Adapting farms to weather extremes and climate uncertainty

December 20th, 2016

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Northeast, Midwest, Northern Forests
Natural Resources Conservation Service
Agriculture Research Service
U.S. Forest Service

Dan Dostie, NRCS Project Liaison

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Adapting Farms to Weather Extremes and Climate Uncertainty

Presentation Topics:

1. New Resources for Climate Adaptation Assistance
2. Planning Adaptive Management Contingencies
   A. Climate Considerations & Effects
   B. Climate Adaptation Responses
3. Adaptation Workbook & Emerging Decision Support Tools

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Adaptation Resources for Agriculture:

Responding to Climate Variability and Change in the Midwest and Northeast

U.S. Department of Agriculture, Washington, DC, Technical Bulletin 1944, October 2016

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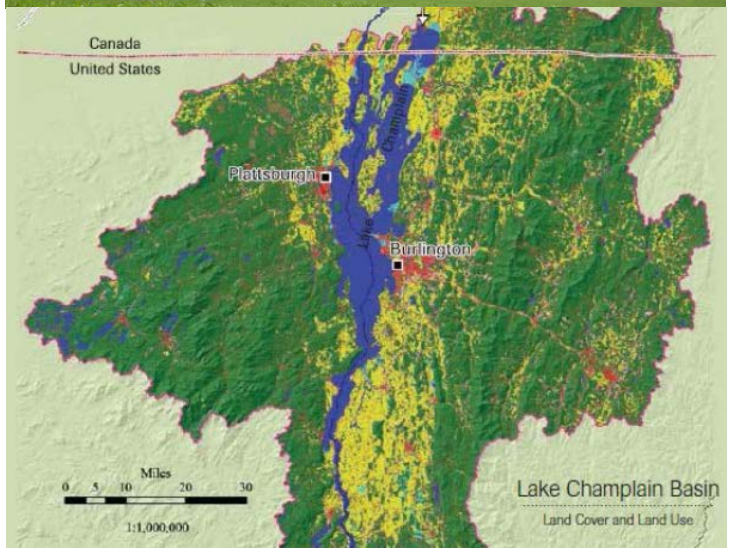
About Adaptation Resources for Agriculture:

- For **educators**, conservationists, advisors, farm owners, **operators**
- **Farm** or **Area** wide scale, **NOT** state or national policy scale
- Broad ecological site and planning **considerations**
- **NOT** financial, legal, market, human resource considerations



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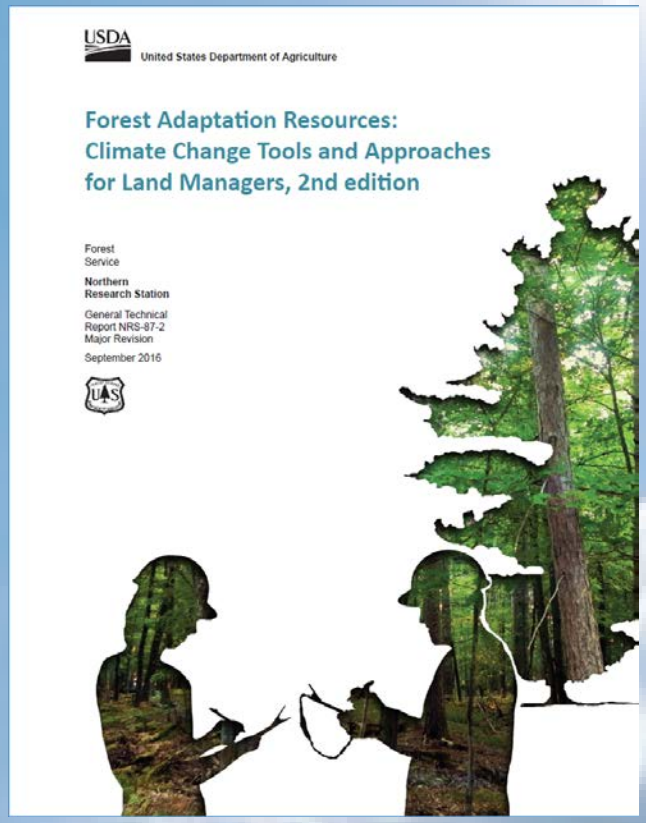
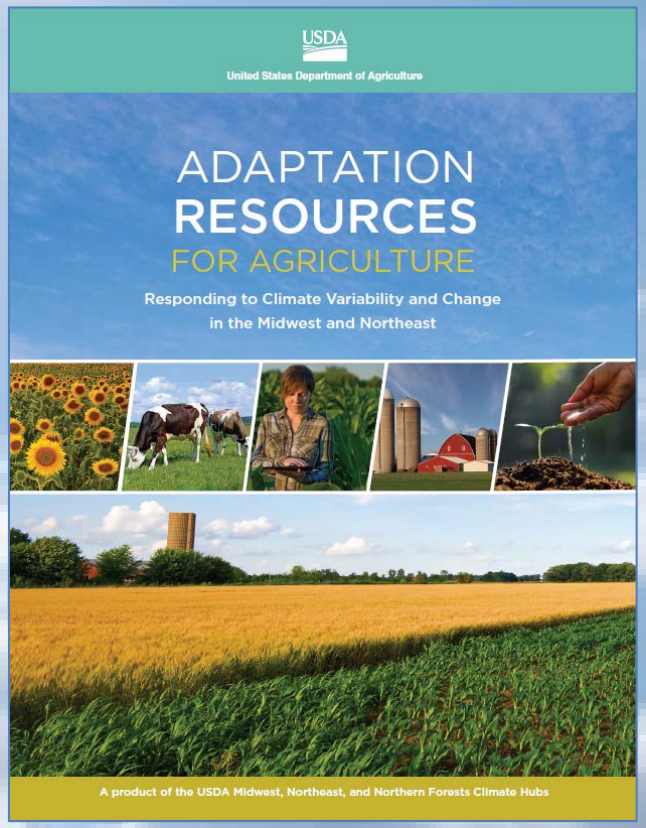
Focus: Midwest & Northeast

New Adaptation Resources in 2016:





Visit www.climatehubs.oce.usda.gov and look for "Adaptation Assistance"

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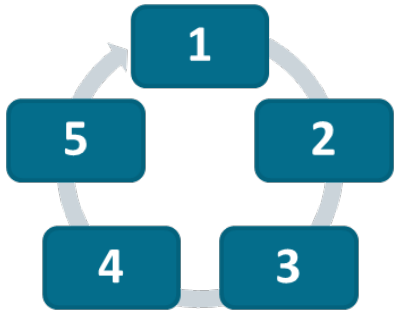
Adaptation Resources

Strategies & Approaches

Menu of adaptation actions

Adaptation Workbook

- Structured process to integrate climate change considerations into management
- Workbook approach



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Adaptation Resources

- **Does NOT provide specifications**
- Supports planning processes for production and conservation
- Flexible **Adaptation Workbook** process can be used in any location
- Menus of regionally-relevant adaptation **strategies and approaches**
- **Real-world examples : 180+ forest demonstrations; tested for agriculture**

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About Adaptation Resources for Agriculture:

Contents:

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Adaptation Workbook

1. Where are you and what do you care about?

2. How is that particular place vulnerable to climate change?

3. What challenges or opportunities does climate change present?

4. What actions can help systems adapt to change?

5. What data will show whether those actions were effective?

Resource: Climate Change Assessments

Resource: Adaptation Strategies & Approaches

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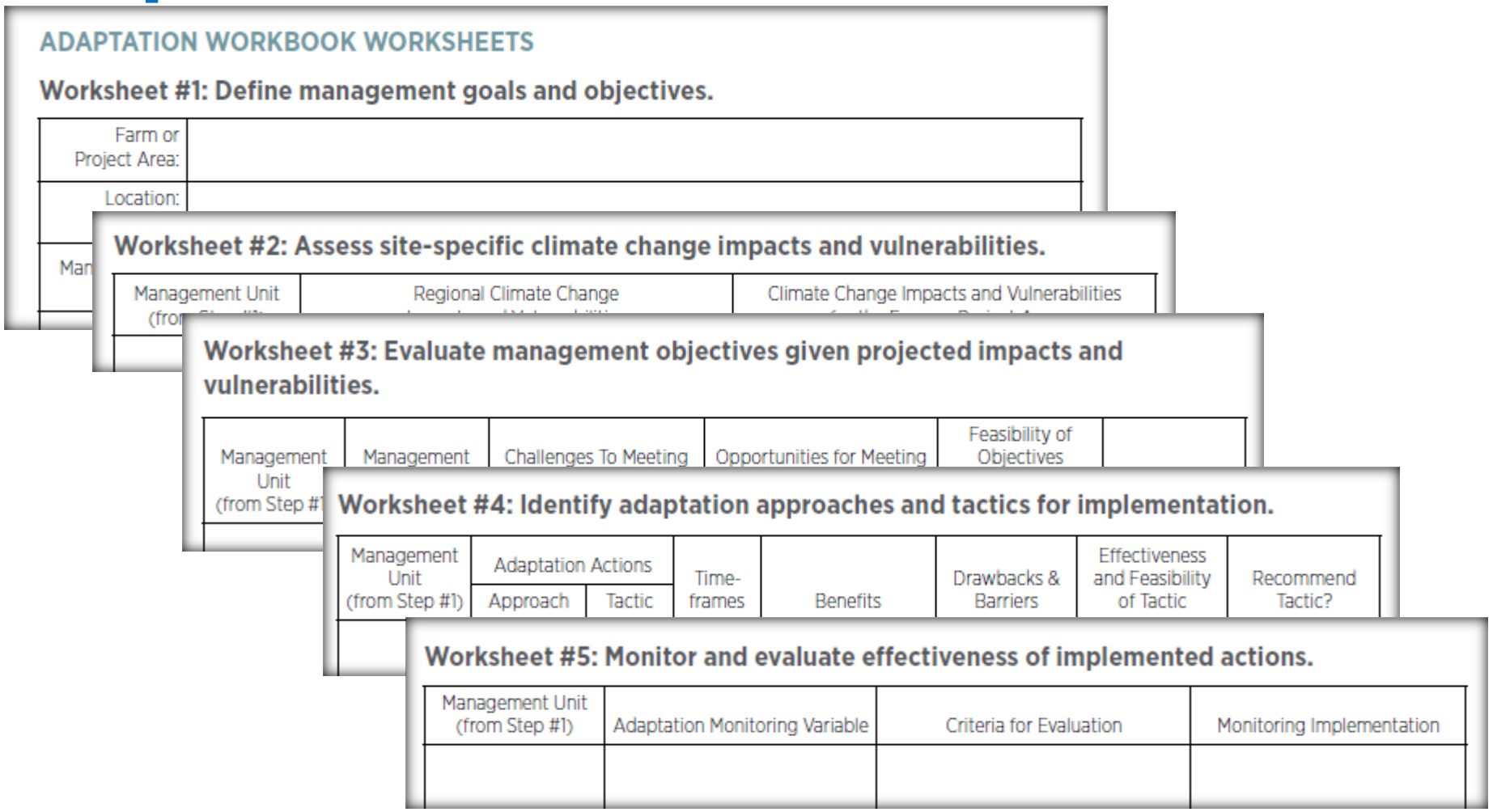
Adaptation Workbook



ADAPTATION WORKBOOK WORKSHEETS

Worksheet #1: Define management goals and objectives.

Farm or Project Area:	
Location:	

Worksheet #2: Assess site-specific climate change impacts and vulnerabilities.

Management Unit (from Step #1)	Regional Climate Change	Climate Change Impacts and Vulnerabilities

Worksheet #3: Evaluate management objectives given projected impacts and vulnerabilities.

Management Unit (from Step #1)	Management	Challenges To Meeting	Opportunities for Meeting	Feasibility of Objectives	

Worksheet #4: Identify adaptation approaches and tactics for implementation.

Management Unit (from Step #1)	Adaptation Actions		Time-frames	Benefits	Drawbacks & Barriers	Effectiveness and Feasibility of Tactic	Recommend Tactic?
	Approach	Tactic					

Worksheet #5: Monitor and evaluate effectiveness of implemented actions.

Management Unit (from Step #1)	Adaptation Monitoring Variable	Criteria for Evaluation	Monitoring Implementation

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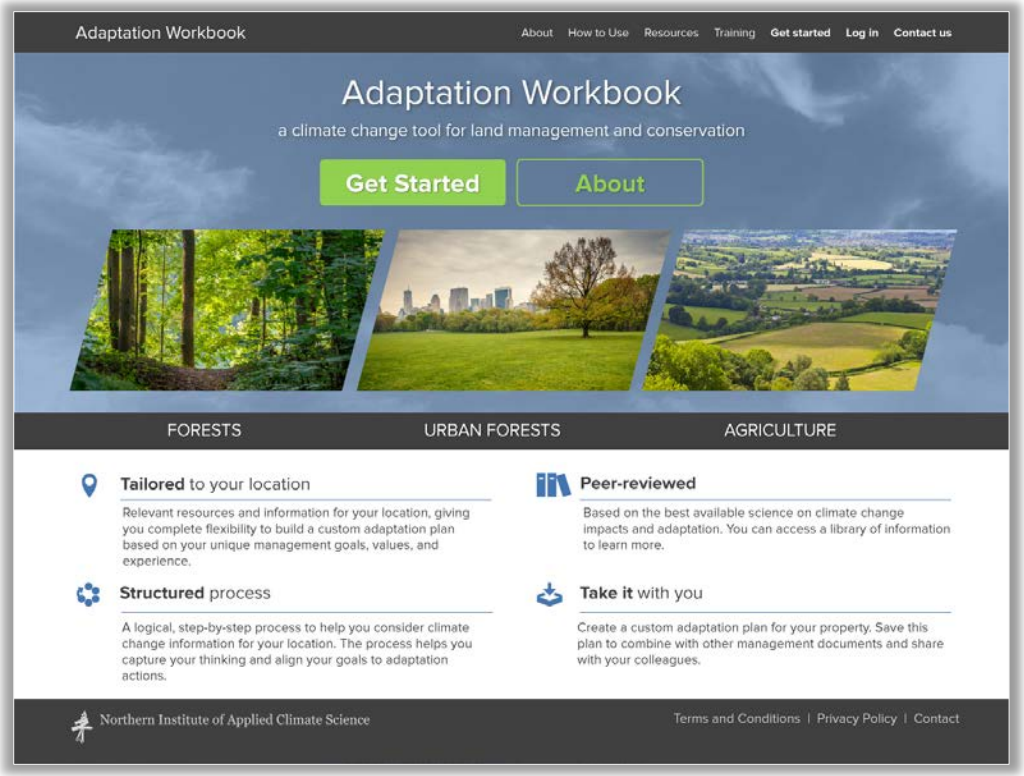
Coming soon! Online Workbook

Currently available for forest ecosystems.

Expanded features for agriculture and urban forests will be available in January 2017!



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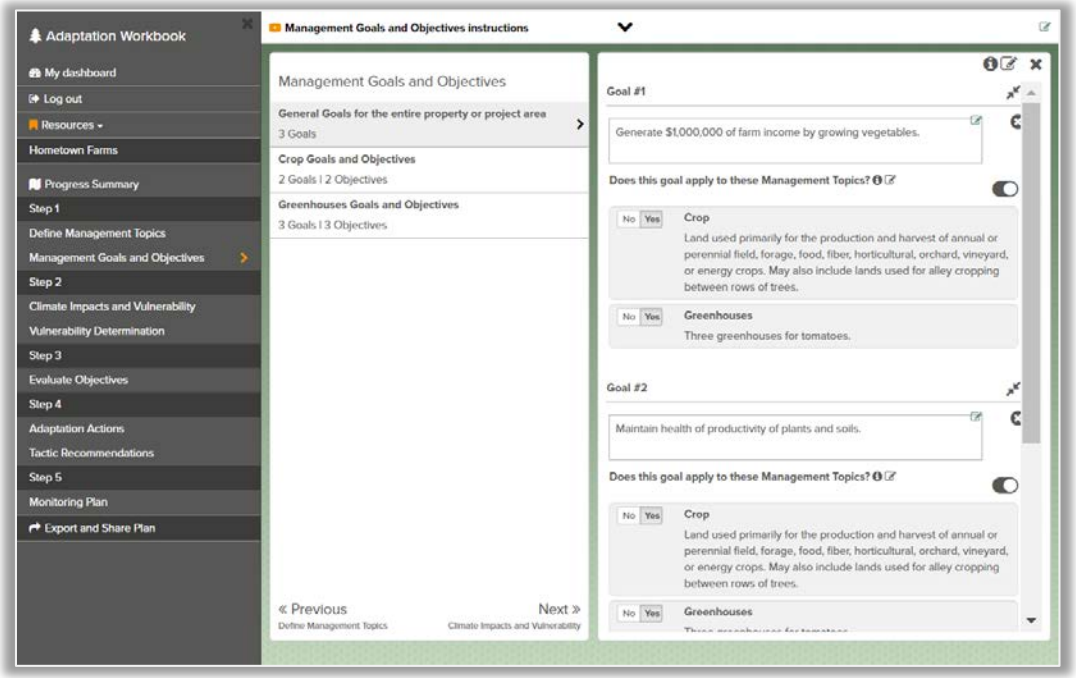
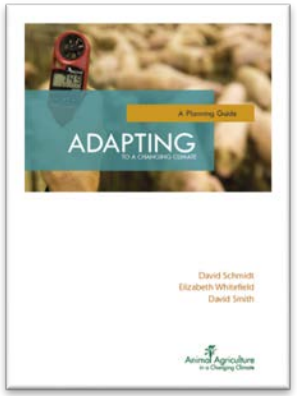
Coming soon! Online Workbook

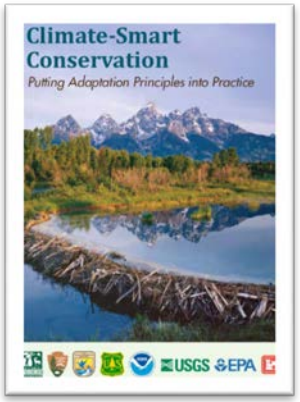
- Structured planning process.
- Integrates climate change information from NCA and other resources.
- Generates report supporting adaptation.

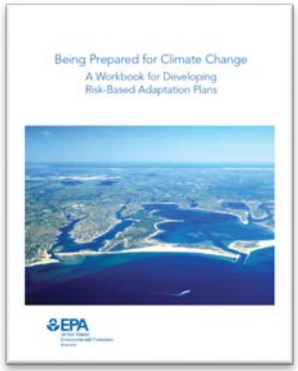


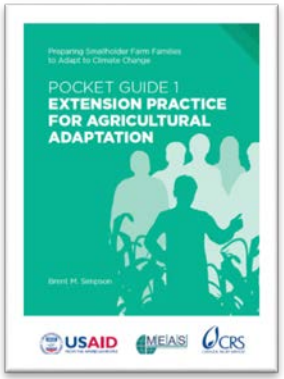
Other Adaptation Resources:

- Different perspectives
- Animal Ag, Wildlife, Estuaries, & International Development Smallholders
- A variety of land owners with diverse goals
- Summarizing information and help accessing decision tools



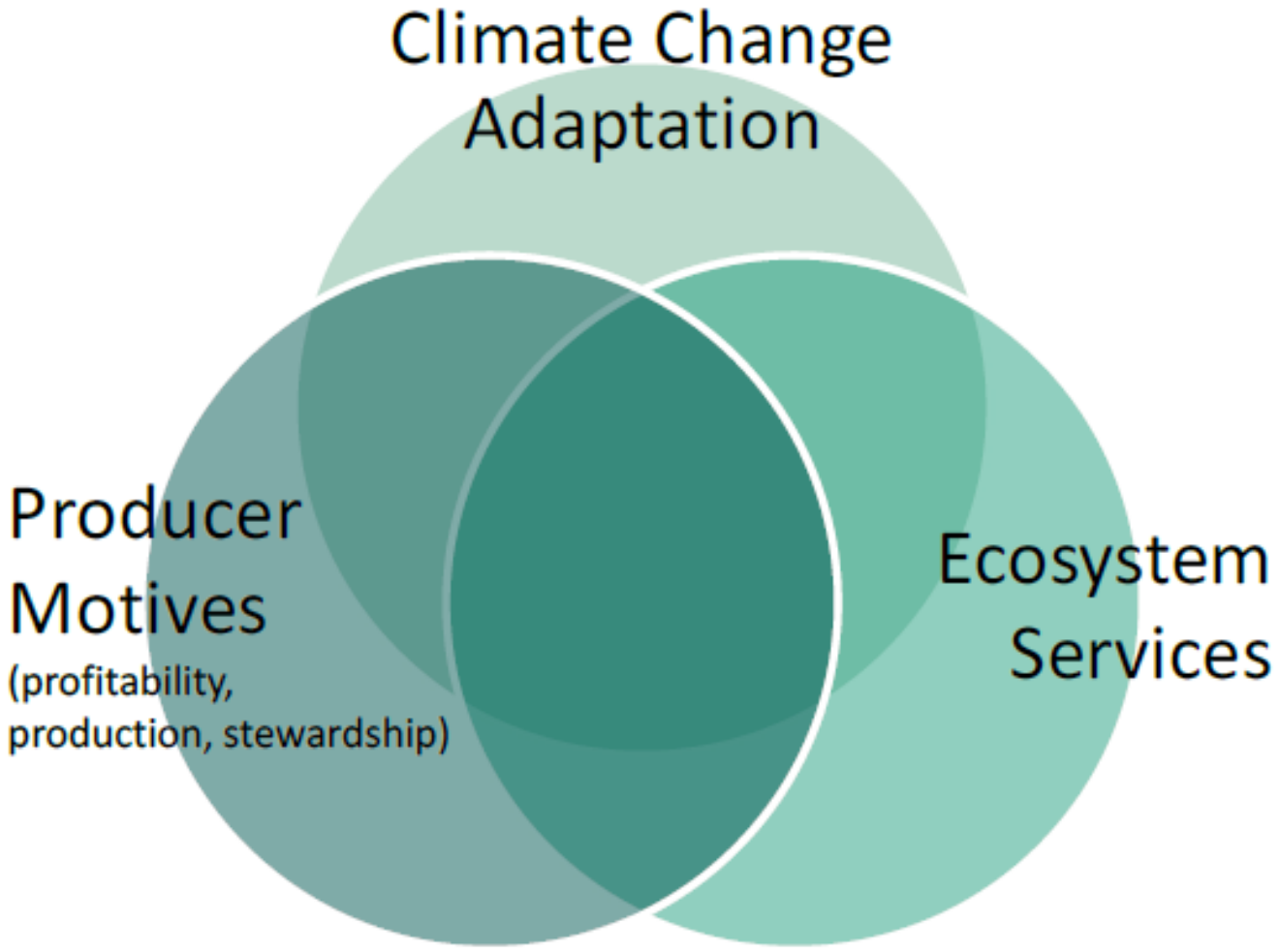






Planning Adaptive Management Contingencies, Part One:

Planning Considerations for extreme, variable, and uncertain weather and climate



Consider "Win-Win-Win" opportunities

Parry et al. 2007, SCBD 2009, Groves et al. 2010

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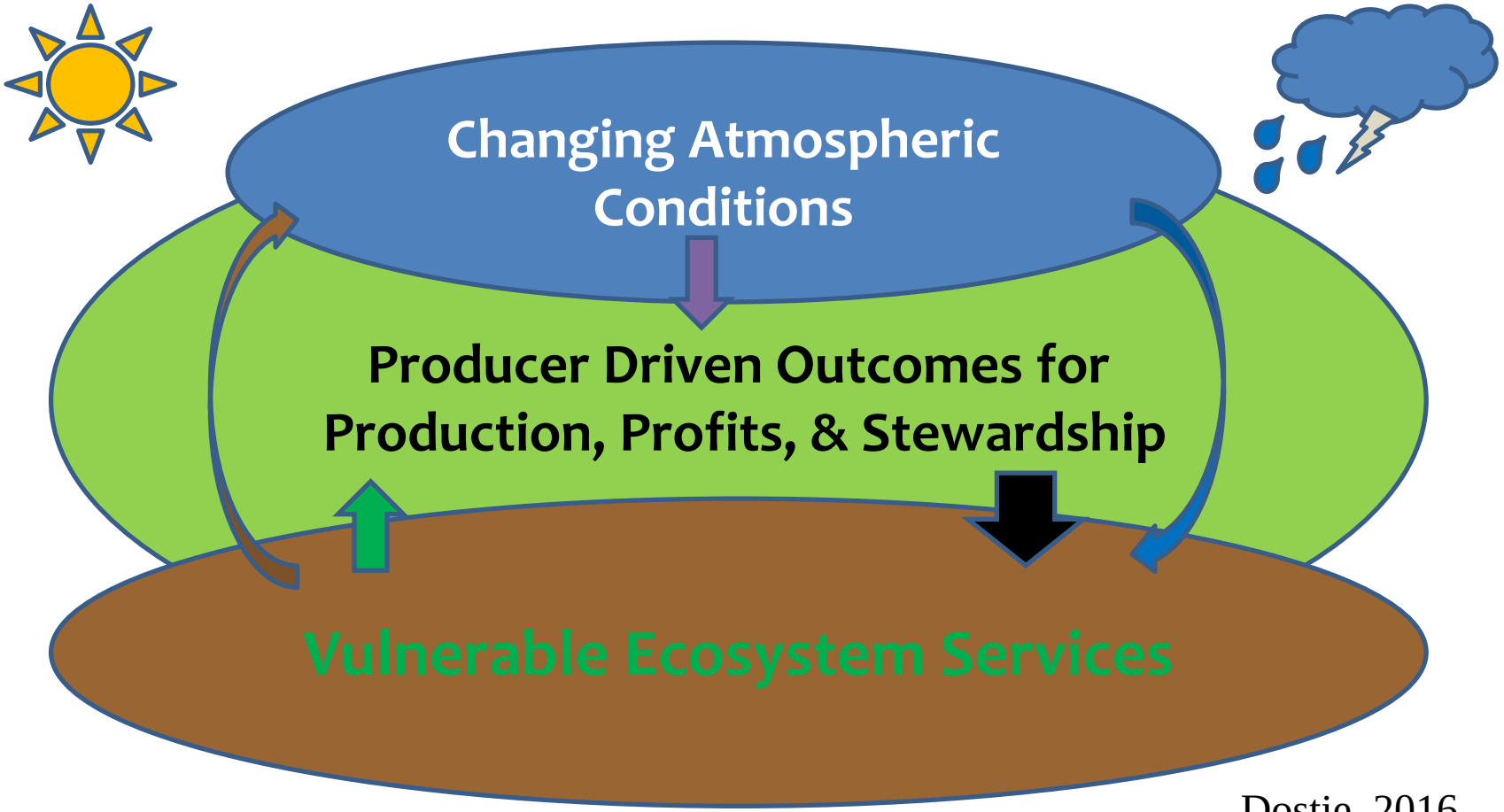
Considerations and Effects



Dostie, 2016

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What is changing in the Midwest and Northeast?

- **Annual average temperatures will continue to warm**
  The annual average temperature may be 3 – 6 °F higher by mid-century (2041-2070) than it was in the late 20th century (1971-2000).
- **Heat waves and intensity will continue to increase**
  especially in summer.
- **Annual precipitation amounts will continue to increase**
  especially in winter and spring.
- **Precipitation events will be heavier with longer dry spells**
- **The growing season will be longer . . .**

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Weather and a Changing Climate

Weather consists of the hourly and day to day **variations** in meteorological conditions in the atmosphere:

- Precipitation
- Temperature
- Relative Humidity
- Wind
- Cloudiness & Solar Radiation

Climate is average weather conditions in given locations over longer periods of time influencing:

- Types of crops grown, yield potential, insects, diseases, weeds
- Types of livestock, native plants & animals suitable to an area
- Design of buildings, watering systems, other infrastructure
- Naturally variable, averages can change over time

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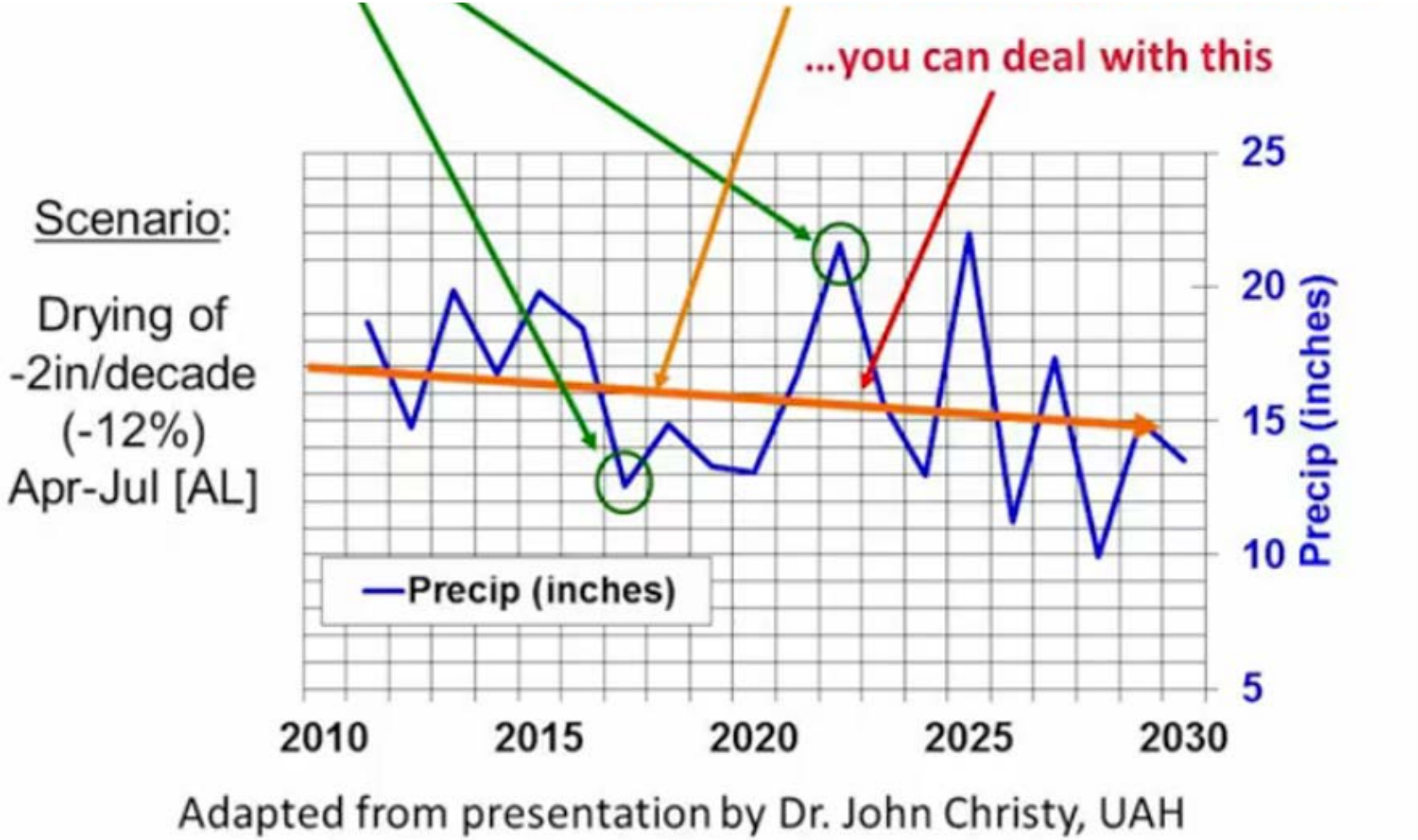
Prepare for extremes



Adapted from presentation by Dr. John Christy, UAH

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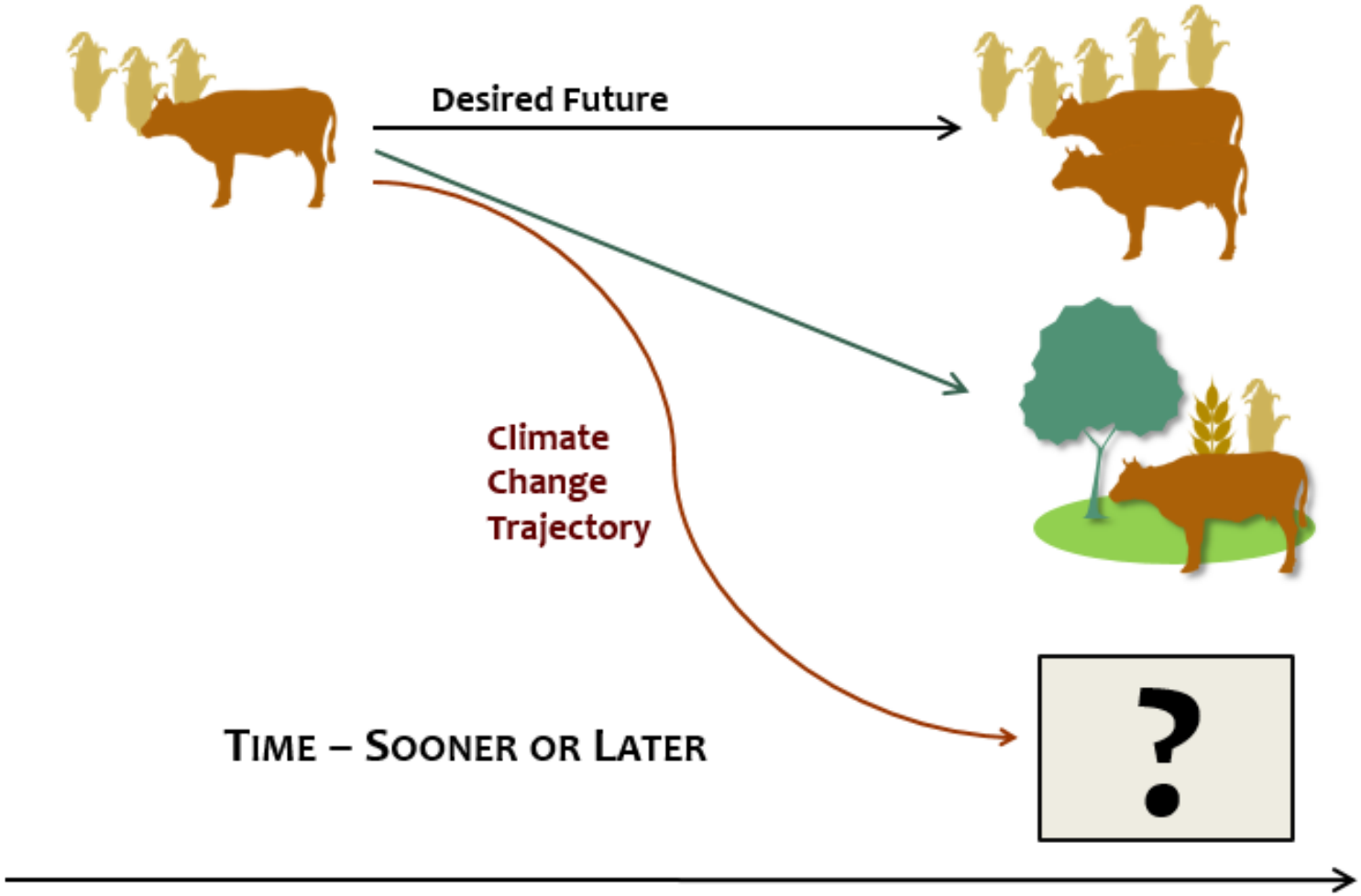
Consider the uncertainty of the future



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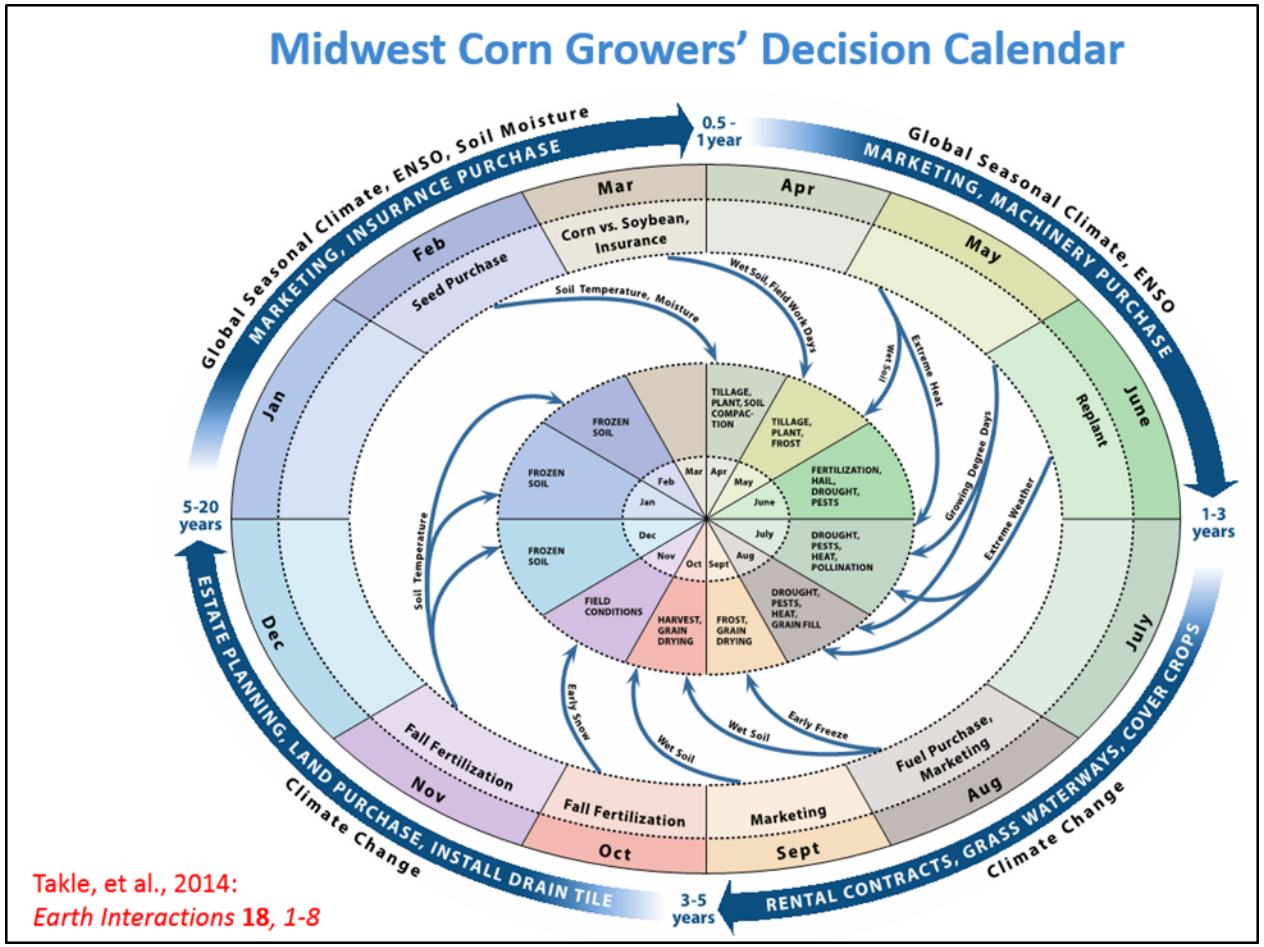
Consider Planning Horizons



Takle, et al., 2014:
Earth Interactions **18**, *1-8*

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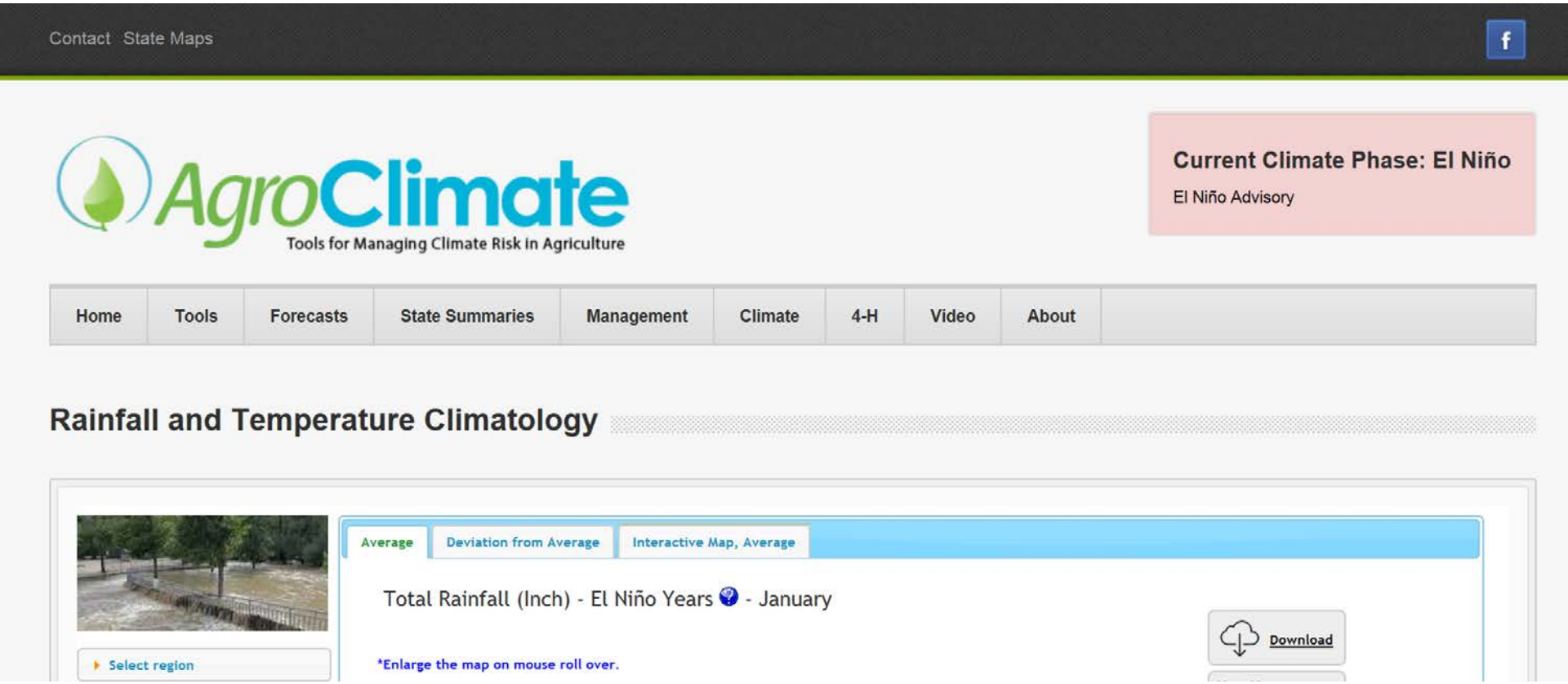
Use Climate Services to Make Considerations Relevant



Pests & Invasives

Natural System Dynamics

Fertility Management

Crop Yield & Revenue Goals

Soil Health

Past Management History

Business Requirements

Wildlife Habitat & Recreation

A Changing Climate

And more!!

Environmental Outcomes

Regulations and Neighbor Relations

Climate change may not be an explicit consideration

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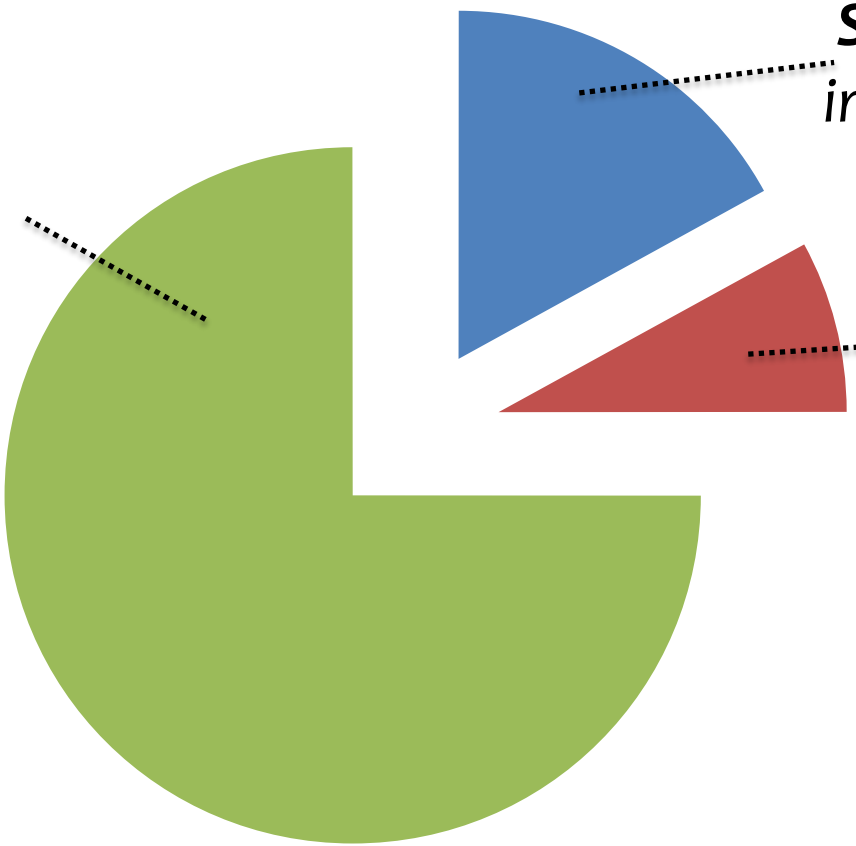
Current management may be fine

Same actions– *climate change just makes them that much more important*

Small "tweaks" *that improve effectiveness*



New & different *actions to consider, even some that may seem* ***wild & crazy***

**individual results will vary*

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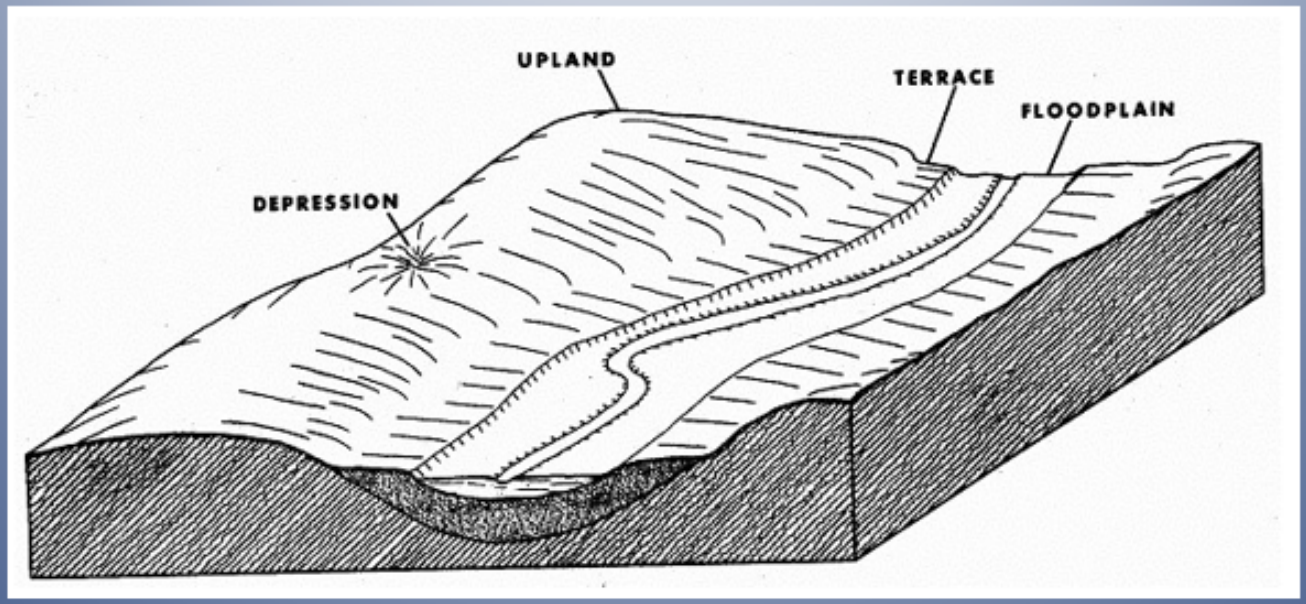
Consider Site Conditions



- landscape positon and proximity to water
- inherent soil properties
- plant community composition and structure
- adjacent plant and animal communities

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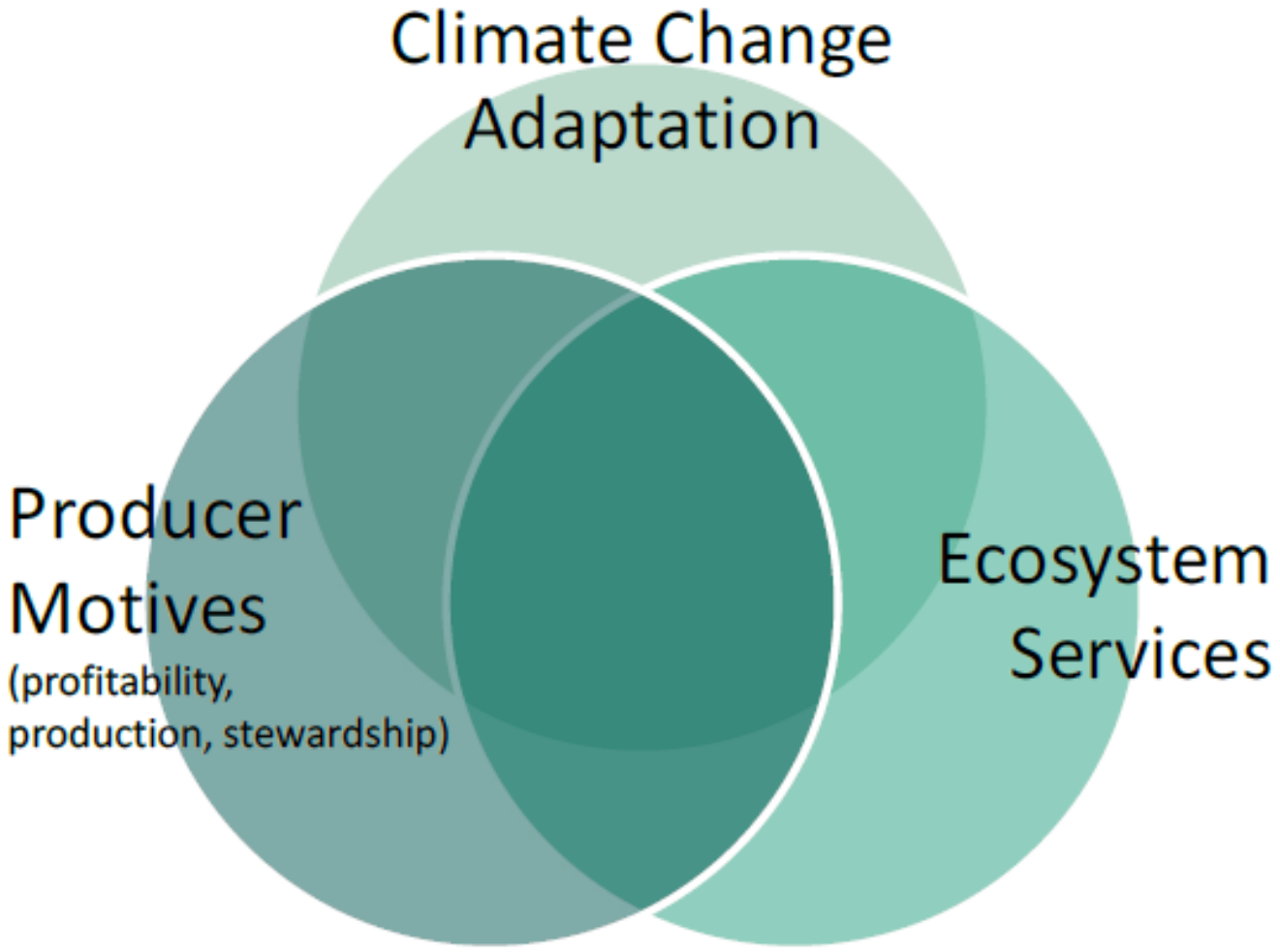
Consider mitigation opportunities

Adaptation and Mitigation are connected . . .

Adapting today without mitigating impacts on tomorrow increases the future cost of adaptation



Consider "Win-Win-Win" opportunities

Parry et al. 2007, SCBD 2009, Groves et al. 2010


Planning Adaptive Management Contingencies, Part Two:
Regional Tiered Menu of Adaptation Responses

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About the Adaptation Strategies and Approaches Menu

- Translates broad **concepts** into specific **actions**
- A full spectrum of possible adaptation **responses:**
  - Adaptation **strategies**
  - Adaptation **approaches**
  - Adaptation **tactics**
- Provides the **rationale** for making decisions

Two Broad Options

Manage for Change:
System fundamentally becomes something different

Manage for Persistence:
Still be recognizable as being the same system

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Adaptation Strategies

Forestry

1. Sustain fundamental ecological functions.
2. Reduce the impact of existing biological stressors.
3. Protect forests from severe fire and wind disturbance.
4. Maintain or create refugia.
5. Maintain and enhance species and structural diversity.
6. Increase ecosystem redundancy across the landscape.
7. Promote landscape connectivity.
8. Enhance genetic diversity.
9. Facilitate community adjustments through species transitions.
10. Plan for and respond to disturbance.

Agriculture

1. Sustain fundamental functions of soil and water.
2. Reduce existing stressors of crops and livestock.
3. Reduce risks from warmer and drier conditions.
4. Reduce the risk and long-term impacts of extreme weather.
5. Manage farms and fields as part of a larger landscape.
6. Alter management to accommodate expected future conditions.
7. Alter agricultural systems or lands to new climate conditions.
8. Alter infrastructure to match new and expected conditions.

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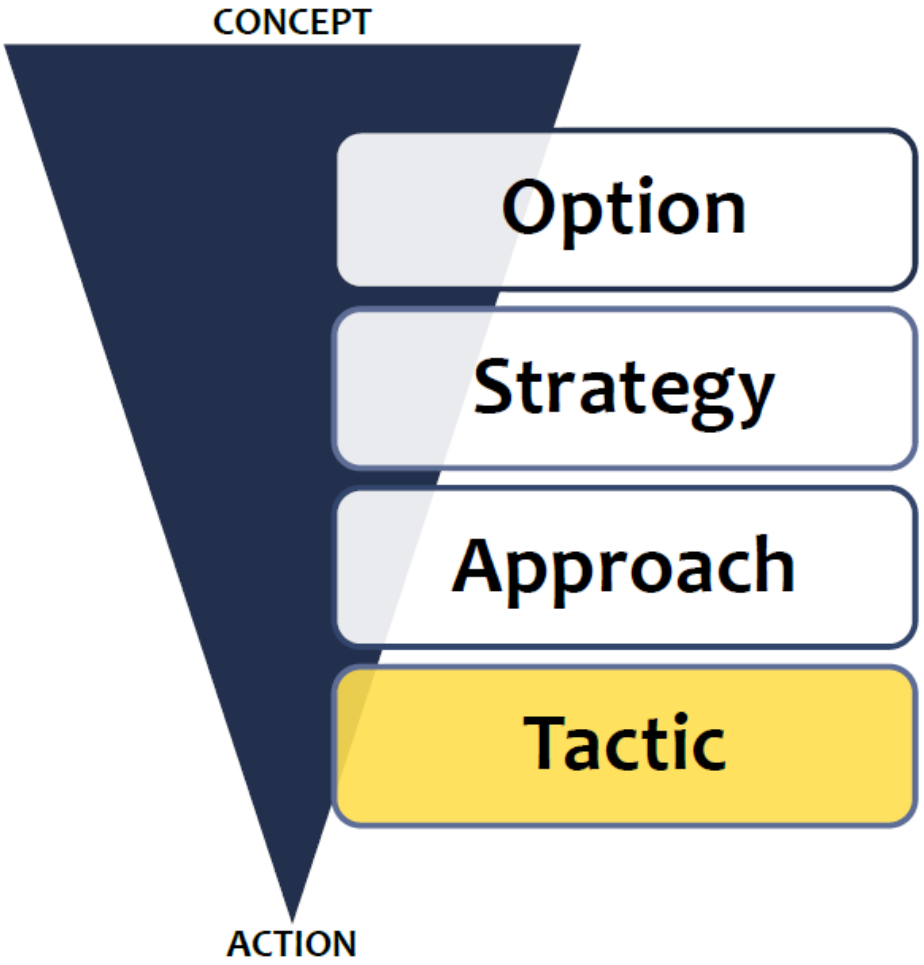
Different Approaches for Different Types of Agriculture

Tactics



Prescriptive actions selected by producer that are designed for individual site conditions and management objectives

Actions are monitored and evaluated to inform future decisions

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Many Tactics. . .

Strategy 1: Sustain fundamental functions of soil and water.

Approach 1.1: Maintain and improve soil health for field crop, forage, vegetable, and small fruit production, establishment and management of pastures, orchards, vineyards, or tree plantations.

Example Adaptation Tactics
For soil disturbing activities:
Minimize soil disturbance by avoiding or reducing tillage for planting, weed control, or other purposes
Provide nearly year-round ground cover of residue or plants to reduce soil exposure to erosive forces
Grow plants and add organic amendments to increase soil organic matter and improve physical soil qualities
Diversify crop rotations to improve soil life and address threats from disease, weed, and insect pests.
Shift planting dates to avoid field operations during wet conditions
Control vehicle traffic to minimize soil compaction by equipment
Integrate grazing to further improve soil biology
Consider windbreaks where soil erosion by wind is a concern
Additional example tactics for established pastures or other perennial crop land use systems:
Manage grazing rest periods, stocking densities, and rotational intensity
Manage rates and timing of harvesting hay, biomass, or other similar herbaceous perennial crops

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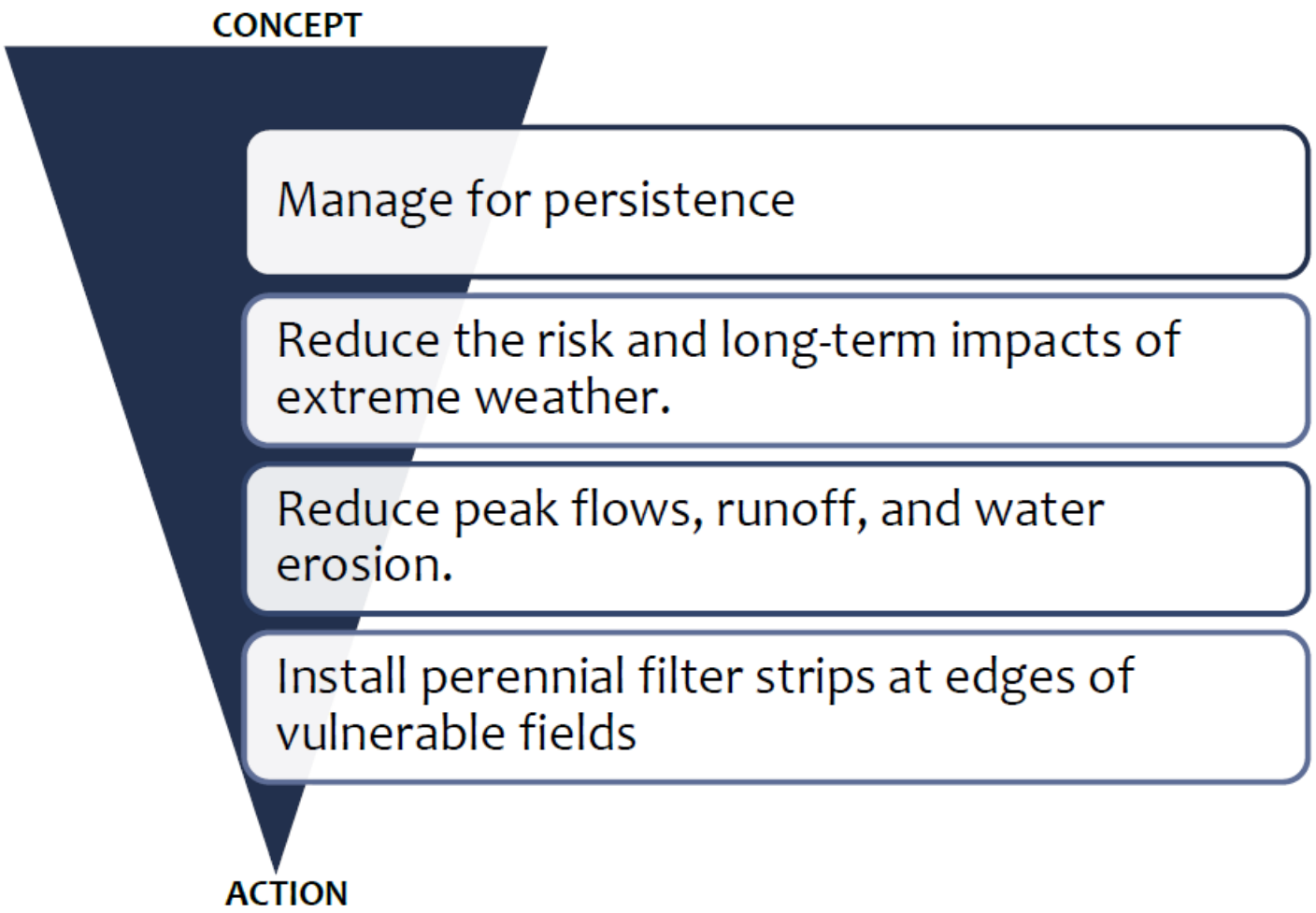
Manage for Persistence



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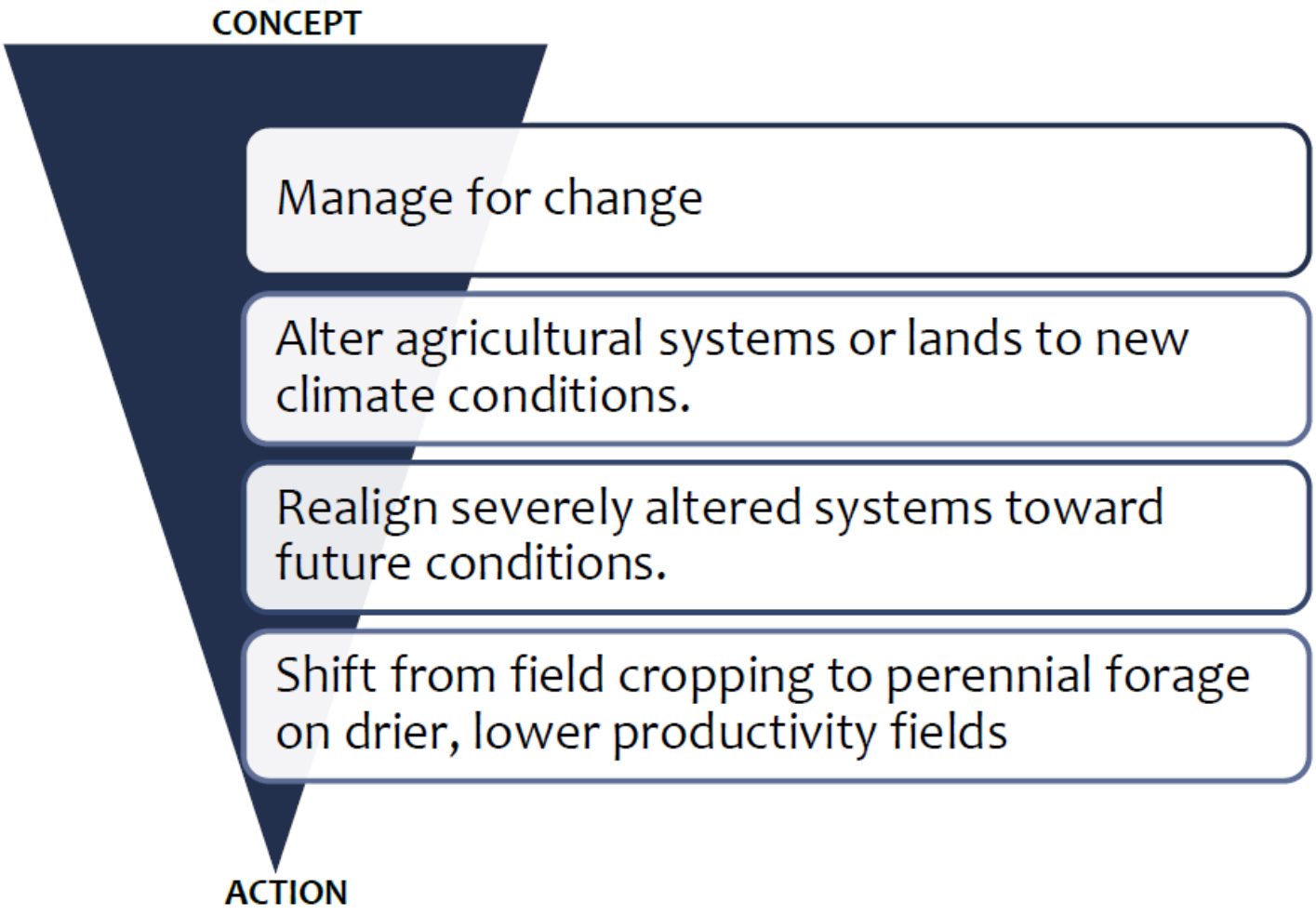
Manage for Change



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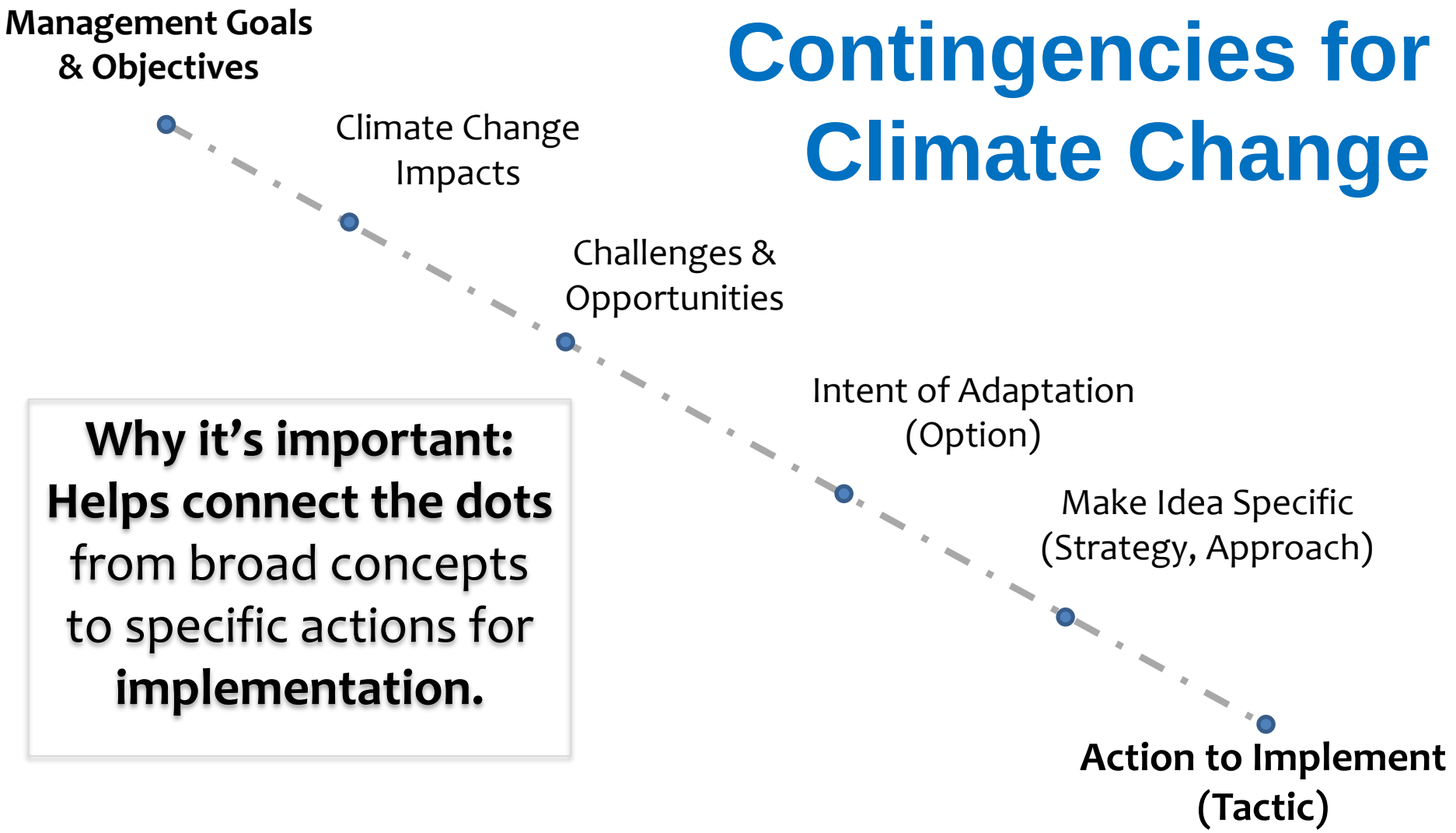
Planning Adaptive Management Contingencies for Climate Change



Why it's important:
Helps connect the dots from broad concepts to specific actions for **implementation.**

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Summary: Planning Adaptive Management Contingencies:

Each decision is unique and will vary based upon:

- **Place:** Location & Site Conditions
- **Purpose:** Goals & Objectives
- **People:** Values, Culture, & Resources
- **Level of Uncertainty:** Learn as you go!

There isn't a single answer.

Adaptation Workbook for Agriculture & Emerging Decision Support Tools

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Adaptation Workbook

1. Where are you and what do you care about?

2. How is that particular place vulnerable to climate change?

3. What challenges or opportunities does climate change present?

4. What actions can help systems adapt to change?

5. What data will show whether those actions were effective?

Resource: Climate Change Assessments

Resource: Adaptation Strategies & Approaches

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Key Principles of Adaptation

Setting priorities for the most vulnerable
Considering the co-benefits of planned actions
Being flexible and creative
Taking precautionary actions
Monitoring & adaptive management

Keys to sustaining farms, ranches, and forests under extreme, variable and uncertain climate

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Workbook Testing for Agriculture

- 03/03/2016, USDA Climate Hub Workshop, Madison, WI
- 07/24/2016, Soil & Water Conservation Society, Louisville, KY
- 09/23/2016, Small Farms Conference, Virginia Beach, VA

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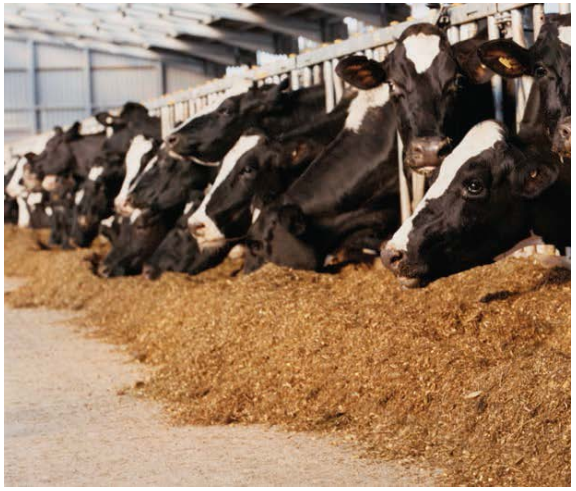
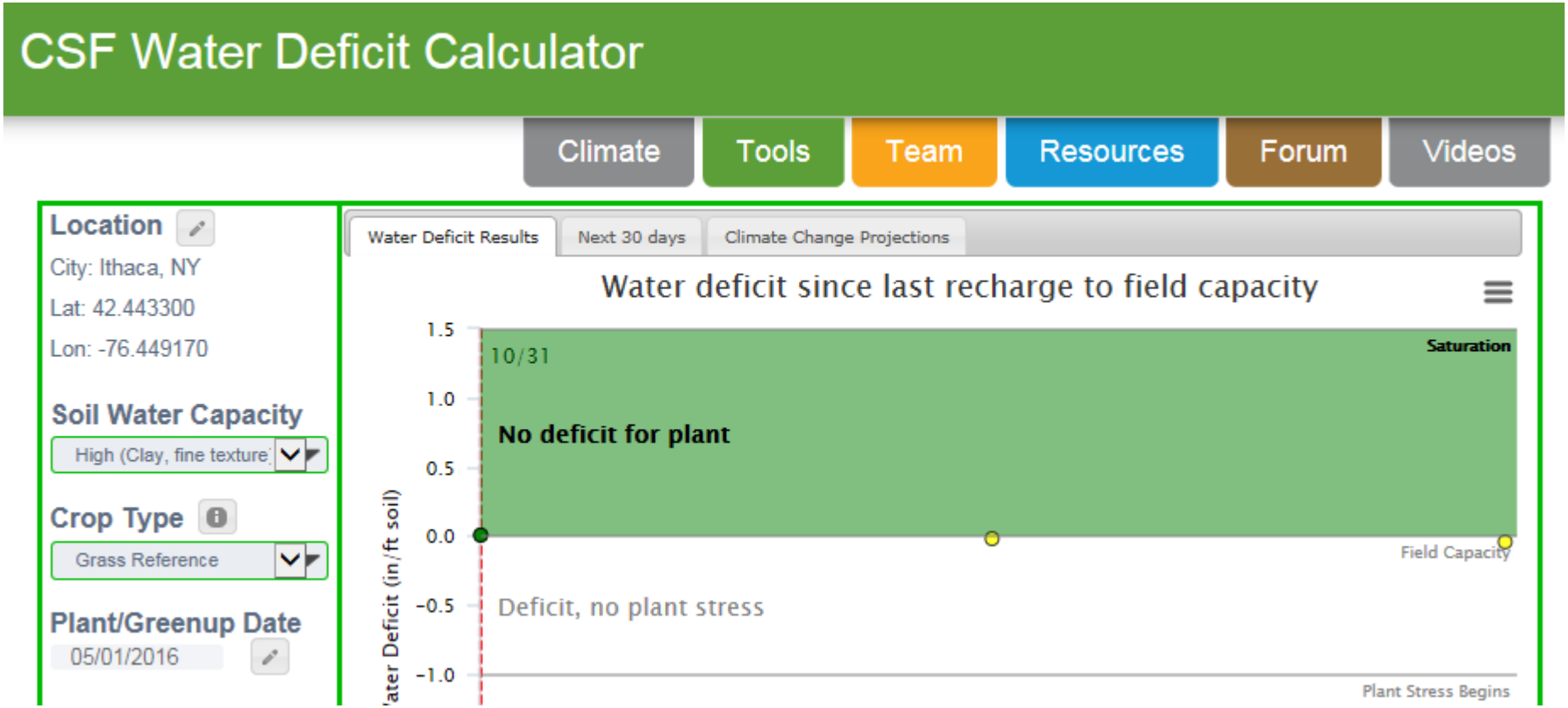
Four Workbook Examples



CSF Water Deficit Calculator



http://climatesmartfarming.org/tools/

U2U DECISION SUPPORT TOOL USER GUIDE
August 2016

Irrigation Investment DST

Explore the profitability of investing in irrigation equipment within the Corn Belt

Irrigation.AgClimate4U.org

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NRCS Climate Connections Tool
(Beta)

Climate Connections

Broad categories of climate variability and change with definitions and links to supporting scientific literature.

Climate Adaptation Practices

Find conservation practices that are most frequently used to address concerns that are climate related.

Practice Details and Trade-offs

A complete inventory of NRCS practices with interaction summaries and links to primary documentation.

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Southeast Regional Climate Hub

Accessibility

Privacy Policy

Important Notices

Beta v0.080916

Step by Step Instruction Video

https://www.youtube.com/watch?v=5QFjga1pwso&feature=youtu.be

Conclusion

- Use the Adaptation Workbook as a climate change response framework
- Use decision support tools to adaptively manage practices
- Current management may be fine, need small tweaks or large transformations
- Engage trusted advisors to develop win-win-win solutions!

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Questions ?

Maria Janowiak mjanowiak02@fs.fed.us for Online Workbooks

Dan Dostie daniel.dostie@pa.usda.gov NRCS role in Climate Adaptation