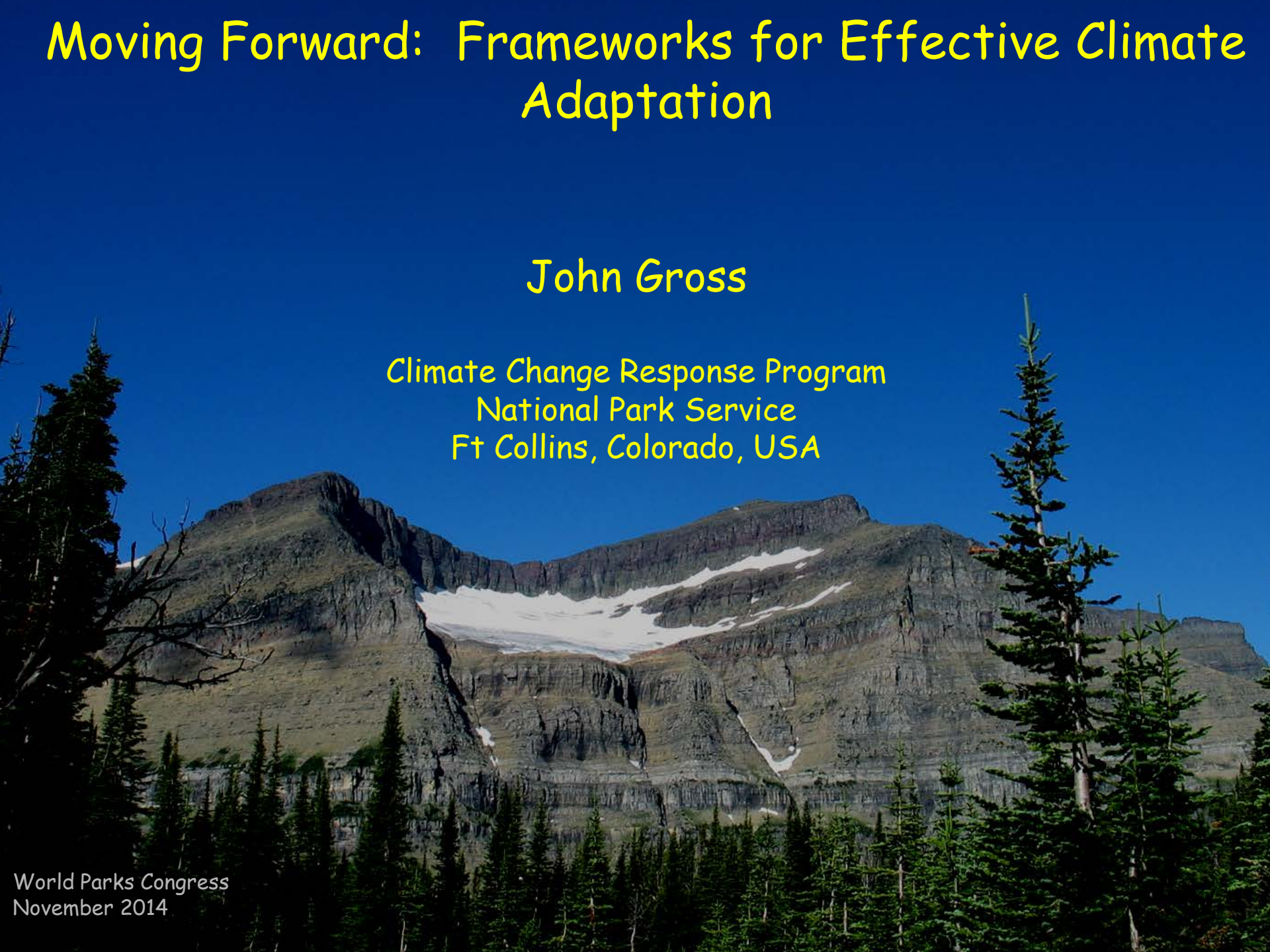
# Moving Forward: Frameworks for Effective Climate Adaptation



John Gross

Climate Change Response Program
National Park Service
Ft Collins, Colorado, USA

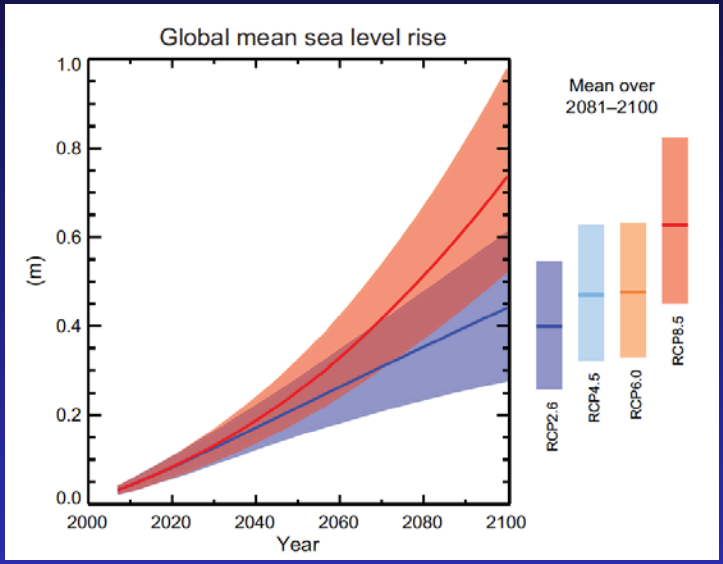
World Parks Congress
November 2014

Pinyon mortality at Bandelier National Monument. Photo: Craig Allen


Pinyon mortality at Bandelier National Monument. Photo: Craig Allen

Mitigation: Addresses causes of CC. Focus on reducing GHGs.

Adaptation: Adjusting to and coping with actual or expected climate changes. Focus on preparing for and managing CC.




(IPCC 2013)

## Challenges

- **Time horizon longer than planning and management horizons**
- **Relevant areas larger than management units**
- **Uncertainty in science (climate change, ecological response) and management effectiveness**
- **Coordination among management units, jurisdictions, stakeholders**
- **Approaches and methods are rapidly evolving**

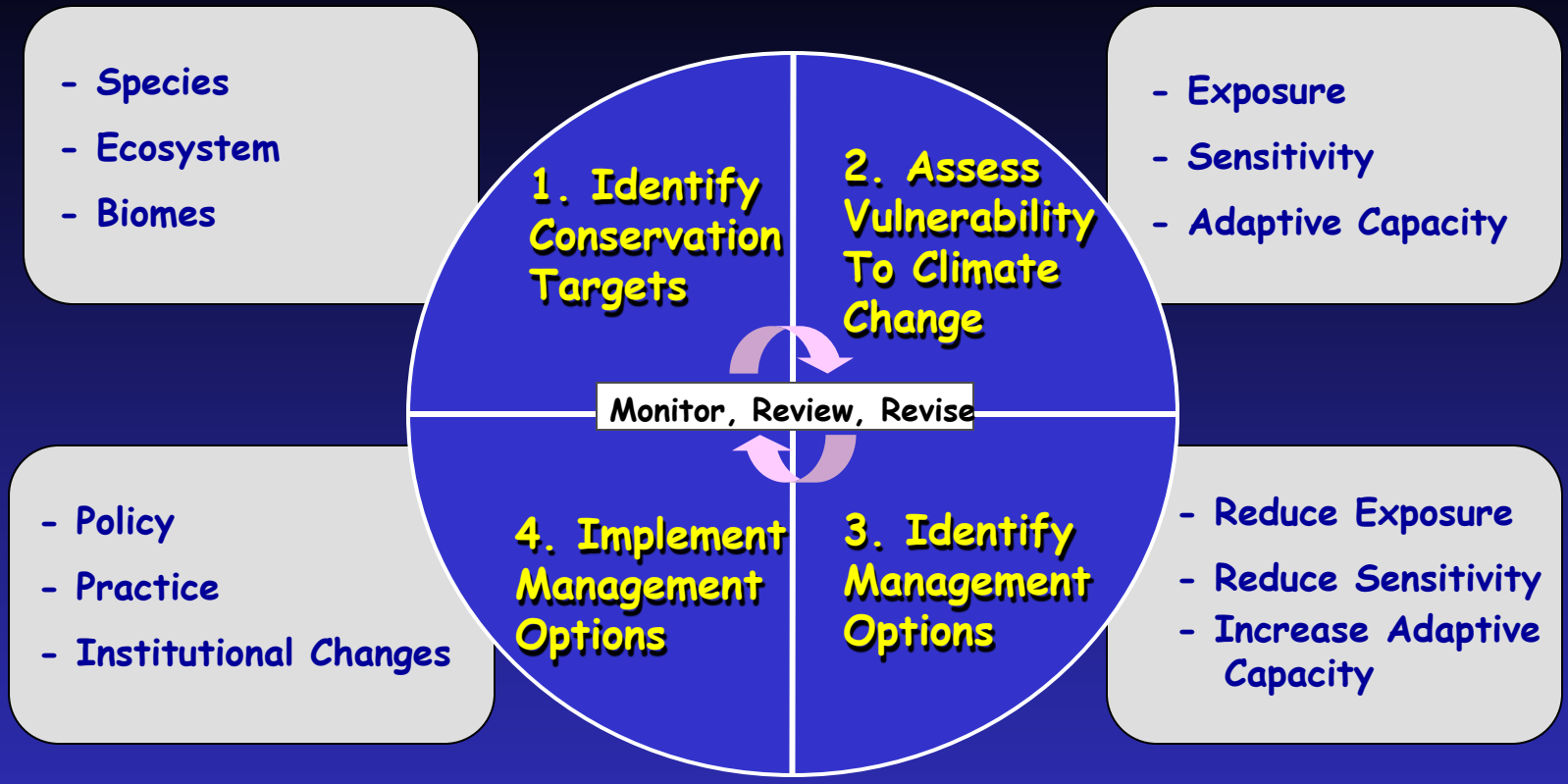
Planning for CC adaptation is different

What constitutes an effective adaptation framework?

- Sufficiently comprehensive & simple
- Right-scaled and scalable
- Logical and intuitive
- "Connect the dots"
- Easily incorporates existing capital**

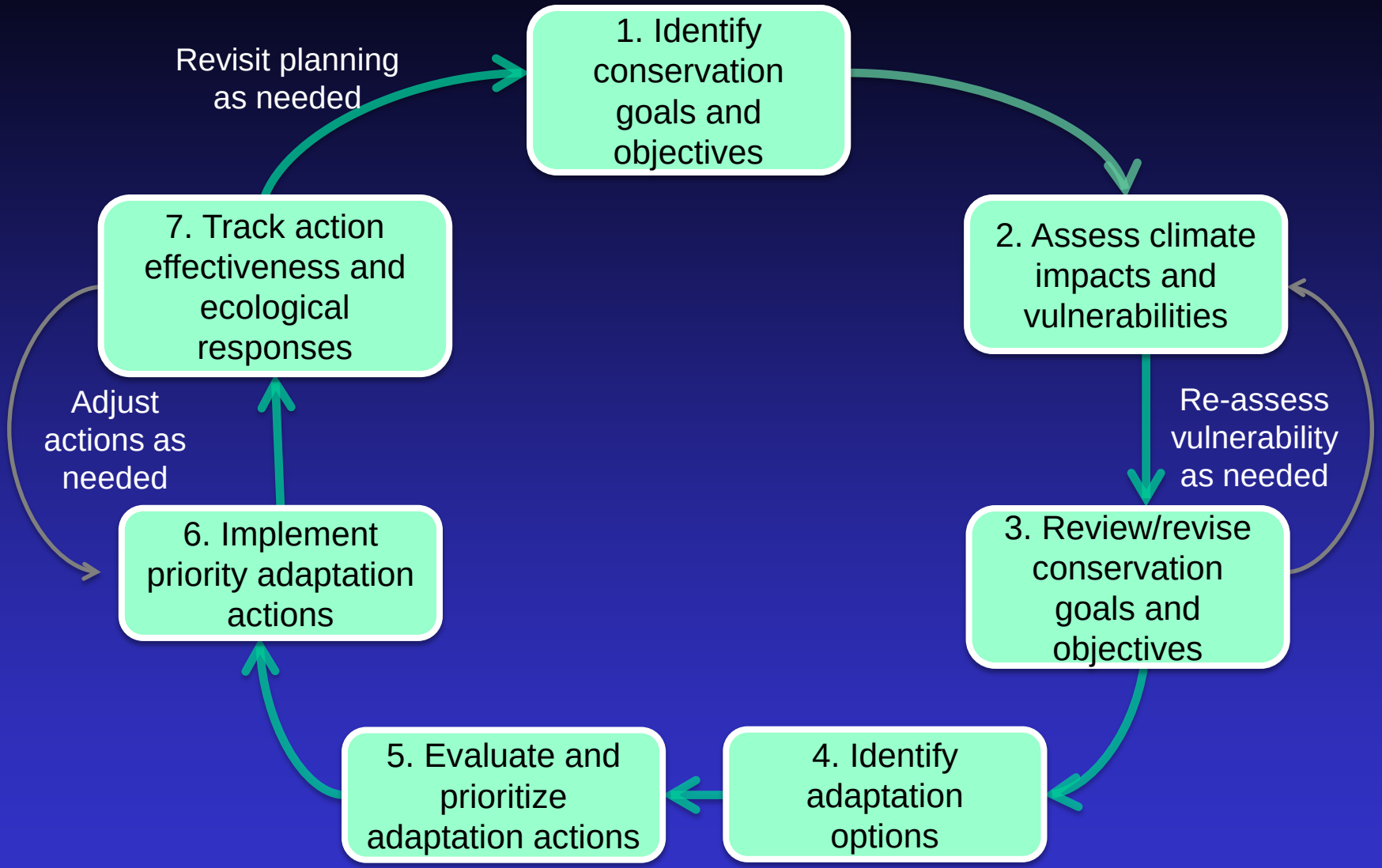
** processes, knowledge, expertise


(Stein & Glick 2011 Chpt 1 *in* Scanning the Conservation Horizon)



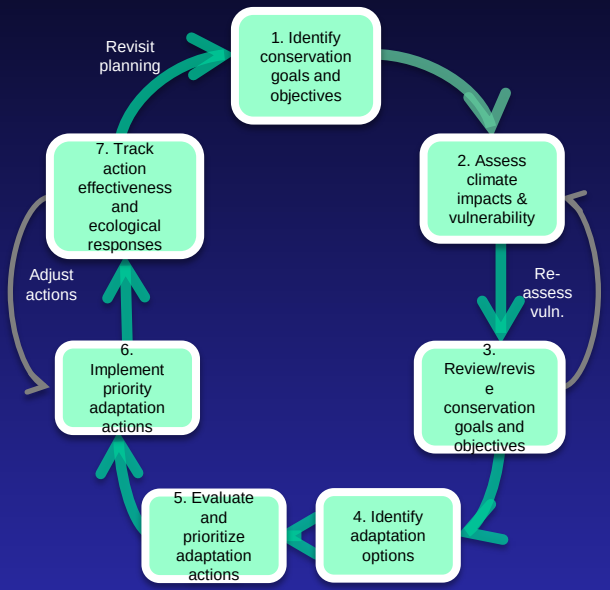

(Stein & Glick 2011 Chpt 1 *in* Scanning the Conservation Horizon)

# Generalized Adaptation Framework

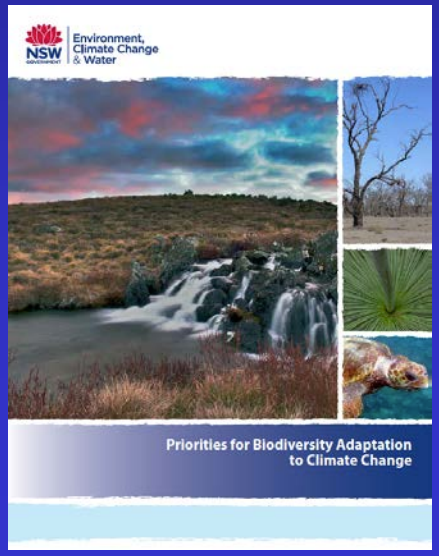


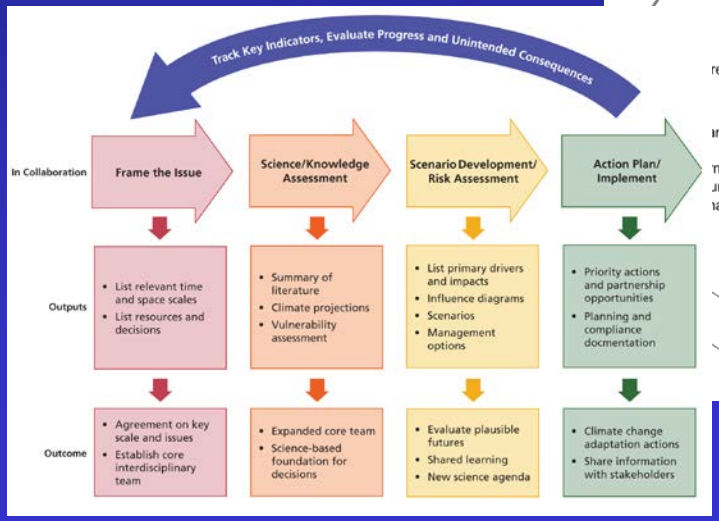

Stein et al. 2014. Climate-Smart Conservation: Putting Adaptation Principles into Practice

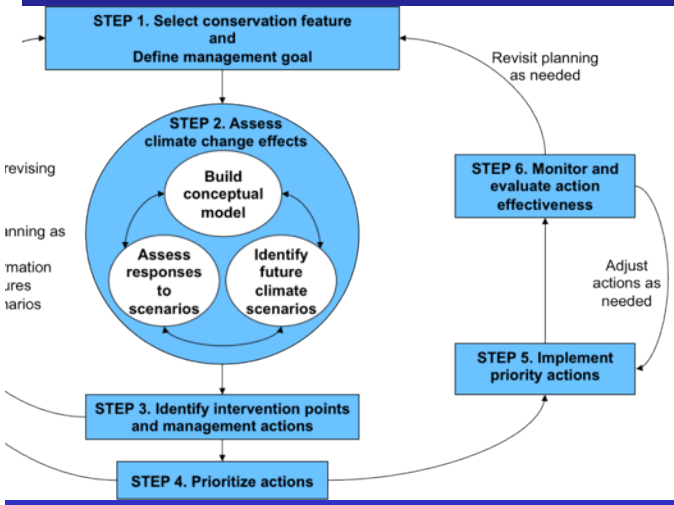
# Adaptation Approaches





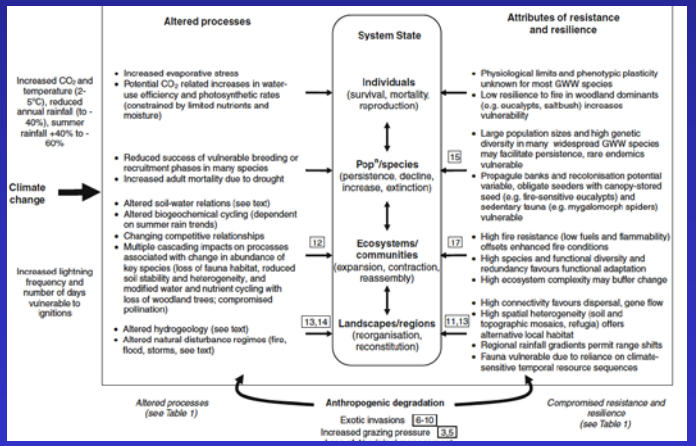



# Table 5.1 from Glick & Cross (2014; Climate Smart chpt 5.)

| Approach | Purpose and key features | Spatial scale[a] | Starting point | Effort/Cost[b] | Institutional affiliation | References |
|---|---|---|---|---|---|---|
| Adaptation for Conservation Targets (ACT) Framework | Stepwise process for developing actions to achieve climate-informed conservation goals for specific species, ecological processes, or ecosystems | Site, Landscape | Management targets, goals, or activities | *Time:* low/moderate *Expertise:* moderate *Cost:* low/moderate | NCEAS Climate Change & Wildlife Conservation working group; Wildlife Conservation Society; | Cross et al. 2012b, 2013 |
| Awareness to Action (A2A) | Adaptation planning services to develop climate change adaptation plans focused on specific regions, species, or ecosystems | Site, Landscape | | | | |
| Climate Change Adaptation Framework for Ecosystems | Stepwise process for integrating climate into natural resource management for many species and ecosystems | Landscape | | | | |
| Climate Change Response Framework | Stepwise process for integrating climate into forest planning and management for forest species and ecosystems | Site, Landscape | | | | |
| Climate Project Screening Tool | Questionnaire-based tool to explore options for ameliorating climate effects on forest resource management projects | Site | | | | |
| Climate-Ready Estuaries Expert Elicitation Approach | Expert elicitation approach for assessing vulnerabilities and identifying adaptation options | Site, Landscape | | | | |
| Climate-Smart Coastal Restoration Planning | Stepwise framework for the design and implementation of climate-smart coastal restoration projects in the Great Lakes | Site | | | | |
| ClimateWise | Stepwise process for developing adaptation strategies and actions coordinated across local ecosystem and human community concerns | Site, Landscape | | | | |
| Conservation Action Planning for Climate Change | Stepwise process for integrating climate into existing plans developed using the Conservation Action Planning (CAP) process for specific species or ecosystems | Site | | | | |
| Decision Framework for Climate Change Adaptation | Decision tree that identifies and prioritizes actions to increase the adaptive capacity of species | Site, Landscape | Particular species and species distribution/ bioclimatic envelope model | *Time:* low/moderate *Expertise:* moderate *Cost:* low/moderate | NERC Centre for Ecology & Hydrology; UK Population Biology Network | Oliver et al. 2012 |
| National Park Service Scenario Planning | Scenario planning process to address climate-related uncertainties in managing species, ecosystems, cultural and recreational resources | Site, Landscape | Potential climate-related changes | *Time:* moderate *Expertise:* moderate *Cost:* moderate | National Park Service | Weeks et al. 2011, Rose and Star 2013 |
| North Cascadia and Olympic Peninsula Adaptation Partnership | Science–management partnership for assessing vulnerability and developing adaptation options for species and ecosystems across federal land management units | Landscape | Potential climate-related changes | *Time:* moderate/high *Expertise:* moderate *Cost:* moderate | U.S. Forest Service and National Park Service | Raymond et al. 2013, Littell et al. 2012, Halofsky et al. 2011 |
| Open Standards for the Practice of Conservation | Incorporation of climate into a structured conservation planning process for specific species or ecosystems | Site, Landscape | Management targets, goals or activities | *Time:* moderate *Expertise:* moderate *Cost:* moderate | Conservation Measures Partnership | CMP 2013 |
| Refuge Vulnerability Assessment and Alternatives | Stepwise process for spatially explicit assessment of a refuge's vulnerability to climate change and other stressors, and identification of adaptation options | Site, Landscape | Either management concerns or potential climate-related changes | *Time:* moderate/high *Expertise:* high Cost: moderate/high | NatureServe | Crist et al. 2012a, 2012b |
| Template for Assessing Climate Change Impacts and Management Options (TACCIMO) | Web-based tool that synthesizes published research on climate impacts and adaptation options relevant to forest planning and management | Site, State, Landscape | Potential climate-related changes | *Time:* low *Expertise:* low Cost: low | U.S. Forest Service | Treasure et al. 2014 |
| Yale Framework | Guidance for selecting assessment and modeling strategies relevant to specific conservation and resource | Site; Landscape | Matrix of adaptation options at different | *Time:* low/ moderate/high *Expertise:* moderate/ high | Yale School of Forestry | Schmitz et al. In press |

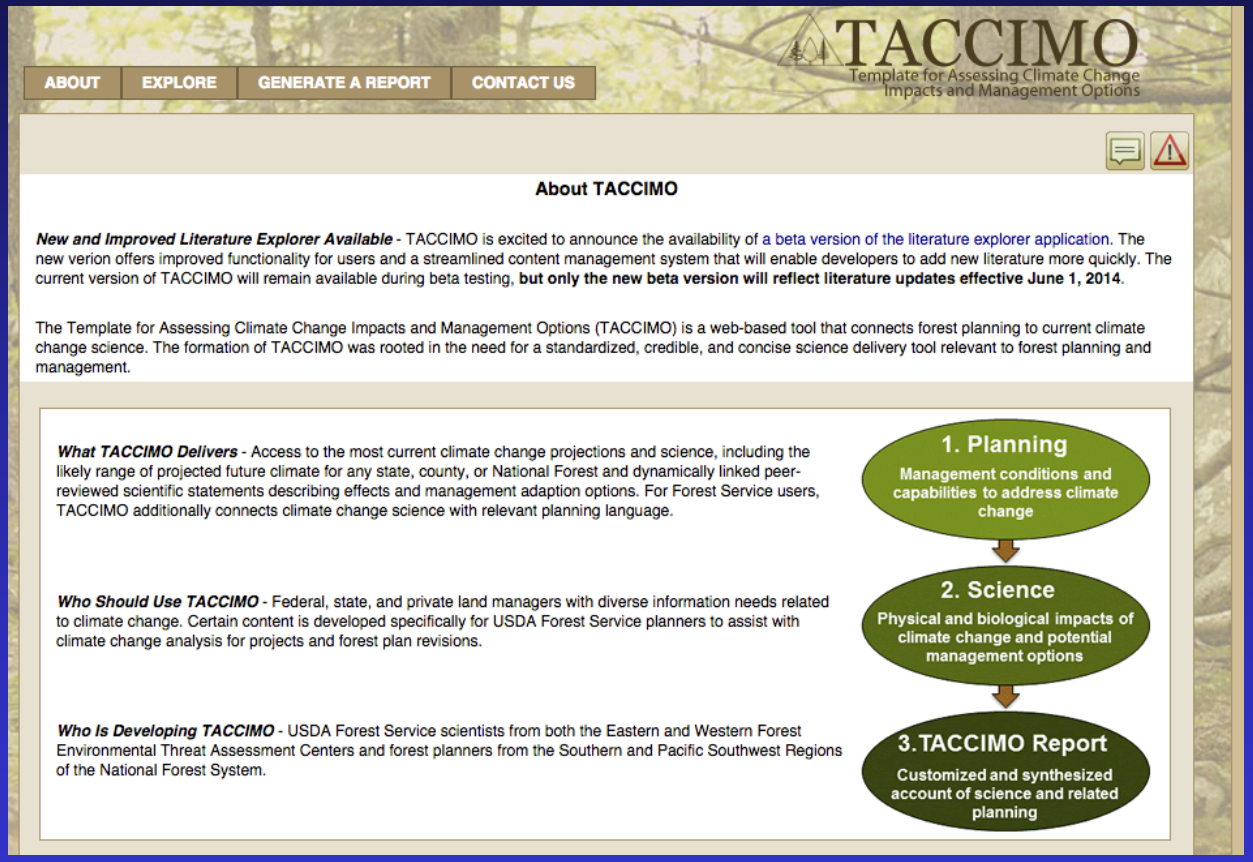
# TACCIMO

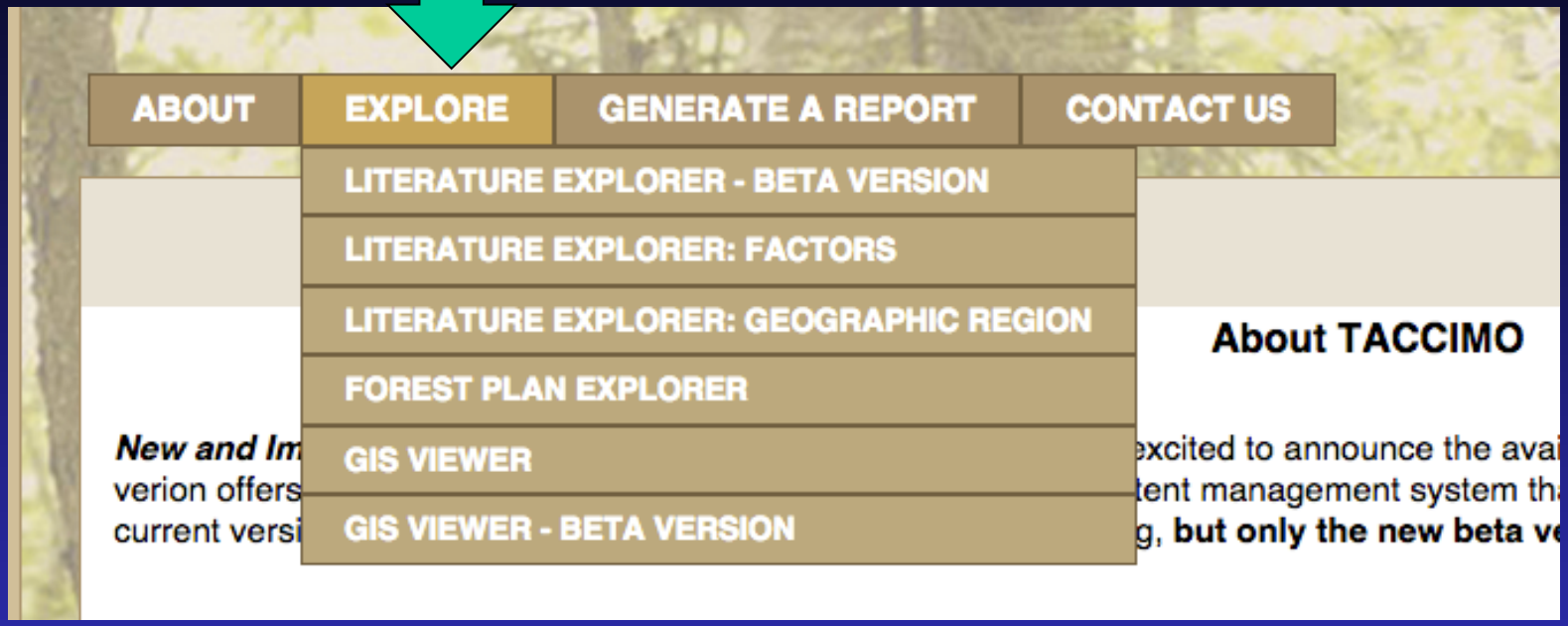

# Change-resilience framework



# "Adaptation Lite"

**TACCIMO** - Template for Assessing Climate Change Impacts and Management Options (USFS - http://www.taccimo.sgcp.ncsu.edu/)



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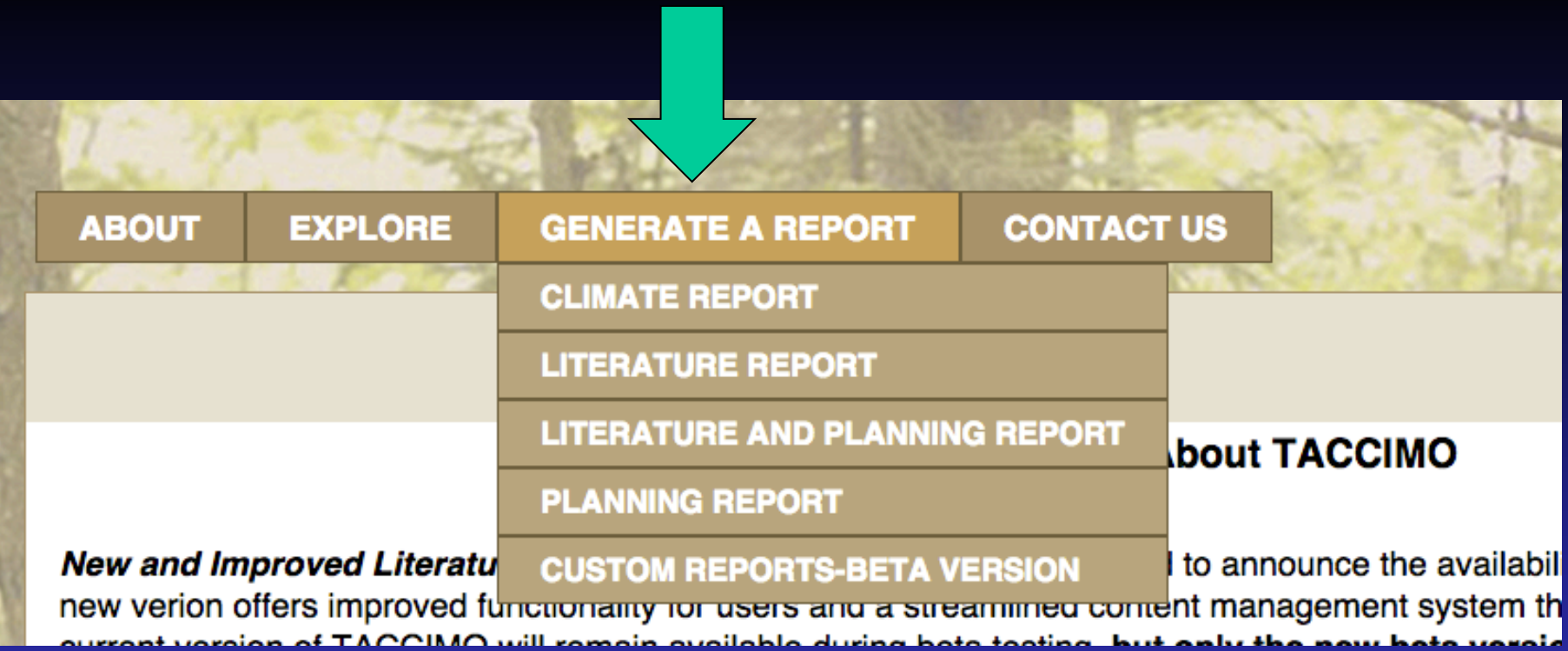
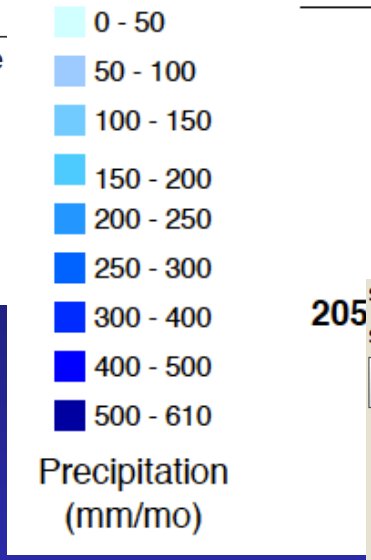


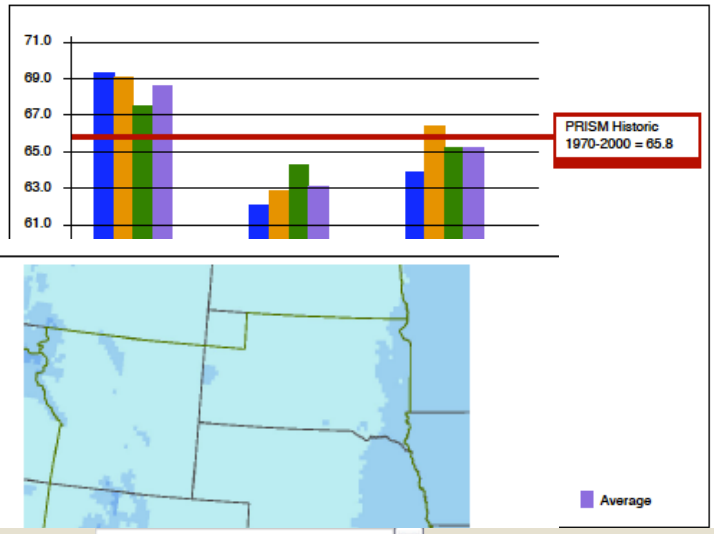

http://www.taccimo.sgcp.ncsu.edu

**Table 3.**
National average precipitation by GCM and SRES (mm, monthly average spanning 2009-2099, multiply by 12 to get annual total)

| SRES/GCM | CGCM3.1 | CM2.0 | HadCM3.1 |
|---|---|---|---|
| A2 | 69.3 | 62.1 | 63.9 |
| A1B | 69.1 | 62.9 | 66.4 |
| B1 | | | |

Average




205

Step 1: Select Factor: Climate Trends; Fire; Forest He
Step 2: Select Category: Exotic Insect Pests; General In
Step 3: Select Region: National; R2 & R4: Mountain W
Step 4: Select Resolution: General; Moderately Specific; S

8 of 63 Export to the selected format Export

Fire-induced tree mortality is recognized as an important ecosystem process that varies among tree species (Ryan and Reinhardt 1988) and is influenced by patterns of fire severity (Glitzenstein et al. 1995, Kobziar et al. 2006) and fuel consumption (Stephens and Finney 2002) as well as postfire bark beetle dynamics (McHugh and Kolb 2003, Parker et al. 2006, Fettig et al. 2007). Fire-killed trees are important habitat for wildlife (Farris and Zack 2005) and the resulting gaps in the canopy result in accelerated growth of remaining trees and provide sites for tree regeneration and the establishment of a diverse understory of grasses, forbs, and shrubs (Cooper 1960, Brockway and Lewis 1997, Keeley and Stephenson 2000, Agee and Lolley 2006, Moghaddas et al. 2008). 205

In a climate change scenario of warmer and dryer future climates, one could expect slower rates of decomposition, more frequent drought conditions, and consequently, more fires in post-outbreak stands. 123

**Management Options** **Source**

When a species has already changed one or more characteristics of the fire regime, the altered regime needs to be evaluated for its potential to have negative effects on natural resources, local economies, and public 291

**Getting Started in TACCIMO:**

| | |
|---|---|
| TACCIMO Overview Video | Provides general overview of the TACCIMO application. |
| TACCIMO Factsheet | Provides a downloadable factsheet covering key aspects of TACCIMO. |
| How to Use TACCIMO | Comprehensive User Guide, Quick Start Guides, and set of short introductory videos. |
| Content Sources | Current list of peer-reviewed Content Sources included in TACCIMO. |

- Free
- Fast
- Focused on USA forests
- Directed to USFS needs but very useful to others

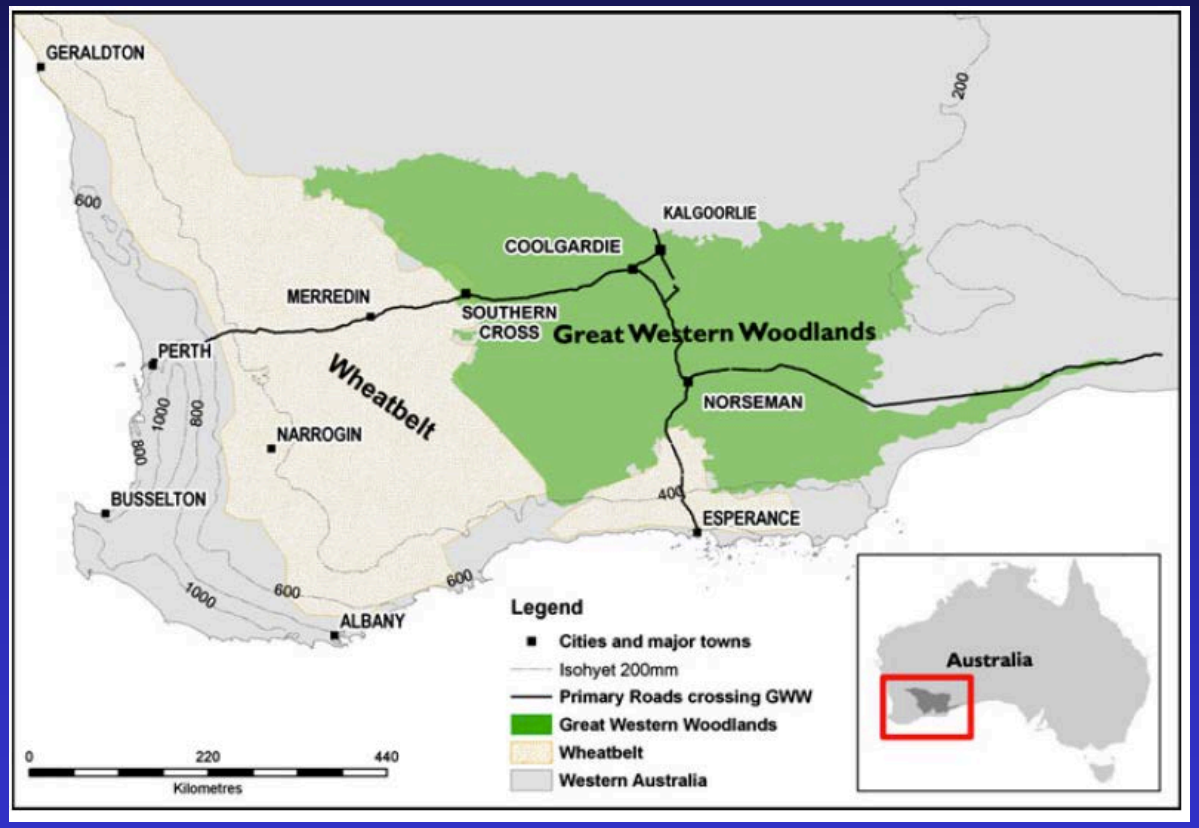
http://www.taccimo.sgcp.ncsu.edu/

UKCIP Wizard: http://www.ukcip.org.uk/wizard/

# Prober et al. 2012 – Change-resilience framework

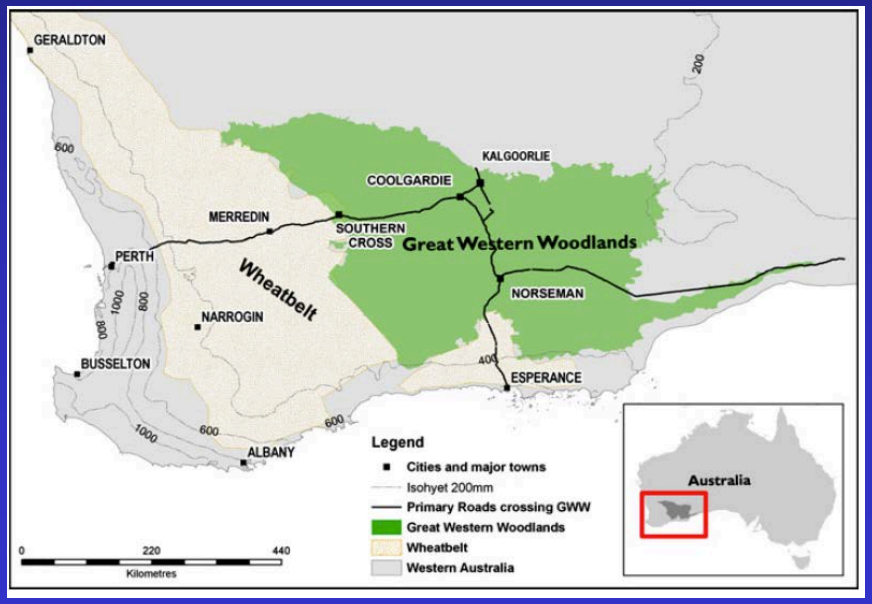
## Mediterranean-climate woodland

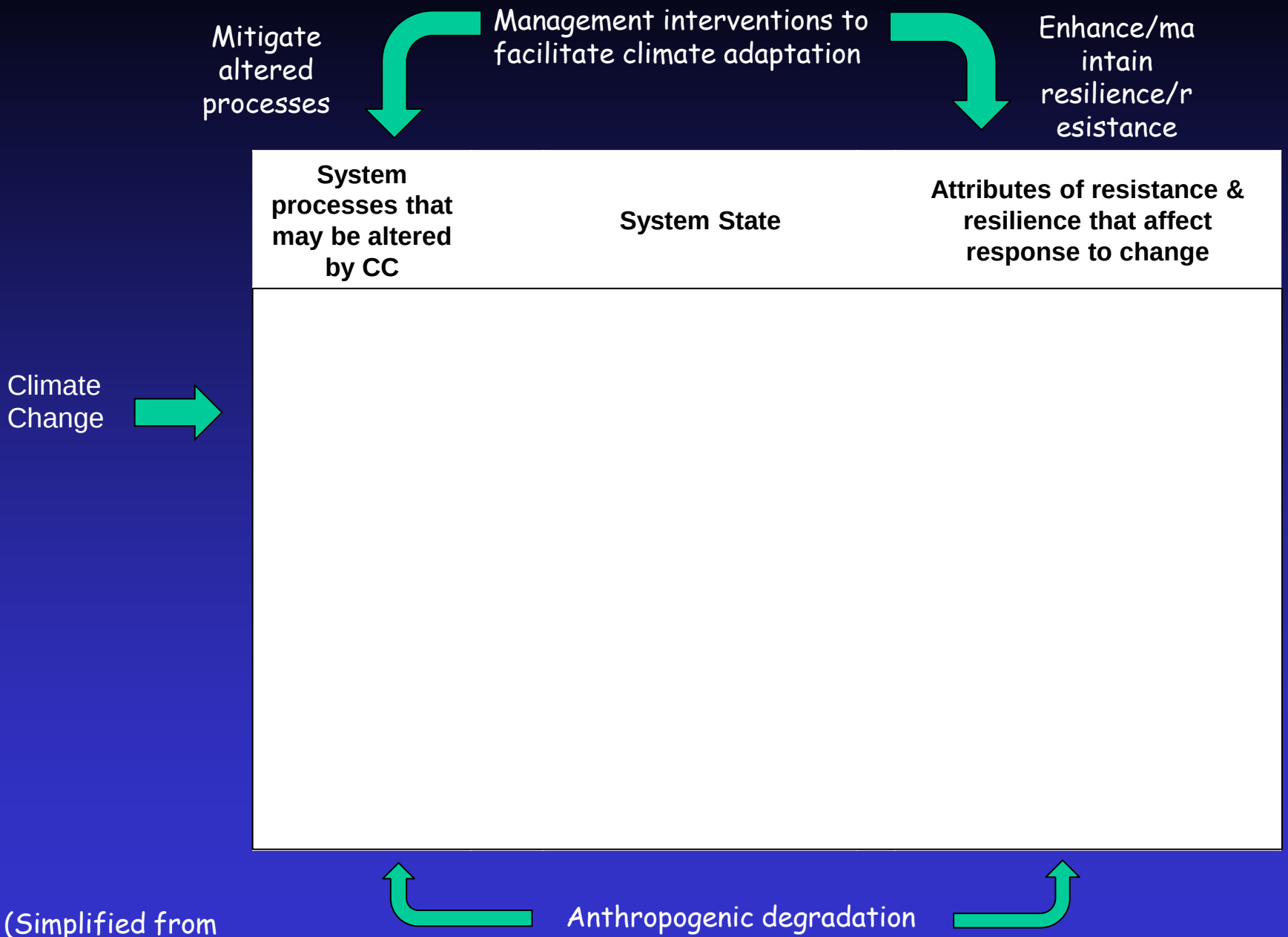
### Great Western Woodlands



Focus on:

- Achieving defined, climate-informed goals
- Biome to regional scale
- Resistance and resilience to CC
- Multi-level, hierarchical interactions
- Expertise of stakeholders -> 3-day workshop with + follow-up






(Simplified from Prober et al 2012)

Features of the change-resilience framework:

- Clear link to CC impacts
- Emphasis on interactions (~ indirect effects)
- Focus on "adaptive capacity"
- Straight-forward process
- Excellent use of right-scaled science
- ID & evaluation of practical management options

Prober, S. M., K. R. Thiele, P. W. Rundel, (15 co-authors), and A. Watson. 2012. Facilitating adaptation of biodiversity to climate change: a conceptual framework applied to the world's largest Mediterranean-climate woodland.

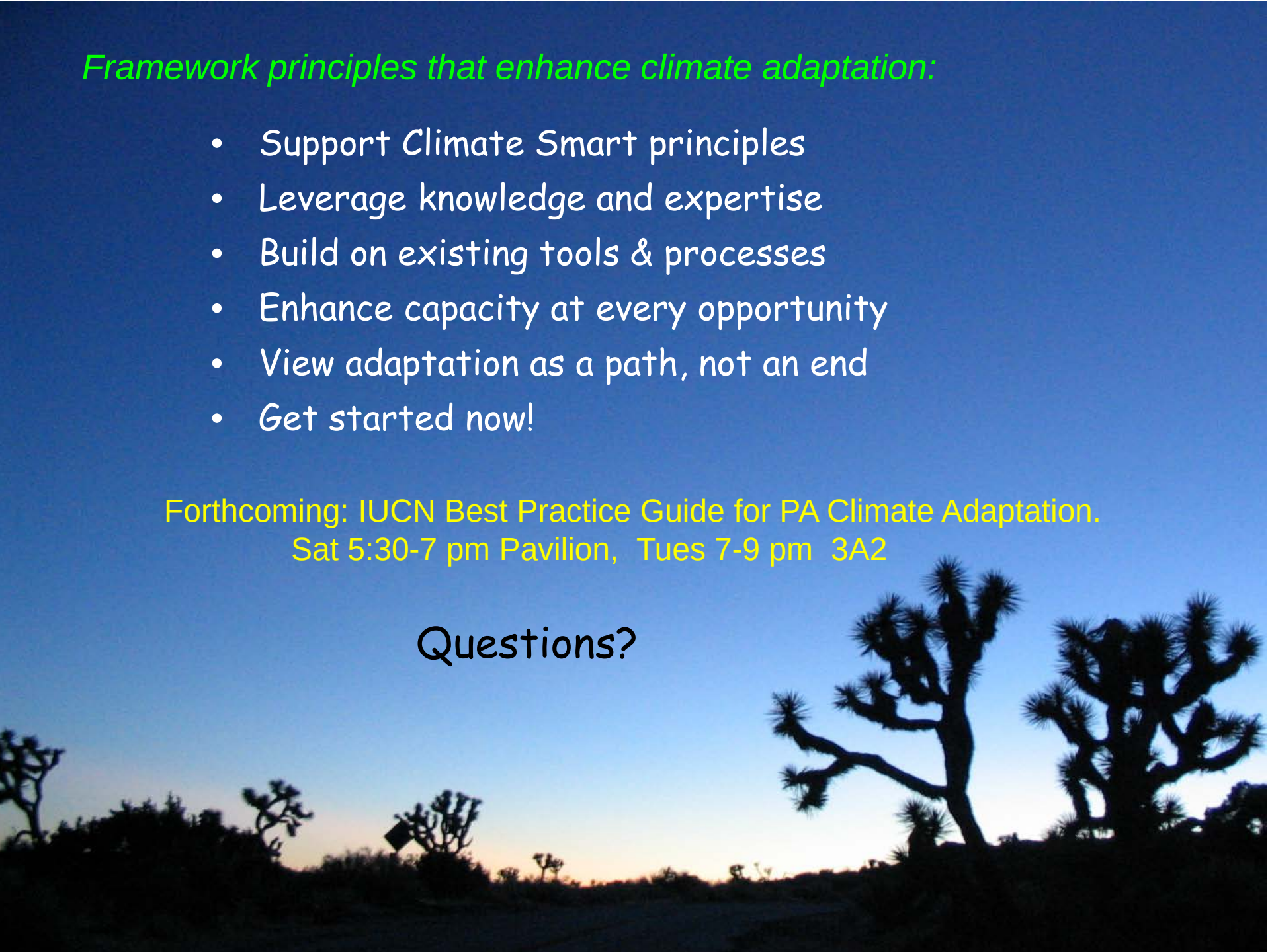
Climatic Change **110**:227-248. DOI 10.1007/s10584-011-0092-y

*Framework principles that enhance climate adaptation:*

- Support Climate Smart principles
- Leverage knowledge and expertise
- Build on existing tools & processes
- Enhance capacity at every opportunity
- View adaptation as a path, not an end
- Get started now!

Forthcoming: IUCN Best Practice Guide for PA Climate Adaptation.
Sat 5:30-7 pm Pavilion, Tues 7-9 pm 3A2

Questions?



# *A few good resources*

Forthcoming: IUCN Best Practice Guide for PA Climate Adaptation.
Sat 5-7 pm, Tues 7-9 pm

Publications:

Moser & Boykoff. 2013. Climate change and successful adaptation: The scope of the challenge. Pages 1-33 *in* Moser & Boykoff, editors. Successful Adaptation to Climate Change: Linking Science and Practice in a Rapidly Changing World. Routledge, London.

Preston et al. 2011. Climate adaptation planning in practice: an evaluation of adaptation plans from three developed nations. Mitigation and Adaptation Strategies for Global Change **16**:407-438.

Prober, S. M., et al. 2012. Facilitating adaptation of biodiversity to climate change: a conceptual framework applied to the world's largest Mediterranean-climate woodland. Climatic Change **110**:227-248.

Stein et al. (eds.). 2014. Climate-smart conservation: Putting adaptation principles into practice. National Wildlife Federation, Wash., D.C.

Web Sites:

UKCIP -- http://www.ukcip.org.uk/

TACCIMO - http://www.taccimo.sgcp.ncsu.edu/

# Multi-scale assessment of vulnerability

| | Species | Ecological System | LCC-Scale |
|---|---|---|---|
| **Exposure** | CC Projections; TOPS variables | CC Projections; TOPS variables | CC Projections; TOPS variables |
| **Sensitivity** | SDMs; Life history traits | Climate variation; LPJ modeling | Biome BGC responses; NPP controls |
| **Adaptive Capacity** | Species & habitat traits; Life history traits | Connectivity; Refugia; Topography | ES diversity; Connectivity; Land forms |

LCC-VP
LANDSCAPE CLIMATE CHANGE VULNERABILITY PROJECT

Match adaptation approach to situation & resources:

- Time
- Money
- Existing knowledge
- Expertise
- Management capacity

Many activities are opportunistic