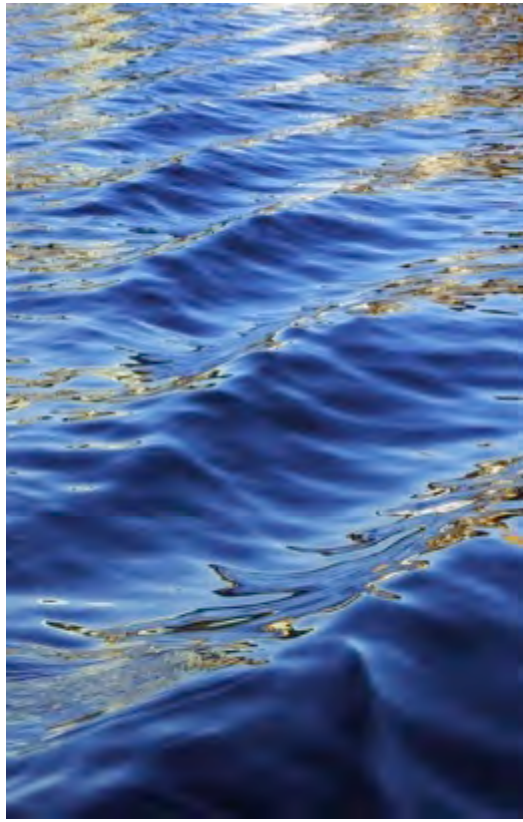
Yale Framework

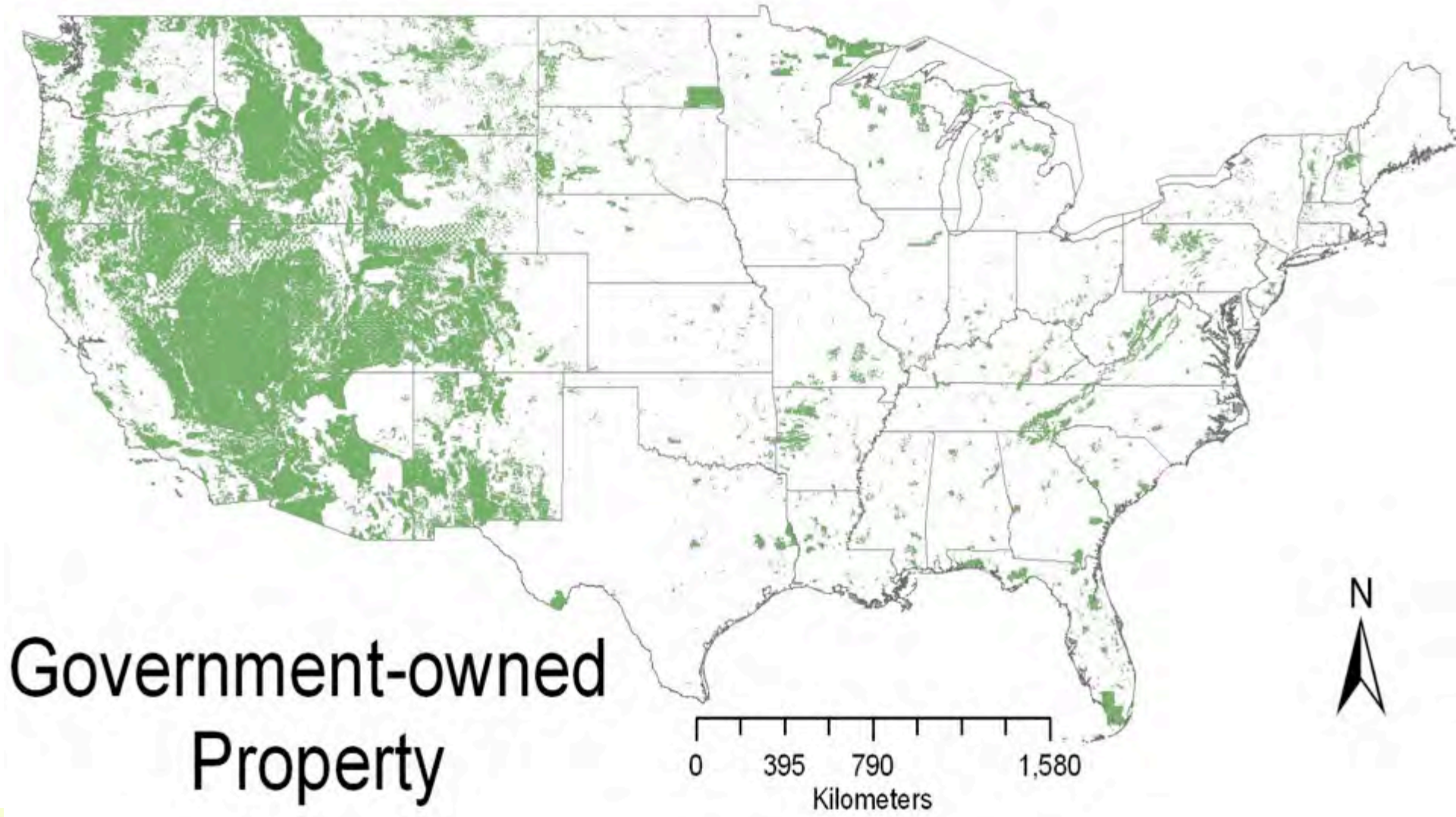
Strategies for Integrating Climate Adaptation Models Into Resource Planning



Anne M. Trainor
Yale University

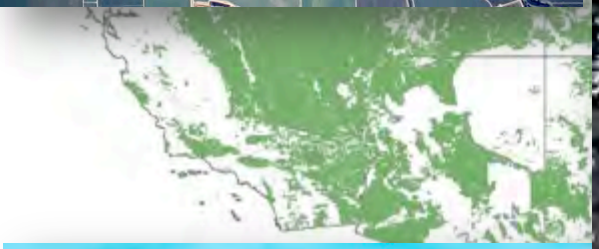
Classic conservation approach

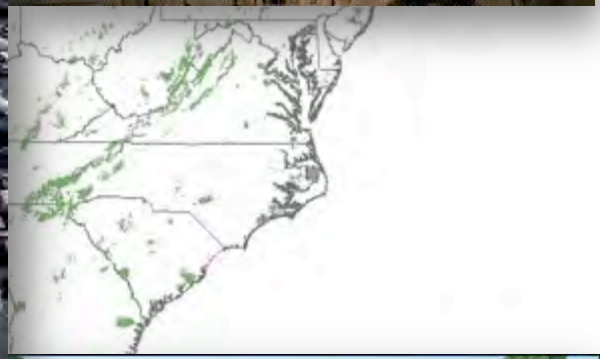
Managing for the persistence of biodiversity and natural processes through restricting or excluding human activities within defined tracts of natural systems.

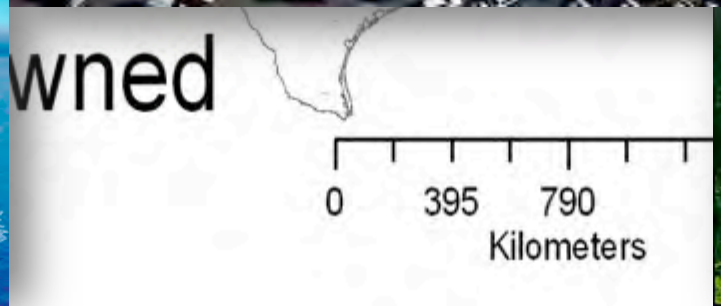


Classic conservation approach

Managing for the persistence of biodiversity and natural processes through restricting or excluding human activities within defined tracts of wilderness.

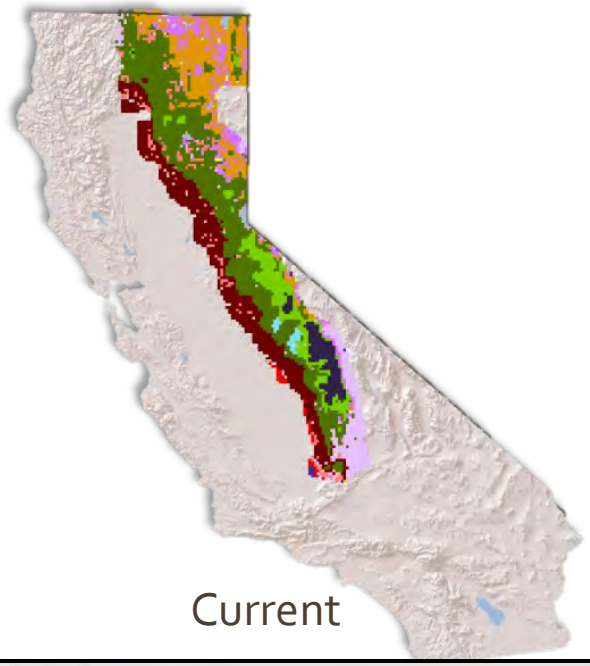




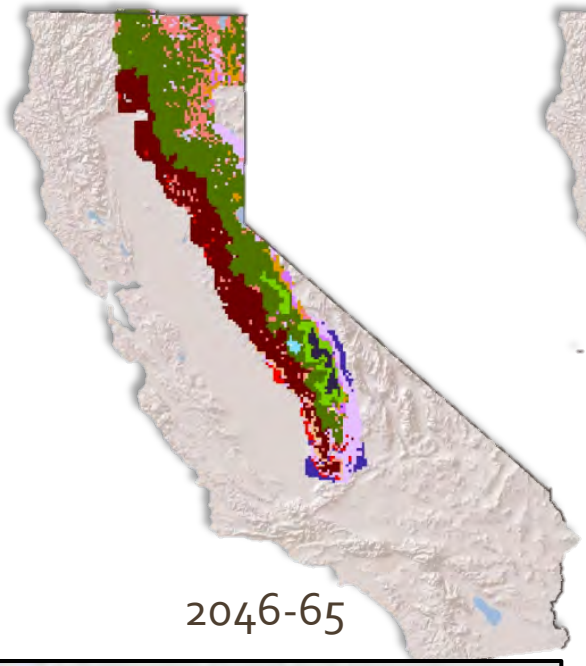


Climate change and dynamic landscapes

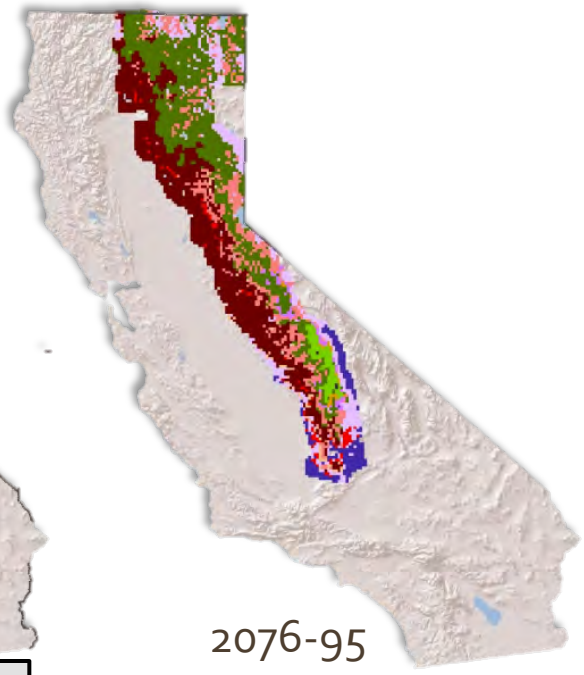
Shifting Major Ecosystem Types & Wildlife



Current



2046-65



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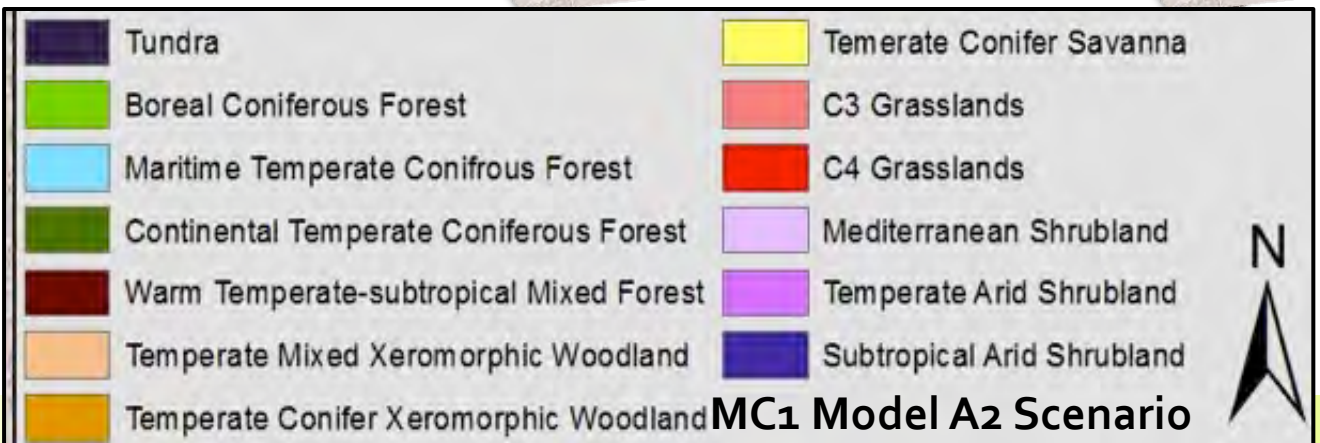

Global change is requiring conservation embrace a more dynamic view of landscapes

- Scientific assessment to evaluate spatial domains that natural systems require.

- Develop and implement adaptation approaches that will enable species and ecosystems to persist.

Credit: USGCRP & IPCC

BIOLOGICAL CONSERVATION 142 (2009) 14–32

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Review

Biodiversity management in the face of climate change: A review of 22 years of recommendations

Nicole E. Heller, Erika S. Zavaleta*

Environmental Studies I

Conservation Biology

Review

A Review of Climate-Change Adaptation Strategies for Wildlife Management and Biodiversity Conservation

JONATHAN R. MAWDSLEY,* ROBIN O'MALLEY, AND DENNIS S. OJIMA

The Heinz Center, 900 17th Street NW, Suite 700, Washington, D.C. 20006, U.S.A.

Global Change Biology

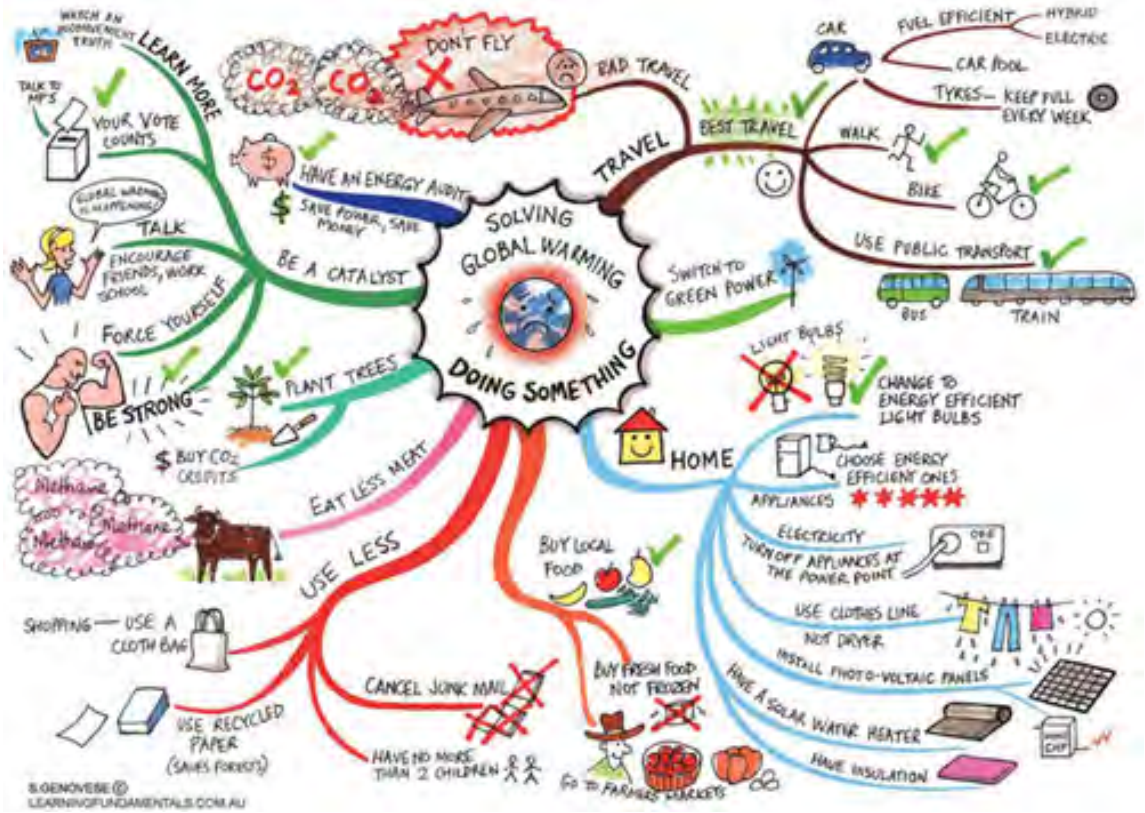
Global Change Biology (2011) **17**, 3150–3160, doi: 10.1111/j.1365-2486.2011.02457.x

Incorporating climate change adaptation into national conservation assessments

EDWARD T GAME*†, GEOFFREY LIPSETT-MOORE*, EARL SAXON‡, NATE PETERSON* and STUART SHEPPARD§

*The Nature Conservancy, South Brisbane, QLD 4101, Australia, †The School of Biological Sciences, University of Queensland, St Lucia, QLD 4072, Australia, ‡Center for Environment, Energy and Enterprise, AED, Washington DC 20009, USA, §The Nature Conservancy, Sanur, Bali, Indonesia

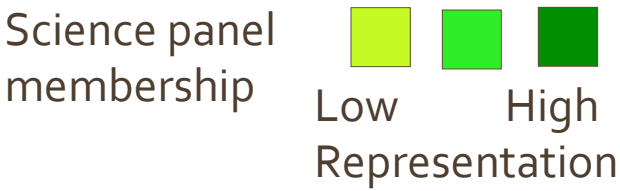
The approaches have not been conveyed in ways that can help practitioners choose the approach(es) that match particular conservation goals and needs.



This has the unintended consequence of breeding confusion and hence a failure to develop necessary adaptation policy and planning.

Science Panel Representation

	Federal Govt.	State Govt.	NGO	Academia
Policy & Science				
Technology & modeling				
Conservation Biology				



Science Panel and Peer Review Representation

	Federal Govt.	State Govt.	NGO	Academia
Policy & Science				
Technology & modeling				
Conservation Biology				

	Ecological Level		
Adaptation Approach	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
1) Protect current patterns of biodiversity			
2) Protect large, intact, natural landscapes			
3) Protect the geophysical setting			

Adaptation Approach	Ecological Level		
	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
1) Protect current patterns of biodiversity			
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3) Protect the geophysical setting			
B. Anticipating and responding to future conditions			
4) Identify and appropriately manage areas that will provide future climate space for species expected to be displaced by climate change.			
5) Identify and protect climate refugia			
6) Maintain and restore ecological connectivity			

	Ecological Level		
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Assess population sizes, viability, conservation status, and map species occurrences

	Ecological Level		
Adaptation Approach	Species & Population	Ecosystem	Landscape
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Map terrestrial and aquatic ecosystems and their associated services

Ecological Level			
Adaptation Approach	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
1) Protect current patterns of biodiversity			
2) Protect large, intact, natural landscapes			
3) Protect the geophysical setting			
B. Anticipating and responding to future condi			
4) Identify and appropriately manage areas that will provide future climate space for species expected to be displaced by climate change.			
5) Identify and protect climate refugia			
6) Maintain and restore ecological connectivity			

Map genetic pattern across the landscape
Map beta and gamma diversity,
Map biodiversity hotspots

	Ecological Level		
Adaptation Approach	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
1) Protect current patterns of biodiversity	✖	✖	
2) Protect large, intact, natural landscapes			
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5) Identify and protect climate refugia			
6) Maintain and restore ecological connectivity			

- Examine how the current distributions of martens and fishers are influenced by
  - Vegetation characteristics (e.g., forest composition and structure),
  - Climate (e.g., temperature, precipitation, snow depth and duration),
  - Physical variables (e.g., elevation, % slope)
  - Presence or absence of the other species.

Fisher

Marten

- Closely related forest carnivores of conservation concern in California
- Inform conservation efforts for these species

climate only.
vegetation only.
climate + vegetation.
climate + vegetation + physical.
climate + vegetation + presence/absence of the other *Martes* species.
climate + vegetation + physical + presence/absence of the other *Martes* species.

CONSERVATION BIOLOGY INSTITUTE

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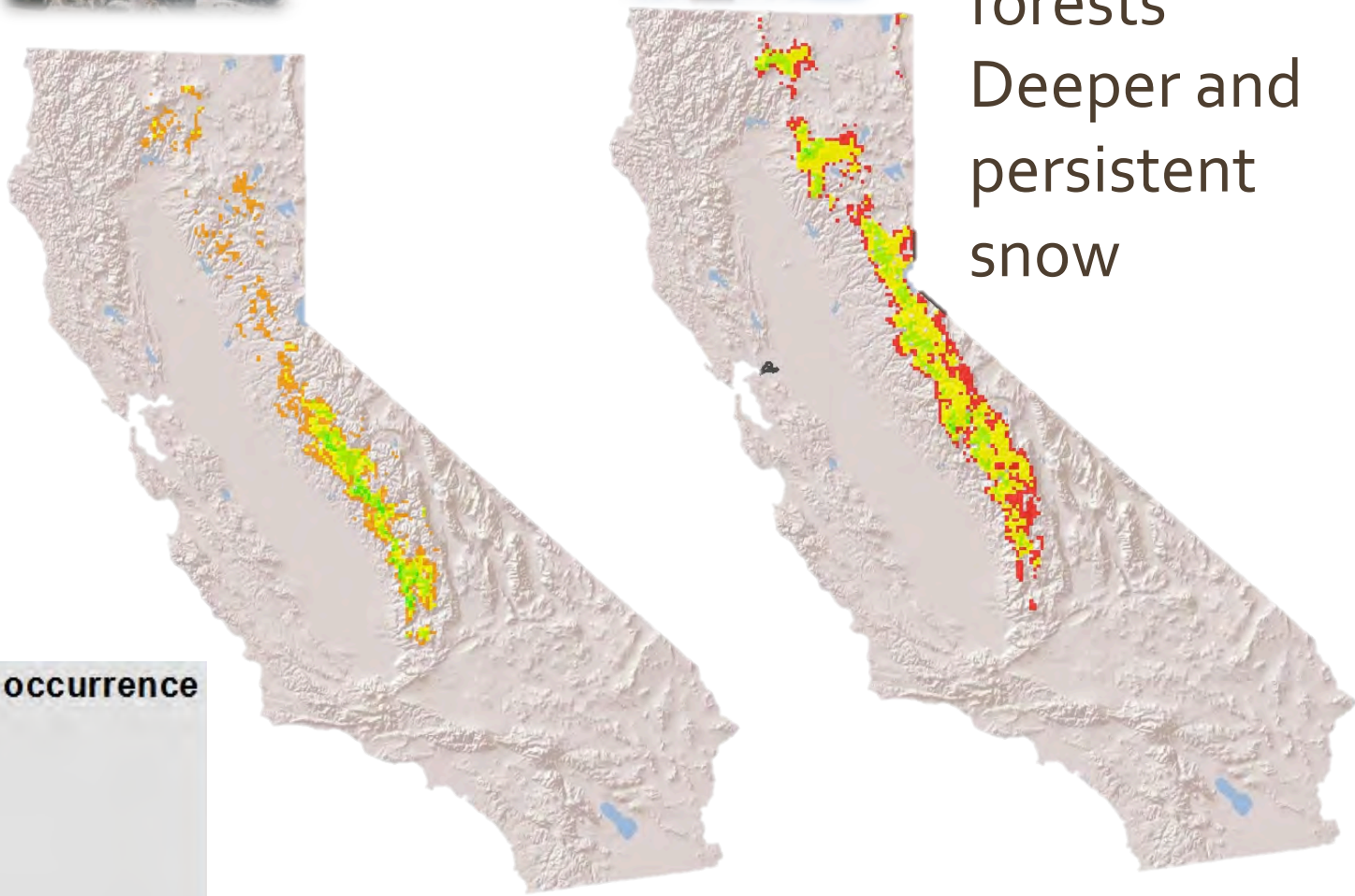
CONSERVATION BIOLOGY INSTITUTE

Fisher

Mid-elevation
Yellow pine & mixed conifer forests
Less snow
Warmer Temp.

Marten

High subalpine forests
Deeper and persistent snow



Adaptation Approach	Ecological Level: Species & Population	Ecosystem	Landscape
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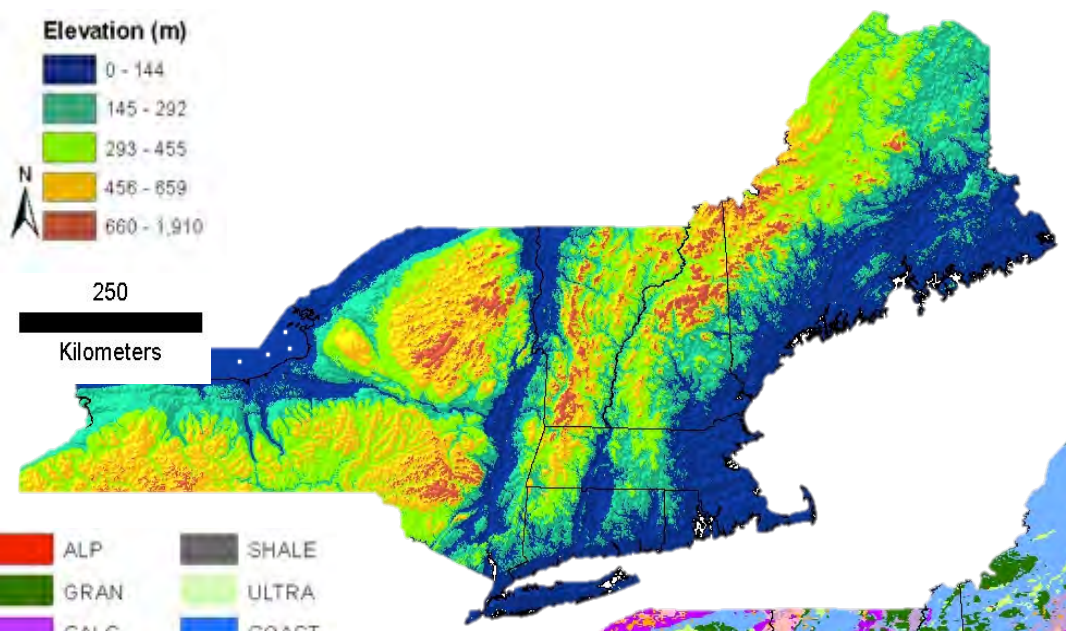
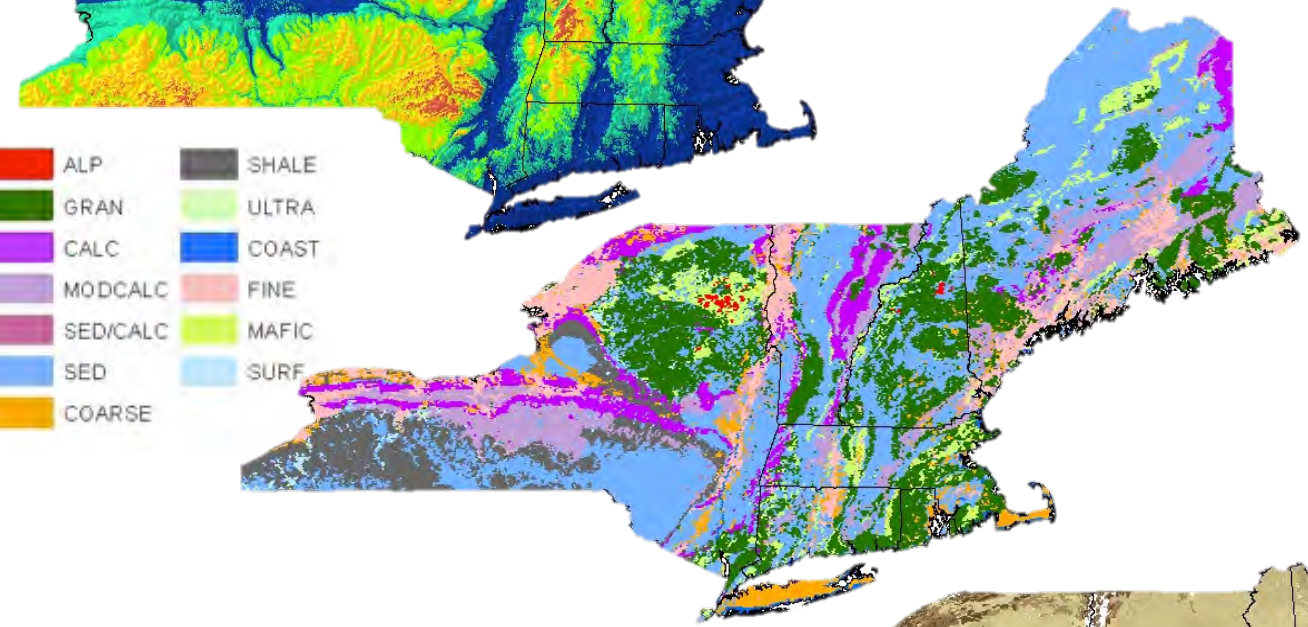
5) Identify and protect climate refugia			
6) Maintain and restore ecological connectivity			

Map areas of high ecological integrity
Map areas of high topographic complexity

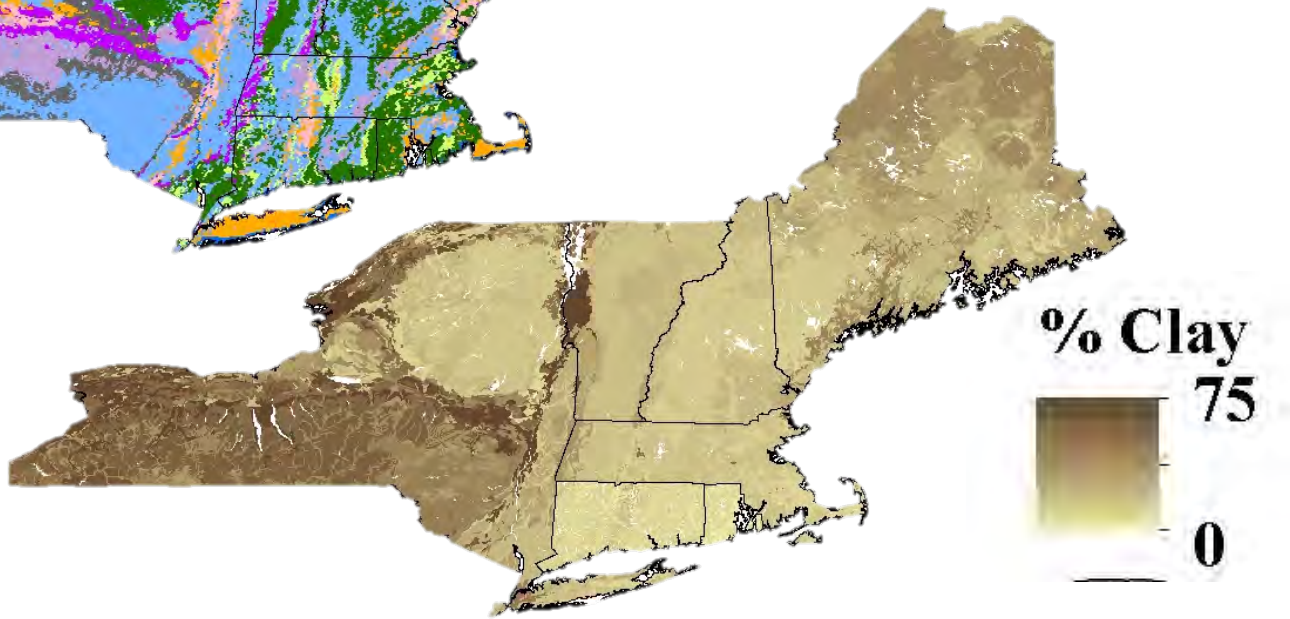
Ensure that conserved lands or lands under long-term stewardship cover a wide range of geophysical settings

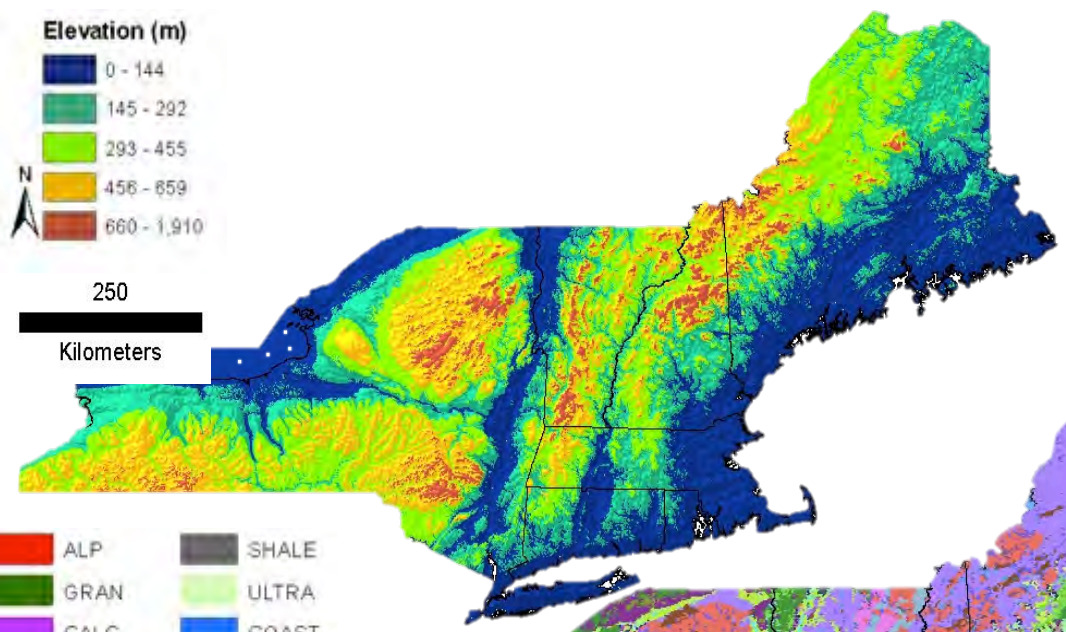


Protecting a wide variety of Geophysical settings that remain relatively constant as climate changes & plants and animals shift.

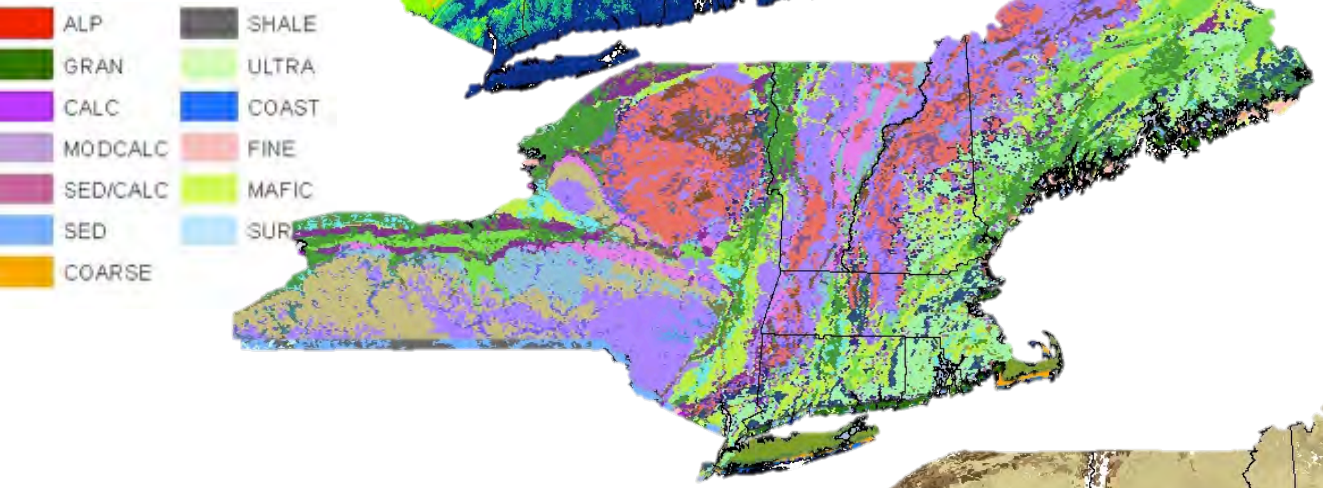


Topography, Bedrock, & Surface Material

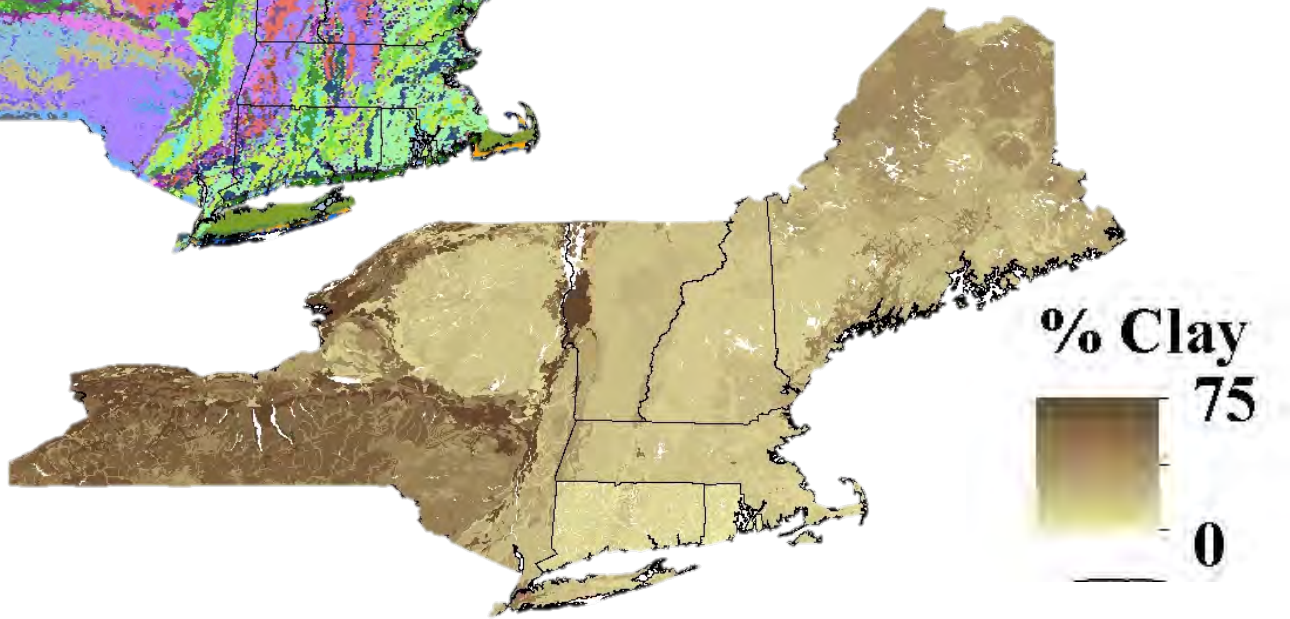




Protecting a wide variety of Geophysical settings that remain relatively constant as climate changes & plants and animals shift.



Topography, Bedrock, & Surface Material



Adaptation Approach	Ecological Level		
	Species & Population	Ecosystem	Landscape
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Identify areas critical to species movements in a changing climate
Map movement corridors for species life-history and migration

Adaptation Approach	Ecological Level		
	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
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Map connections between current and projected future locations
Anticipate species invasions along planned corridors

Adaptation Approach	Ecological Level		
	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
1) Protect current patterns of biodiversity			
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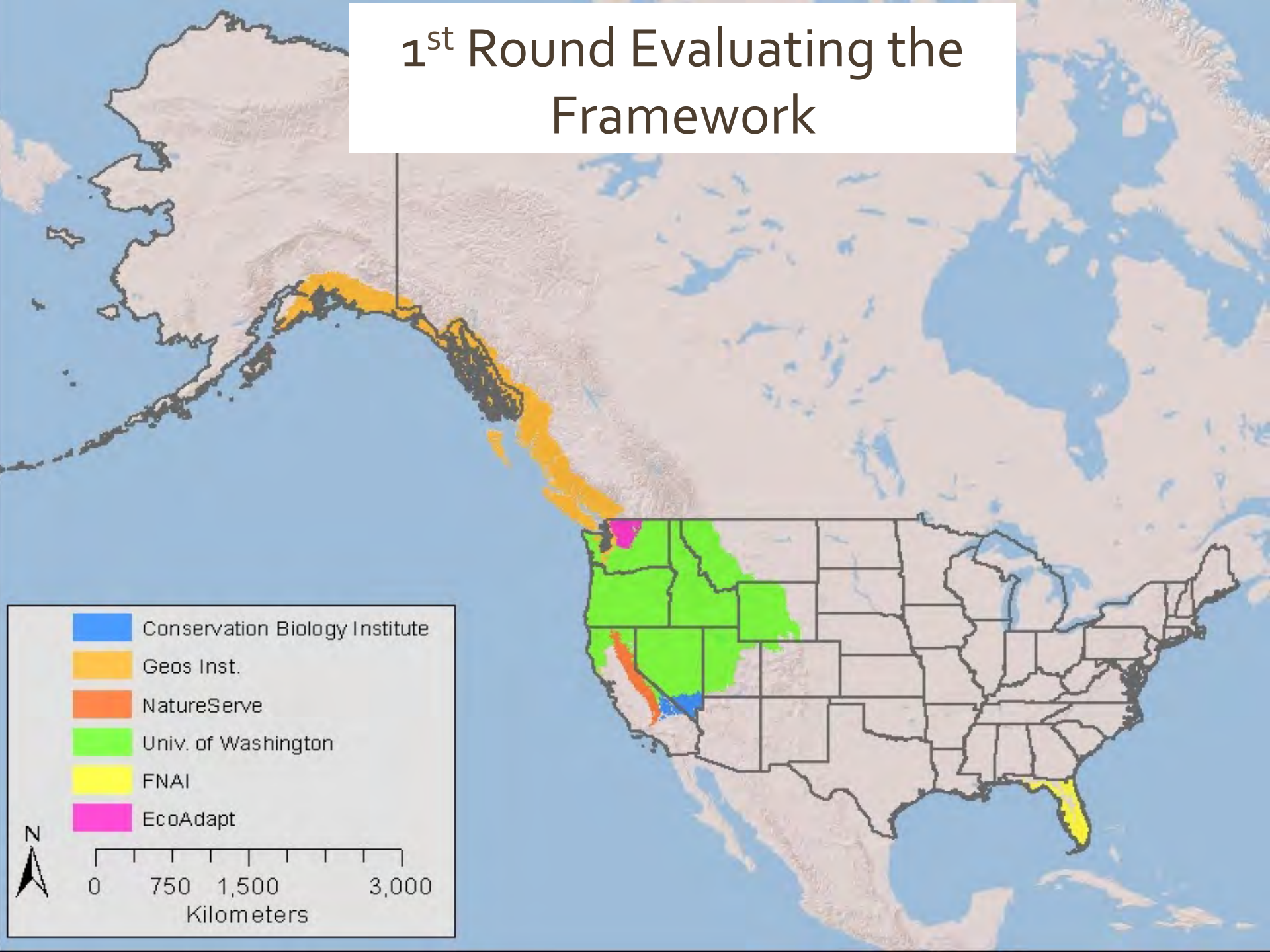
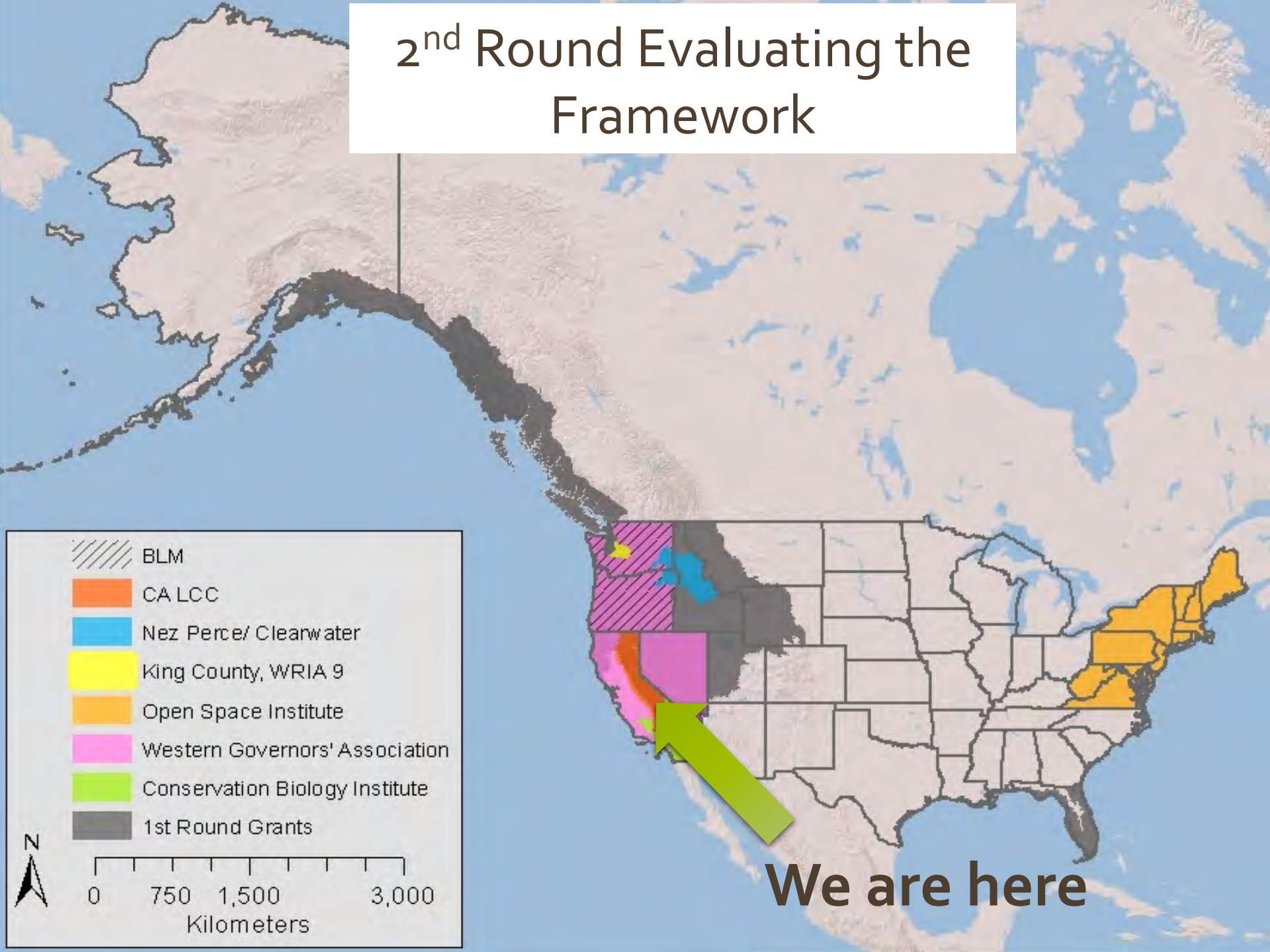
5) Identify and protect climate refugia			
6) Maintain and restore ecological connectivity			

Map connections between land facets, ecological land units, refugia or areas of high ecological integrity

1st Round Evaluating the Framework



2nd Round Evaluating the Framework



Using Yale Framework

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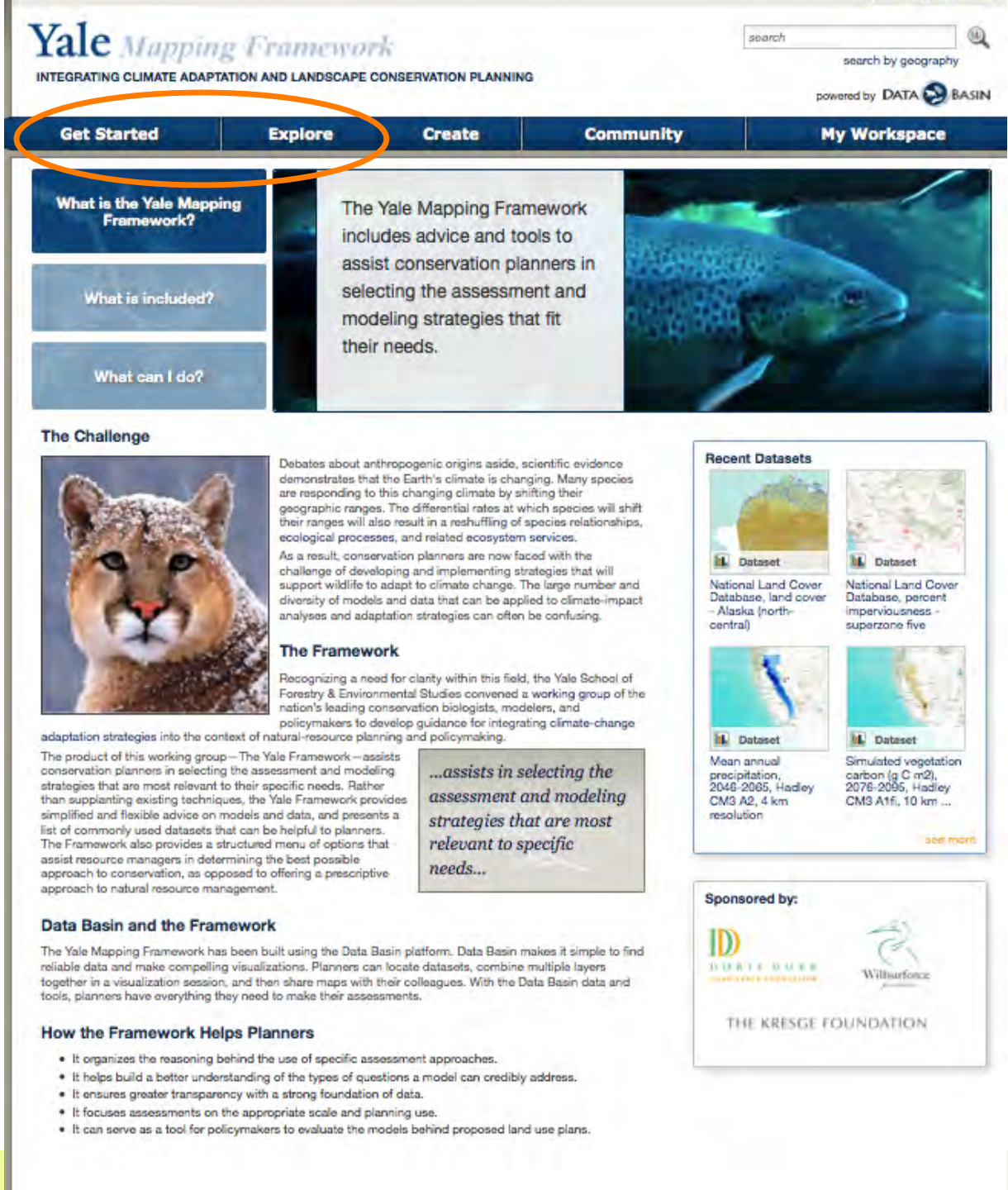
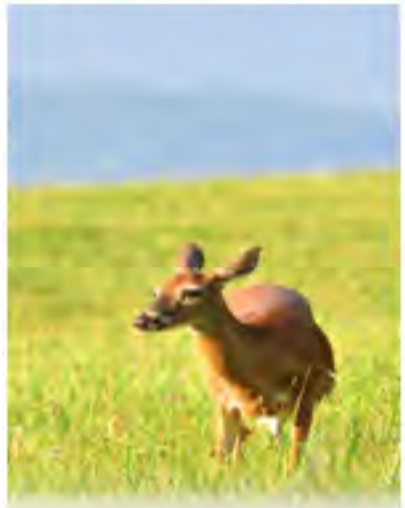


Using Yale Framework

yale.databasin.org/pages/matrix

Each cell links to :

- Description of Approaches
- Tool commonly used
- Pilot Projects



Yale Mapping Framework

INTEGRATING CLIMATE ADAPTATION AND LANDSCAPE CONSERVATION PLANNING

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YALE MAPPING FRAMEWORK | THE FRAMEWORK MATRIX

The Framework Matrix

The Framework Matrix is built around the consideration of six major adaptation objectives for biodiversity conservation and climate adaptation and three levels of ecological analysis. The matrix is structured to provide a systematic way to arrive at an appropriate assessment approach and related tools:

1. Select the desired adaptation objectives (How?)
2. Select the desired level of ecological analysis (How?)
3. Use the links in each cell of the matrix to further investigate information about the appropriate approaches one would use to carry out an assessment

Adaptation Objectives How to choose adaptation objectives	Levels of Ecological Analysis How to choose levels of ecological analysis		
	(A) Species and Populations	(B) Ecosystems	(C) Landscape
Strengthen current conservation efforts			
(1) Protect current patterns of biodiversity	1A Description Pilot projects: Conservation Biology Institute EcoAdapt Geos Institute NatureServe	1B Description Pilot projects: Conservation Biology Institute EcoAdapt Geos Institute NatureServe	1C Description Pilot projects: EcoAdapt Geos Institute
(2) Protect large, intact, natural landscapes and ecological processes	2A Description Pilot projects: Geos Institute NatureServe	2B Description Pilot projects: EcoAdapt Geos Institute NatureServe	2C Description Pilot projects: Geos Institute NatureServe
(3) Protect the geophysical setting		3B Description Pilot projects: Geos Institute University of Washington	3C Description Pilot projects: Geos Institute University of Washington
Anticipate and respond to future conditions			
(4) Identify and appropriately manage areas that will provide future climate space for species expected to be displaced by climate change.	4A Description Pilot projects: Conservation Biology Institute EcoAdapt Geos Institute NatureServe	4B Description Pilot projects: Conservation Biology Institute EcoAdapt Florida Natural Areas Inventory Geos Institute NatureServe	4C Description Pilot projects: EcoAdapt Florida Natural Areas Inventory Geos Institute NatureServe
(5) Identify and protect climate refugia	5A Description Pilot projects: NatureServe	5B Description Pilot projects: EcoAdapt Florida Natural Areas Inventory Geos Institute NatureServe	5C Description Pilot projects: EcoAdapt Florida Natural Areas Inventory Geos Institute NatureServe
(6) Maintain and restore ecological connectivity	6A Description Pilot projects: NatureServe	6B Description Pilot projects: NatureServe	6C Description Pilot projects: Geos Institute NatureServe

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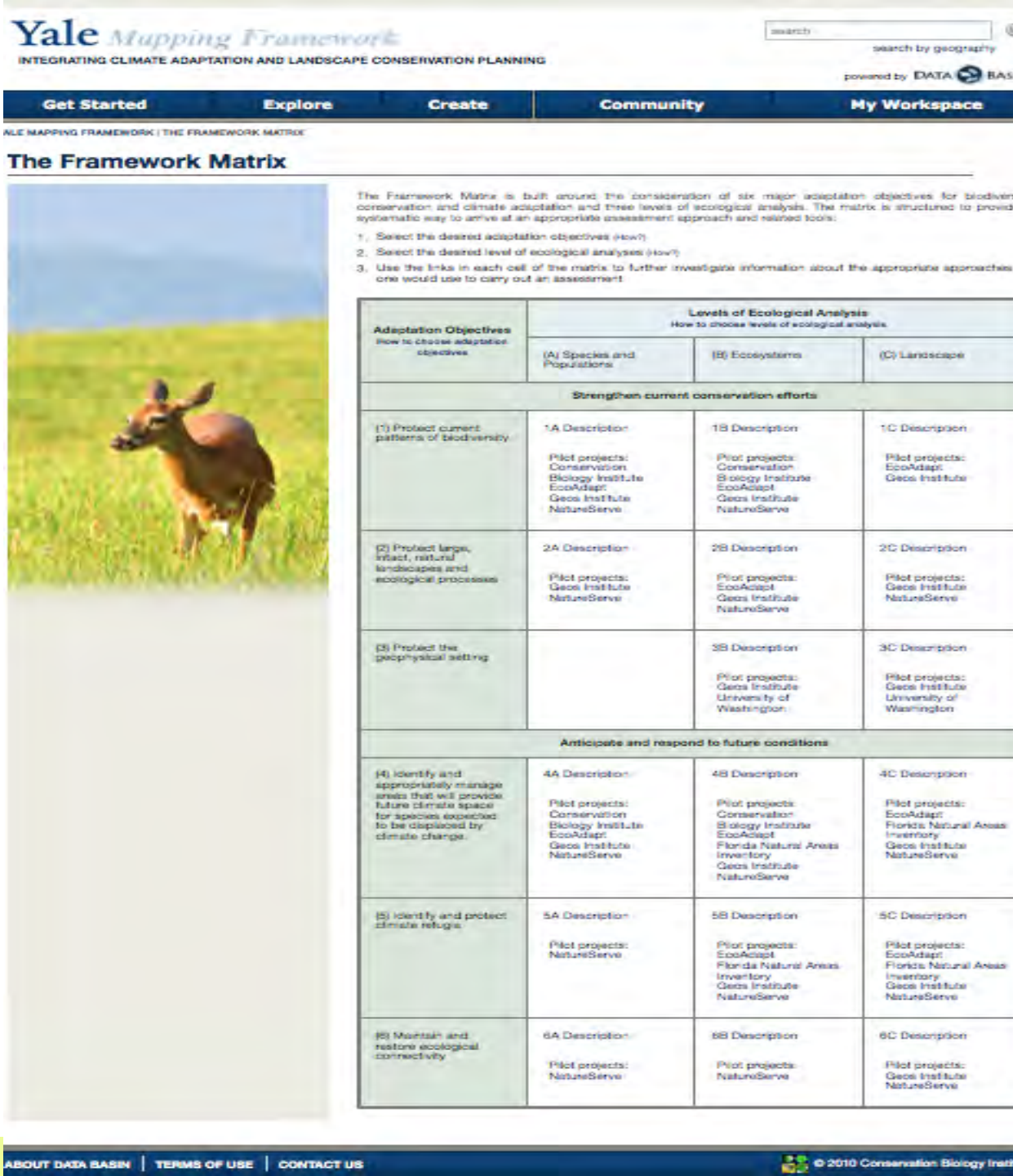
Using Yale Framework

Selecting and developing adaptation approaches

Choose the:

1. *Adaptation strategy(ies)* goals.
2. *Level(s) of ecological organization*.
3. *Analysis tool(s)*.
4. *Data sets*.
5. *Assessment time horizon*



Evaluating the Guidance

- Project Overview
  - Study Area/Ecosystem
  - Objectives
  - Adaptation Strategies
- Full Project Analysis
  - Methods
  - Outcomes
  - Interpretation
  - Related Data

Yale *Mapping Framework*

INTEGRATING CLIMATE ADAPTATION AND LANDSCAPE CONSERVATION PLANNING

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Pilot Projects *Practical experience with the Yale Mapping Framework*

The Yale Framework will be evaluated through a process of grants to regional mapping and analysis teams that reflect the wide diversity of planning needs and challenges across the United States. These teams will use the Framework guidelines to implement geospatial analysis approaches pertinent to their respective regional planning contexts and objectives. After implementing and evaluating the Yale Framework, these teams will then provide feedback on the utility of its guidelines and the strengths and weaknesses in relation to each team's specific approach, objectives, scales, and planning timeframe. Teams will also identify improvements to the guidelines that are delineated in the Yale Framework. During this time the Science Panel will continue to refine the Framework as input from outside experts and policy makers is sought through a peer review process. Below are the guides and case studies developed by these teams.

Guide/Study

Climate Change Adaptation Strategies for BLM Resource Management in ...

Guide/Study

Effects of climate and vegetation on martens and fishers in the Sierra ...

Guide/Study

From the Mountains to the Sea: Applying the Yale Framework in Puget ...

Guide/Study

Land Facets for Conservation Planning

Guide/Study

Rapid Assessment of the Yale Framework and Adaptation Blueprint for the ...

Guide/Study

Re-evaluating Florida's ecological conservation priorities in the face ...

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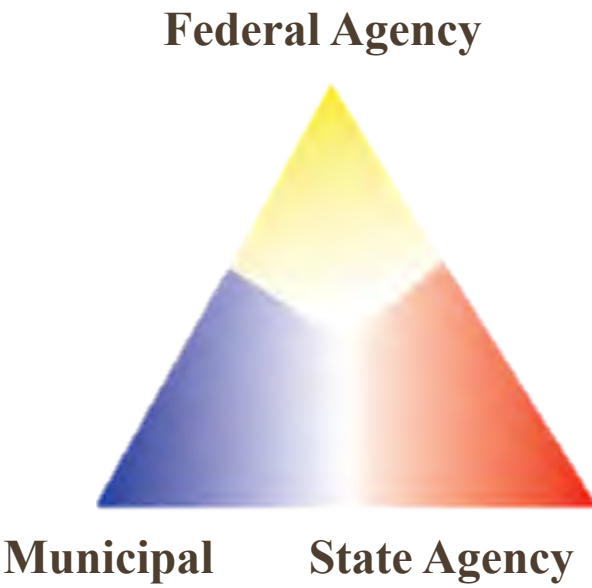
Ecological Level			
Adaptation Approach	Species & Population	Ecosystem	Landscape
A. Strengthen current conservation efforts			
1) Protect current patterns of biodiversity	USFWS, State Wildlife and Local Agencies	BLM, USFS	USFWS, Regional State Assoc.
2) Protect large, intact, natural landscapes	State Wildlife and Local Agencies	USGS	NOAA
3) Protect the geophysical setting		NPS	NPS
B. Anticipating and responding to future conditions			
4) Protect future patterns of biodiversity	BLM	BLM, USGS	USFS
5) Identify and protect climate refugia	NPS, USFS	NPS, USFS	NPS, USFS
6) Maintain and restore ecological connectivity	USFWS, State Wildlife Agencies	Regional State Assoc.	BOR



Acknowledgements

DORIS DUKE
CHARITABLE FOUNDATION

THE KRESGE FOUNDATION

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Questions?


STRATEGIES for INTEGRATING
CLIMATE ADAPTATION MODEL
into RESOURCE PLANNING