)
- Moderate stream temperature increases (2.1)
- Adapt forests to new or changing water levels (4.6)

Impacts addressed:

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Next Steps

Adaptation Strategies and Approaches for Forested Watersheds!

Develop menu

- ✓ Literature review
- ✓ Testing workshop – Midwest (Mar 15-16)
- Testing workshop – Northeast (Apr 4-5)
- Additional comments
- Peer review & publication

Help Support Managers

- Create more Adaptation Demonstrations
- Training workshops



Details at:

www.forestadaptation.org/water



Thank you!

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