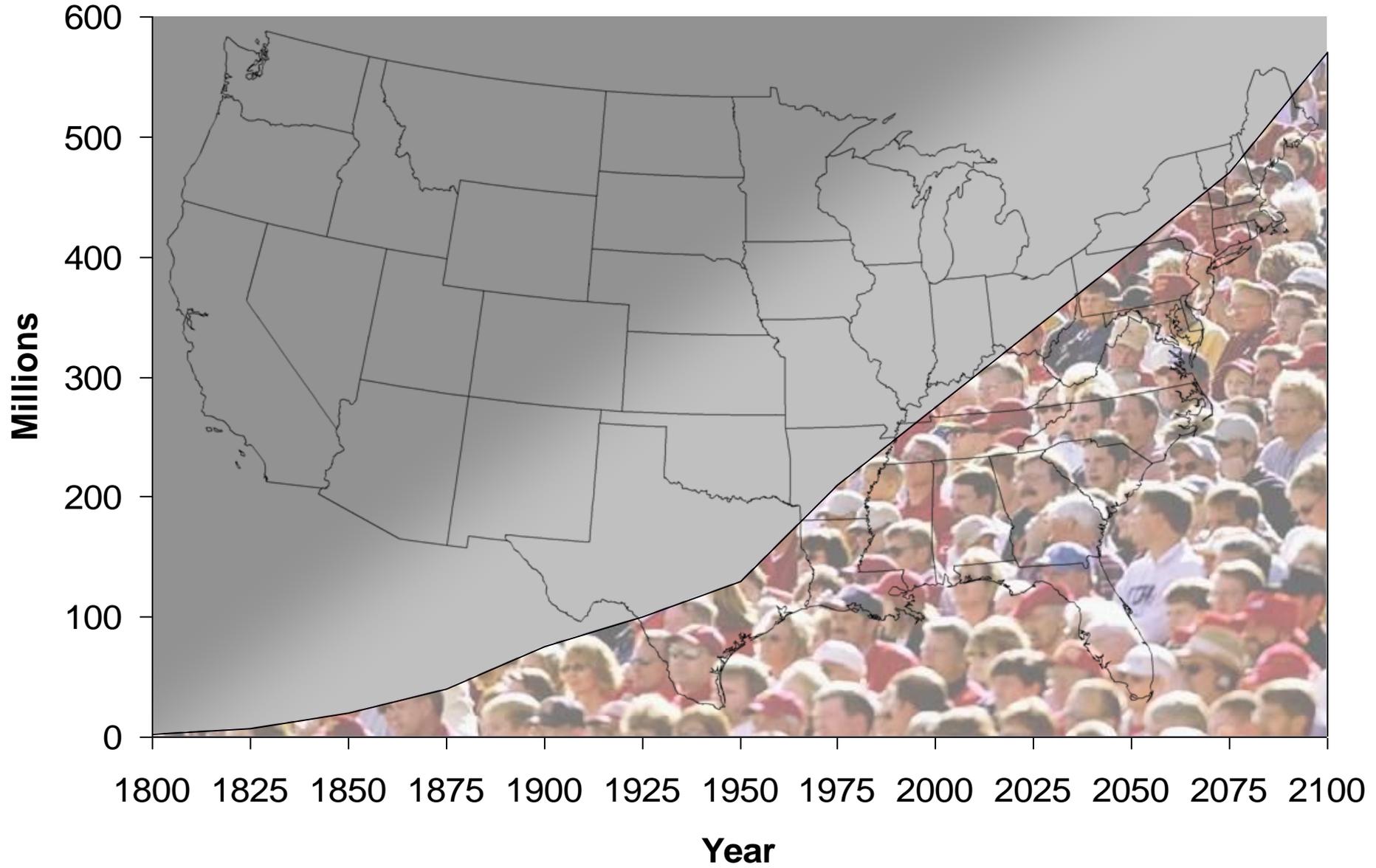


America's Conservation Landscape in the Face of Changing Land Use and Climate Change.

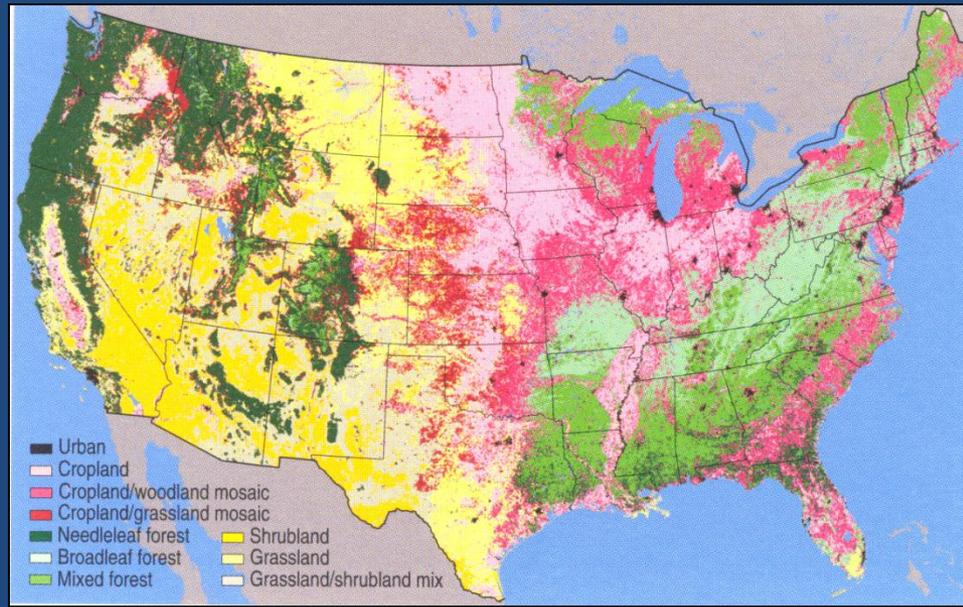
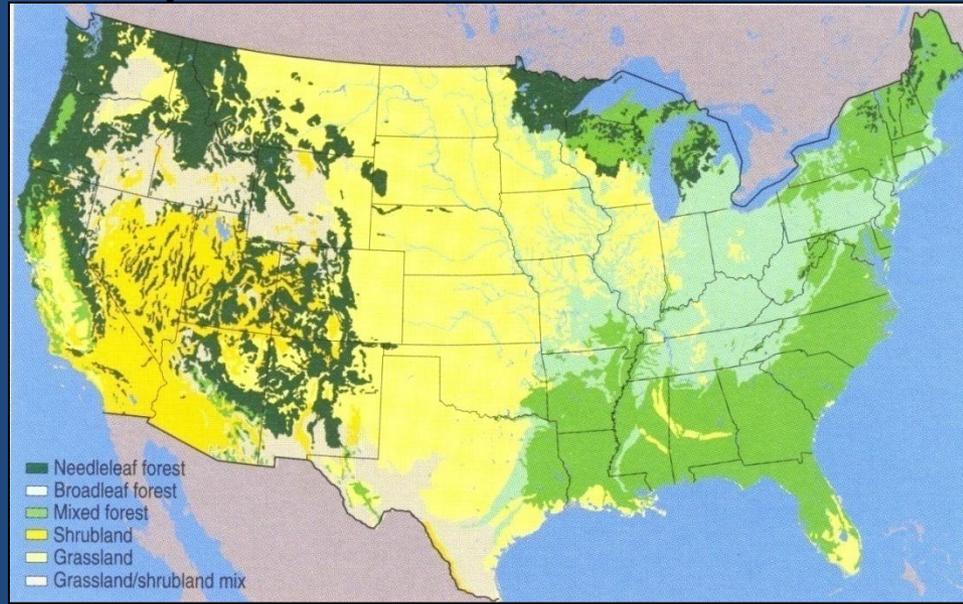
J. Michael Scott

USGS, Idaho Cooperative Fish & Wildlife Research

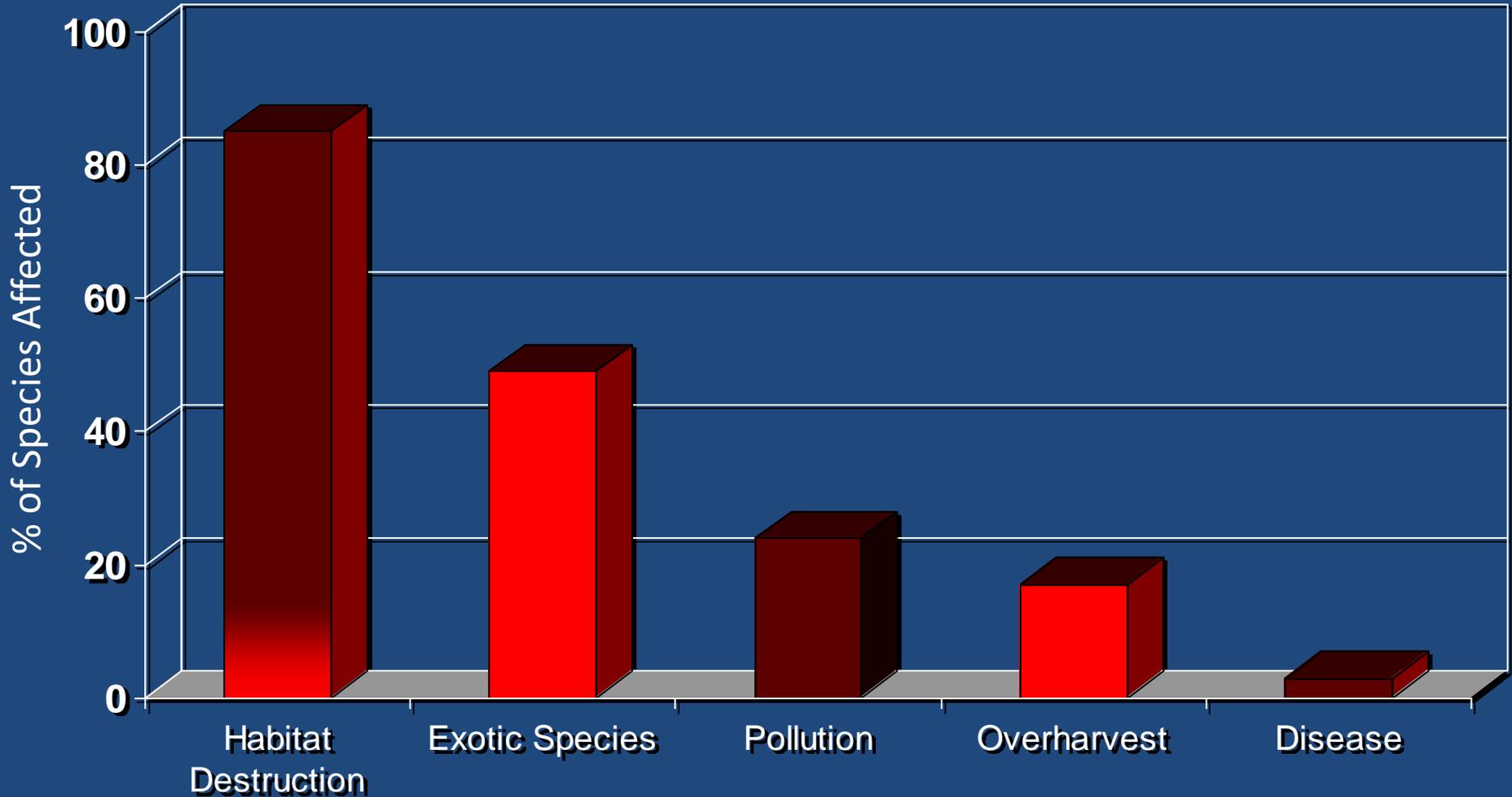
U.S. Population



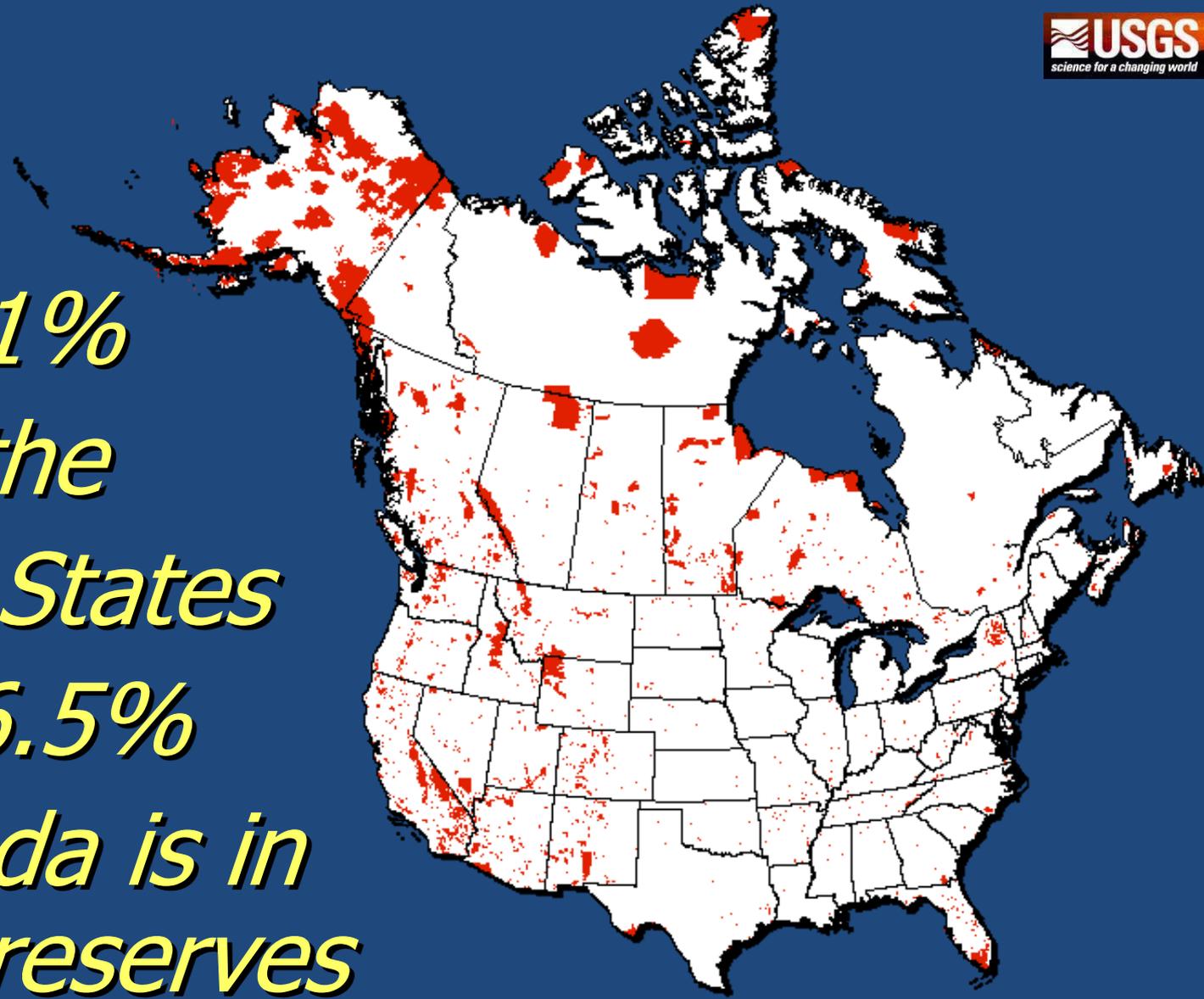
How much of the landscape has been converted from pre-settlement condition?

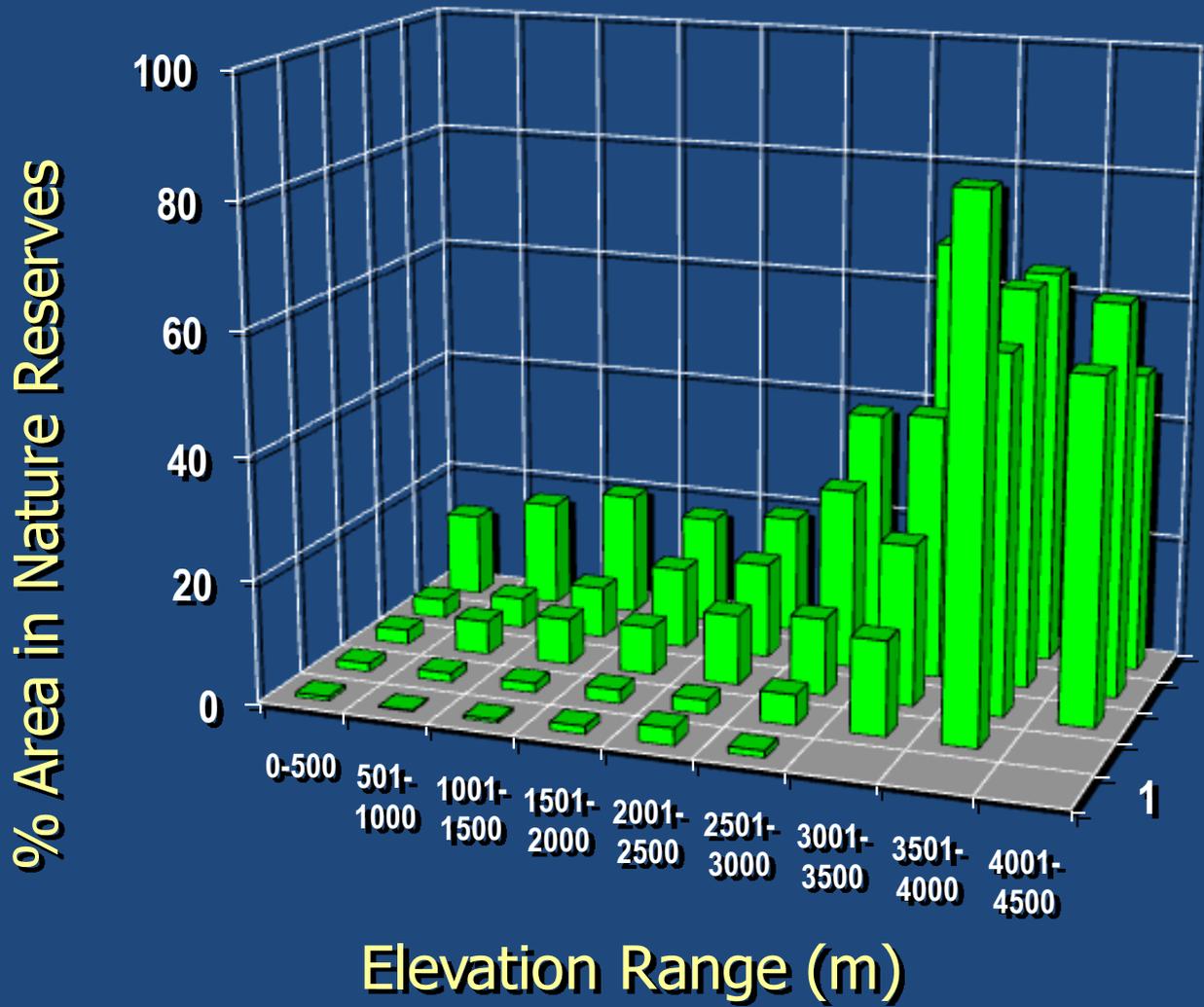


Major Threats to Biodiversity



*5.1%
of the
United States
and 6.5%
of Canada is in
nature reserves*



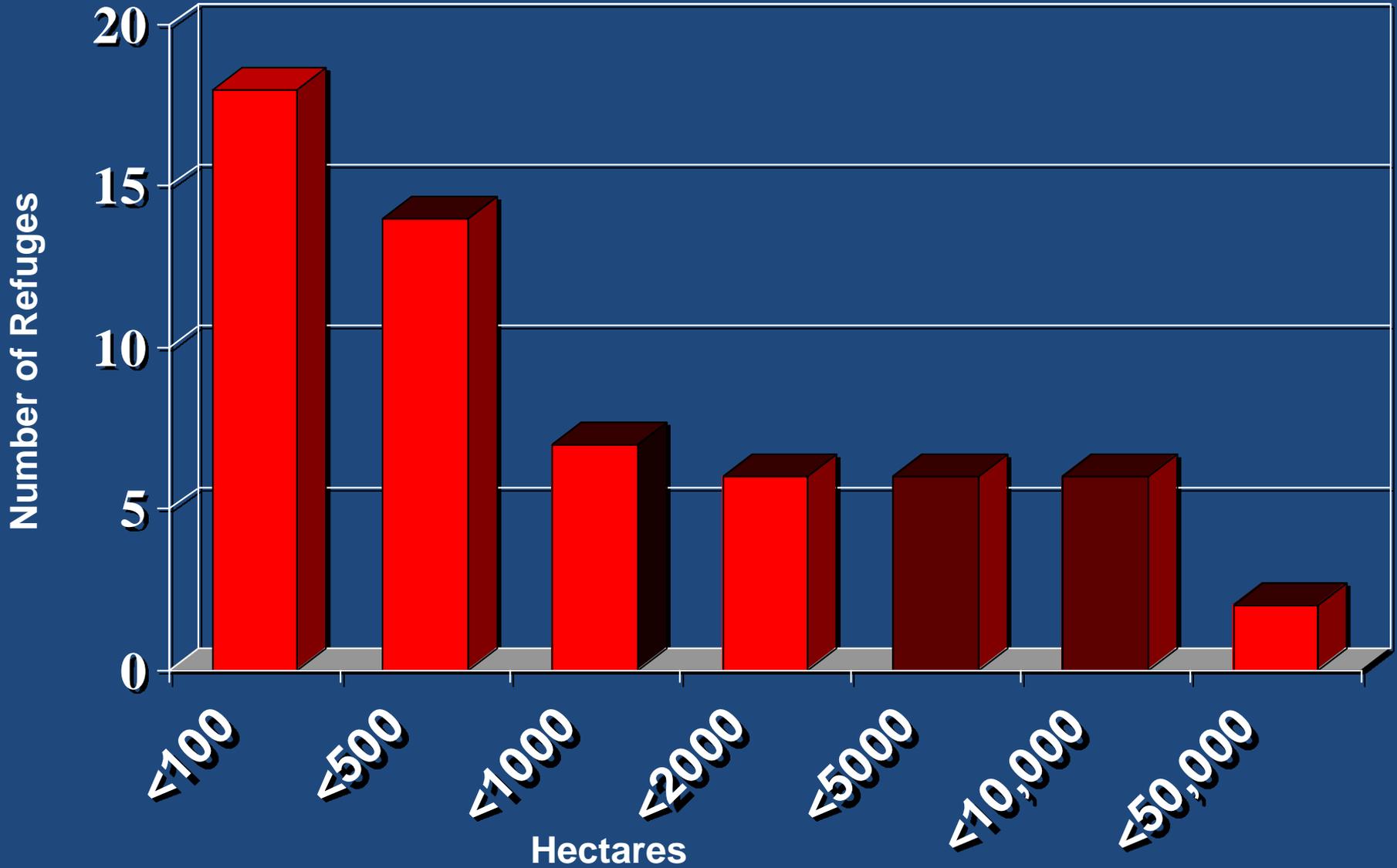


Soil
Productivity
Ranking

Elevation Range (m)



Area of National Wildlife Refuges Established for Listed Species





59% genetically viable
populations



45% demographically
viable populations

12% evolutionarily viable
populations

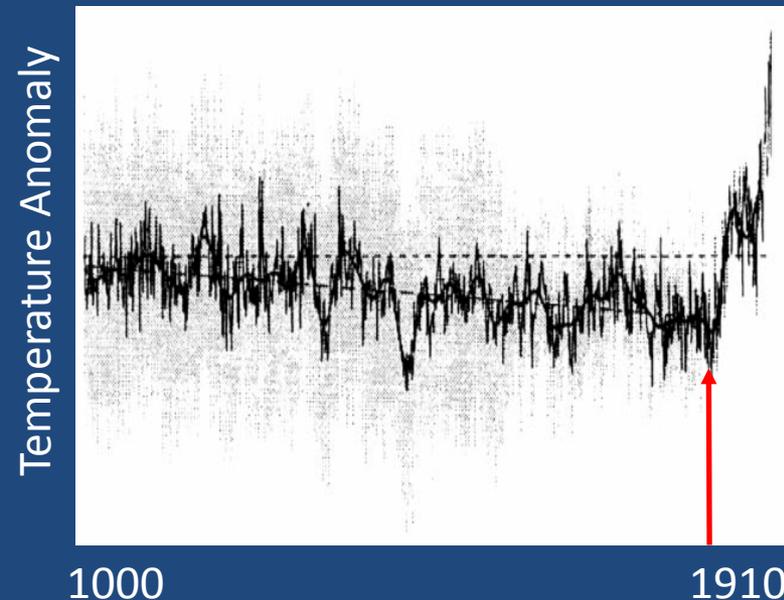
America's Conservation Landscape 2076:

Where, What, Who?



Historical Public Lands Management

- Implicit Assumption:
 - Dynamic equilibrium
 - Stable climate
- Management philosophy:
 - Reduce, eliminate, or mitigate challenges
 - Maintain or return to equilibrium
 - Maximize predictability



Warming Requires a Transformation of Management

- Abandon Dynamic Equilibrium
 - “Pre-Columbian” conditions not attainable
- Embrace Dynamic Trends
 - Spatially and temporally variable
 - Add complexity
 - Synergy with non-climate challenges
 - Dominated by uncertainty
 - especially for individual species and places

Two Classes of Adaptation

- Maintain or enhance resilience
 - Reduce or eliminate non-climate challenges
 - Support the capacity of species/systems to adapt
- Prepare for regime shifts
 - Develop the capacity to
 - Modify management actions
 - Anticipate regime shifts
 - Identify alternate ecosystem services
 - Shift targets to new areas or agencies
 - Manage transitions to new states

Components of an Adaptation Strategy

- Develop a vision of targets in a warming world
- Assess the range of possible futures (scenarios)
- Identify effects of scenarios on conservation targets
- Develop robust scale-specific management strategies
- Plan for the scenarios at multiple scales
- Implement and monitor in an adaptive (cyclic) framework

Scales of Adaptation

- National
 - Vision, Strategy, Targets, Funding
- Regional
 - Off-unit collaboration/coordination
 - Performance Standards
 - Rewards for adaptation
- Local Unit
 - Minimize non-climate challenges within unit
 - Adjust priorities
 - Incorporate climate change in unit plans

Most Vulnerable

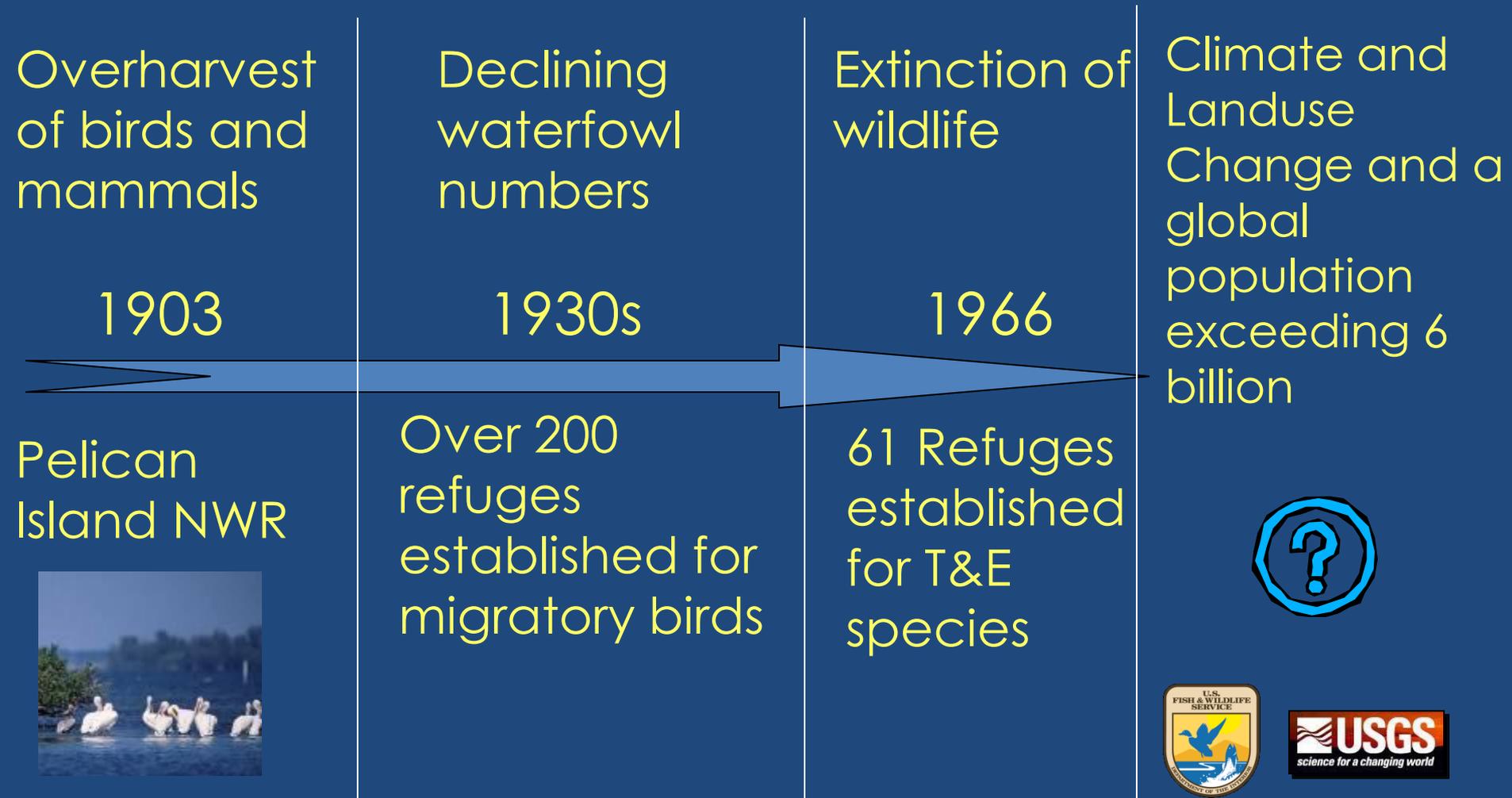
- Species:
 - Specialists
 - Poor dispersers
 - Restricted ranges
 - Peripheral populations
- Areas:
 - History of change
 - Projected change
 - Extremes of range

A Case Study

The National Wildlife Refuge System

A System Born in Crises

Refuge System Timeline

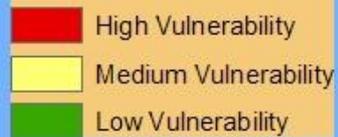


National Wildlife Refuge System

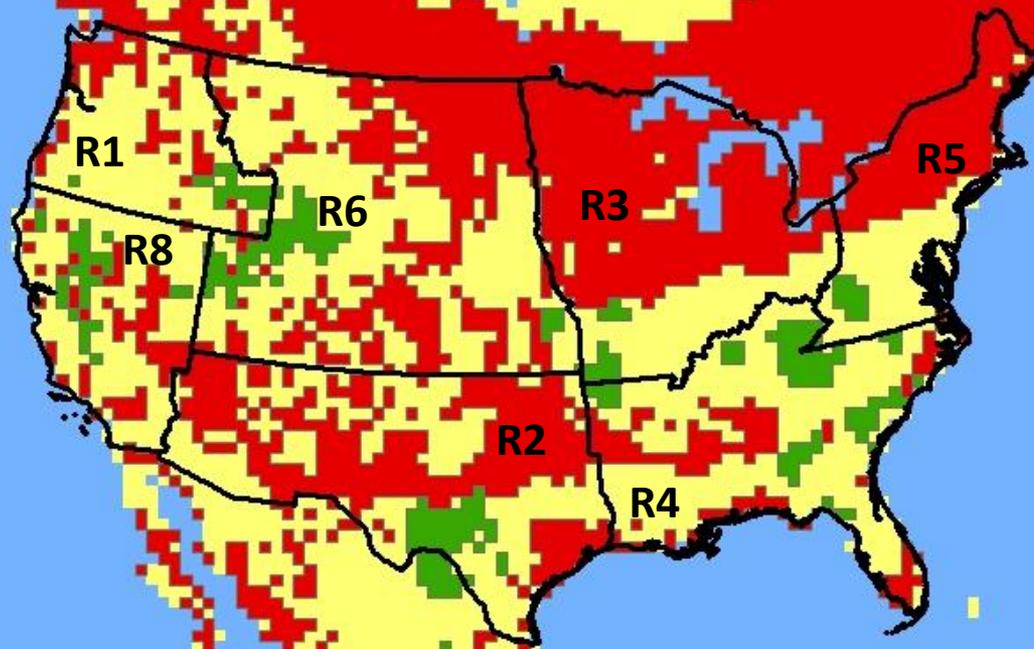


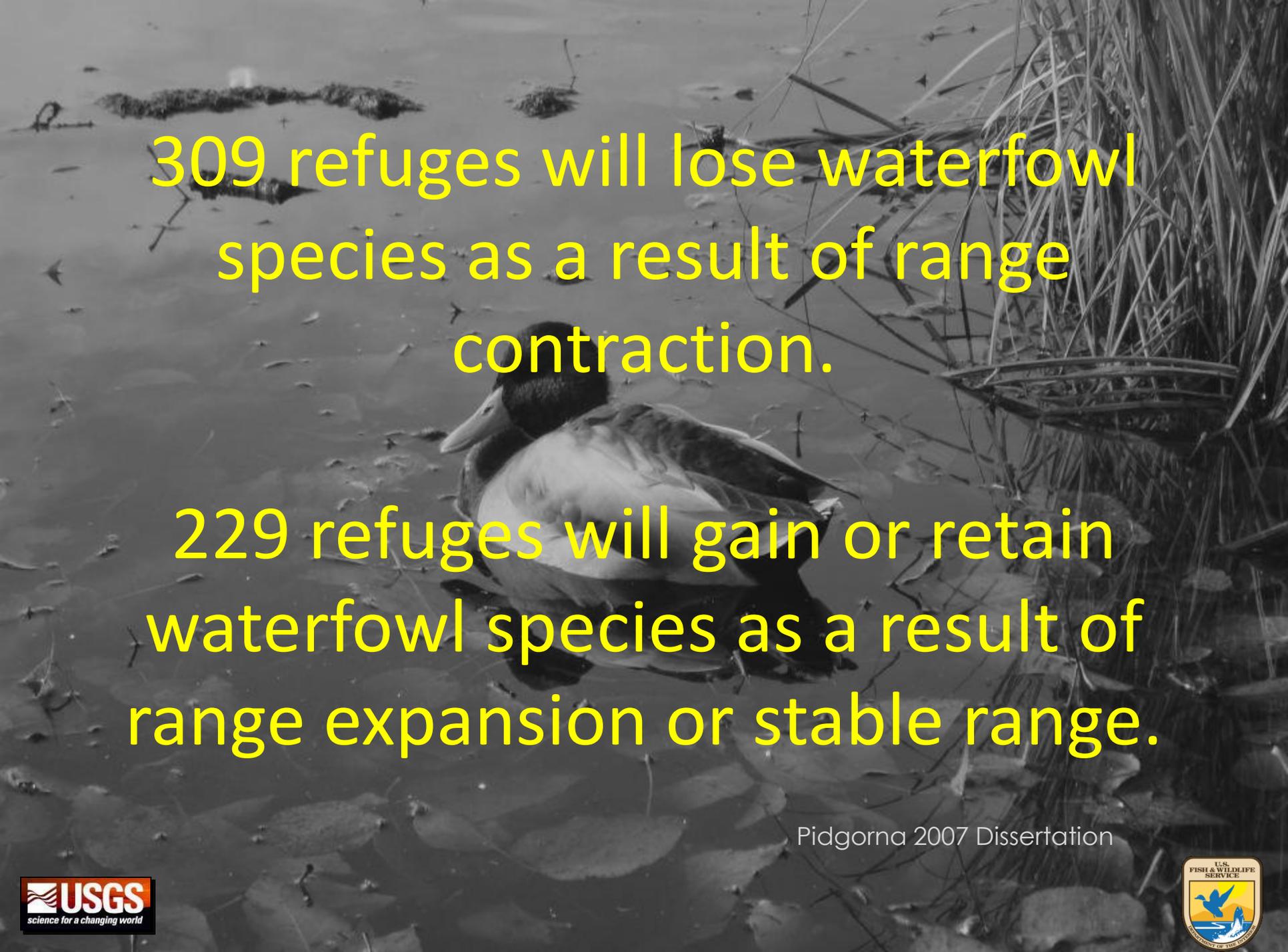
FWS REGIONS: Vulnerability to Biome Change from 1990 to 2100

Legend



Gonzales *et al.* 2009





309 refuges will lose waterfowl species as a result of range contraction.

229 refuges will gain or retain waterfowl species as a result of range expansion or stable range.

Pidgorna 2007 Dissertation

Most Vulnerable Refuges

- Alaskan refuges (16)
- Coastal refuges (161)
- Refuges projected to experience a biome shift



Arctic NWR



Blackwater NWR



Prairie pothole region

www.usgcrp.gov

Where to go from here?



Latitude: 38° 59' 2.4" N
Longitude: 75° 15' 36.9" W

Clarify the Vision of NWRS

- Complete basic inventories
 - Cannot assess effects of warming without baselines
- Identify conservation targets for a warming world
 - Without targets, success/failure cannot be judged
 - Targets include species, guilds, habitats, and refuges
 - Quantify targets in terms of
 - Representation
 - Redundancy
 - Spatial Distribution
 - Connectivity
 - Size
- Develop a strategic plan for target attainment
 - Prioritize targets and scales of implementation

Maintain & Enhance Resilience - I

- Minimize non-climate challenges
- Increase connectivity among existing units
- Increase conservation footprint by all means (**BCOR²**)
 - spatially **B**alanced
 - functionally **C**onnected
 - directionally **O**ptimized
 - **R**epresentative (one of each target)
 - **R**edundant (replicates of each target)

Maintain & Enhance Resilience - II

- Communicate and Educate
 - Reintegrate refuges into the American mindset
 - Build support for climate adaptation and mitigation
- Attempt to conserve refugia
 - Only for threatened or endangered species or habitat
 - ~ one-third of T&E refuges highly vulnerable
- Relocate
 - Only as a last resort

Prepare for Regime Shifts - I

- Project possible futures
 - Multiple scenarios to address uncertainty
 - Multiple scales
 - Identify mechanisms of response
 - Acknowledge potential “surprises”
- Develop scenario specific policy responses
 - Scale specific
 - State objective criteria for choosing among policy options
- Prioritize research agenda
- Increase collaboration with everyone

Prepare for Regime Shifts - II

- Increase length of planning/budgeting horizons
 - 1-yr operational and 3-yr research funding > inadequate
- Develop and implement monitoring programs
 - To assess status and trends of targets
- Use adaptive monitoring/management to
 - Inform the planning process regarding:
 - Required frequency and intensity of monitoring
 - Additive or compensatory nature of seasonal effects

Immediate Need

- Act now
 - Do not wait for perfect models
 - Use expert opinion
 - Lost opportunities cannot be regained
 - Mistakes will be made
 - Reward innovative risk taking
 - Capitalize on existing management experience
 - recent rapid warming encompasses entire history of NWRS

Management opportunities for Individual Refuges

- Increase resilience, reduce stress



Management opportunities for the National Wildlife Refuge System

- Increase representation and redundancy



Flyway Representation – Number of NWRs



Atlantic – 99
Central – 44
Mississippi – 79



Central – 67
Mississippi – 83
Pacific – 75



Atlantic – 99 Central
– 79 Mississippi – 95
Pacific - 90

www.pacificviews.org



Atlantic – 103
Central – 74
Mississippi – 100
Pacific - 81

America's Conservation Landscape 2076:

Where, What, Who?



**“And it is your obligation to... move forward...
in a way that does not denigrate, dilute or
diminish in the slightest degree that which
came before you, because many thousands of
men and woman gave their careers, and some
even gave their lives, for what you are working
toward– saving dirt.”**

--Lynn Greenwalt



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- U.S. Fish & Wildlife Service
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- Environmental Protection Agency
- U.S. Climate Change Science Program
- ~100 collaborators and contributing authors

Environmental Management 2009 Volume 44

5 summary articles online – “climate”

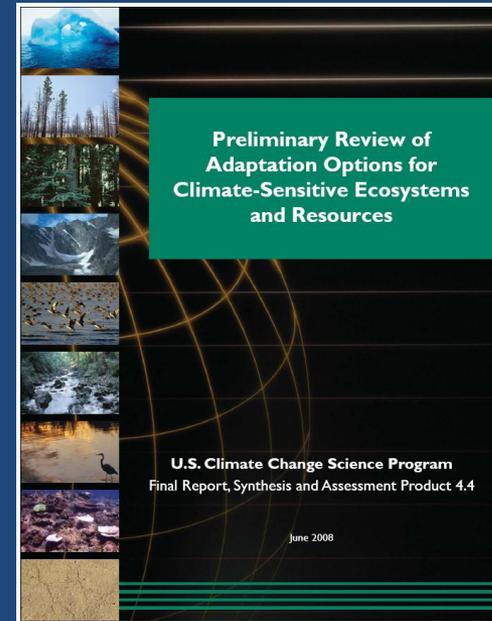
SAP 4.4 final report

<http://www.climatechange.gov/Library/sap/sap4-4/final-report/>



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

National Forests
National Parks
National Wildlife Refuges
Wild and Scenic Rivers
National Estuaries
Marine Protected Areas

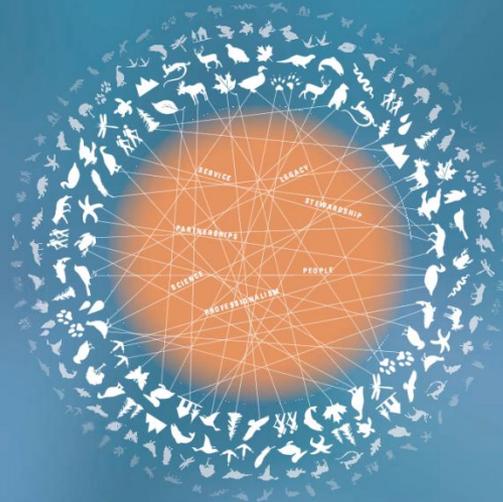


[http://www.climatescience.gov/Library/sap/sap4-4/final-report/
Environmental Management 2009 Volume 44 - 5 articles online – “climate”](http://www.climatescience.gov/Library/sap/sap4-4/final-report/Environmental%20Management%202009%20Volume%2044-5%20articles%20online-%20climate)



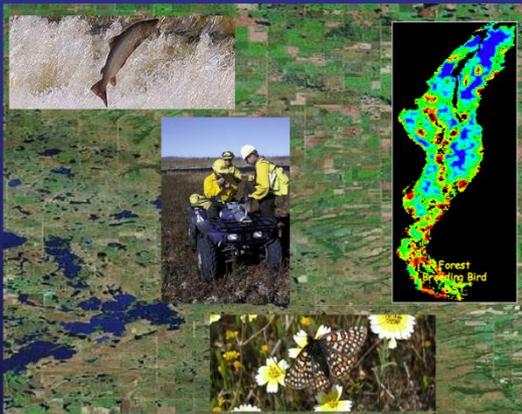
Conservation in Transition

Leading Change in the 21st Century



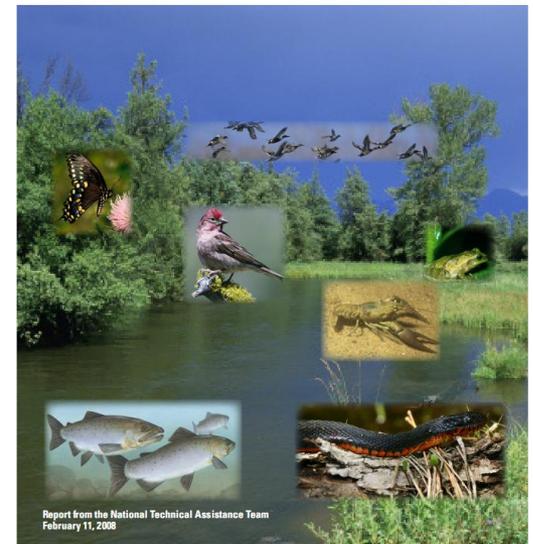
Strategic Habitat Conservation

*Final Report of the
National Ecological
Assessment Team*



Strategic Habitat Conservation Handbook

*A Guide to Implementing the Technical Elements
of Strategic Habitat Conservation (Version 1.0)*



Conclusions

- Provide species with opportunity to respond
 - Species composition will likely change
 - Does not mean that mission is compromised
- Discard no refuges
 - Realign the purposes to emerging needs
- Manage refuges in concert with all partners
 - Federal, State, NGO, private
- Expand the conservation footprint
 - Using all methods, to fill gaps in targets