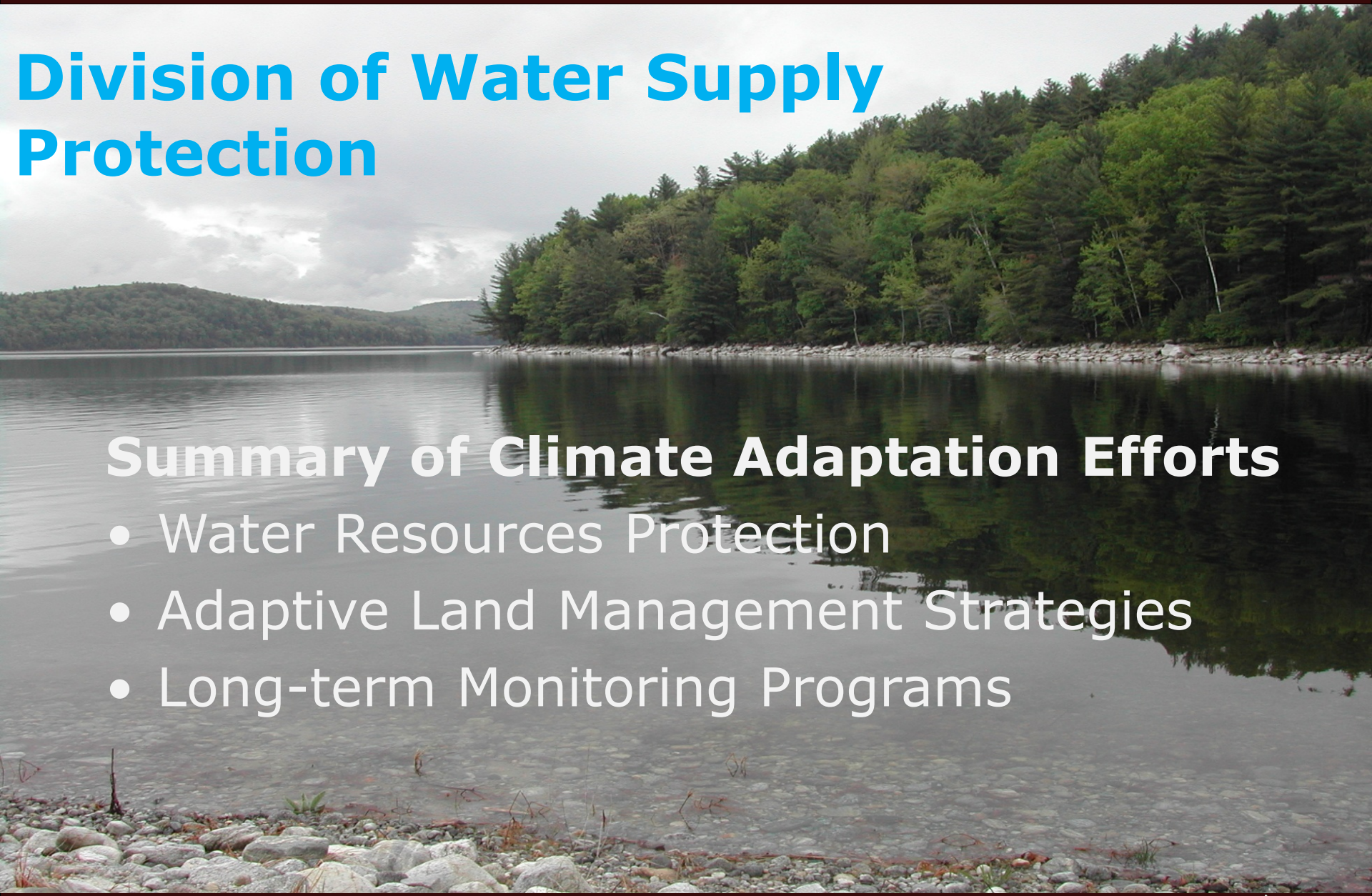


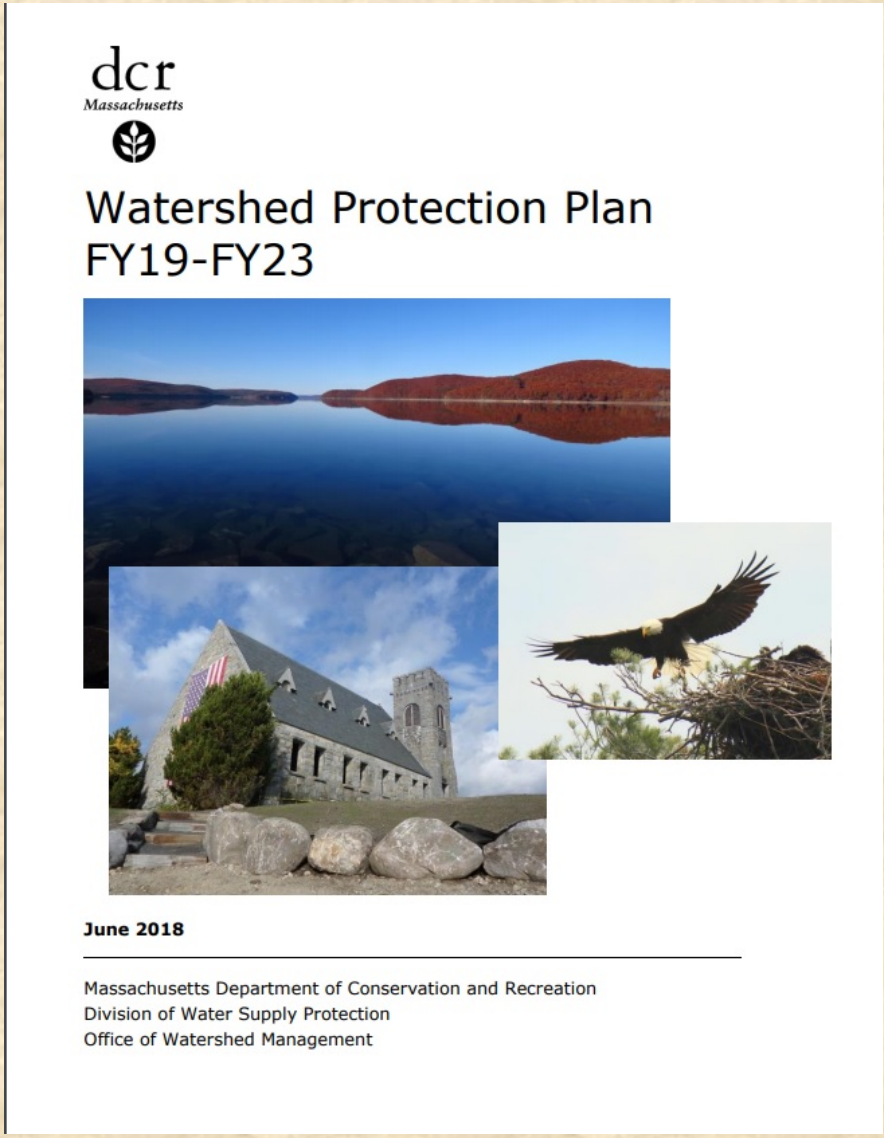
Division of Water Supply Protection

Summary of Climate Adaptation Efforts

- Water Resources Protection
- Adaptive Land Management Strategies
- Long-term Monitoring Programs

DWSP: Water Resource Protection

- DWSP Climate Change Vulnerability Assessment
  - Parallel to SHMCAP
  - Consider predicted Climate Change effects
    - Precipitation changes
    - Sea level rise
    - Temperature rise
    - Extreme weather
  - Assess potential impacts to Watershed Protection Programs



DWSP: Water Resource Protection

	Changes in Precipitation			Sea Level Rise			Rising Temperatures			Extreme Weather			
DCR Control Program	Inland flooding	Drought	Landslide	Coastal Flooding	Coastal Erosion	Tsunami	Extreme Temperatures	Wildfires	Invasive Species	Hurricanes/ Tropical storms	Severe Winter Storms	Tornadoes	Earthquakes
Land Acquisition	■			■					■	■			
WPRs	■						■		■				
Land Management	■	■	■				■	■	■	■	■	■	
Wildlife Management	■	■					■	■	■	■	■	■	
Public Access	■	■	■	■			■	■		■	■	■	
Security									■	■	■	■	■
Infrastructure	■	■	■				■	■	■	■		■	■
WsPA													
Education	■	■							■	■	■		
Water Quality and Hydrologic Modeling	■	■	■	■			■	■	■	■	■	■	
Aquatic Invasive Species	■	■					■	■	■	■	■	■	
Wastewater	■			■						■			
Stormwater	■	■							■	■	■	■	
Emergency Response	■	■	■				■	■		■	■	■	■

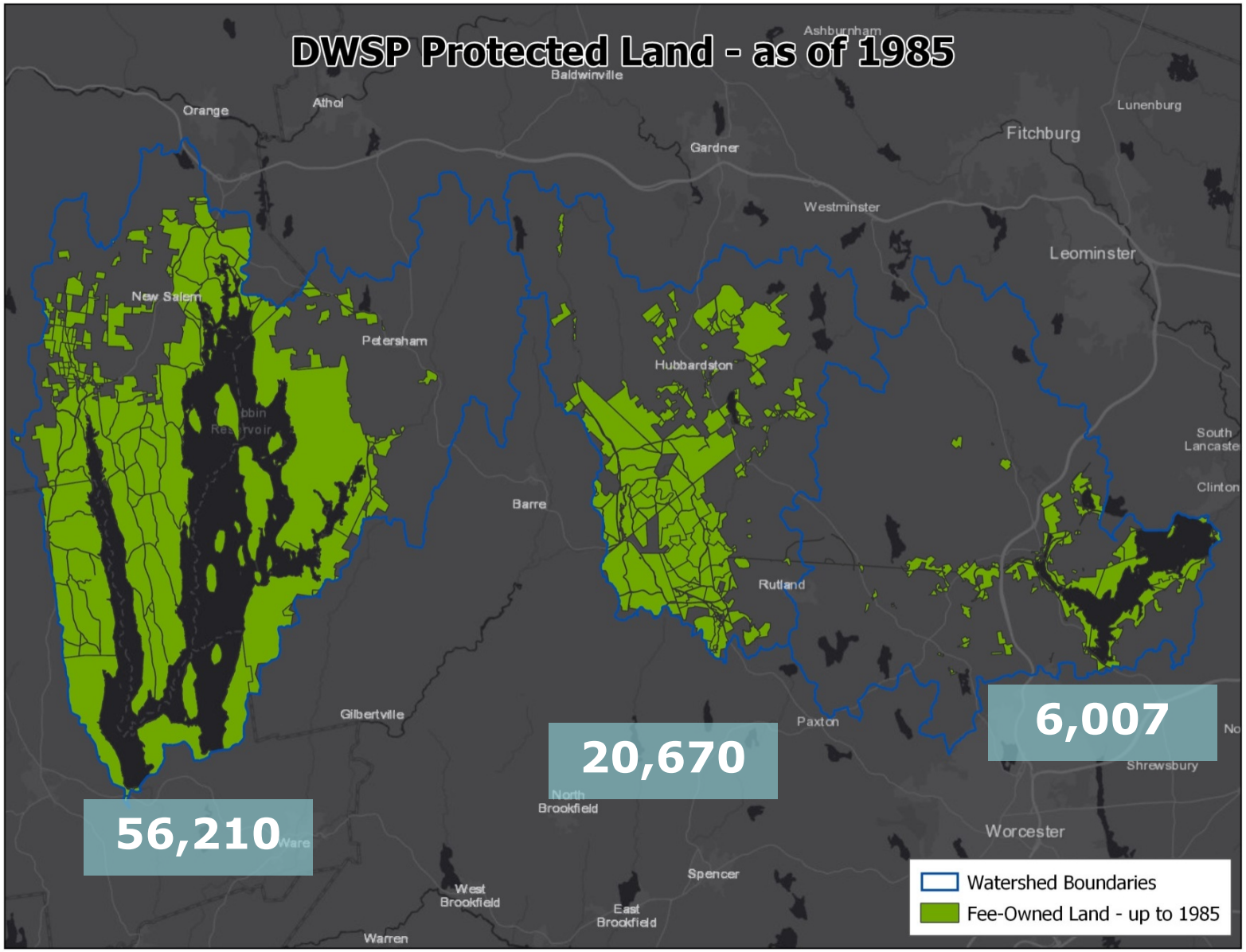
dcr

DWSP: Water Resource Protection

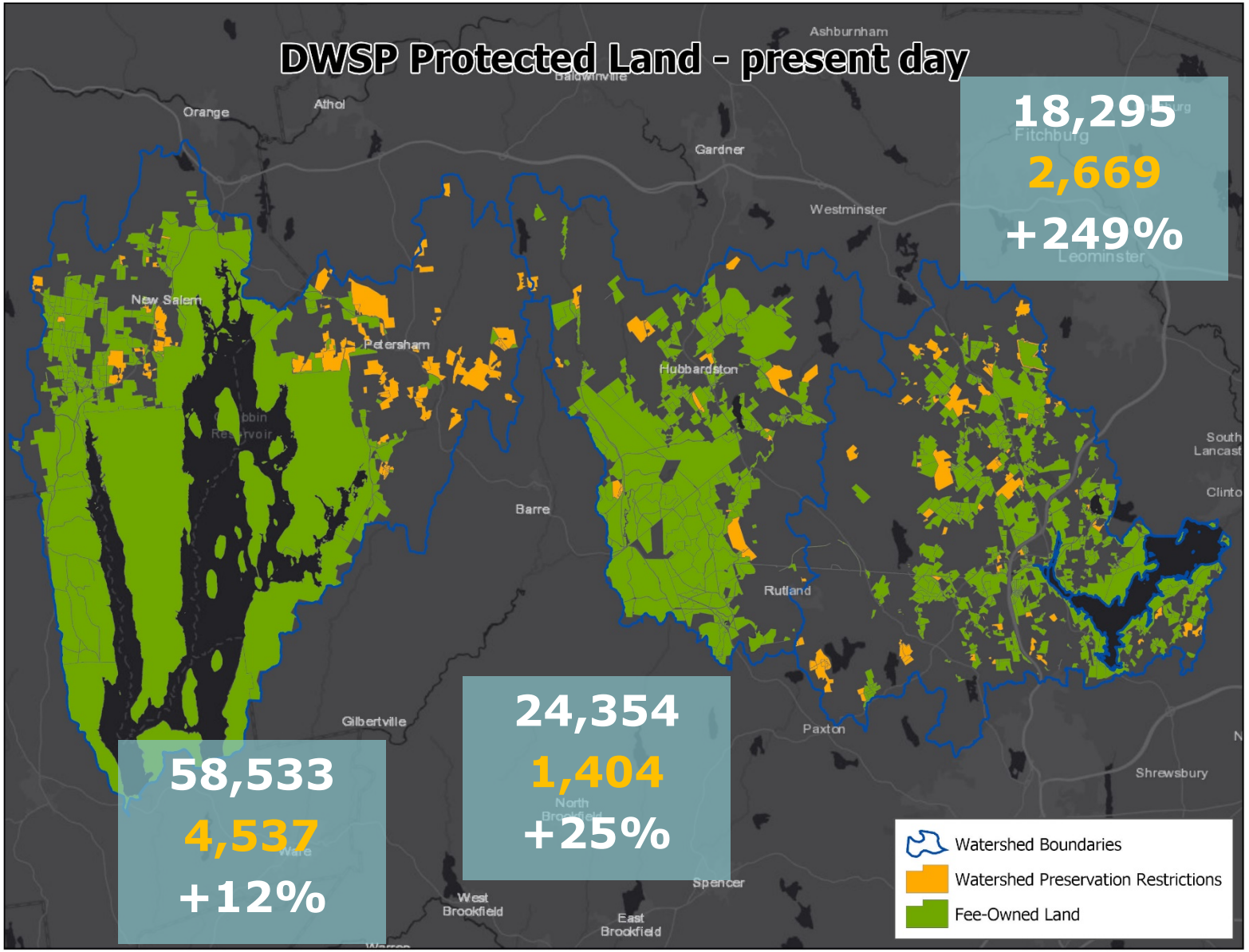
Land Protection

- Forest = Carbon
- Forest = Clean Water
- Keep forests as forest

DWSP: Water Resource Protection



DWSP: Water Resource Protection



dcr

DWSP: Water Resource Protection

DWSP: Adaptive Land Management

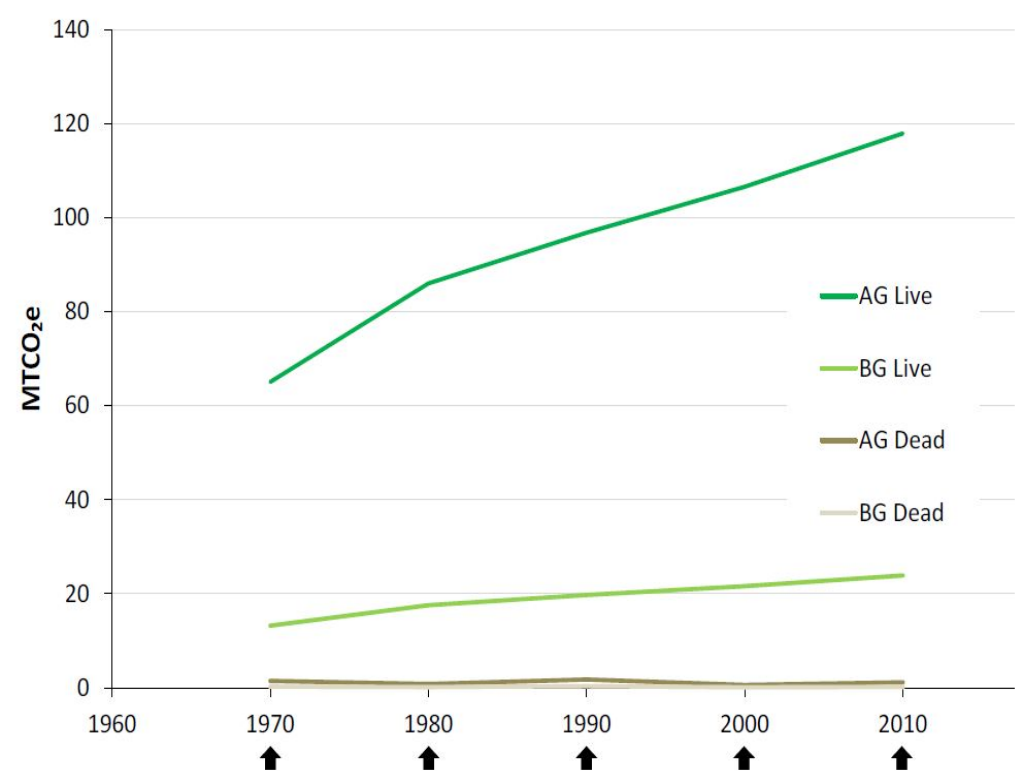
- Adaptation strategies discussed in LMP
  - Borrowed heavily from NIACS Forest Adaptation Handbook and workshops
  - **RESISTANCE**
  - **RESILIENCE**
  - **TRANSITION**

	Examples of Activities Currently Being Implemented	Examples of Activities under consideration based on additional research and stakeholder input
Sustain fundamental ecological functions	Maintain riparian areas	
	Maintain hydrology (protect wetlands, streams)	
	Maintain soil quality and nutrient cycling using harvesting BMPs, timing, and CWD	
Reduce the impact of existing biological stressors	Manage herbivores to protect regeneration	
	Prevent and control invasive plants	
	Make forests more resistant to pests (remove infestations; diversify plantations; thin to enhance vigor)	
Protect forests from severe fire and wind disturbance	Alter forest structure to reduce severity or extent of wind and ice damage	
	Maintain road network for fire access	
Maintain or create refugia	Prioritize and protect existing populations on unique sites	
	Protect sensitive or at-risk species or communities	
Maintain and enhance species and structural diversity	Promote diverse age classes	
	Maintain & restore diversity of native trees	
	Establish reserves	
Increase ecosystem redundancy across the landscape	Manage habitats over a range of sites and conditions	
	Establish multiple reserve locations	
Promote landscape connectivity	Protect land through ownership and CRs to reduce the effects of fragmentation	
	Partnerships to promote mutual conservation goals & create protected habitat corridors	
Enhance genetic diversity		Favor existing genotypes that are better adapted to anticipated future habitats
		Use seeds, germplasm, and other genetic material from across a geographic range
Facilitate community adjustments through species transitions	Allow/encourage range expansion of southern native species	Manage for species and genotypes with wide moisture and temperature tolerances
		Establish or encourage new mixes of native species
Plan for and respond to disturbance		Expect more frequent storms, and plan response options, e.g., salvage, replanting vs. natural regeneration, invasives control

RESILIENCE: Sustain Ecological Function

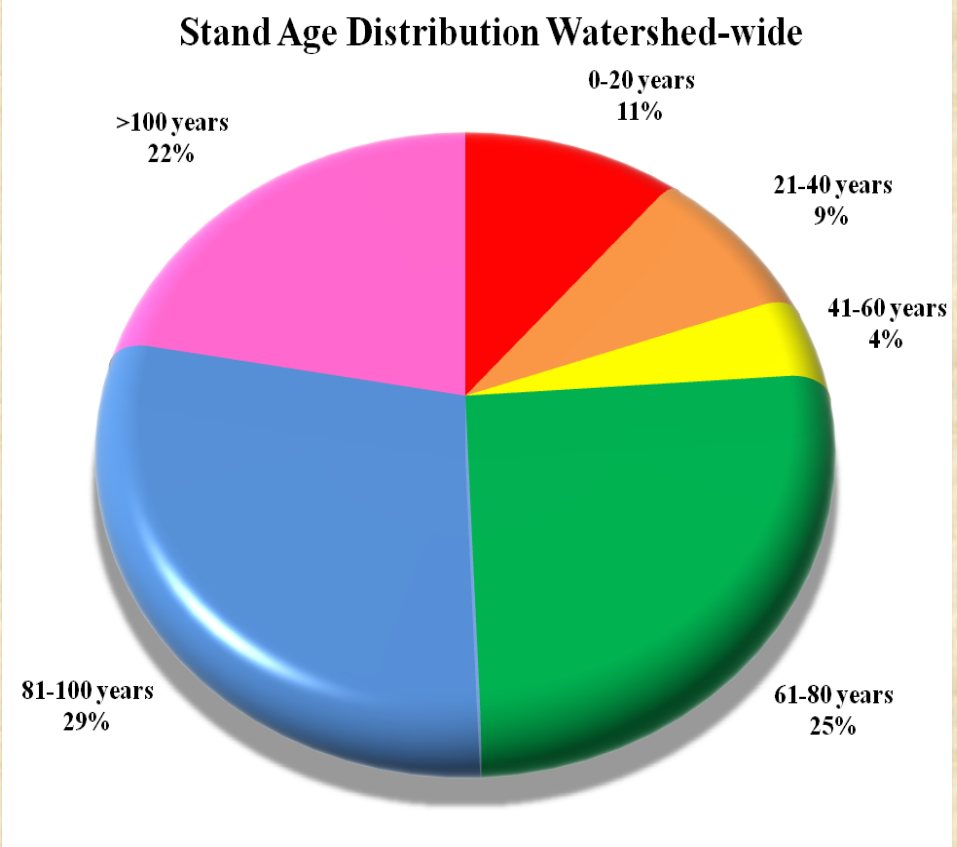
Maintain a Growing Forest

- Continuous net cubic foot volume growth
  - 2000 – 2010: All species showing net CF increases except Red Pine and paper birch
- Harvesting below sustainable levels/growth
  - ~ 2:1 Net Growth to Harvest ratio



RESISTANCE + RESILIENCE

- Silviculture: history of thinning
- Adjustments in regeneration silviculture
- Deliberate patterning of forest disturbance and structure
- Patch sizes offer a range of conditions for new trees
- Minimize re-entry



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DWSP: Adaptive Land Management

RESISTANCE: Fire Adapted Landscapes

RESILIENCE?: Refugia

TRANSITION?: Dense white pines to low density pitch pine/oak

CARBON?: offset by reserves

TRANSITION: Warmer winters

- Frozen ground?
- Today's 'frozen or dry conditions' and our equipment requirements
- ADAPTATIONS:
  - Flexibility in the Permit
  - Longer window for completion
  - Match equipment to the soils

DWSP: Long-term Monitoring

- **Forest inventory (CFI) since 1960**

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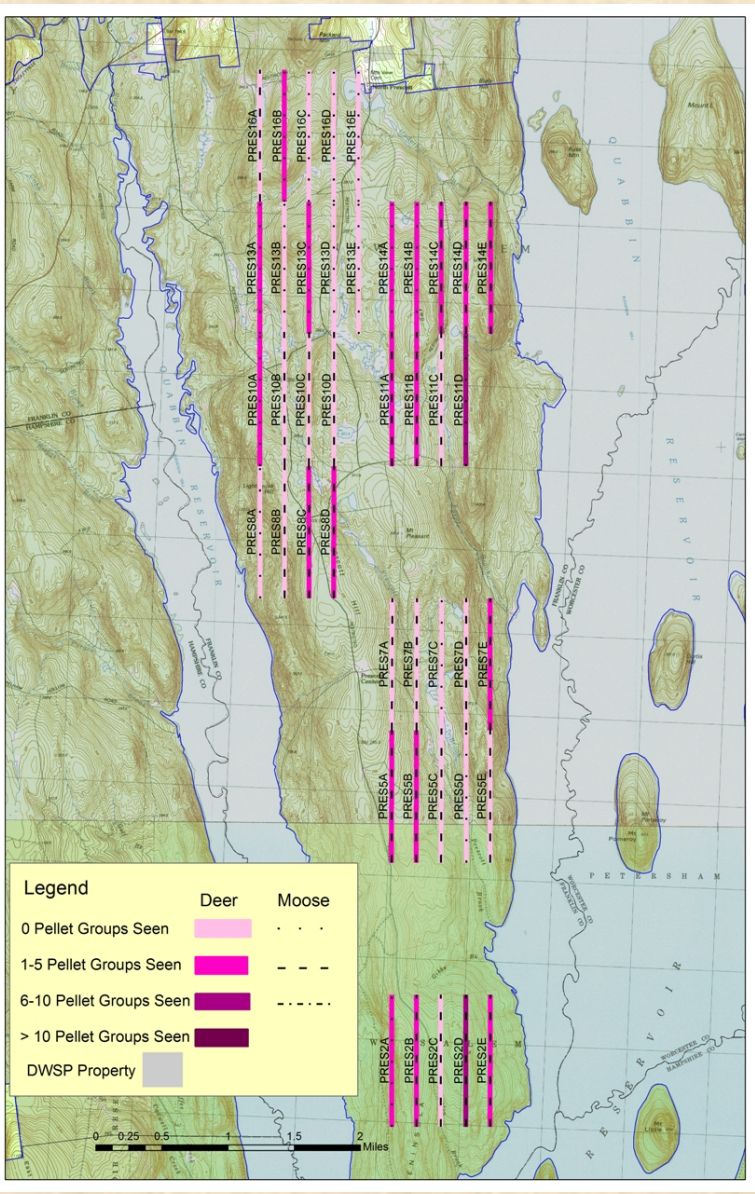
- **Deer and moose monitoring**

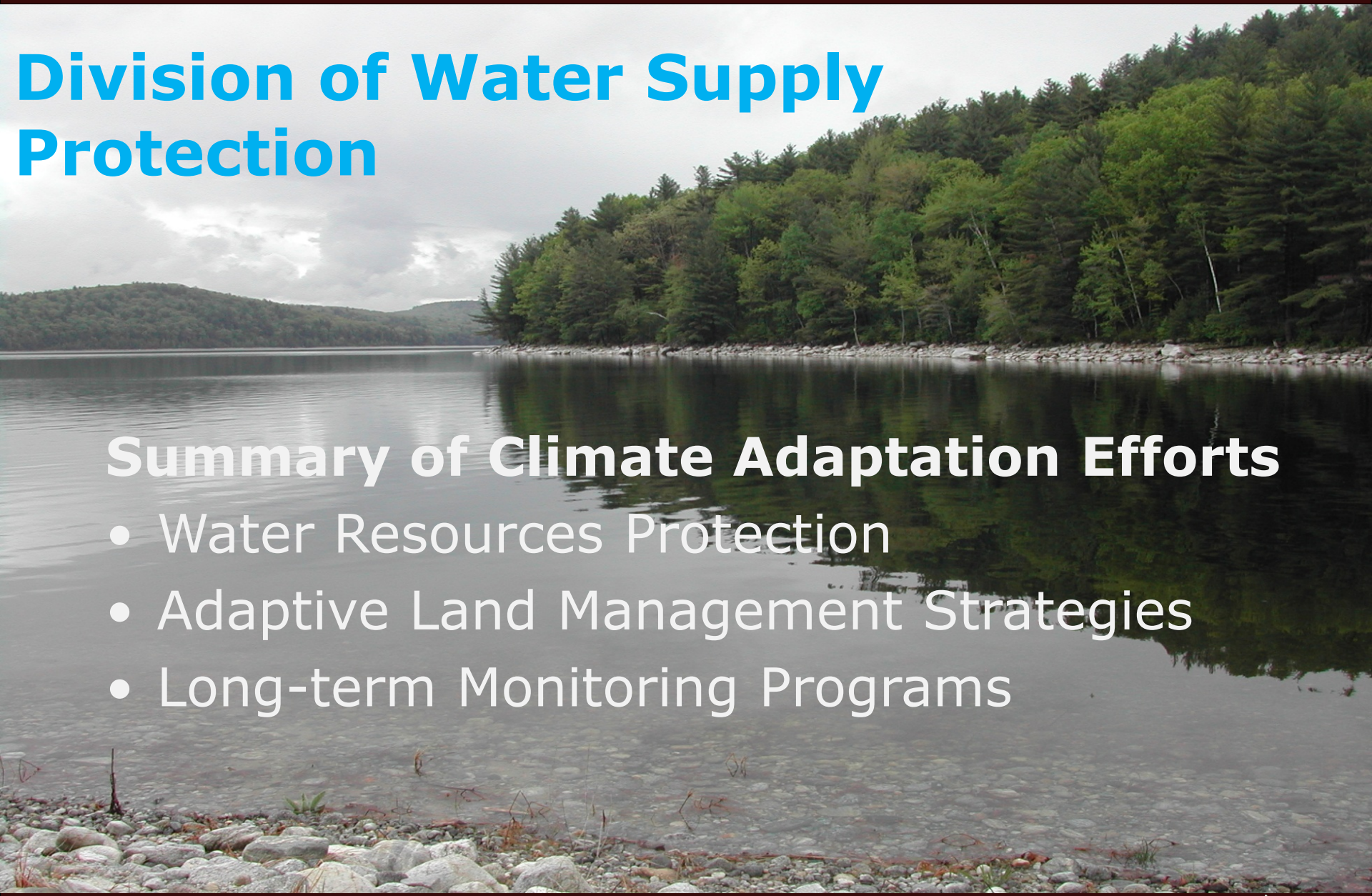


DWSP: Long-term Monitoring

- Forest inventory (CFI) since 1960
- Regeneration and invasive species surveys
- Deer and moose monitoring
- **Water quality sampling**
- **Wachusett:**
  - **30 years**
    - **154, 420 tests**
    - **70 sites**
    - **21 parameters**
  - **2018: 5,864 individual test results**

DWSP: Long-term Monitoring

- Forest inventory (CFI) since 1960
- Regeneration and invasive species surveys
- Deer and moose monitoring
- Water quality sampling
- **Long-term paired watershed studies**



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