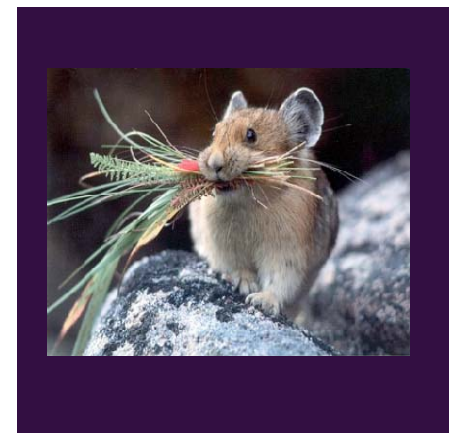
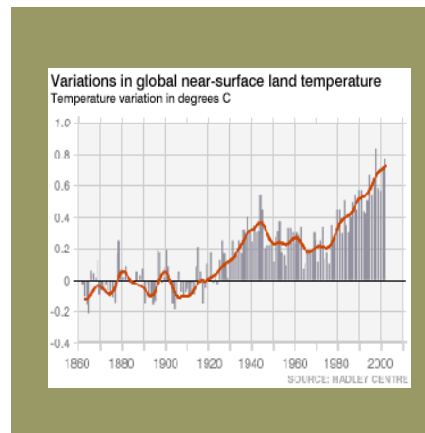
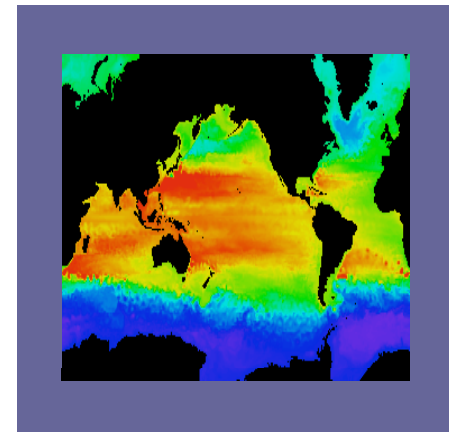
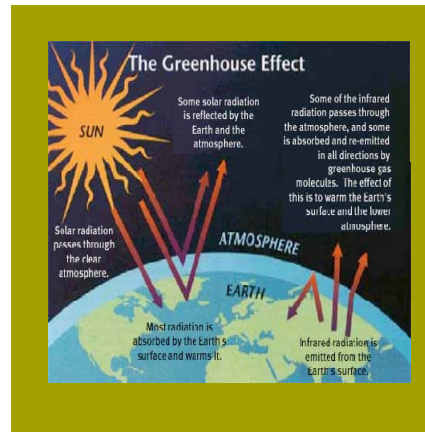




# Climate Change Mitigation and (or versus?) Adaptation



# + Two Branches of Climate Change Law & Policy

## ■ Climate Change Mitigation

- options for limiting climate change by, for example, reducing heat-trapping emissions such as carbon dioxide, methane, nitrous oxide, and halocarbons, or removing some of the heat-trapping gases from the atmosphere

## ■ Climate Change Adaptation

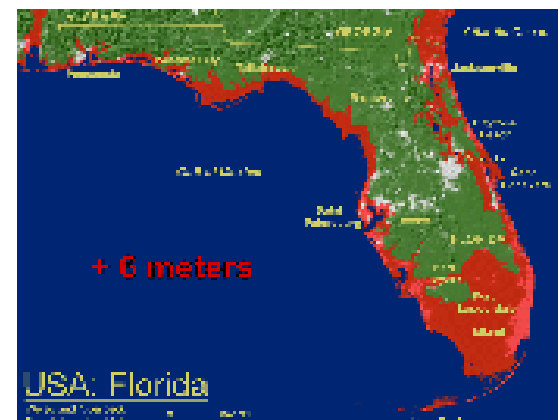
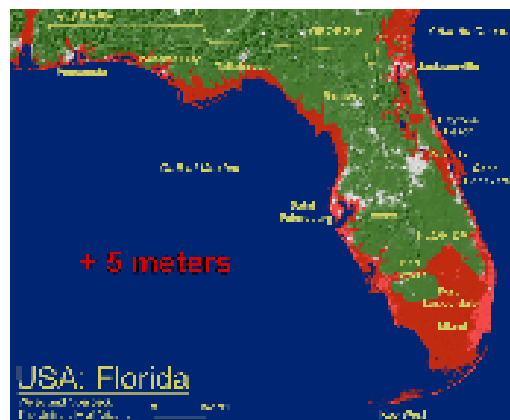
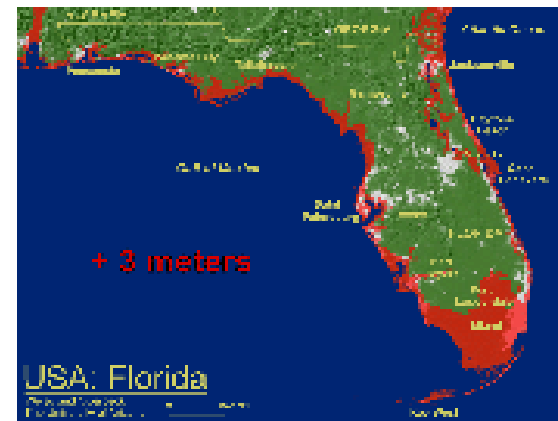
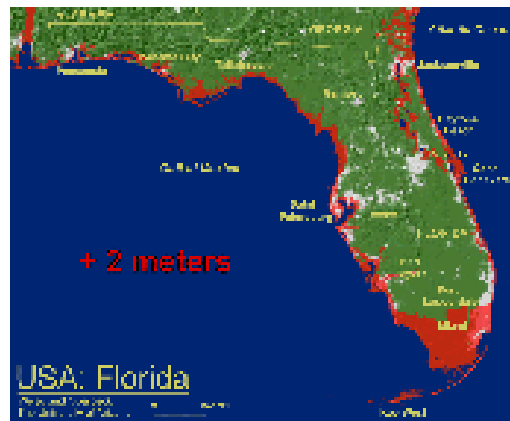
- changes made to better respond to present or future climatic and other environmental conditions, thereby reducing harm or taking advantage of opportunity. Effective mitigation reduces the need for adaptation.

# + Why Adaptation?

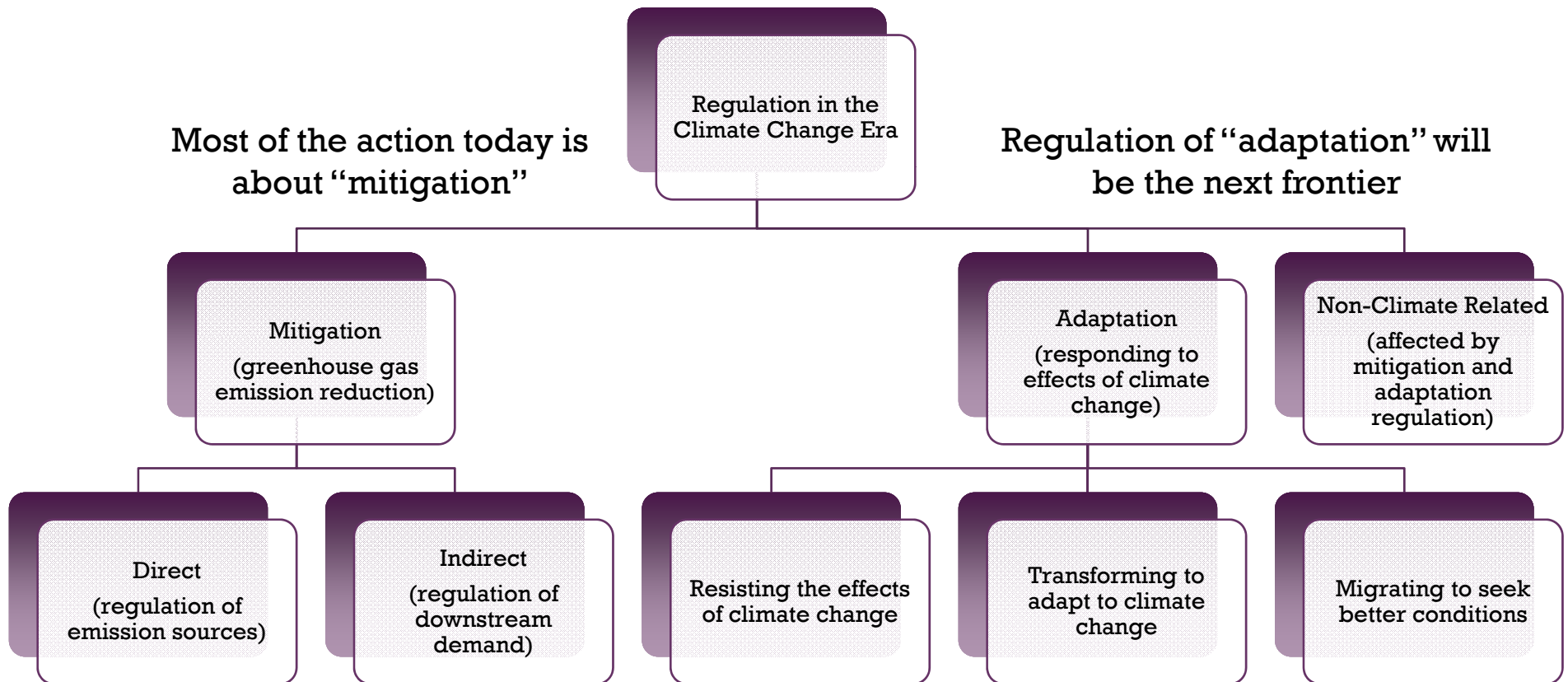
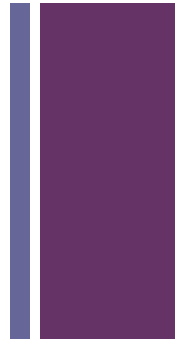
This is your Florida...

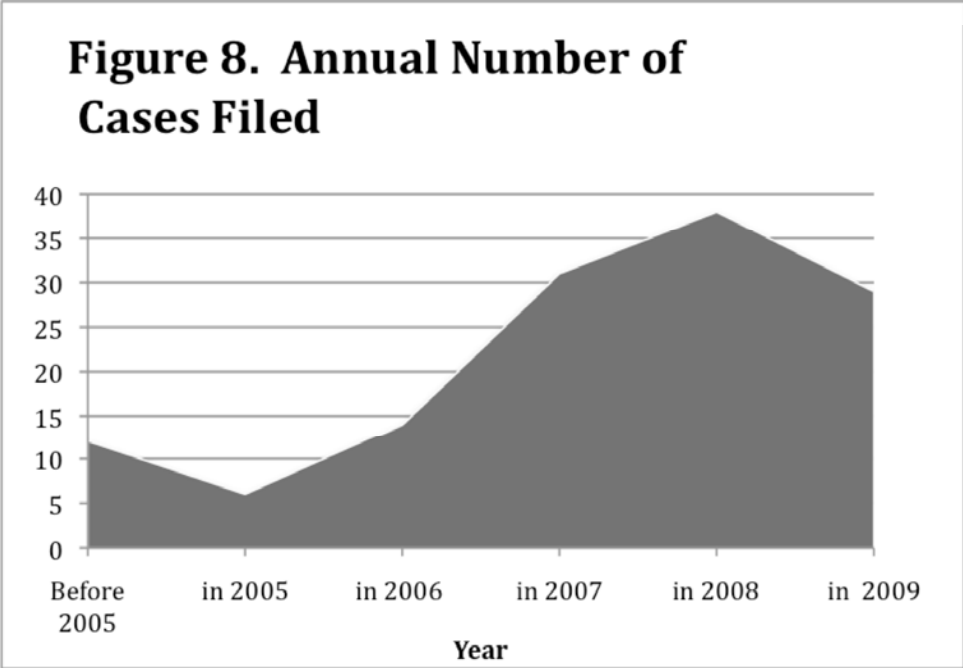


# + This is your Florida on climate change



# + The Regulatory Playing Field







Category	Case Type	Cases # (%)
<b>Substantive Mitigation Regulation</b>	<b>1.</b> Action to prevent or limit a legislative or agency decision to carry out, fund, or authorize a direct or indirect source of greenhouse gas emissions (e.g., building, funding, or permitting a coal power plant).	25 (18%)
	<b>2.</b> Action challenging a legislative or agency decision to refuse or place limits on proposal to carry out, fund, or authorize a direct or indirect source of greenhouse gas emissions (e.g., to overturn denial of a power plant permit).	5 (3.5%)
	<b>3.</b> Action to require a legislature or agency to promulgate a statute, rule, or policy establishing new or more stringent limits on greenhouse gas emissions by regulating direct or indirect sources (e.g., to force EPA to regulate greenhouse gas emissions; to force local government impose green building requirements).	10 (6.5%)
	<b>4.</b> Action challenging legislative or agency promulgation of statute, rule, or policy establishing new or more stringent limits on GHS emissions that regulate direct or indirect sources (e.g., to prevent EPA from regulating greenhouse gas emissions; to challenge local decision to require green building).	13 (9.5%)
	<b>5.</b> Government enforcement action against direct or indirect greenhouse gas emissions source alleging violation of regulatory or permit limits.	0
	<b>6.</b> Citizen enforcement action against direct or indirect greenhouse gas emissions source alleging violation of regulatory or permit limits.	4 (3%)
<b>Substantive Adaptation Measures</b>	<b>7.</b> Action to require legislative or agency action on statute, rule, policy, or permit to require new or more extensive climate change adaptation actions (e.g., to require coastal development permittee to retain wetlands as sea level buffer).	0
	<b>8.</b> Action to prevent legislative or agency action on statute, rule, policy, or permit that proposes to require new or more extensive climate change adaptation actions (e.g., to challenge proposed sea wall).	0
	<b>9.</b> Government enforcement action against public or private entity alleging violation of regulatory or permit condition related to climate change adaptation.	0
	<b>10.</b> Citizen enforcement action against public or private entity alleging violation of regulatory or permit condition related to climate change adaptation.	0



Category	Case Type	Cases # (%)
<b>Procedural Monitoring, Impact Assessment, and Information Reporting</b>	<b>11.</b> Action to impose on public or private entities a new or more extensive monitoring, impact assessment, or information disclosure requirement focused on GHG emissions, impacts of climate change, or means and success of climate change adaptation (e.g., to require NEPA documentation for coastal development to account for sea level rise in EIS; to require public companies to disclose greenhouse gas emissions).	57 (41%)
	<b>12.</b> Action to prevent imposition on public or private entities a new or more extensive monitoring, impact assessment, or information disclosure requirement focused on GHG emissions, impacts of climate change, or means and success of climate change adaptation (e.g., to challenge proposed greenhouse gas emissions monitoring requirement).	0
<b>Rights &amp; Liabilities</b>	<b>13.</b> Action to extend scope of human rights, property rights, or civil rights to provide protection of individual or public against effects of or responses to climate change (e.g., claim that GHG source violates civil rights; claim that immigration policy for climate refugees violates human rights).	0
	<b>14.</b> Action to impose statutory, tort, nuisance, or other property damage or personal injury liability on source of GHG emissions or for inadequate climate change mitigation or adaptation measures (e.g., public nuisance action against GHG emission sources; public nuisance claim for destruction of coastal dunes).	6 (4.5%)
	<b>15.</b> Action to impose contract, insurance, securities, fraud, failure to disclose, or other business or economic injury liability on source of GHG emissions or for inadequate climate change mitigation or adaptation measures (e.g., insurance recovery claim for effects of sea level rise; dispute over carbon credit market transaction).	2 (1.5%)
<b>Identification of Climate-Threatened Resources</b>	<b>16.</b> Action to force agency to identify species or other resource as climate threatened and list under federal or state ESA or other statute.	7 (5%)
	<b>17.</b> Action to reverse decision by agency to identify species or other resource as climate threatened and list under federal or state ESA or other statute.	2 (1.5%)
<b>Other</b>	<b>18.</b> Other—not defined by other categories.	8 (6%)



# + We Face an “Adaptation Deficit”

- Interest in adaptation was overwhelmed by concern about the need to reduce greenhouse gas emissions and stabilize atmospheric greenhouse gas concentrations. Proponents of adaptation faced two obstacles that were attributed to adaptation: reducing the apparent need for mitigation; and playing down the urgency for action. For one, “adaptationists” were distrusted because their proposals seemed to undermine the need for mitigation. Critics felt that belief in the potential value of adaptation would soften the resolve of governments to grasp the nettle of mitigation and thus play into the hands of the fossil fuels interests and the climate change sceptics. In addition, because climate change was popularly perceived as a gradual process, adaptation was not considered urgent as there would be time to adapt when climate change and its impacts became manifest. These views dominated in the mid and late 1990s



# + Surprise—The EU is ahead of us

Environment

EUROPA / European Commission / Environment / Climate Change / Living with climate change in Europe

English (en)

About this site | What's new? | Site map | AZ index | RSS

## Living with climate change in Europe

The world's climate is changing and its impacts are already being felt in Europe and across the world.

Global temperatures are predicted to continue rising, behind a range of weather patterns, rising sea levels and increased frequency and intensity of extreme weather events such as storms, floods, droughts and heat waves. Such climatic events can have a realer impact on households, businesses, critical infrastructure (transport, energy and water supply) and vulnerable sections of society (elderly, disabled, poor income households) as well as having a major economic impact.

We must therefore prepare to cope with living in a changing climate. This process is known as adaptation.

In April 2009 the European Commission presented a policy paper known as a White Paper which presents the framework for adaptation measures and policies to reduce the European Union's vulnerability to the impacts of climate change.

Decisions on how best to adapt to climate change must be based on solid scientific and economic analysis. It is therefore important to increase the understanding of climate change and the impacts it will have. The White Paper outlines the need to create a Climate Change Mechanism by 2011 where information on climate change risks, impacts and best practices would be exchanged between governments, agencies, and organisations working on adaptation policies.

Since the impacts of climate change will vary by region - with coastal and mountain areas and flood plains particularly vulnerable - many of the adaptation measures will need to be carried out nationally or regionally. The role of the European Union will be to support and complement these efforts through an integrated and coordinated approach, particularly in cross-border issues and policies which are highly integrated at EU level.

Adapting to climate change will be integrated into all EU policies and will feature prominently in the Union's external policies to assist those countries that are affected.

### Documents and links

- White Paper on adaptation to climate change (April 2009)
- Impact assessment on the White Paper on adaptation to climate change (April 2009)
- Executive summary of the impact assessment (April 2009)
- Climate summary on the White Paper (April 2009)
- Discussion paper on agriculture (April 2009)
- Discussion paper on health (April 2009)
- Policy paper on Water, Coasts and Rivers Issues (April 2009)
- Press release on adapting to climate change (April 2009)
- Questions and answers on adaptation to climate change (April 2009)
- Consultation in preparation to the White Paper (May 2009)

### A number of EU Member States have adopted national adaptation strategies:

- Denmark
- France
- Germany and <http://www.smgamung.net>
- Finland
- Hungary
- Netherlands
- Spain
- Sweden
- United Kingdom

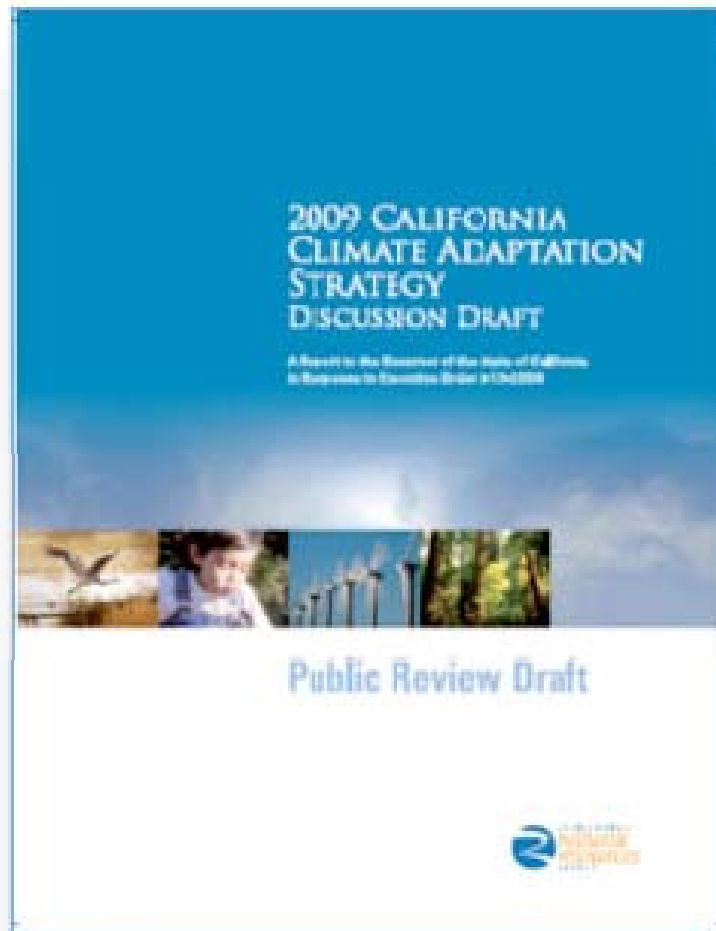
### The building of a framework to adapt to climate change

In June 2007, the European Commission presented a discussion paper known as a Green Paper on adapting to the impacts of climate change. The paper builds upon the work and findings of the [European Climate Change Programme](#).

The next steps that need to be taken to help reduce greenhouse gas emissions are also needed to adapt to the changing climate conditions. It describes possible avenues for action at EU level.

- Green Paper on adaptation to climate change (June 2007) [FI](#)
- Access to the Green Paper (June 2007) [Go!](#) [198](#)
- Press release on presenting the impacts of current and future scenarios (June 2007)
- Main conference launching the public debate on adaptation in Europe (Brussels, 3 July 2007)

# + Surprise—California is ahead in the US



# + But the federal government is starting to get focused



THE SECRETARY OF THE INTERIOR  
WASHINGTON

ORDER NO. 3289

Subject: Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources

Sec. 1 **Purpose and Background.** Secretarial Order No. 3285, issued on March 11, 2009, made production and transmission of renewable energy on public lands a priority for the Department. This Order establishes a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages. This Order replaces Secretarial Order No. 3226, Amendment No. 1, issued on January 16, 2009, and reinstates the provisions of Secretarial Order No. 3226, issued on January 19, 2001.

To fulfill our nation's vision for a clean energy economy, Interior is now managing America's public lands and oceans not just for balanced oil, natural gas, and coal development, but also – for the first time ever – to promote environmentally responsible renewable energy development. Sun, wind, biomass, and geothermal energy from our public and tribal lands is creating new jobs and will power millions of American homes and electric vehicles.

The Department is also taking the lead in protecting our country's water, land, fish and wildlife, and cultural heritage and tribal lands and resources from the dramatic effects of climate change that are already occurring – from the Arctic to the Everglades. The realities of climate change require us to change how we manage the land, water, fish and wildlife, and cultural heritage and tribal lands and resources we oversee. For example:

- New water management imperatives associated with climate change may require restoration of natural systems and construction of new infrastructure to reduce new flood risks or to capture early run-off.
- Strategies to address sea level rise may require acquisition of upland habitat and creation of wetlands and other natural filters and barriers to protect against sea level rise and storm surges. It may be necessary to relocate certain iconic and culturally historic structures.
- Shifting wildlife and habitat populations may require investments in new wildlife corridors.
- New invasions of exotic species and new wildland fire threats due to longer fire seasons and more severe droughts will require innovation and more effective ways of managing the Department's resources.



<http://www.epa.gov/climatechange/effects/adaptation.html>  
Last updated on Tuesday, September 8th, 2009.

Climate Change - Health and Environmental Effects

You are here: [EPA Home](#) » [Climate Change](#) » [Health and Environmental Effects](#) » [Adaptation](#)

## Adaptation

Some degree of future climate change will occur regardless of **future greenhouse gas emissions**. Adapting to or coping with climate change will therefore become necessary in certain regions and for certain socioeconomic and environmental systems. The need for adaptation may be increased by growing populations in areas vulnerable to extreme events. However, according to the IPCC, "adaptation alone is not expected to cope with all the projected effects of climate change, and especially not over the long term as most impacts increase in magnitude."

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2007).

Climate Change Science Program Synthesis and Assessment Product 4.4, Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources:

The U.S. EPA, in collaboration with other federal agencies, is carrying out this study, to be completed by the end of 2007.

The purpose of this study is to review management options for adapting to climate variability and change in the United States, and to identify characteristics of ecosystems and adaptation responses that promote successful implementation and meet resource managers' needs. The following questions will be addressed in this study:

- What are the management goals in the selected systems, upon what ecosystem characteristics do these goals depend, what are the stressors of concern, what are the management methods currently being used to address those stresses, and how could climate variability and change affect attainment of management goals?
- For selected case studies, what is the current state of knowledge about management options that could be used to adapt to the potential impacts of climate

The extent of climatic change impacts upon different ecosystems, regions and sectors of the economy will depend not only on the sensitivity of those systems to climate change, but also on the systems' ability to adapt to climate change.

An example of an adaptation strategy to prevent damage from climate change is shore protection (e.g., dikes, bulkheads, beach nourishment), which can prevent sea level rise from inundating low-lying

### Related Links

EPA Global Change Research Program

Climate Change Science Program

- Synthesis and Assessment Product 4.4: Preliminary review of adaptation options for climate-sensitive ecosystems and resources
- Synthesis and Assessment Product 4.7: Impacts of Climate Variability and Change on Transportation Systems and Infrastructure - Gulf Coast Study

Climate Change Impacts and Adaptation in California

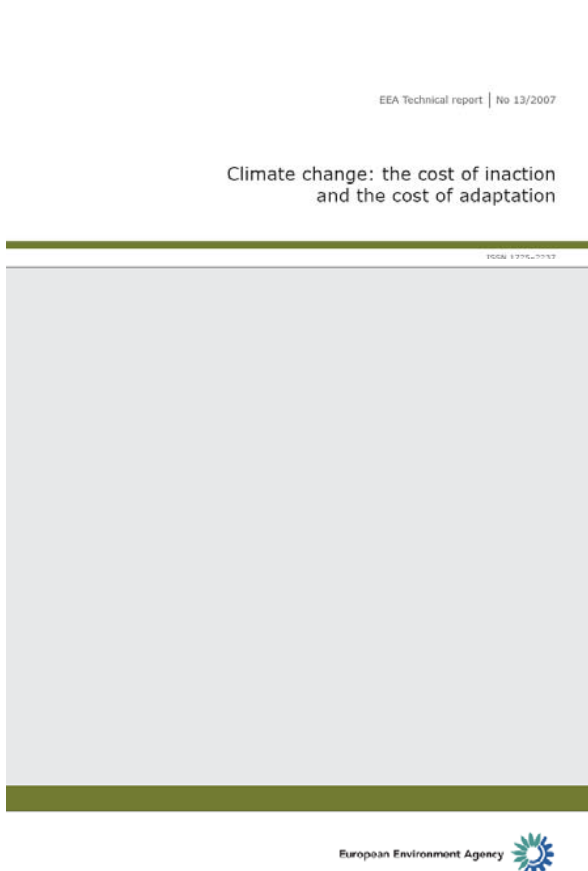
European Environment Agency, Vulnerability and Adaptation to Climate Change in Europe (PDF, 84 pp., 3.9 MB, About PDF) [\[EXIT Disclaimer\]](#)

Government of Canada, Climate Impacts and Adaptation Program [\[EXIT Disclaimer\]](#)

IPCC Working Group II, Fourth Assessment Report, Chapter 17, Assessment of Adaptation Practices, Options, Constraints, and Capacity [\[EXIT Disclaimer\]](#) [PDF, 28 pp., 406KB, About PDF]

Pew Center Report: Coping with Global Climate Change: The Role of Adaptation in the United States [\[EXIT Disclaimer\]](#)

# + Adaptation will be necessary and costly

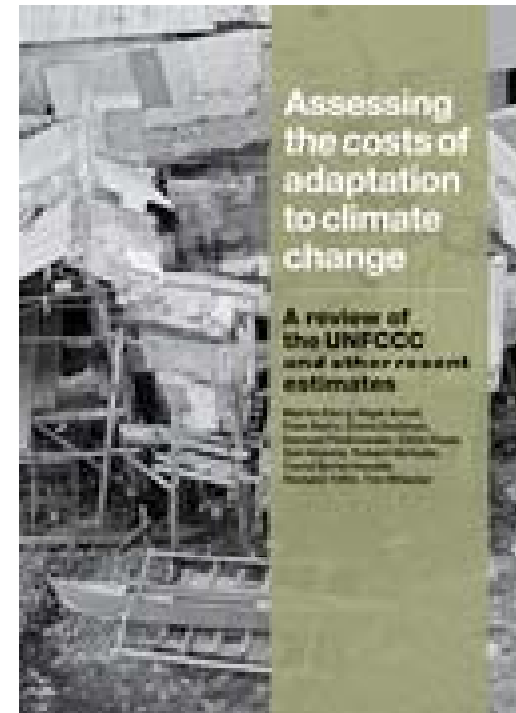


## The Costs to Developing Countries of Adapting to Climate Change

*New Methods and Estimates*

## The Global Report of the Economics of Adaptation to Climate Change Study

Consultation Draft





## Climate Change Mitigation

- **Single core policy target – GHG emissions**
- **Primary policy concerns – economic impact and distributional effects**
- **All CO<sub>2</sub> molecules are equal**
- **Global scale of causation**
- **Many different sources and sinks and many possible approaches**
- **Not a good handle on the complexity of climate drivers**
- **Main policy challenges:**
  - **Free riding**
  - **Lag effects**

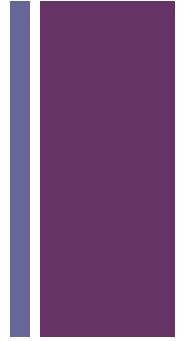
## Climate Change Adaptation

- **Many core climate and environment targets (sea level; water; invasive species; disease; health)**
- **Many core policy concerns (food, water supply; conservation; security; migration)**
- **High variability across globe, continents, even states and regions**
- **Local and regional downscaling of models still weak**
- **Main policy challenges:**
  - **Competition for resources**
  - **Transboundary effects**

## + ESA Adaptation Questions Include...

- What is the model of the “foreseeable future” for listings?
- What is the “best available science” regarding the effects of climate change on species?
- What is “critical habitat” when habitat is transforming and species are migrating?
- What constitutes “recovery” for recovery planning?
- Should climate change be factored into HCP permit “adaptive management” provisions?
- How reliable are models of “mitigation” and “conservation” measures such as habitat preservation?

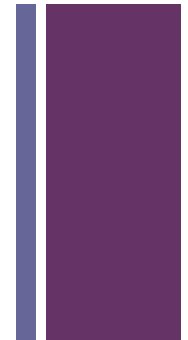
# + PART I



- What *Is* Climate Change Adaptation?
  - Theory
  - Modes
  - Environmental Impacts



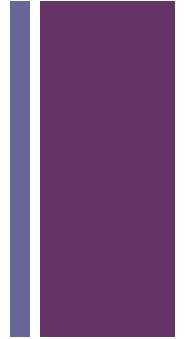
# + The Theory of Adaptation



<b>Attribute</b>	<b>Spectrum of Options</b>
<b>Actor</b>	public (e.g., states) ⇔ private (e.g., insurance companies)
<b>Orientation</b>	proactive (a/k/a preventative, anticipatory) ⇔ reactive
<b>Goal</b>	avoid and repair harm ⇔ capture and harness benefits
<b>Management Target</b>	variability (e.g., hurricanes, a/k/a Type I) ⇔ change (higher sea level, a/k/a Type II)
<b>Policy Foundation</b>	substantive ⇔ procedural
<b>Capital Employed</b>	technological ⇔ financial ⇔ human ⇔ social ⇔ natural
<b>Strategy</b>	reduce vulnerability ⇔ increase resilience

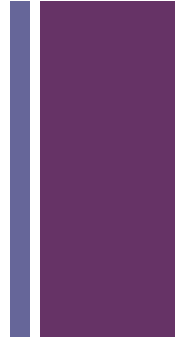


# The Three Modes of Adaptation



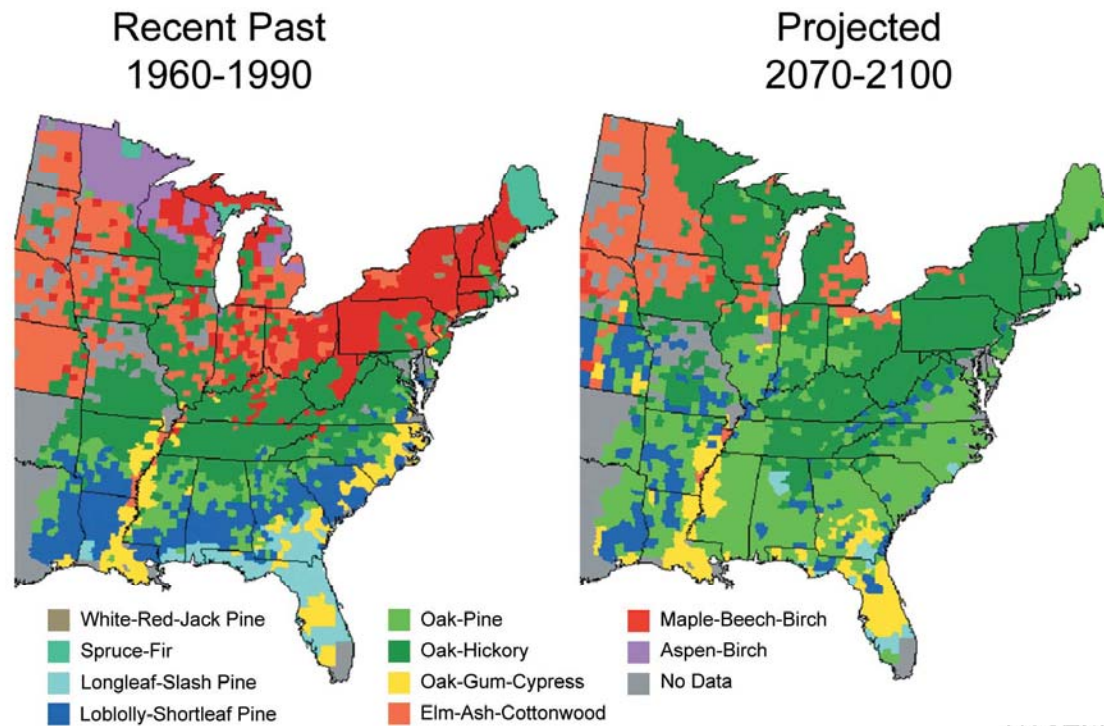
- **Resist**: Prevent or offset the effects of climate change to maintain the status quo
  - Seawalls and levees
  - Water diversions & desalination
  - Habitat and species management
  
- **Transform**: Alter physical, social, environmental, or economic conditions to minimize harm or maximize benefits associated with climate change impacts
  - Shift to agriculture
  - Yield to the sea
  - Increase resilient population centers
  
- **Move**: Relocate humans (and other species) to areas with more adaptive capacity
  - Human migration
  - Reconstruct coastal cities inland
  - Populate areas with new capacity

# + Adaptation and Environmental Impacts



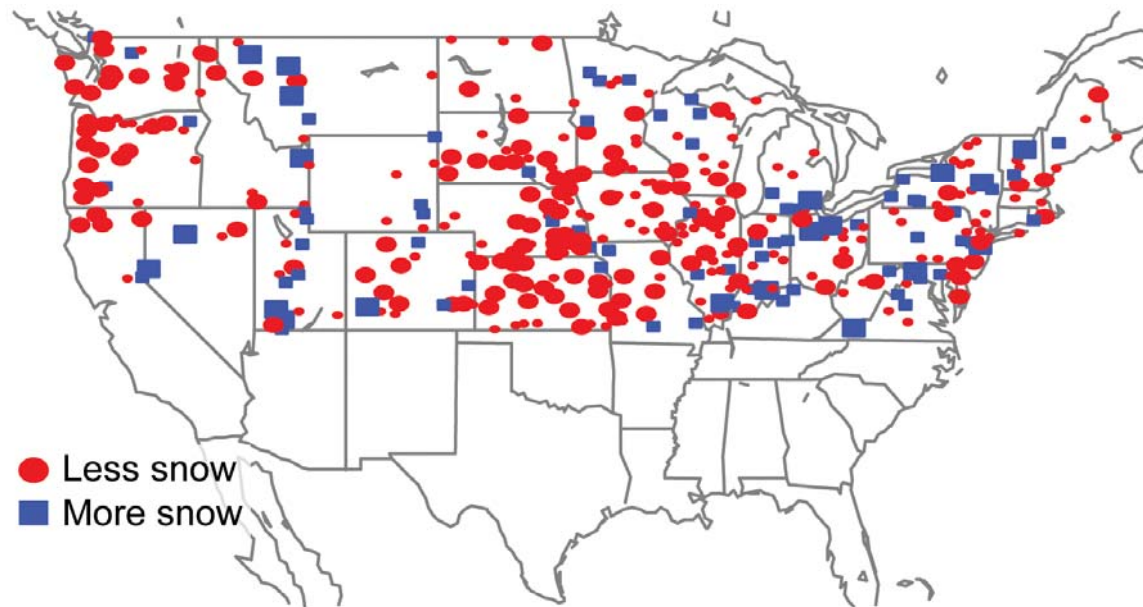
- **Type I**: Direct effects of climate change on environment
  - Habitat degradation in refuge
  - Stresses on species
  - Loss of wetlands to inundation
- **Type II**: Direct effects of adaptation on environment
  - Seawalls
  - New settlements
  - Water diversions
- **Type III**: Indirect effects of adaptation on environment
  - Immigration and relocation policy
  - National security
  - Public health policy

# + Type I Change



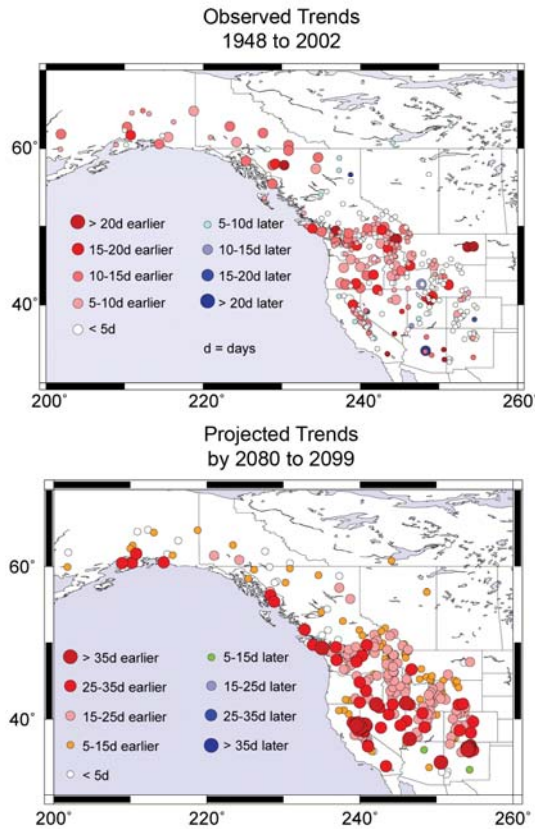
NAST<sup>219</sup>

The maps show current and projected forest types. Major changes are projected for many regions. For example, in the Northeast, under a mid-range warming scenario, the currently dominant maple-beech-birch forest type is projected to be completely displaced by other forest types in a warmer future.<sup>243</sup>

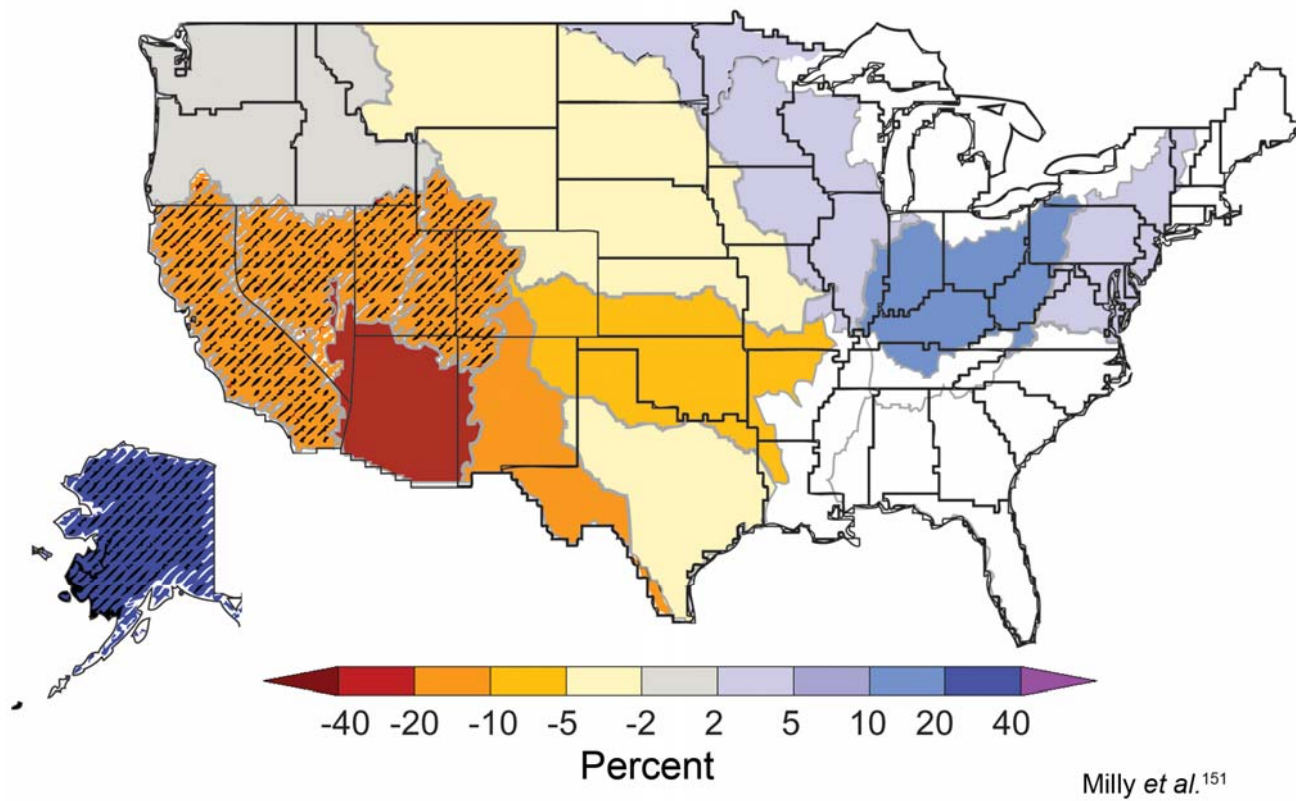


Feng and Hu<sup>143</sup>

Trends in winter snow-to-total precipitation ratio from 1949 to 2005. Red circles indicate less snow, while blue squares indicate more snow. Large circles and squares indicate the most significant trends.<sup>143</sup> Areas south of 37°N latitude were excluded from the analysis because most of that area receives little snowfall. White areas above that line have inadequate data for this analysis.

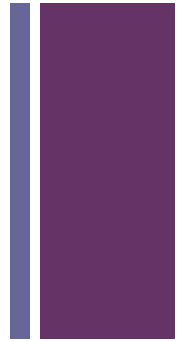


Top map shows changes in runoff timing in snowmelt-driven streams from 1948 to 2002 with red circles indicating earlier runoff, and blue circles indicating later runoff. Bottom map shows projected changes in snowmelt-driven streams by 2080-2099, compared to 1951-1980, under a higher emissions scenario.<sup>91</sup>



Projected changes in median runoff for 2041-2060, relative to a 1901-1970 baseline, are mapped by water-resource region. Colors indicate percentage changes in runoff. Hatched areas indicate greater confidence due to strong agreement among model projections. White areas indicate divergence among model projections. Results are based on emissions in between the lower and higher emissions scenarios.<sup>91</sup>

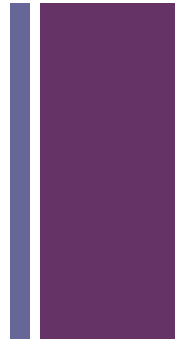
# + PART II



- Ten Structural Trends In Environmental Law & Policy
  - External Forces (6)
  - Governance (3)
  - Overarching (1)

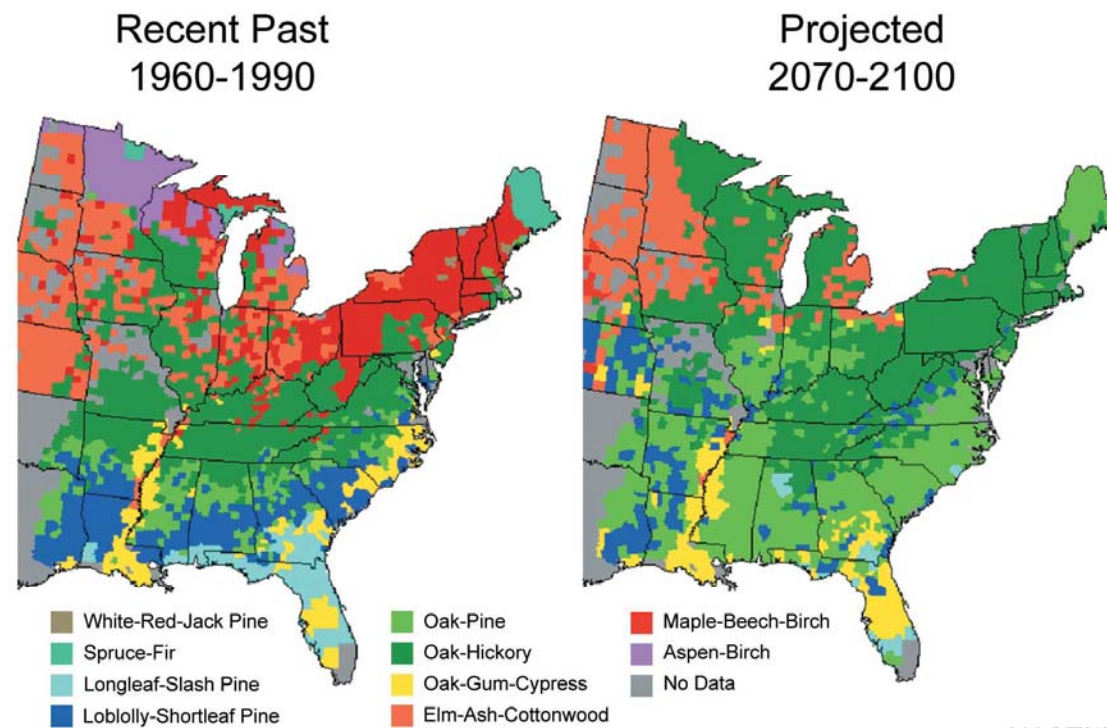


# + Six External Forces



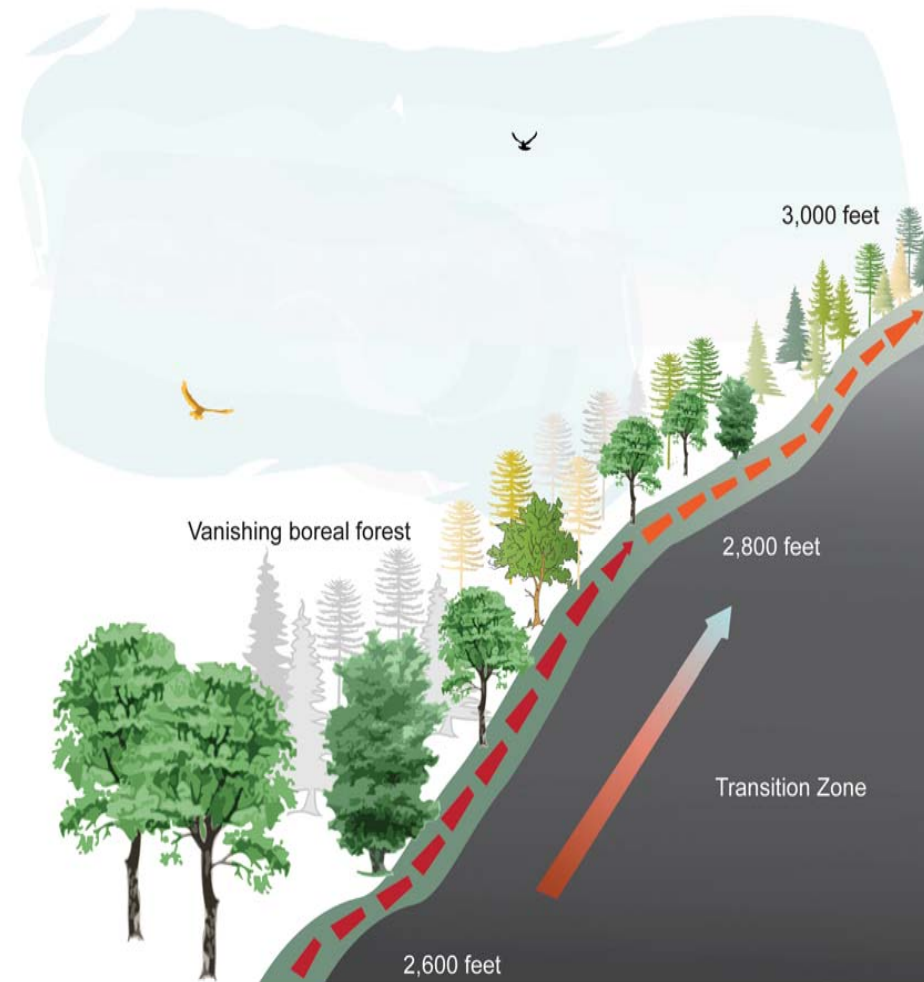
- **Trend One**: Shift in emphasis from preservationism to transitionalism in natural resources management policy
- **Trend Two**: Rapid evolution of property rights and liability rules associated with natural capital adaptive resources
- **Trend Three**: Accelerated merger of water law, land use law, and environmental law
- **Trend Four**: Incorporation of a human rights dimension in climate change adaptation policy
- **Trend Five**: Catastrophe and crisis avoidance and mitigation as an overarching policy priority
- **Trend Six**: Frequent reconfigurations of trans-policy linkages and trade-offs at all scales and across scales

# + The end of preservationism?



NAST<sup>219</sup>

The maps show current and projected forest types. Major changes are projected for many regions. For example, in the Northeast, under a mid-range warming scenario, the currently dominant maple-beech-birch forest type is projected to be completely displaced by other forest types in a warmer future.<sup>243</sup>



Beckage *et al.* 260/Schematic adapted from J. Abundis

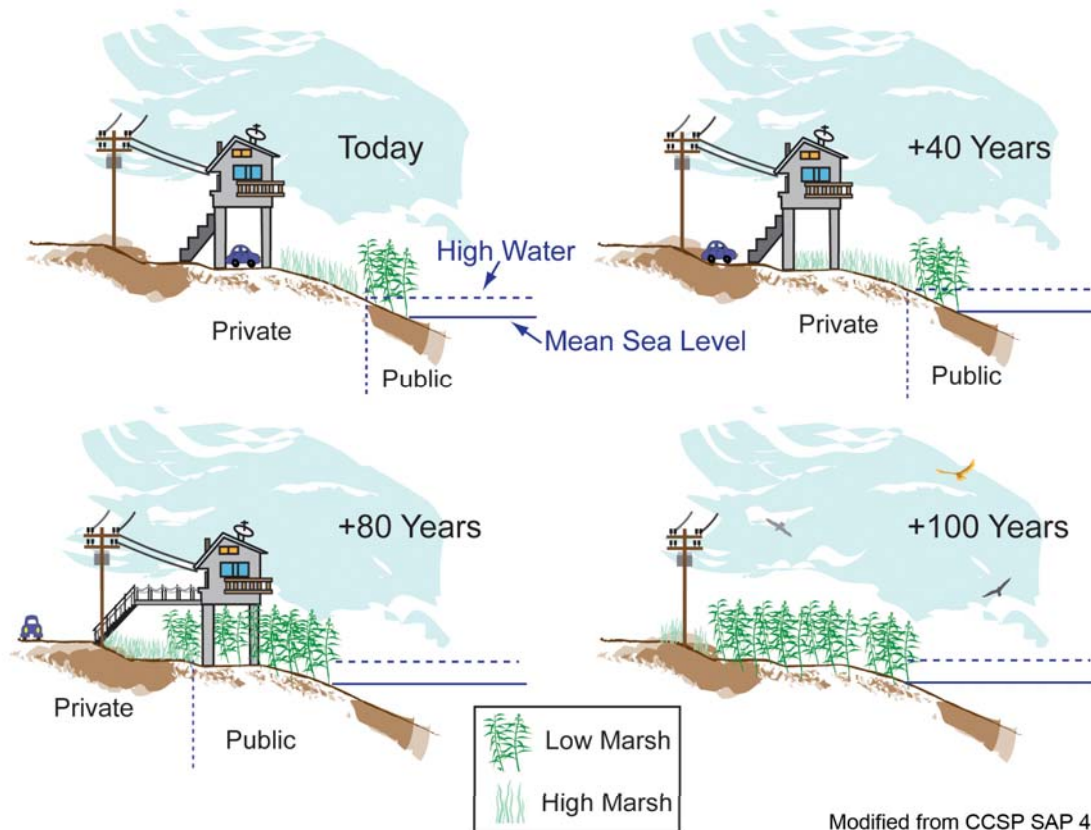
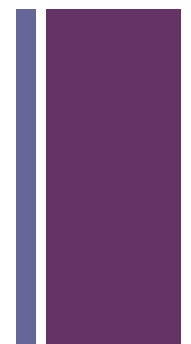
As climate warms, hardwood trees out-compete evergreen trees that are adapted to colder conditions.



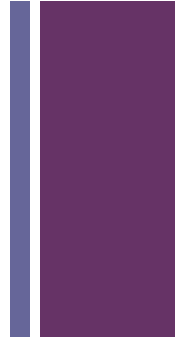
As climate warms, many species in the United States are shifting their ranges northward and to higher elevations. The map shows the response of Edith's checkerspot butterfly populations to a warming climate over the past 136 years in the American West. Over 70 percent of the southernmost populations (shown in yellow) have gone extinct. The northernmost populations and those above 8,000 feet elevation in the cooler climate of California's Sierra Nevada (shown in green) are still thriving. These differences in numbers of population extinctions across the geographic range of the butterfly have resulted in the average location shifting northward and to higher elevations over the past century, illustrating how climate change is altering the ranges of many species. Because their change in range is slow, most species are not expected to be able to keep up with the rapid climate change projected in the coming decades.<sup>244</sup>



# + A property rights revolution?



# + Three Governance Trends



- **Trend Seven:** Shift from “front end” decision methods relying on robust predictive capacity to “back end” decision methods relying on active adaptive management.
- **Trend Eight:** Greater variety and flexibility in regulatory instruments.
- **Trend Nine:** Increased reliance on multi-scalar governance networks.

# + One Overarching Trend

- Trend Ten: Conciliation

