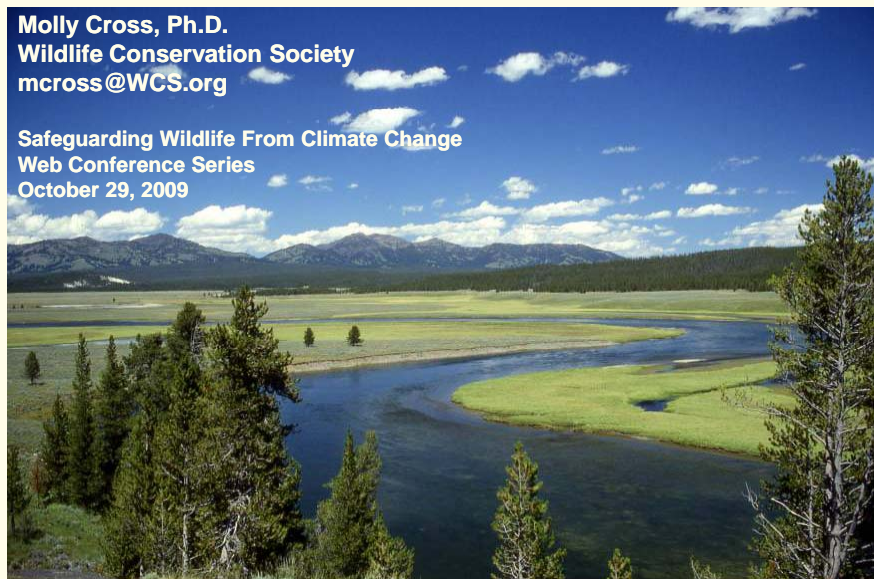




Place-based climate change adaptation: Overcoming the paralysis of uncertainty

Molly Cross, Ph.D.
Wildlife Conservation Society
mcross@WCS.org

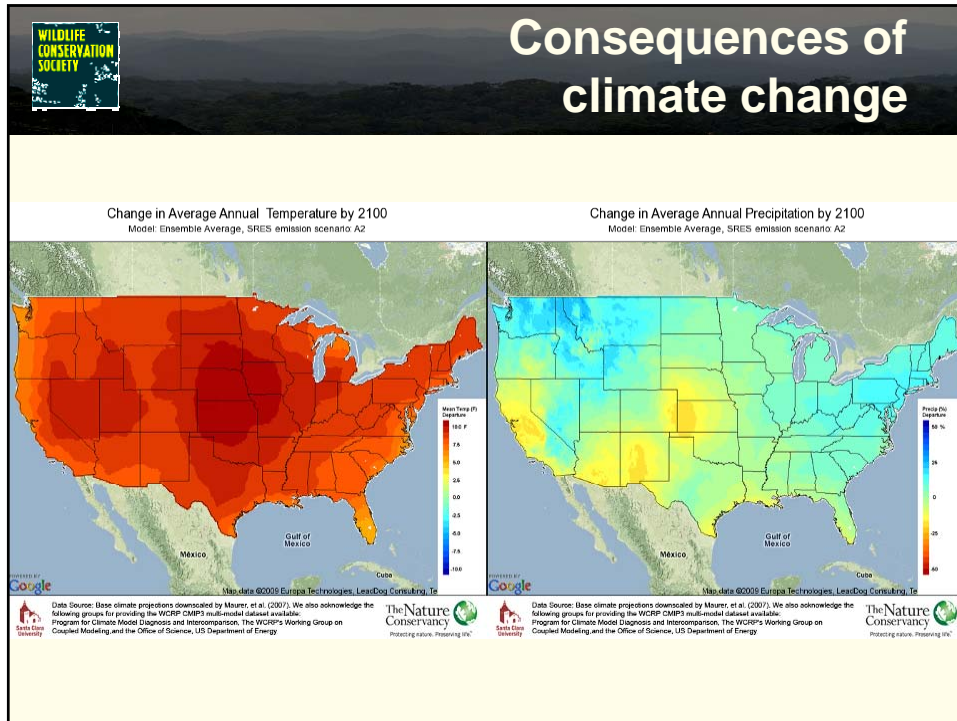
Safeguarding Wildlife From Climate Change
Web Conference Series
October 29, 2009



Climate change adaptation

Adaptation = actions that enable species or systems to better cope with or adjust to changing conditions.





Adapt, move or go extinct?

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General principles of adaptation

- Reduce non-climate stressors
- Manage for ecological function and biodiversity
- Establish buffer zones and connectivity
- Implement “proactive” management strategies
- Increase monitoring and facilitate management under uncertainty

Adapted from “Adaptation 2009” discussion paper by Glick et al. and other sources



Challenges facing natural resource management

How to make applicable to my system?

Where to begin?

Uncertainty?
Complexity?

What to manage FOR?





Reframing management goals

Increase **RESISTANCE** to change

Promote **RESILIENCE** to change

Enable ecosystems to **RESPOND** to change

Adapted from Millar et al. 2007, Ecological Applications and USFS Climate Change Resource Center



Challenges facing natural resource management

How to make applicable to my system?




Where to begin?

Uncertainty?
Complexity?

What to manage FOR?

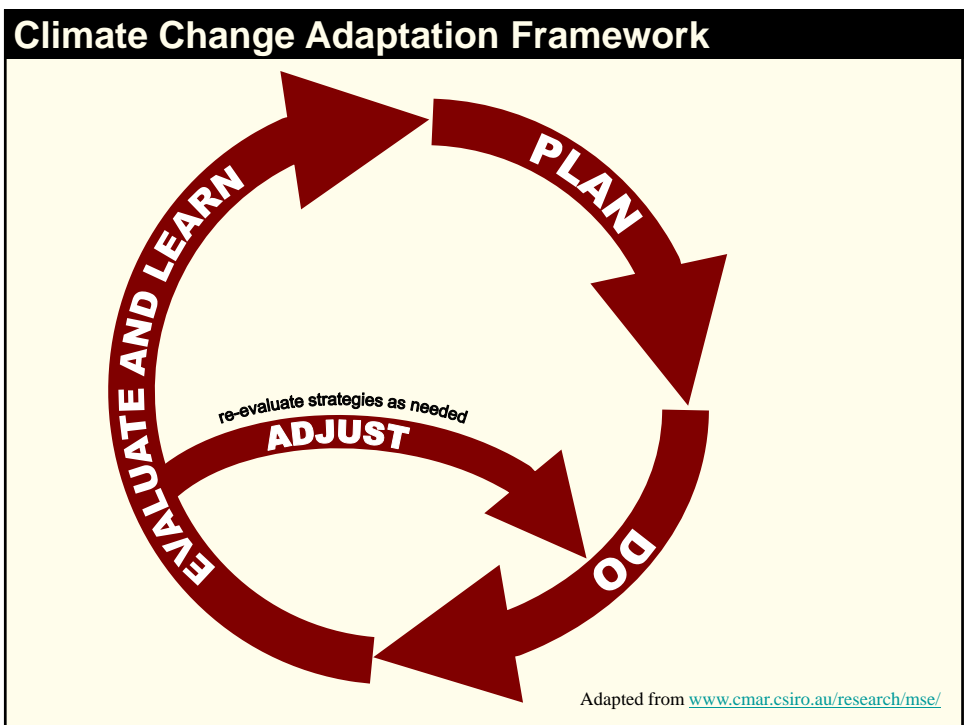


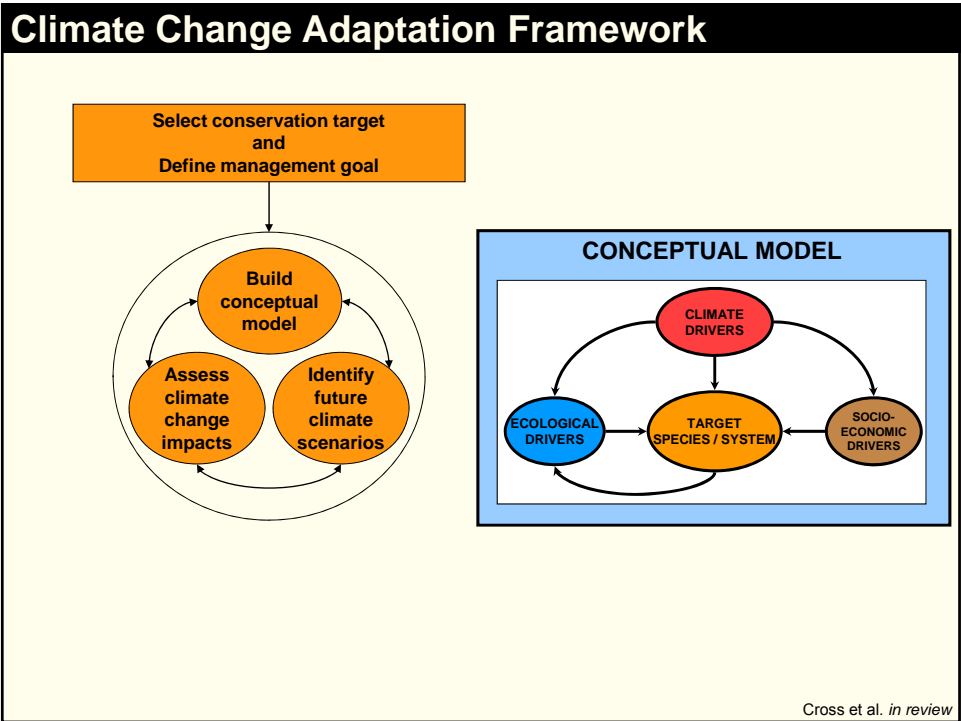
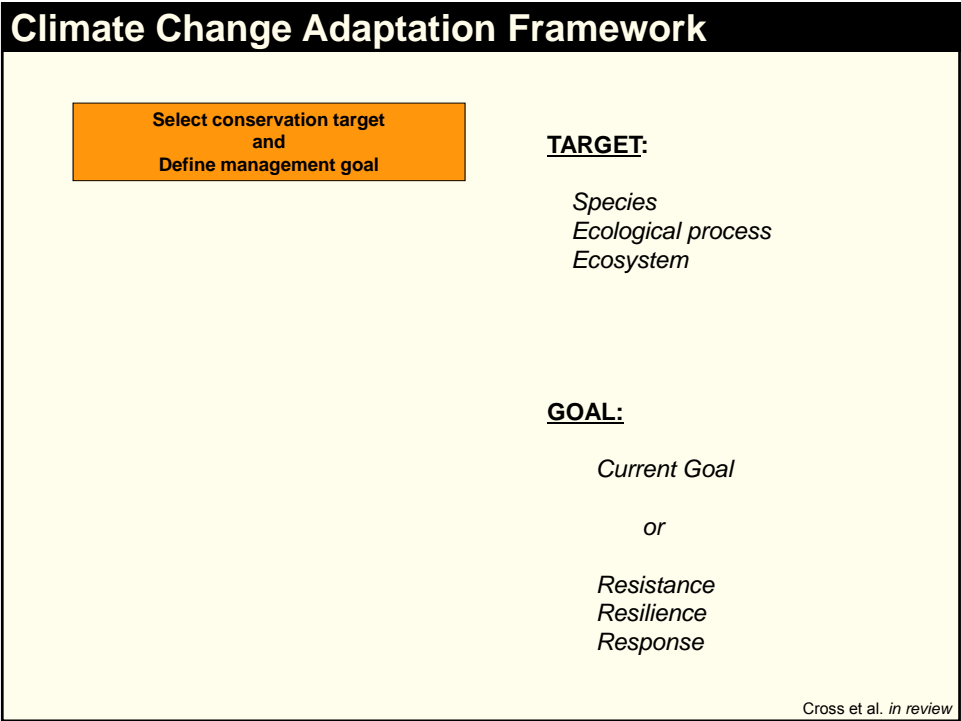
Climate Change and Wildlife Conservation working group

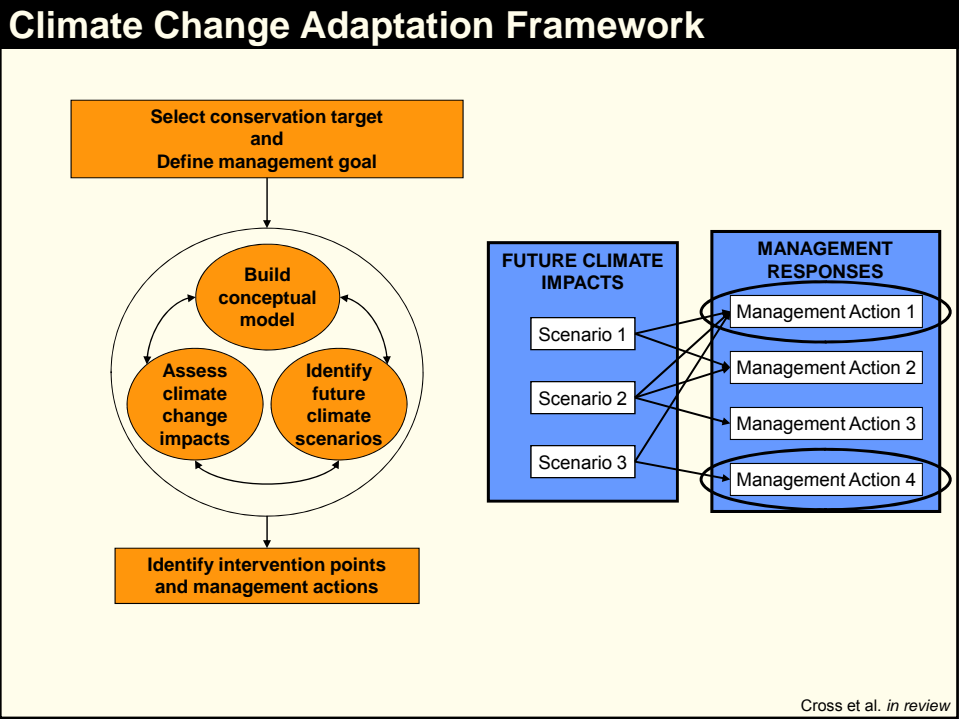
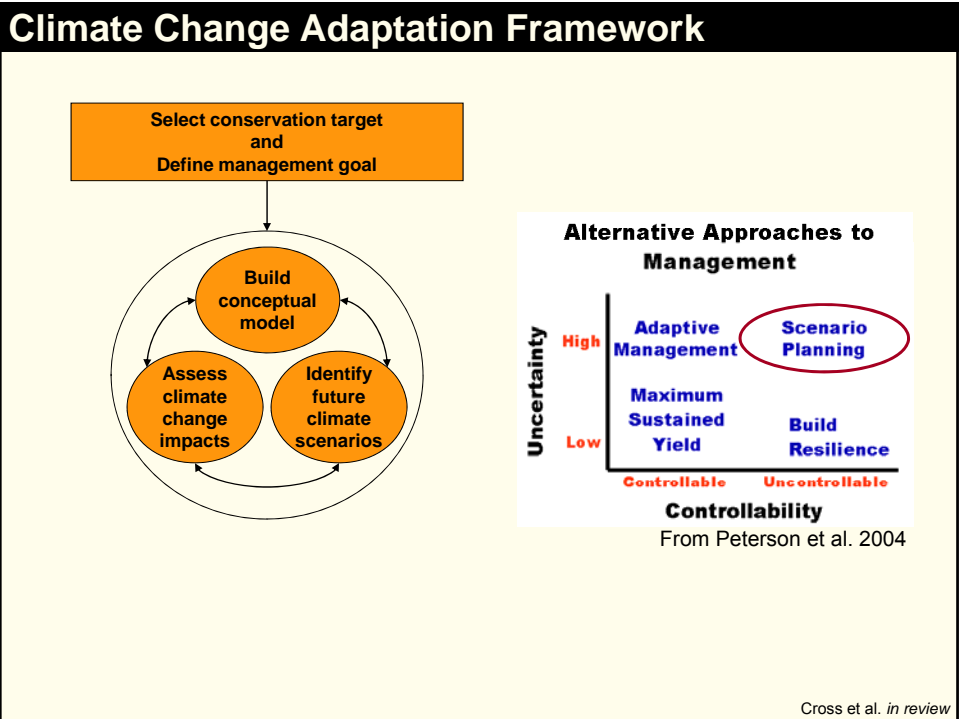
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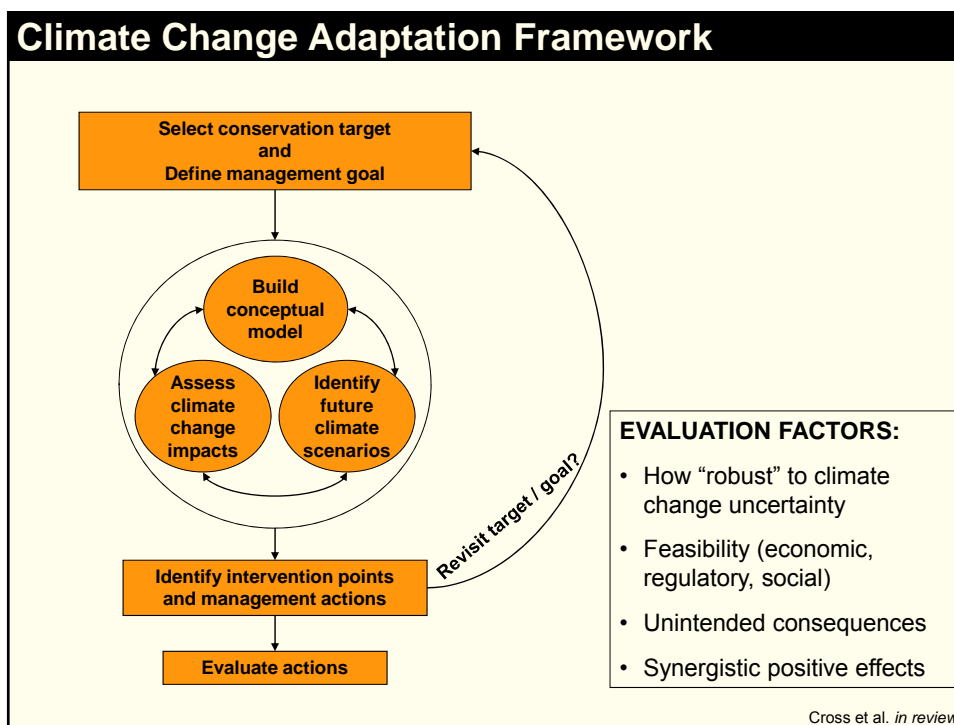
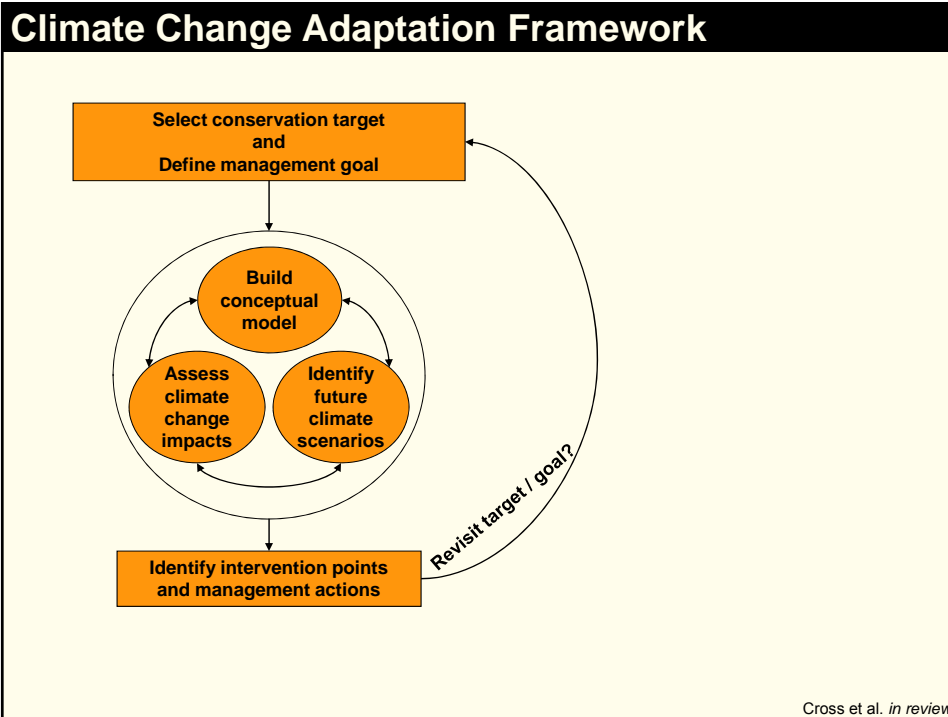
PARTICIPANTS: Academic, government agency and conservation NGO researchers

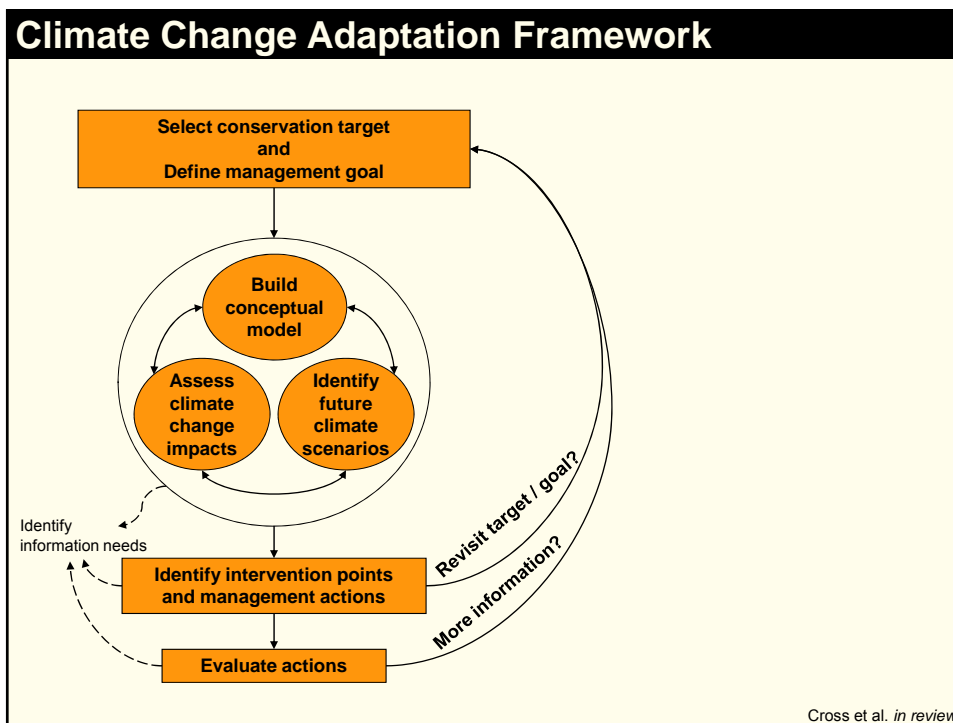
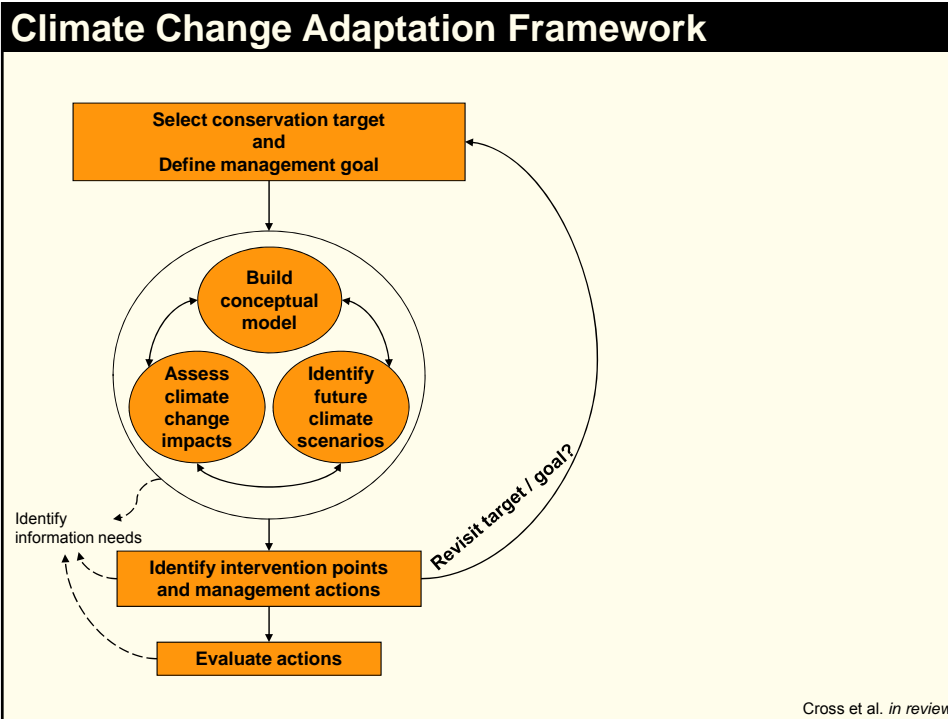
GOAL: Develop a *participatory and iterative* framework for generating place-based adaptation strategies.

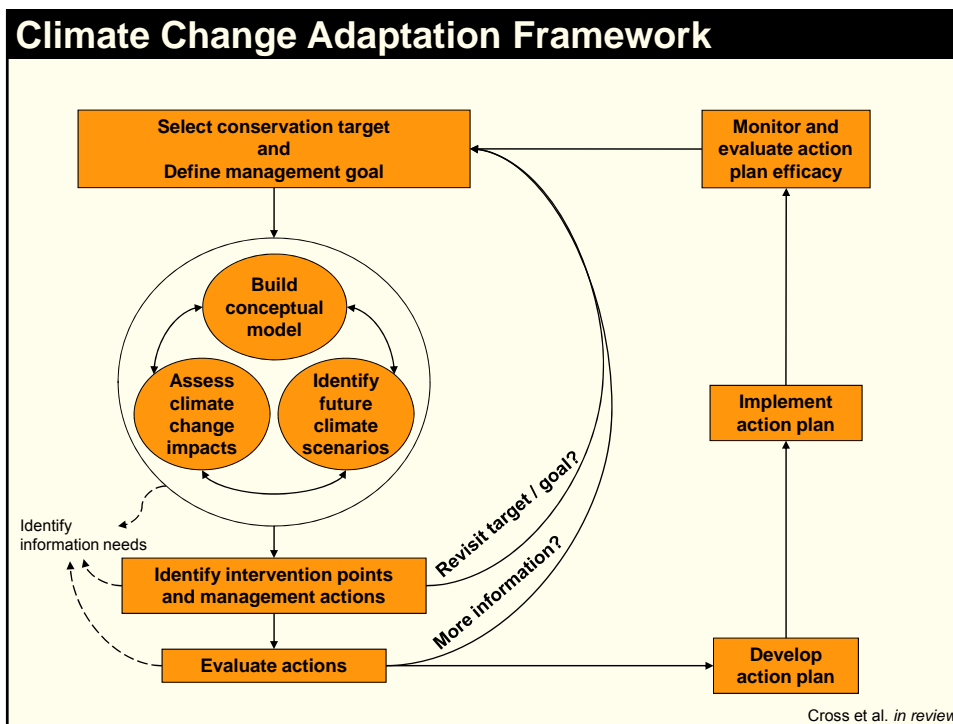
















Testing the framework


Greater Yellowstone Ecosystem and Northern U.S. Rockies



Ecological processes
River flows } Working group


Species
Grizzly bears } Workshop with USFWS
Wolverine } and other agencies

Ecosystems
Yellowstone River } Workshop with MT
Sagebrush steppe } Fish, Wildlife and Parks, WWF, NWF



Testing the framework



Greater Yellowstone Ecosystem and Northern U.S. Rockies



Ecological processes
River flows

Species
Grizzly bears
Wolverine


Ecosystems
Yellowstone River
Sagebrush steppe


Species: grizzly bears

“Climate change and carnivores in the Northern U.S.
Rockies: Strategies for conservation”

Workshop co-organized by WCS & US Fish and Wildlife Service
October 6-7, 2009

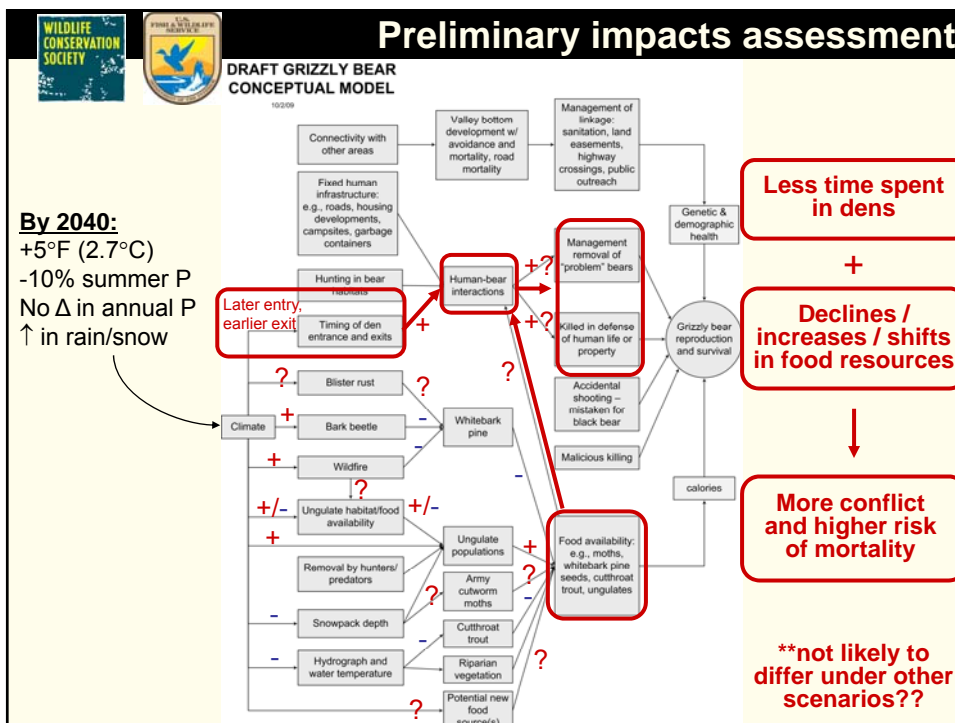
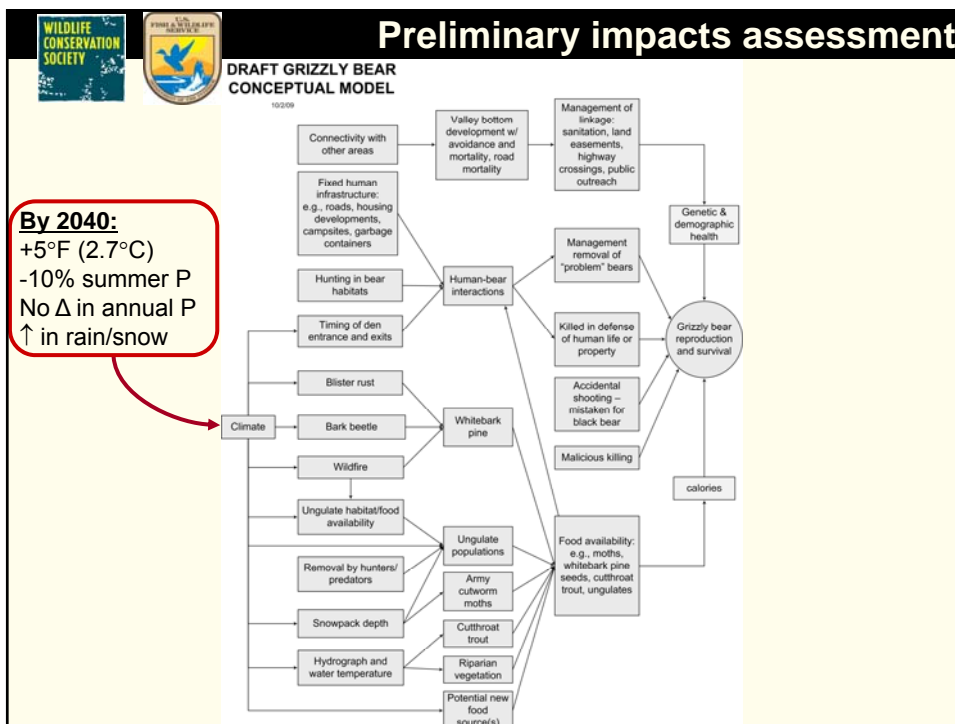


Grizzly Bear



Wolverine







Grizzly bear recommendations

Conservation / Management Actions

- Establish grizzly bear populations in the Bitterroot Mountains to provide more connected and resilient populations.
- Increase/maintain connectivity between the large blocks of public land in the Northern Rockies to allow bears to move in response to shifting resources.







Grizzly bear recommendations

Conservation / Management Actions

- Build human tolerance for bears so bear movements in response to climate change are possible.
- Consider adapting land management activities in response to habitat and food changes (e.g., setting hunting season dates).







Grizzly bear recommendations

Monitoring / Research

- Predict and test hypotheses about habitat quality changes – when and where do current foods decline/move and new foods appear?
- Monitor grizzly bear body condition over time to track physiological responses to climate change.




Grizzly bear recommendations


Next Steps (for workshop participants)

- Create a cross-agency climate change working group to work cooperatively in monitoring and management – **this is a Landscape Conservation Cooperative (LCC).**

For WCS:

- Explore how to further translate recommendations into on-the-ground actions.
- Explore alternate scenarios to see whether/how they differ from initial scenario.





Ecosystem: Yellowstone River


“Anticipating climate change in Montana”

Workshop co-organized by MT-FWP, WWF, WCS & NWF
December 9-10, 2008








Sagebrush Steppe

Yellowstone River

 <h2 style="text-align: right;">Yellowstone River scenarios</h2>			
Scenario	Temperature	Precipitation	Base Flows, Runoff Peak and Water Temperatures
A	+3°F	No change (same variability as last 800 yrs)	<ul style="list-style-type: none"> ▪ ~15% decline in summer baseflow ▪ spring peak 2-4 weeks earlier ▪ warmer late summer water temp.
B	+3°F	+5 to 10% (same variability as last 800 yrs)	<ul style="list-style-type: none"> ▪ 4-11% decline in summer baseflow ▪ spring peak 2-4 weeks earlier ▪ warmer late summer water temp.
C	+3°F	-5 to 10% (same variability as last 800 yrs)	<ul style="list-style-type: none"> ▪ ~30% decline in summer baseflow ▪ spring peak more than 2-4 weeks earlier ▪ much warmer late summer water T

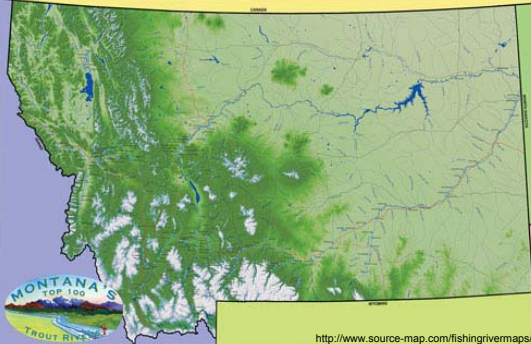
 <h2 style="text-align: right;">Yellowstone River goals</h2>	
	<p>Maintain native fisheries</p>
	<p>Maintain water in the river</p>
	<p>Maintain number of angler days</p>





Yellowstone River results

Key impacts on:

- Upper vs. lower river
- Tributaries vs. mainstem
- Competition for water among multiple users
- Water temperatures
- Riparian condition
- Disease
- Wildfire



http://www.source-map.com/fishingivemaps/

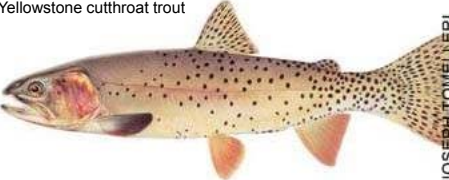





Yellowstone River results

Key impacts on:


- Cold-, cool- and warm-water fisheries and species
- Mainstem and tributary spawners
- Long- and short-lived species
- Bottom feeders, insectivores, predatory fish

Yellowstone cutthroat trout




JOSEPH TOMELLERI


Pallid sturgeon



Burbot



Sauger



Images from <http://fieldguide.mt.gov>










Yellowstone River results

Management Responses

- Protect/restore cold-water habitat in refugia areas
- Secure senior water rights in key areas and seasons
- Remove fish passage barriers
- Reduce pressures in riparian areas
- Address road crossing and culvert issues
- Explore beaver restoration opportunities



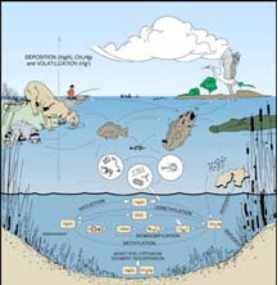


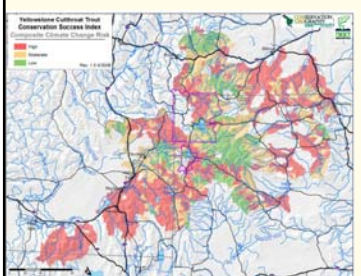
Yellowstone River results

Monitoring

- Aquatic food webs
- Flow and temperature gauges
- Direct measurements of consumptive water use




<http://www.gvbchina.org.cn/xiangmu/caogen/grassvoice27en.htm>



Research

- Identify habitat refugia
- Linking air and water temperatures
- Species biology to determine vulnerability



Yellowstone River results

General observations


- Scenarios did not differ significantly in terms of impacts and management responses.
- Management recommendations similar to current actions (although increase priority and urgency).



Yellowstone River next steps

Next steps

- Expand on workshop findings with other agencies and prioritize adaptation actions.
- Work with agencies to implement highest priority adaptation actions.



Initial lessons learned

- Framework provides an entry point for considering climate change in decision-making.
- Focusing on specific systems allows participants to link abstract concepts to concrete concerns and solutions.
- Some new tools identified – but many adaptation actions look similar to current actions (*with some adjusting and increased priority and urgency – likely to depend on the target considered*).
- Scenario-based planning is a useful tool – need more examples of how to develop scenarios and use them in planning → *see scenario-based planning efforts by Leigh Welling, National Park Service.*



Future directions

- **Expand on initial workshops to *develop clear guidance for on-the-ground actions* with relevant managers and stakeholders**




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Future directions

- Expand on initial workshops to *develop clear guidance for on-the-ground actions* with relevant managers and stakeholders



- Continue evaluating multiple targets, goals and scenarios to *provide guidance on the process of adaptation planning and implementation*



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Future directions

- Expand on initial workshops to *develop clear guidance for on-the-ground actions* with relevant managers and stakeholders




- Continue evaluating multiple targets, goals and scenarios to *provide guidance on the process of adaptation planning and implementation*



- Test the framework at multiple locations and spatial scales → *e.g., across WCS priority landscapes, TNC Southwest Climate Change Initiative (NM, CO, AZ, UT)*





Thanks to collaborators + funders

Climate Change and Wildlife Conservation Working Group:

- G. Tabor (Center for Large Landscape Conservation, Y2Y)
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- T.O. Smith (MT-FWP)
- Chris Hunter (MT-FWP)
- Ken MacDonald (MT-FWP)
- Anne Schrag (WWF)
- Sterling Miller (NWF)
- Workshop participants

Climate change and carnivore workshop:

- Chris Servheen (US-FWS)
- Workshop participants

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Marisla Foundation	US Fish and Wildlife Service
Surdna Foundation	World Wildlife Fund
Turner Foundation	National Wildlife Federation
Hewlett Foundation	



Thank You!!



Questions?
Comments?

B. Karash, WCS