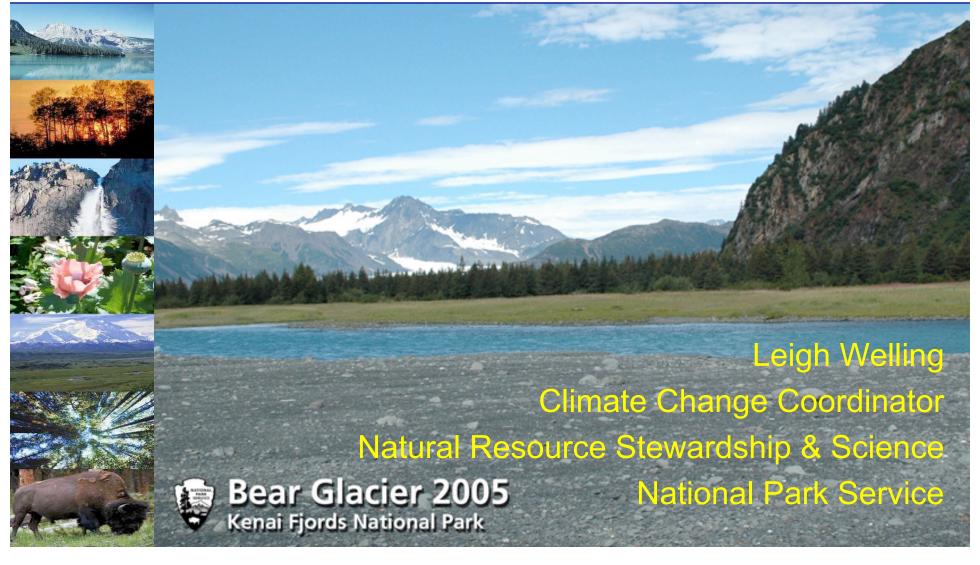




## Responding to the Challenge of Climate Change: NPS Strategies





## Climate change is often perceived as a longterm issue – difficult to address in the





"Long term, I'm worried about global warming – Short term, about freezing my ass off."



# Resource management decisions must be based on future expectations...







While some impacts from climate change are already measurable...

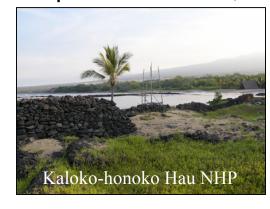




## Long range effects of climate disruption...



on park resources,



Glacier NP

infrastructure,



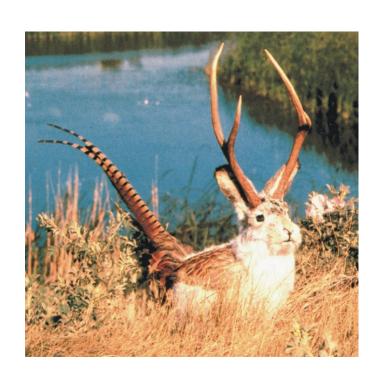
& visitor experience

...are just beginning to be understood.



## Of potentially even greater concern...





... are potential impacts that cannot yet be recognized or anticipated.



## How can land managers respond to the challenge of a changing climate?



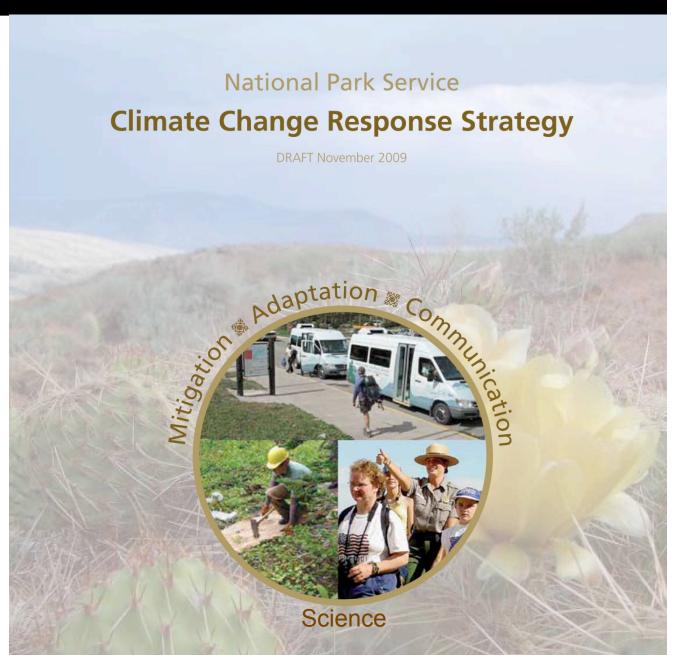
Need to build capacity to cope with rapid climate change

### By empowering managers to

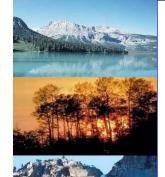
- think about climate change in a systems context
- develop, implement, and sustain mitigation and adaptation strategies
- work in interdisciplinary team involving all Directorates and Divisions in the NPS
- engage strategically with partner organizations to promote multi-agency collaboration and planning

## 4 Key Components

- ·Science
- Mitigation
- Adaptation
- Communication

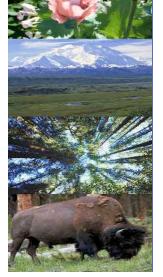


## Science is critical for effective management response → emerging information needs





- Downscaled models at management-relevant scales
- Forecasts/scenarios
- Resource vulnerability assessments
- Long-term monitoring
- Science syntheses
- On-the-ground relationships for
  - decision support
  - understanding the science as it changes



## NPS Vital Signs Monitoring Networks



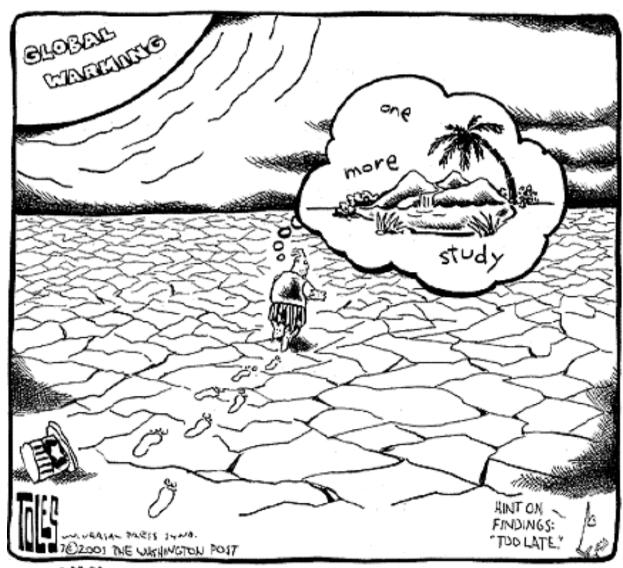


enhanced monitoring for climate change focusing on critical systems and data sharing and synthesis



## Acquiring more information is not enough

While we need to better understand the complex interactions that can lead to various futures......



#### NATIONAL PANK SERVICE

## Mitigation: Leadership by Example



Ongoing efforts to reduce emissions of park and concessions operations and develop sustainable, green practices

- "Climate Leadership In Parks" (CLIP) tool → web-based emissions inventory tool
- Promote transportation alternatives
- Embrace green programs and standards
- LEED certification for buildings includes plant salvage during preconstruction
- Carbon management

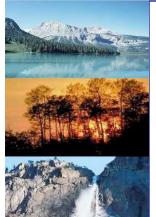






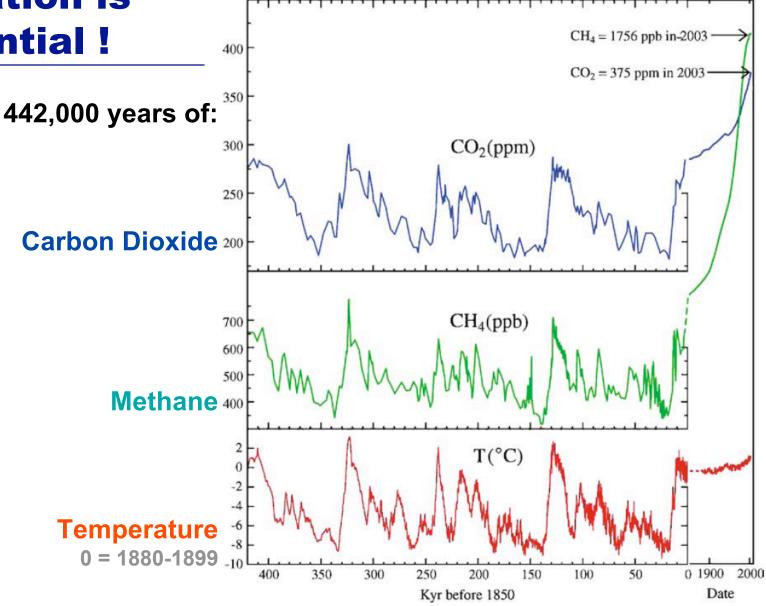


## Mitigation is essential!



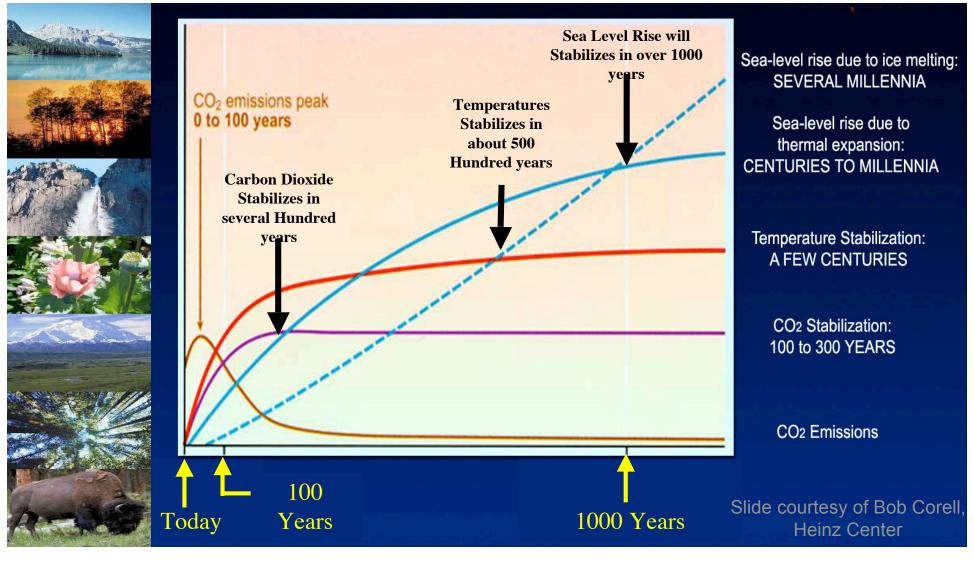




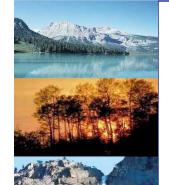




## Once emissions stop, it still takes time for Earth's systems and processes to stabilize



## Adaptation: 3 "arms"







2. Preserving Cultural and Ethnographic Resources





3. Protecting Facilities and Infrastructure



## **Adaptation Strategies**



- Require:
- Science What is known and what is uncertain?
- Policy What are our boundary conditions?
- Planning What is our context?
- Leadership What guidance do we have? Will we be supported as we move into unknown territory?

Planning for change will challenge us to question some of our basic assumptions





## **Scenarios Defined**



"Scenarios are a tool for helping us take a long view in a world of great uncertainty. They are stories about the ways the world might turn out tomorrow that can help us

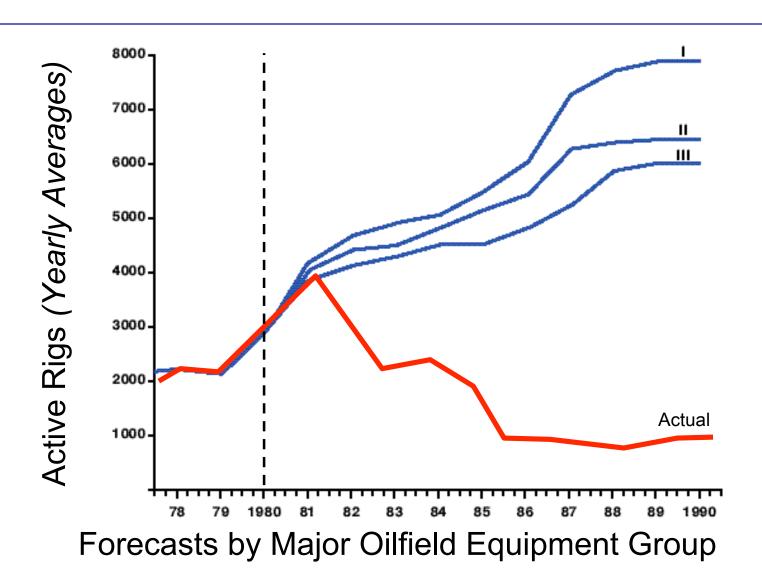
recognize and adapt to changing aspects of our current environment"





## Multiple Forecasts of Oil Drilling: 1980–90





## Climate Change Scenarios: IPCC

"A scenario is a coherent, internally consistent and plausible description of a possible future state of the world. It is not a forecast; rather, each scenario is one alternative image of how the future can unfold." — IPCC, 2006

**Economic Concerns** A1 Storyline A2 Storyline A future world of rapid A very heterogeneous economic growth, low world with regionally population growth and oriented economic more new technolog development **Driving** Global **Forces** Regional evelopment Development **Patterns Patterns** 

#### **B1** Storyline

A convergent world with the same low population growth, but with rapid changes in economic structures toward a service and information economy

#### **B2 Storyline**

A world which the emphasis is on local solution to economic, social, and environmental sustainability

Source: IPCC Special Report on Emissions Scenarios, 2000



## **NPS High-Level Scenario Framework**

#### >We asked:

What will be the social and political landscape around climate change over the next 25 years?

Forces marked in red were deemed to be the most important, and most uncertain, in shaping the future social and political landscape

1.rate and magnitude of GHG emissions

2.mood / position of administration

3.intensity of impacts on average American citizen

4.political stability of oil-producing and quickly-developing nations

5.population growth and development and energy demand

6.regional population shifts and consequent development

7.public perception of federal lands and their purpose

8.leadership

9.budgets (for funding science and management)

10.degrees of cooperation between agencies, sectors, etc.

11.energy availability and cost

12.levels of global conflict

13.public reaction to rate of temperature and sea level change

14.media portrayal

15.sense of public ability to make a difference

16.degree to which CC is a partisan issue

17.economic prosperity

18.knowledge of CC

19.threshold changes and wildcards

20.federal agriculture policies

21.urban planning policies

22.sequestration and technology developments

23.power of carbon tax / cap and trade / Kyoto

24.concern of / in society about natural systems

25.social and environmental movements / renaissance

26.resource availability / scarcity (water, lithium, etc.)

27.global health concerns / epidemics / disease

### **High-Level Scenario Framework**

4 different pictures for the future social and political landscape around climate change

**Broad Understanding** 

Nature of Leadership

Concern

#### Riots and Revolution

At a time of growing social concerns and fear about the impacts of climate change, governments and political leaders are unable to articulate a coherent set of policies and approaches. The result? Growing public unease, and movements to overturn existing systems and structures.

Lack of senior
commitment
Varied approaches and
alignment
Short-term concerns

#### Is Anyone Out There?

To the frustration of many, climate change becomes a variable concern that is often ignored by political and business leaders. Scientific consensus breaks down, other societal challenges loom large, meaning that climate change is seldom on the front pages, or in the forefront of political and business leaders' minds.

### Heightened Urgency Big Problems, Big Solutions

Coordinated action around the world as climate change (and its effects on weather, resources and people) becomes seen as an increasingly urgent and widespread challenge. Political leaders initiate bold decisions and policies to mitigate the worst, and adapt to the inevitabilities of climate change effects.

Senior commitment International alignment Long-term perspectives

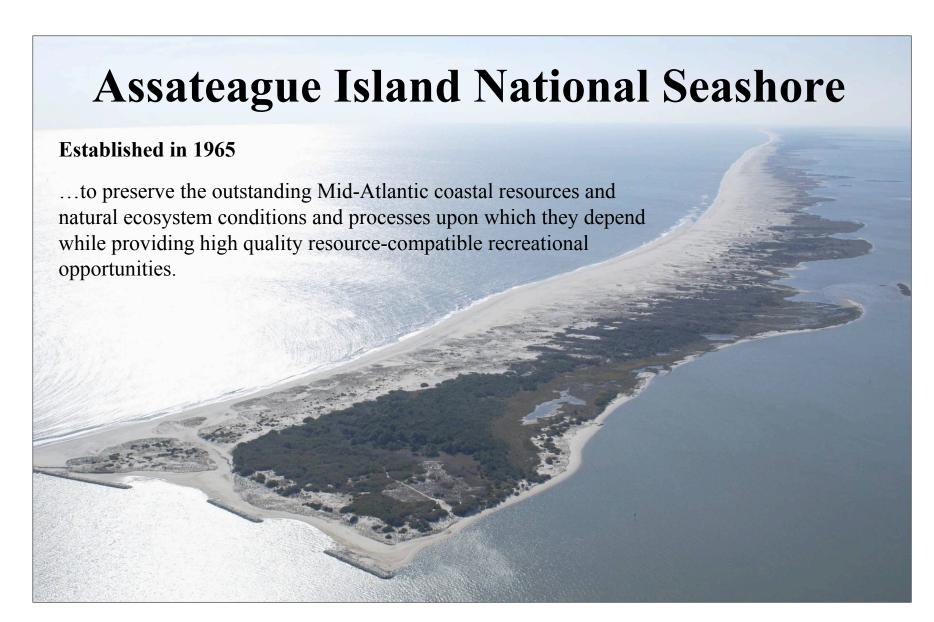
#### Wheel-Spinning

Despite growing scientific evidence that has convinced leaders across the world, climate change remains a remote concern for the majority of everyday people. Consumers and businesses rail against carbon caps and prices, claiming them to be "just another tax" imposed by the elite.

Widespread indifference Competing concerns

### Case Study: Assateague Island National Seashore

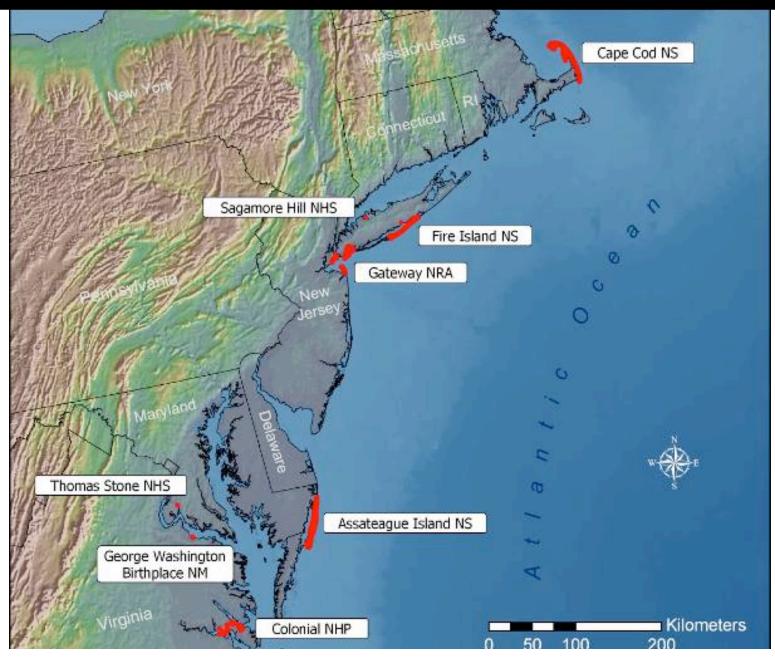




## U.S. Department of the Interior National Park Service

#### Assateague Island National Seashore





#### Case Study 1: Assateague Island National Seashore



## **Assateague Island**

- 57 km long; varies from less than 1 km to nearly 4 km wide
- Approximately 19,700 hectares
  - 7,000 hectares land
  - 12,700 hectares water
- Three agencies with differing missions manage parts of Assateague Island
  - National Park Service
  - US Fish and Wildlife Service
  - State of Maryland



## The ASIS team identified the key climate change drivers that are likely to impact on the geomorphology, flora and fauna of the park

Climate Variable	General Change Expected	Confidence Level
Temperature	Increase, but not uniform	Virtually certain
Precipitation	Probable decrease in total annual precipitation	Low
Sea Level	Increase	Moderate
Drought	A modest increase in drought frequency in the warm season	Moderate
Snow cover	Increase in snow-free days; decreased snow accumulations	High
Length of growing season	Increase	High
Extreme Events: Temperature	Warm Events Increase / Cold Events Decrease	Moderate to high
Extreme Events: Precipitation	Possible decrease of frequency of heavy rain, but countered by rise in intensity.	Low to moderate
Extreme Events: Cold Season Storms	Increased intensity.	Low to moderate
Extreme Events: Warm Season Storms	Increased intensity; possible decrease in frequency	Low

Note: 1. The study also included additional information such as "Range of Change Expected & Reference Period", "Size of Expected Change Compared to Recent Changes" and "Synoptic Signs". The complete table can be found in the appendix to this document.



The ID team identified the most important and most uncertain climate drivers that will affect conditions in the Park over the next 40 years. Sand Bar

#### **Moving Target**

- Episodic change (wave-driven washover)
- Higher productivity in the marshes
- Increased sediment from runoff
- Island size decreases: estuarine and marine area increases
- Dune erosion
- Simplified habitats
- Impacts on infrastructure

Low / Moderate

### Intense storms,

Increased frequency

Sea-level rise

Status Quo.

Decreased frequency

• Fragmentation; formation of multiple inlets

- Greater potential for breaching
- System unable to keep up with pace of change – from island to sandbar
- Habitats simplify, become uniform; less diverse
- Huge potential impacts to full range of communities (aquatic, terrestrial, salt marshes)

**Significant** 

#### **Shifting Sands**

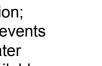
- Dynamic; similar to today
- Expansion of complexity and stability of estuarine communities
- Lengthening of growing season
- Some lowering of the water table with impacts on flora and fauna
- Migration of species northwards
- Greater risk of vectorborne diseases

#### **Parched**

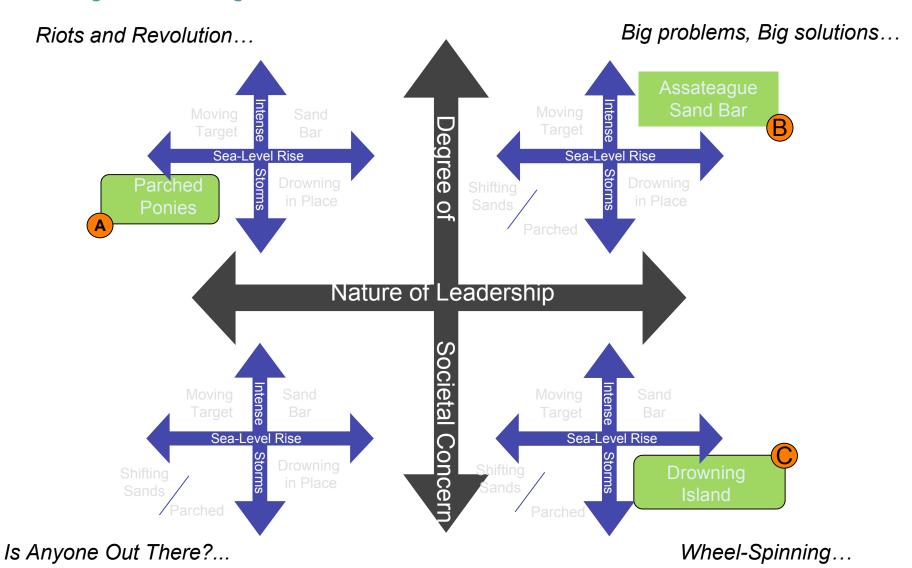
- Less precipitation; more drought events
- Lowering of water table - less available fresh water to the ecosystem
- High precip events may bring nutrient spike, blooms, and negative impacts to fisheries.
- Increased risk of fire.

#### **Drowning in Place**

- Loss of land mass from sea level rise; island exists "further back"
- Individual storm events have big impact on resetting the landscape
- Recovery of system between extreme events is more likely
- Salt water inundation and intrusion. into freshwater aquifer
- Shift in types of plants (tolerance for saline environs, higher temperature etc.)



#### Combining local and high-level scenario frameworks → "nested scenarios"



**High-Level Scenario** 

**Riots and Revolution** 

**Local Scenario** 

**Parched** 

"Parched Ponies" is a world in which societal concerns around climate change are heightened, yet there is little real leadership shown to address challenges at a global or national level. Management response might include more coastal monitoring, reprioritizing access needs, physically maintaining some systems (e.g. shorebird nesting habitat) increased education and outreach, and drawing on partnerships and grass roots support.



**High-Level Scenario** 

**Big Problems, Big Solutions** 

**Local Scenario** 

**Sand Bar** 

"Assateague Sand Bar" is a world where climate change concerns are at the forefront of social and political conversations. A greater intensity of storms, coupled with significant rises in sea-level, leads to major changes in land use, resources and visitor experiences. Management response may involves boundary expansion to allow for migration and creation of marshes. Fewer visitor amenities such as maintained roads, bridges, and parking lots – need for portable and cheap infrastructure. Recruitment and training ties in to communication and relationship

building; public education is key.



#### **High-Level Scenario**

**Wheel-Spinning** 

#### **Local Scenario**

**Drowning in Place** 

"Drowning Island" is a world where regulators and leaders pay attention to climate change issues, but where general societal attitudes are mostly indifferent. Main impacts include wetland and saltmarsh species. Land use changes might include possible land exchanges and consolidation, a more sustainable recreation infrastructure, a blurring of the lines between state and federal lands, alternative transportation systems, and a shifting of infrastructure to the mainland. Cooperation with park and local agencies critical.



## **Communication and Education**



- Developing a broad strategy aimed at park, regional, and national levels
- Educating employees → monthly webinar series; climate change "state of knowledge" summaries
- Use the communication power of the NPS → create new interpretive programs and products



An on-line program that helps people reduce their carbon footprint

managers, scientists,

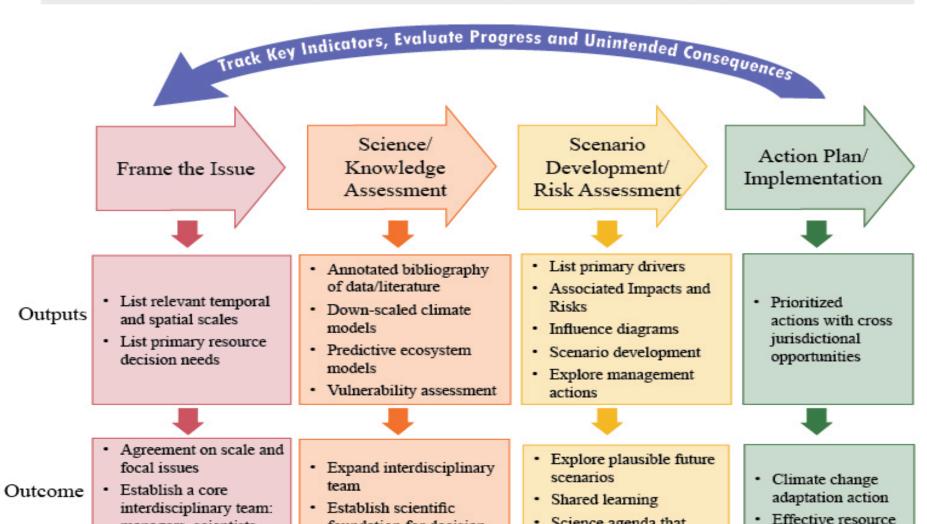
subject-matter

specialists



protection

#### KEY ELEMENTS OF AN ADAPTATION PLANNING FRAMEWORK



foundation for decision

making

Science agenda that

knowledge gaps

identifies and prioritizes

#### NATIONAL PARTIE SERVICE

# The Good News: People are starting to pay attention!





"I'm starting to get concerned about global warming."