Climate-informed management & monitoring for military installations in southern California:

Toward implementation of adaptation strategies

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Rob Wolf, Tierra Data, Inc.
Christy Wolf, Department of the Navy, Detachment Fallbrook

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USA npn National Phenology Network

SPAWAR

TIERRA DATA

Southwest Climate Science Center

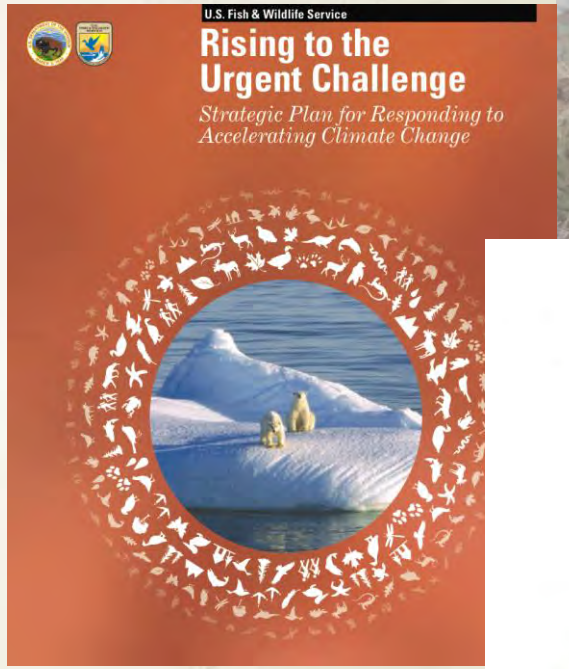
USGS science for a changing world

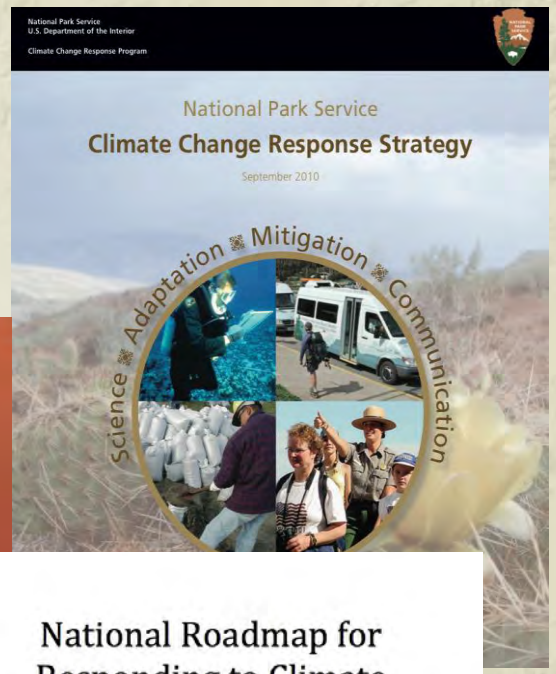
5 February 2016 - FFACCTs

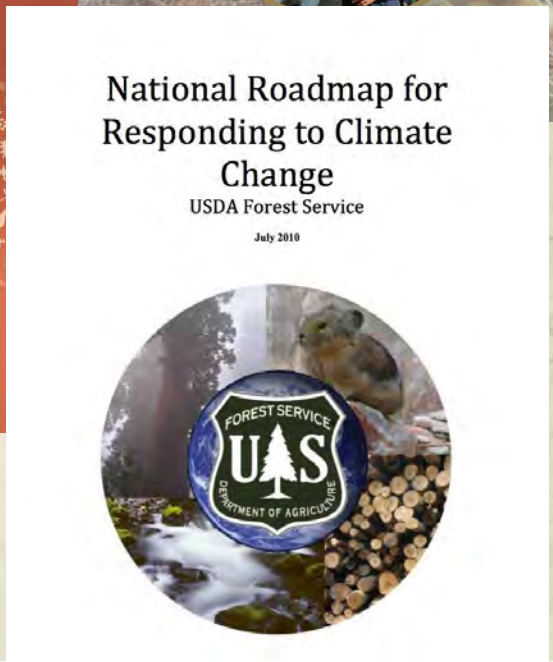
First Fridays All Climate Change Talks

Federal response

- **2009:** Department of Interior's Secretarial Order #3289 (2009) Coordinated Strategy
- **2012:** DOI Climate Science Centers (CSCs) & Landscape Conservation Cooperatives (LCCs)
- **2014:** US Department of Agriculture Climate Hubs







Guidance & tools

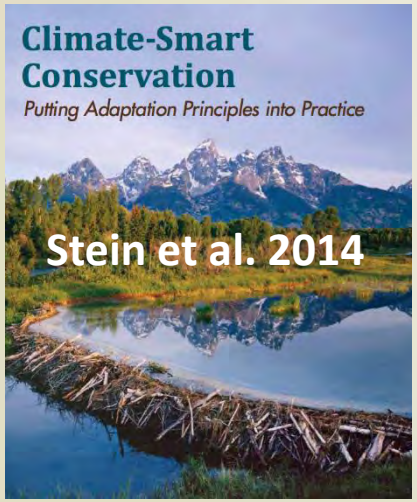
Environmental Management (2012) 50:341–351
DOI 10.1007/s00267-012-9893-7

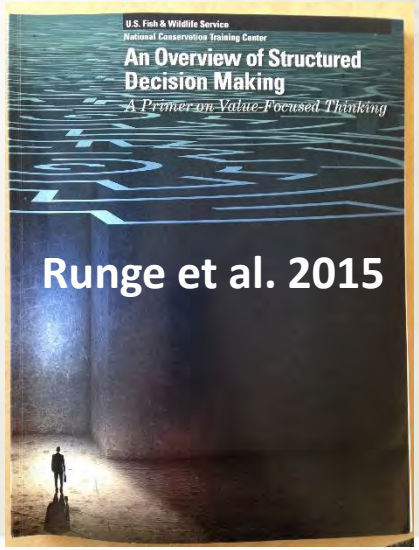
PROFILE

Cross et al. 2012

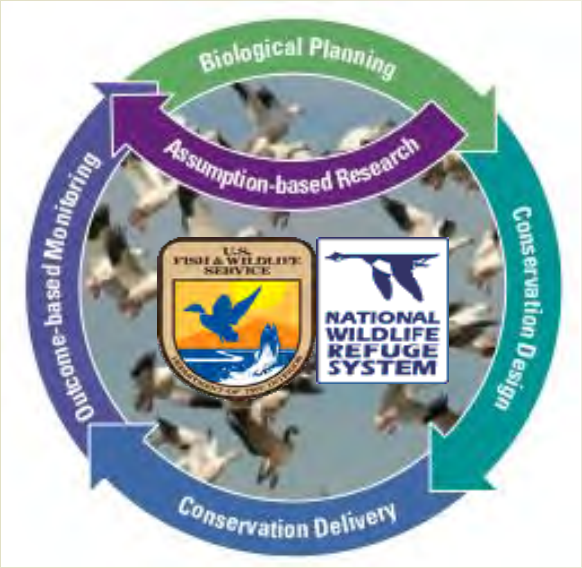
The Adaptation for Conservation Targets (ACT) Framework: A Tool for Incorporating Climate Change into Natural Resource Management

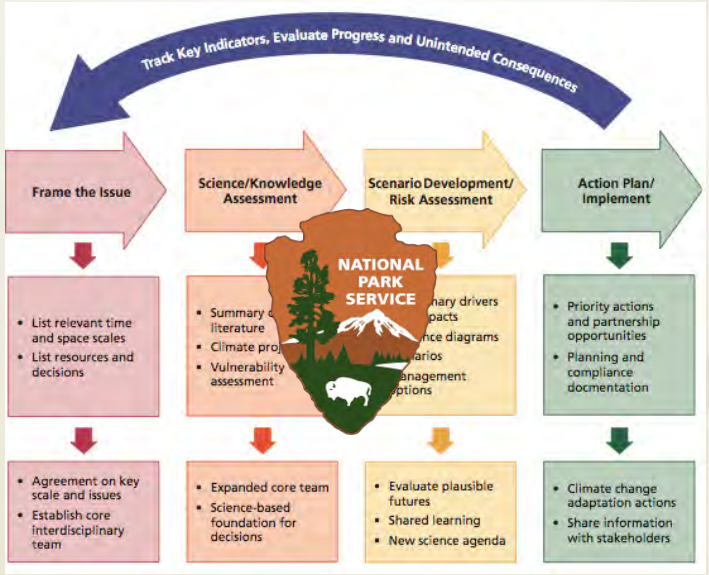
Molly S. Cross · Erika S. Zavaleta · Dominique Bachelet · Marjorie L. Brooks · Carolyn A. F. Enquist · Erica Fleishman · Lisa J. Graumlich · Craig R. Groves · Lee Hannah · Lara Hansen · Greg Hayward · Marni Koopman · Joshua J. Lawler · Jay Malcolm · John Nordgren · Brian Petersen · Erika L. Rowland · Daniel Scott · Sarah L. Shafer · M. Rebecca Shaw · Gary M. Tabor

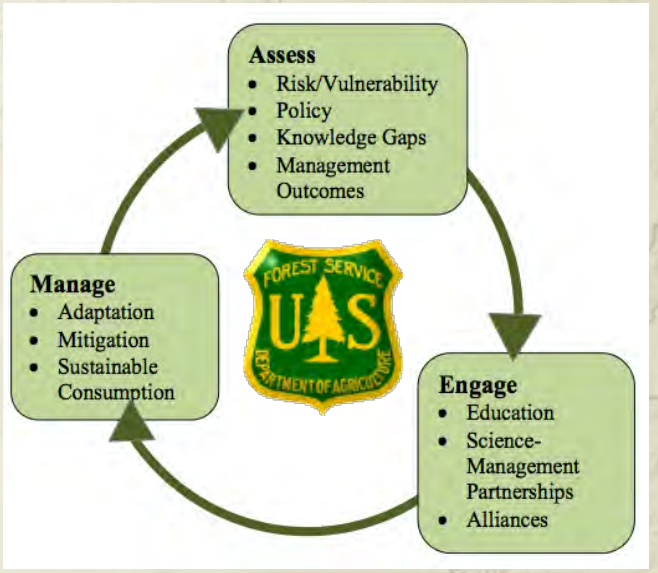




"Climate change makes **monitoring and adaptive management** more important than ever….Only after we have established robust monitoring schemes will we be able to effectively modify our strategies over time." (USFWS)







The Challenge

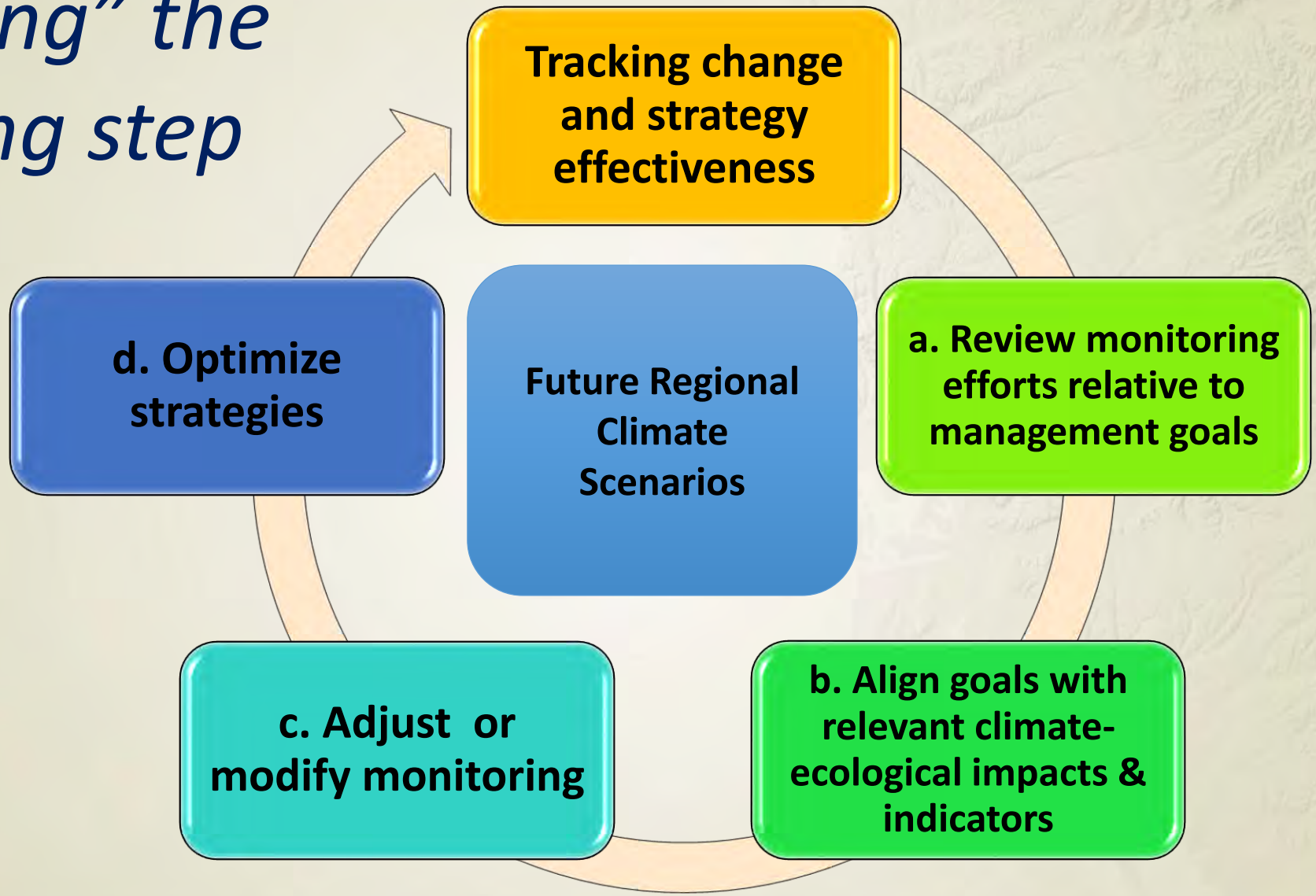
Integrate AM & climate change adaptation into natural resources management programs and plans in practical ways that support:

- *Addressing existing threats & requirements*
- *Making climate informed decisions*

Climate-informed Adaptive Management

Track (monitor) action effectiveness & ecological response

"Unpacking" the monitoring step



Indicators:

Linking Essential Variables

Essential Climate Variable (ECVs)
Temperature (T, Winter Minimum, Summer maximum, mean)
Precipitation (PPT)
Evapotranspiration (ET)
Wind speed (WS)
Surface flow & discharge (SFD)
Groundwater (GD)
Soil moisture (SM)
Relative humidity (RH)

Essential Biological Variables (EBVs)
Pereira et al. 2013

Genetic composition	**Allelic diversity**
	Co-ancestry
	Population genetic differentiation
	Breed and variety diversity
Species populations	**Species distribution**
	Population abundance
	Population structure by age/size class
Species traits	**Phenology**
	Body mass
	Natal dispersal distance
	Migratory behavior
	Demographic traits
	Physiological traits
Community composition	**Taxonomic diversity**
	Species interactions
Ecosystem structure	**Habitat structure**
	Ecosystem extent and fragmentation
	Ecosystem composition by functional type
Ecosystem function	**Net primary productivity**
	Secondary productivity
	Nutrient retention
	Disturbance regime

Climate Informed Monitoring (CIM)

A process to evaluate and optimize existing and identify new efforts relative to climate-informed management goals & objectives; identify gaps & opportunities

Putting CIM into practice:

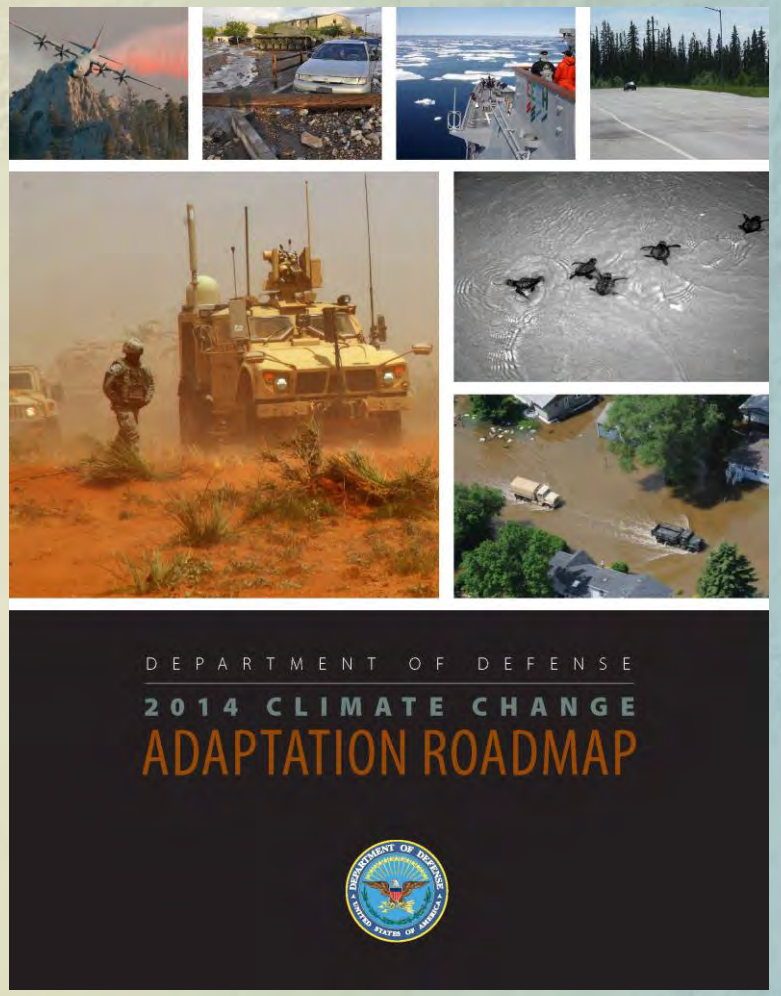
Climate Adaptation Efforts on DoD Installations in southern California

DoD 2014 Climate Adaptation Road Map

"Our first step in planning….identify the effects of climate change on DoD with tangible and specific metrics using the best available science."

DoDI 4715.03 (dtd 2011) Natural Resources Conservation Program Instruction from Enclosure 3 procedures for INRMP preparation

"Utilize existing tools to assess the potential impacts of climate change…[and will] take steps to implement adaptive management to ensure the long-term sustainability of those resources."



Natural Resource Manager's Plates Are Full

- Military Readiness
- Threatened & Endangered Species
- Ecosystem Services, Biodiversity

Case Study:
Naval Weapons Station Det. Fallbrook

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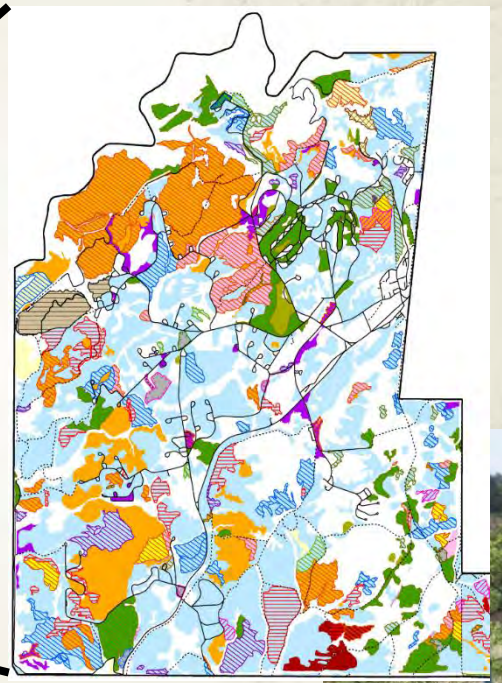


U.S. Navy photo by MC1 Eli J. Medellin

Climate Informed Management & Monitoring

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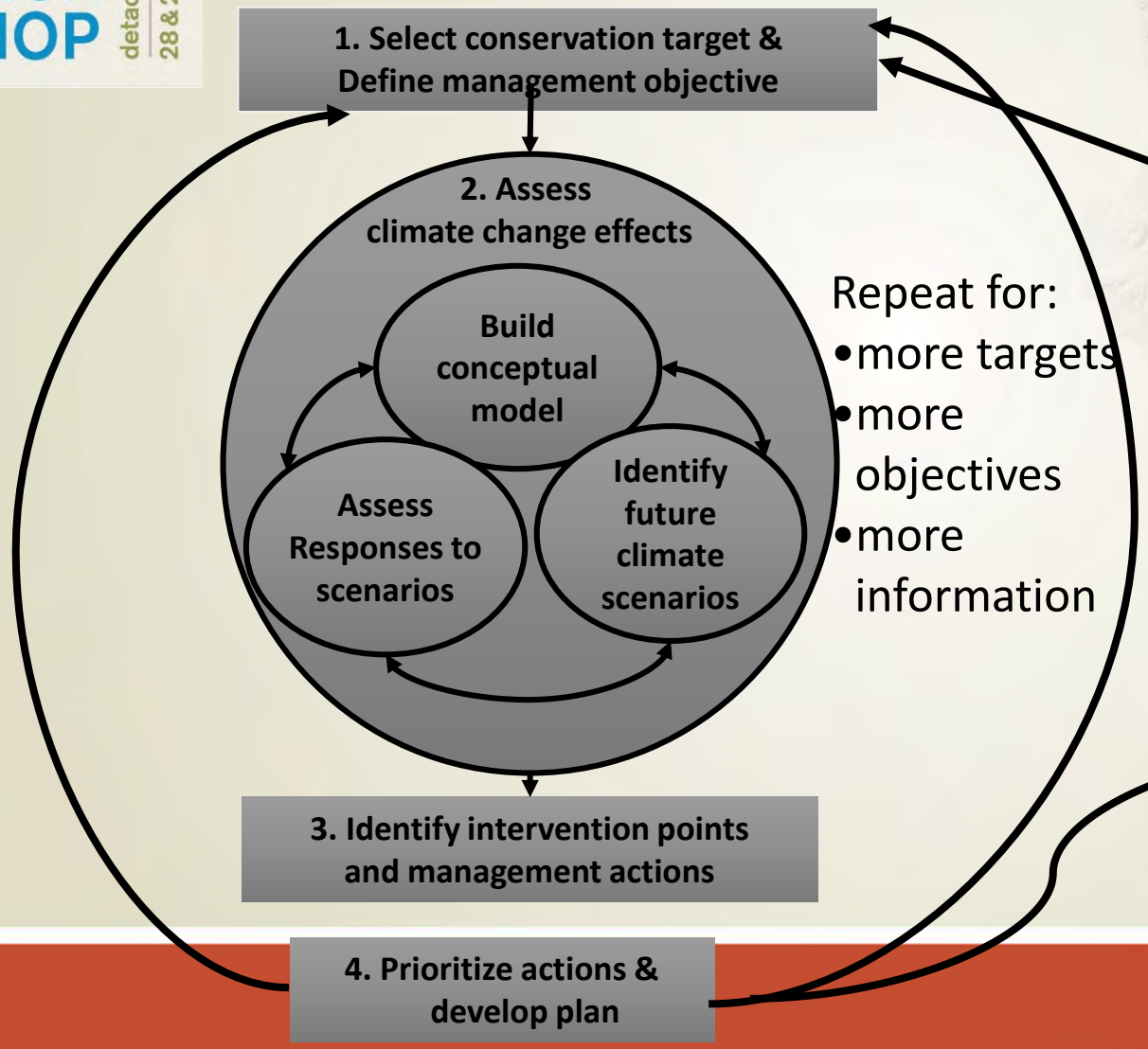
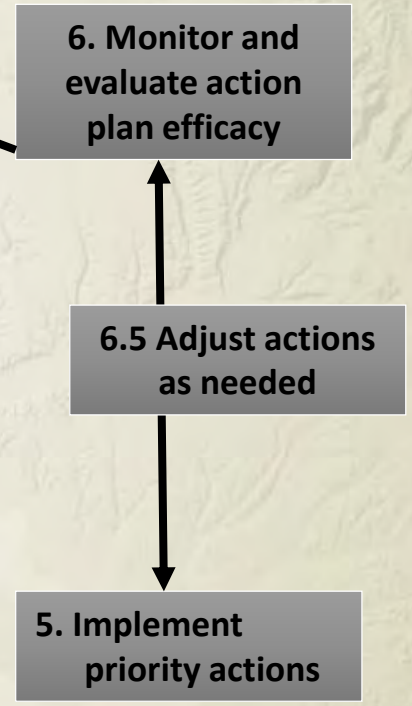
The Adaptation for Conservation Targets (ACT) Framework





Cross et al. 2012

Key Strategies Identified

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1. Conduct targeted herbicide applications for control or eradication of exotics.
2. Identify refugial habitat for target species
3. Conduct targeted grazing to reduce the biomass of annual exotics & wildfire threat to target spp habitat.
4. Work with fire department to develop pre-suppression & suppression actions for refugia.

5. Develop a strategic climate-informed monitoring plan as a key adaptation action…Determine what to monitor & when

Case Study:
Marine Corps Base Camp Pendleton

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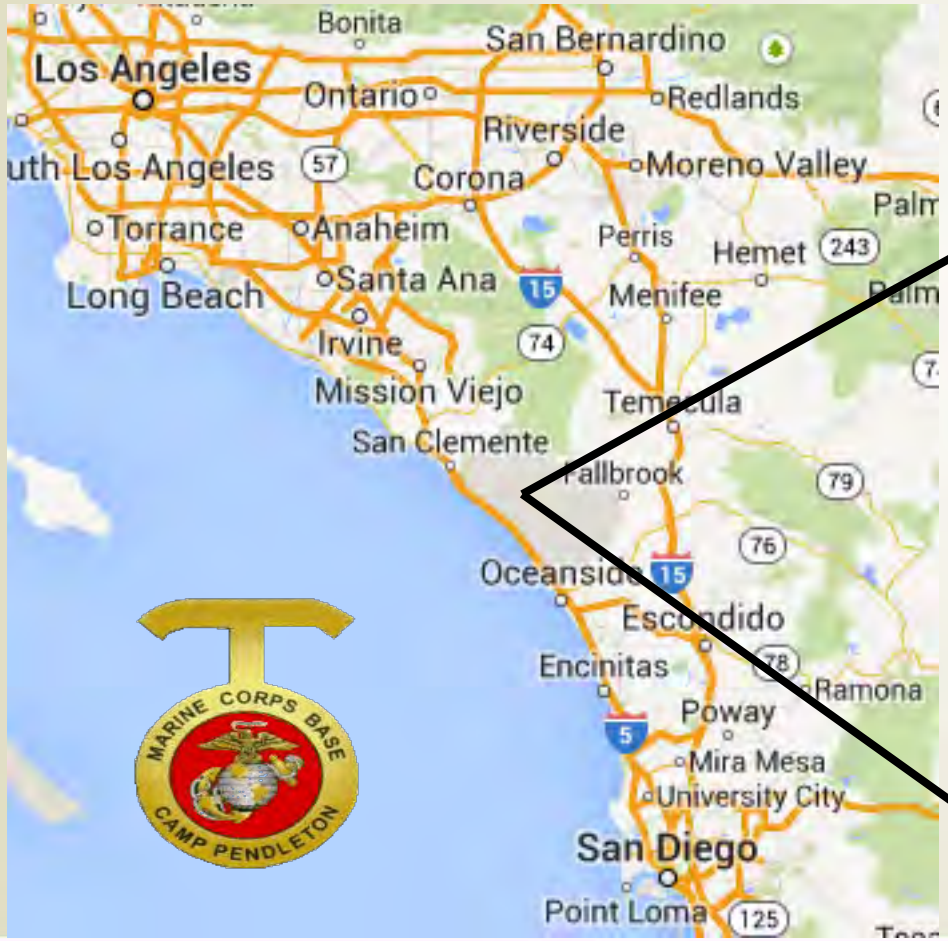

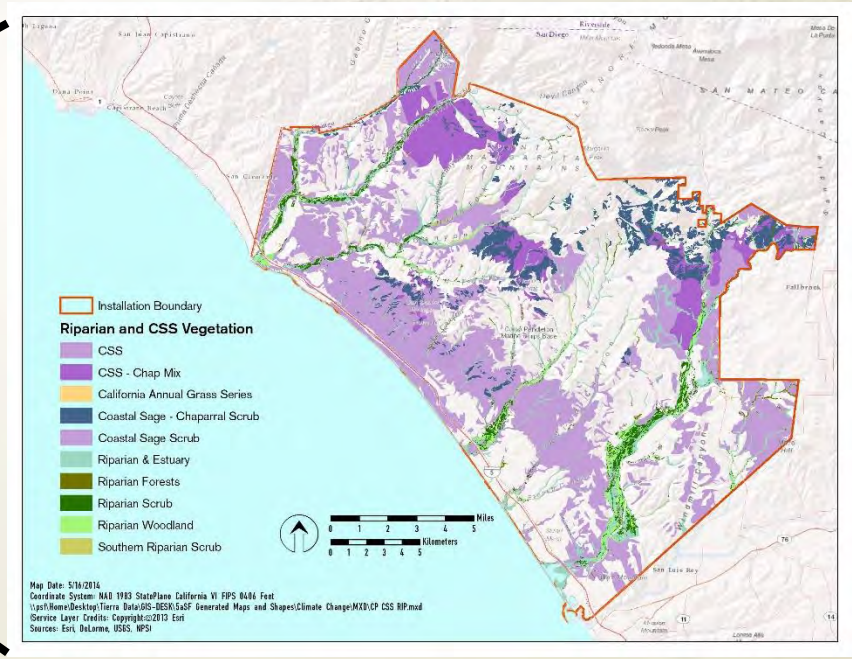

Workshop Goal

To develop methods and a process

- for evaluating, adjusting, and optimizing existing & identifying new monitoring efforts
- to ensure robust information for making climate-informed management decisions

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CLIMATE INFORMED MONITORING WORKSHOP

Workshop Process

1. Linking Management with Climate Change

1. Choose existing management objective(s)

2. Evaluate observed & projected ecological changes

3. Evaluate existing monitoring efforts for CC relevance

2. Linking Climate Change with Monitoring

4. Identify relevant climate & biodiversity variables

5. Identify CC gaps in existing monitoring efforts

6. Consider timing of monitoring & management

3. Outcomes

7. Modify existing & identify potential new initiatives

8. Identify opportunities and barriers to implementation

9. Develop CI monitoring plan

Existing Monitoring Effort	Ecological Impact	Indicators	Existing Monitoring Variable(s)	Climate Informed Monitoring Approach
Fuel Moisture Sampling				

An example…

Existing Monitoring Effort	Ecological Impact	Indicators	Existing Monitoring Variable(s)	Climate Informed Monitoring Approach
Fuel Moisture Sampling	• Fog could decline Increase in shrub seedling mortality • Decrease in shrub seed production & survival • Extended drought short-term changes in dead fuel load from die-back • Exacerbated drought stress • Changes in phenology			

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Existing Monitoring Effort	Ecological Impact	Indicators	Existing Monitoring Variable(s)	Climate Informed Monitoring Approach
Fuel Moisture Sampling	• Fog could decline Increase in shrub seedling mortality • Decrease in shrub seed production & survival • Extended drought short-term changes in dead fuel load from die-back • Exacerbated drought stress • Changes in phenology	Temp & PPT Phenology (green up and brown down)	Fuel moisture (live & dead ARTCAL & MALLAU) Monitor on a weekly basis to compute a Fire Danger Rating	***Continue to:*** • Continue to monitor year round ***Modify by:*** • Add fuels phenology • Add Soil Moisture to understand moisture stress • Utilizing remote-sensed cloud imagery (GOES) to characterize spatial structure of radiation (solar) ***Management Implications of Ecological Impact:*** • Consider changing window for management fuels treatments

What's happening now?

- *Navy Detachment Fallbrook*:
  - Incorporating CIMM in management plan (INRMP) revision
  - Developing monitoring summaries for use in CIMM process
  - Installed a weather station

- *Marine Corps Base Camp Pendleton:*
  - Initiated plant phenology monitoring to couple with fuel moisture surveys
  - Assessing other recommendations from workshop

The importance of monitoring & evaluation

"Monitoring of environmental conditions and the outcomes associated with management actions aimed at preparing for CC are essential for evaluating progress toward climate change adaptation." Hansen et al. 2013

	Impacts Assessment	Vulnerability Assessment	Planning	Capacity Building	Implementation	Resources/ Tools	Monitoring/ Evaluation
Federal							
Tribal							
Region							
State							
Local							

Activity levels of stages of adaptations process relating to natural resources in the U.S.

More Activity

Moderate Activity

Less Activity

Absent or Unknown

Hansen et al. 2013, State of Adaptation Report

"Adapt, improvise, and overcome."
– T.C. Cummings

Thank you!

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