Adaptive Silviculture for Climate Change (ASCC)

Overall project justification: Forest managers need robust examples of how to integrate climate change adaptation into silvicultural planning and on-the-ground actions

Adaptive Silviculture for Climate Change (ASCC)

PROJECT GOALS (1)

Populate a multi-region study design with ecosystem-specific climate change adaptation treatments using input from an expert panel of regional scientists and local managers

- Primary objectives: compare key variables among various climate change adaptation treatments in 3-5 different forest types across the United States
  - Forest growth and productivity
  - Overstory and understory species composition
  - Forest health and/or tree vigor

Treatments
Resistance
Resilience
Transition
No Action
Sensu Millar et al 2007

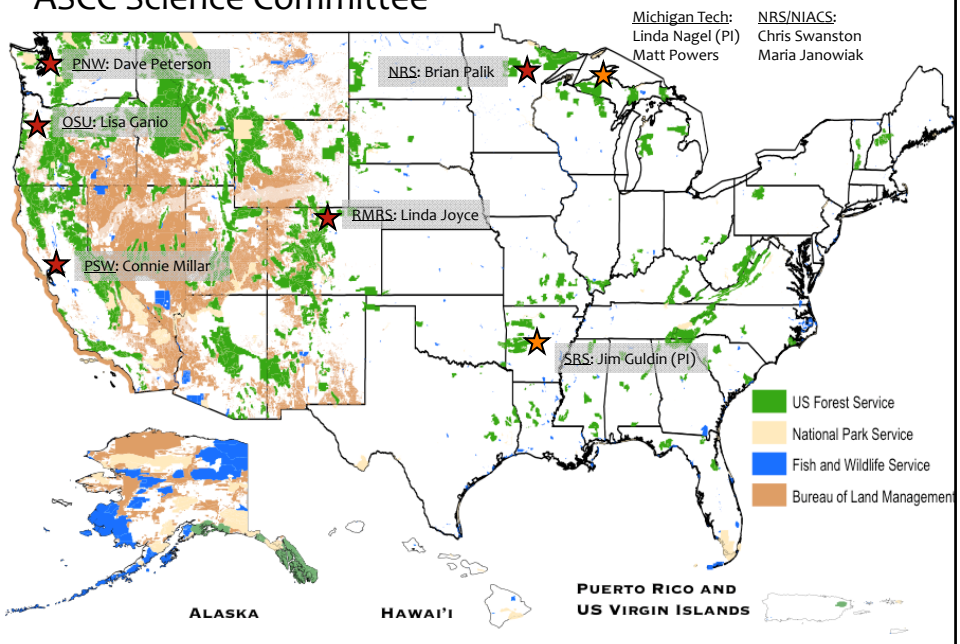
Adaptive Silviculture for Climate Change (ASCC)

PROJECT GOALS (2)

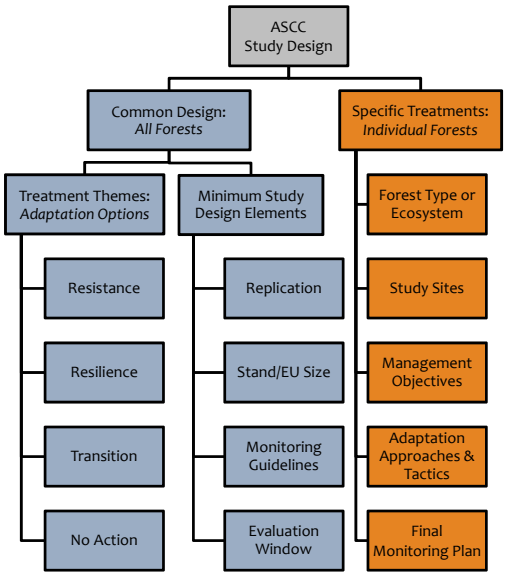
Introduce natural resource managers to conceptual tools and approaches that help integrate climate change into natural resource management and silvicultural decision making

- Primary objectives: conduct training sessions at participating Forests for an audience of local managers and scientists
  - Discuss projected climate change impacts and vulnerabilities relevant to local management goals
  - Introduce conceptual tools that help managers identify appropriate adaptation approaches and tactics

ASCC Science Committee



ASCC Study Design Basics



Preliminary Study Site-Specific Discussions

- Local scientist (silviculturist, climate change, etc)
- Where within the 'region'
  - Forest type – relevant management considerations
  - National Forest
  - Experimental Forest
- Is the site/forest big enough?
- Is there support within the National Forest? Research group?
- Who do we need to talk with first?
  - District Ranger
  - Forest-level climate change coordinator
  - NEPA planner
- Timeline

First ASCC study site: Chippewa National Forest

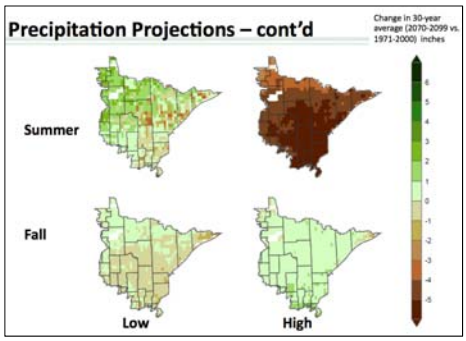
Day One Workshop: June 25, 2013

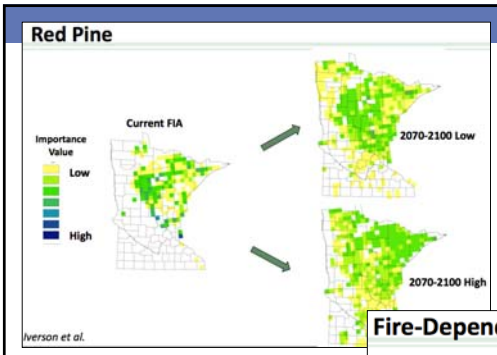
OBJECTIVE: Conduct training sessions at participating Forests for an audience of local managers and scientists

- Discuss projected climate change impacts and vulnerabilities relevant to local management goals
- Introduce conceptual tools that help managers identify appropriate adaptation approaches and tactics

Day One Workshop: June 25, 2013

1. Climate change overview (Swanston)
2. Climate change trends, impacts, and vulnerabilities for northern MN (Handler)





Potential shifts in species distributions (Tree Atlas, LANDIS-II)

Vulnerability Assessment

Fire-Dependent Forests **Moderate Vulnerability**

Drivers:
Coarse/ shallow soils, drought, fire

Dominant Species:
RP, JP, QA, PB, WP, BF, BS, RO, BO, RM

Stressors:
Fire suppression, pests and disease, deer, hazel, fragmentation

Adaptive Capacity:
Adapted to disturbance, persist on poor sites, spp. diversity, need the right balance of fire

Photos by John Almendinger & USFS

Day One Workshop: June 25, 2013

3. Considerations for silvicultural decisions exercise (Janowiak)

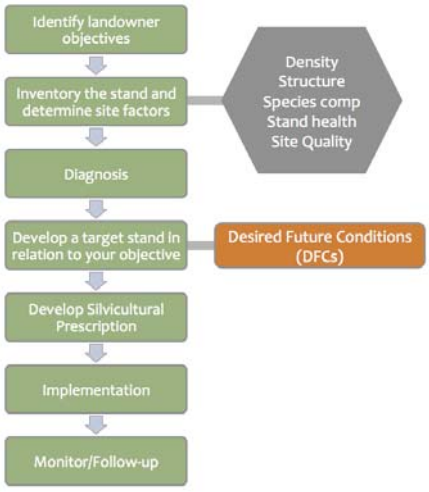
What new or different considerations do we need to think about when managing forests in the face of a changing climate?

Day One Workshop: June 25, 2013

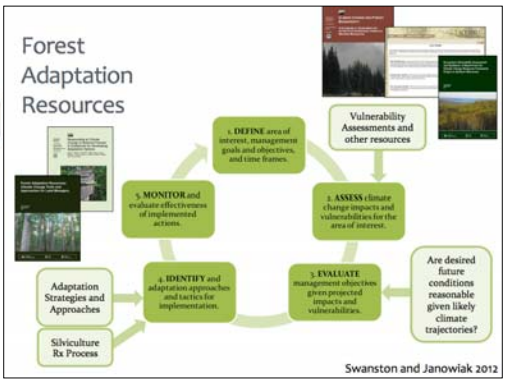
3. Considerations for silvicultural decisions exercise (Janowiak)

Day One Workshop: June 25, 2013

Silviculture Rx-writing Process



4. Climate change adaptation and silvicultural decision-making (Nagel, Powers)



Day One Workshop: June 25, 2013

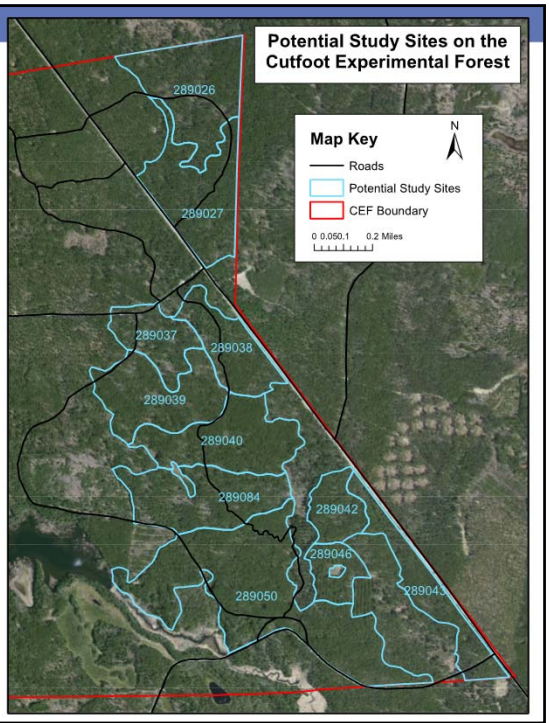
5. Developing adaptation approaches and tactics (Janowiak, others)

What actions can be taken to enhance the ability of the area to adapt to anticipated changes and meet management goals?

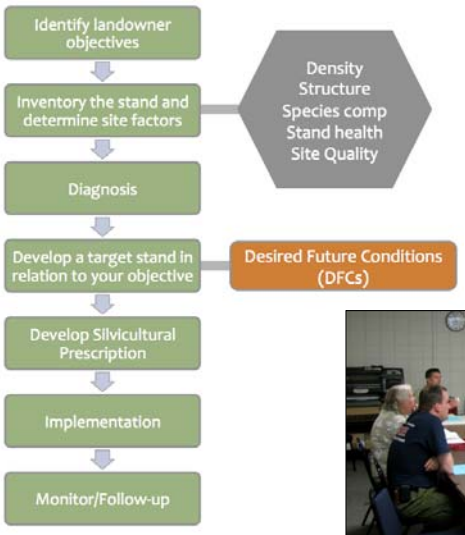
Flipchart #1	***Flipchart #2***
Where are you working and what are your forest management goals? What climate change impacts create challenges or opportunities for meeting these goals?	What actions would you recommend to enhance the ability of forests to adapt?

Day Two: Visit the Study Site

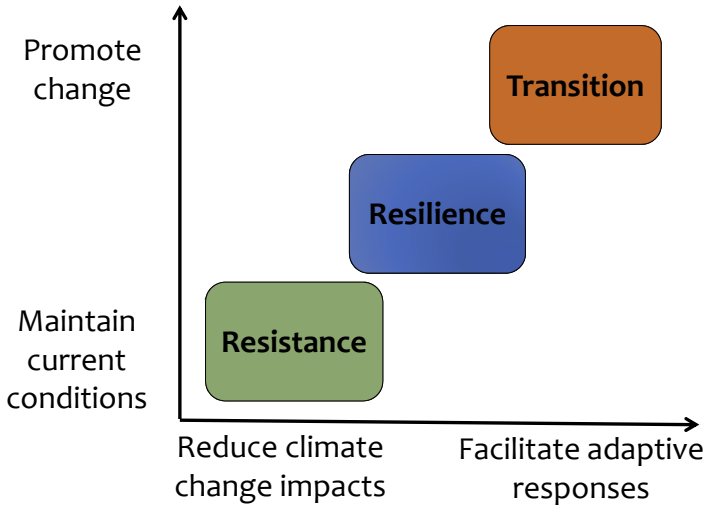
- Site history and current conditions
- Chippewa NF Forest Plan
- Discussion: assess climate change impacts and vulnerabilities specific to site
- Introduce experimental treatment definitions and goals

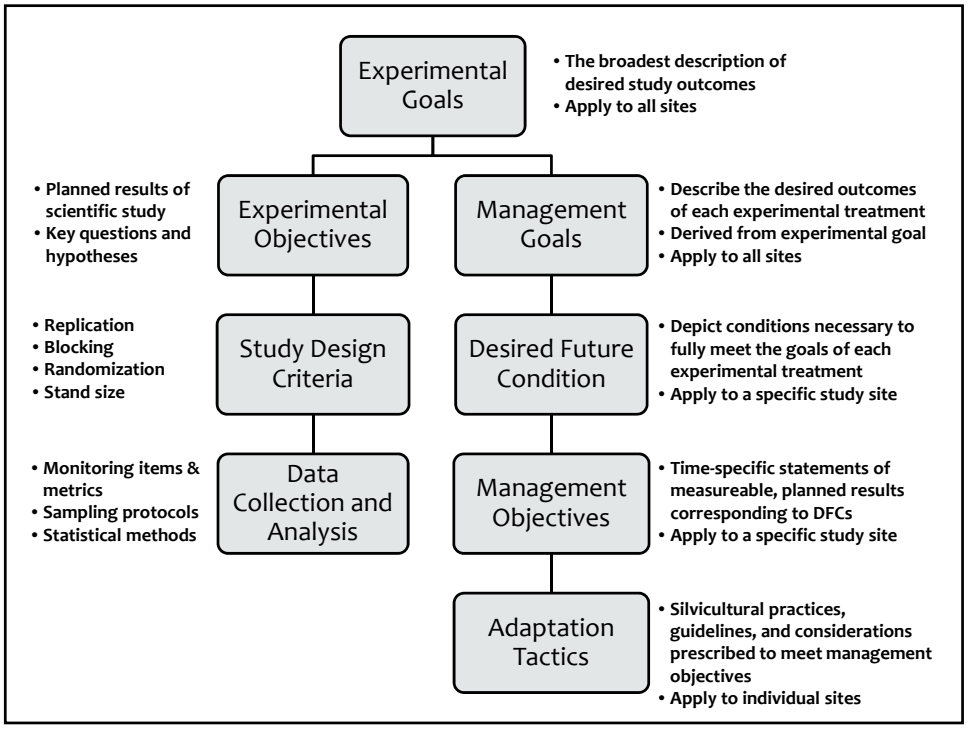


Day Two: Develop Treatments



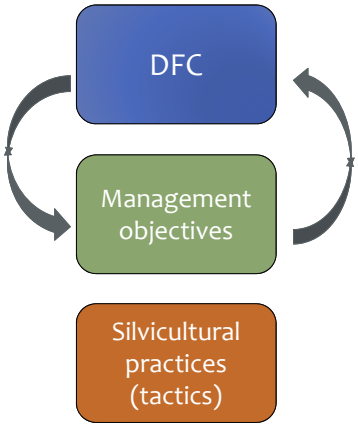
Adaptation options occupy a continuum of management goals related to their levels of desired change in ecosystem attributes and their mechanism for coping with climate change





Developing the Experimental Treatments

- For <u>each</u> experimental treatment (Resistance, Resilience, Transition):

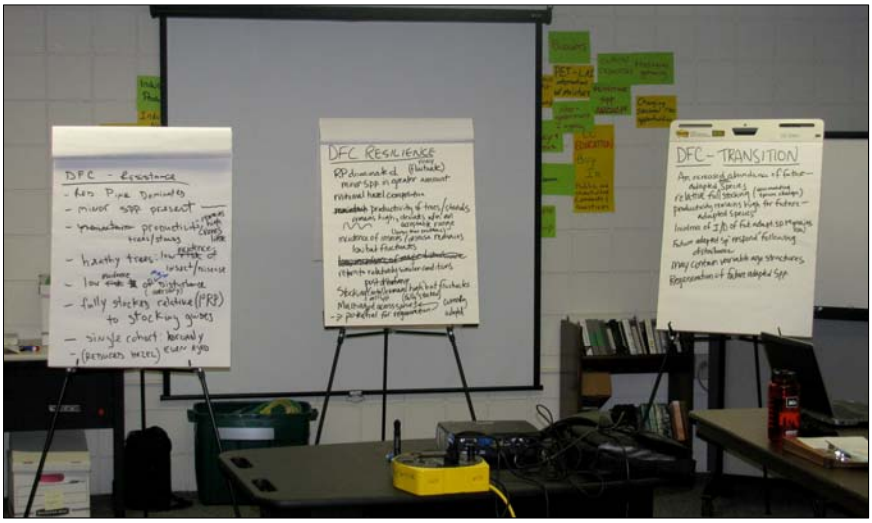


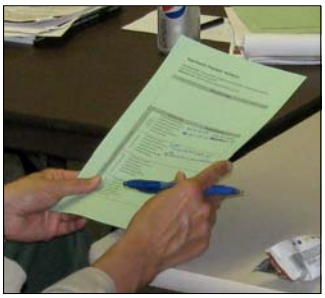
What do you want the stand to look like?

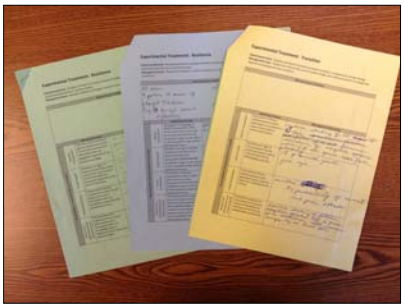
<u>Keep in mind key variables/outcomes</u>:
- Species composition
- Forest health
- Forest productivity
- Response to disturbance

<u>For each silvicultural practice (tactic)</u>:
- Timeframes
- Benefits
- Drawbacks and Barriers
- Practicality
- Recommend tactic?

1st Step: Define Desired Future Conditions







RESISTANCE – species composition goal

Management goal: maintain relatively unchanged conditions over time

DESIRED FUTURE CONDITIONS

- Red pine dominated
- Minor species present

OBJECTIVES

- Red pine is 90% of total stocking (basal area)
- Minor species represent 10% of stocking

TACTICS

- First thin: to target BA
- Second thin: to B-line (lower limit of stocking)
- Incidental scarification from snow-free logging and whole-tree skidding
- Contingency: plant, mechanical treatments, Rx burn

RESILIENCE – species composition goal

Management goal: allow some change in current conditions, but encourage an eventual return to reference conditions

DESIRED FUTURE CONDITIONS

- Red pine dominated, red pine abundance may fluctuate over time
- Minor species in greater amounts than current conditions
- Minimal hazel

OBJECTIVES

- Maintain 50-75% red pine (basal area)
- Minor species increase over time

TACTICS

- Variable density thinning/harvesting (regen, structural complexity, drought resilience)
- Immediate: thin to lower limit of full stocking; gaps ¼ ac
- Annual Rx burning (yr 2-4) or mechanical treatments to reduce hazel and encourage natural regen

TRANSITION – species composition goal

Management goal: actions that intentionally accommodate change and enable ecosystems to adaptively respond to changing and new conditions

DESIRED FUTURE CONDITIONS

- Increased abundance of future-adapted tree species
- Fully stocked relative to biological constraints of a changing climate

OBJECTIVES

- Reduce red pine stocking to 25-50%
- Increase future-adapted species to 50-75%

TACTICS

- Irregular shelterwood with expanding gaps (*Femelschlag*)
  - Multi-cohort structure, recruitment of future-adapted species
- Mechanical site prep to reduce hazel
- Plant future-adapted species
- Include species or seed sources outside current seed zone

Day Three: Implementation and Monitoring

- Recap treatments (working document)
  - DFCs
  - Objectives
  - Tactics
- Implementation
  - Sites (4 replicates minimum, 25 ac treatments, ~400 ac total)
    - Chippewa plans to implement 5 replicates (~500 ac)
  - NEPA
  - Who is going to do what once the workshop is over?
- Monitoring
  - Minimum variables to monitor
  - Basic plot design – across all sites
  - Who will measure? When? With what resources?

Key variables

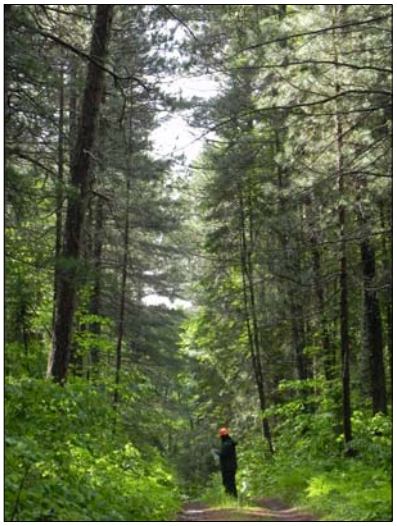
	Species Composition	Forest Health	Productivity
Overstory	Species richness Species diversity Relative density Relative dominance	Mortality Crown density Crown dieback Live crown ratio Tree damage (DSI)	Biomass increment Basal area increment
Understory	Species richness Species diversity Relative density Relative biomass	Relative density or biomass of invasive species	Biomass increment
Ground Layer	Species richness Species diversity Percent cover by species	Percent cover of invasive species	Biomass increment

Outcomes from the workshop

- Experimental design for a long-term silviculture research project
- For each treatment (Resistance, Resilience, Transition):
  - Statement of DFC
  - Management objectives
  - Tactics prescribed to achieve objectives
- Final 'working' treatments shared with the group
  - Rx writing
  - NEPA process
- Action plan
- New collaborations
- Knowledge, skillset, and enthusiasm for incorporating adaptive silviculture for climate change into forest management

Keys to success

- Communication
- Have the right people at the table
  - District Ranger
  - District Silviculturist
  - Forest Silviculturist
  - Climate Change Coordinator
  - NEPA Planner
  - Timber Sale Administrator
  - Fire
  - Local scientists/researchers/experts
- Local oversight to ensure things happen
- Time management, facilitation
- Follow-up



Next steps…

- Chippewa National Forest
  - NEPA Scoping process
- Develop 3-4 additional sites
- Implementation
- Monitoring
- Adding to the network of long-term silviculture research

For more information:
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Experimental treatment definitions

Treatment Name	Experimental Treatment Definition
RESISTANCE	Actions that improve the defenses of the forest against anticipated change or directly defend the forest against disturbance in order to maintain relatively unchanged conditions
RESILIENCE	Actions that accommodate some degree of change, but encourage a return to a prior condition or desired reference conditions following disturbance
TRANSITION	Actions that intentionally accommodate change and enable ecosystems to adaptively respond to changing and new conditions
NO ACTION	Since climate change impacts all forests globally, we cannot maintain a true "control". With this in mind, we consider an approach in which forests are allowed to respond to climate change in the absence of direct silvicultural intervention as an appropriate baseline for many questions.

Experimental treatment goals

Treatment Name	Experimental Treatment Goals
RESISTANCE	Maintain relatively unchanged conditions over time
RESILIENCE	Allow some change in current conditions, but encourage an eventual return to reference conditions
TRANSITION	Actively facilitate change to encourage adaptive responses
NO ACTION	Allow forests to respond to climate change without direct management intervention

Key variables of interest – metrics

- Species composition response
- Forest health response
- Forest productivity response
- Developmental response to disturbance and extreme events

- Boundaries and thresholds described for each variable for each treatment

  Example(sp comp/resilience): Abundance and diversity of species characteristic of the current plant community may temporarily deviate from the acceptable range, but will return to the acceptable range within a defined period of time