

# Climate Resilience at Camp Edwards

Planning, complexity,  
and the road ahead

Jake McCumber  
MA Army National Guard  
Natural Resources and  
Training Lands Manager  
339-202-9343  
[jacob.c.mccumber.nfg@army.mil](mailto:jacob.c.mccumber.nfg@army.mil)

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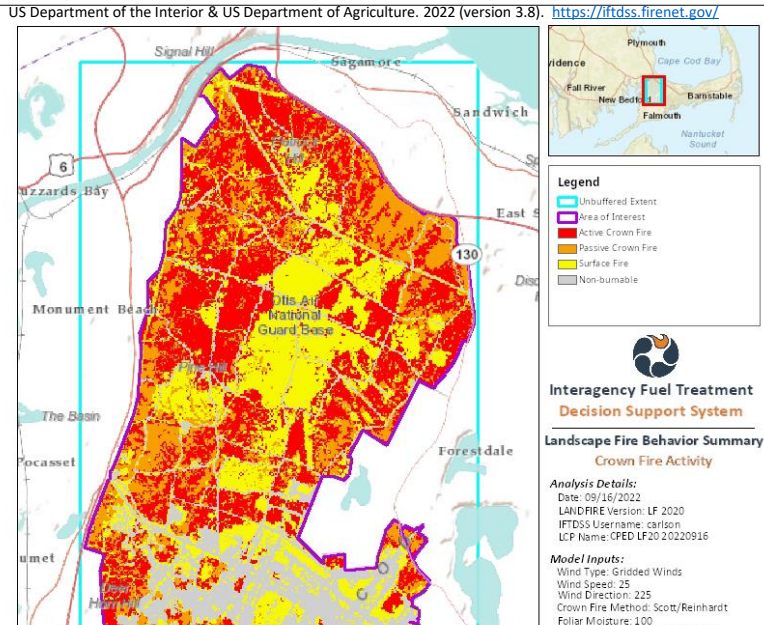


# What is Climate Resilience?

- Planning, preparedness, and science-driven policy and action
  - Economic
  - Community
  - Natural / Ecosystem
  - Coastal
- Requires detailed understanding of:
  - Ongoing changes and predictions
  - Root causes, scales of impact, affected resources
  - Complexity of situation and concurrent challenges (e.g., biodiversity)
- Proactive, collaborative, and effective preparedness actions

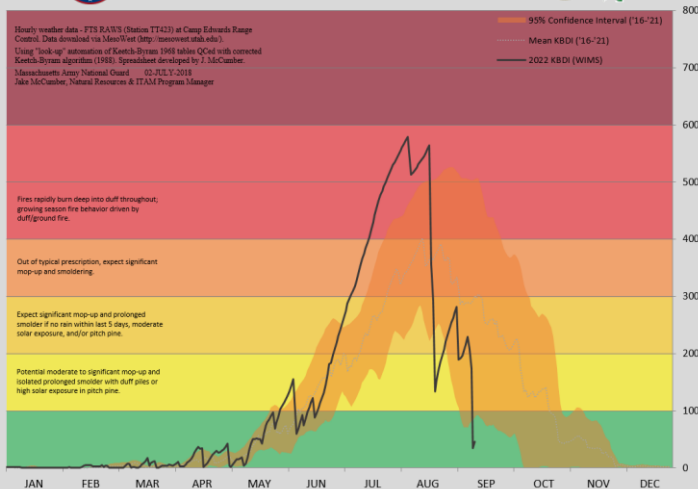


# Major Natural Threats



- Extreme drought and precipitation fluctuations
- More frequent and/or more powerful storm events
- Shifting species ranges
  - Loss of biodiversity and/or more northern species
  - Introduction of more southern species

**Keetch-Byram Drought Index Calculation**  
Camp Edwards, MA (TT243) --- 2022



- Out of sync ecological relationships
- Compounding effects (e.g., drought stress increasing vulnerability to pests)
- Increased fire hazard and vegetative growth



# Southern Pine Beetle

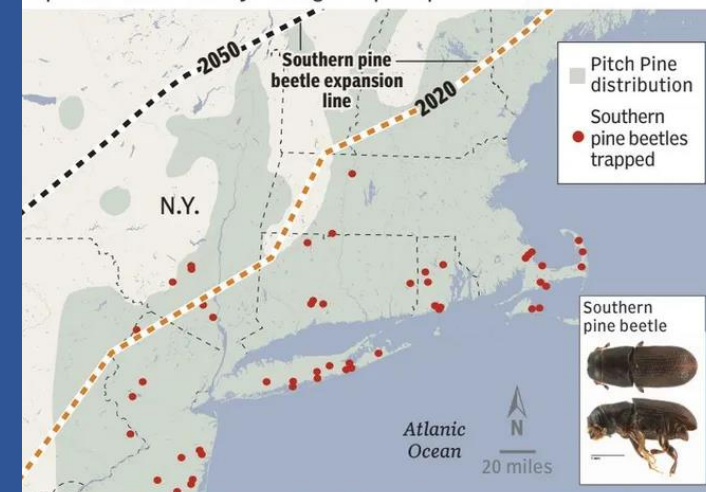
- Most prevalent of large number of encroaching southern species, both native and exotic
- Large-scale, total mortality in unmanaged stands
- Good poster species for climate change
  - Expanded range and active season with warming
  - Attracted by stressed trees
  - Outbreaks occur in dense forests (pheromone accumulation)
  - Drought reduces tree defense
  - Mortality exacerbates fire hazard
  - Major sequestration loss and potential major carbon release



Ronald F. Billings, Texas A&M Forest Service, Bugwood.org

## Southern pine beetle range expands

Researchers are concerned that an invasion of southern pine beetles on Cape Cod could destroy the region's pitch pine forests.



Sources: Southern Pine Beetle Action Plan for Massachusetts; Expansion of Southern Pine Beetle into Northeastern Forests: Management and Impact of a Primary Bark Beetle in a New Region; maps4news.com/©HERE

GATEHOUSE MEDIA

# Concurrent Crises

- Climate Change vulnerabilities

- Land use history effects
- Homogenization and overcrowding of trees
- Development fragmentation
- Sequestration focus over resilience in messaging

- Biodiversity Crisis

- Land use history effects
- Homogenization and overcrowding of trees
- Development fragmentation
- Declining public understanding and support for management



# Ecosystem Health

- Ecosystem based solutions:
  - More cost efficient (short and long term)
  - More likely to succeed
  - Shorter timeframe
  - Meet multiple objectives
  - Address multiple system threats holistically
  - Require collaboration, ecological expertise, and honest evaluation of risks and objectives
  - Require active management, maintenance, and monitoring

Image from: D'Amato, Anthony and P. Catanzaro. 2007. **Restoring old-growth characteristics**. Outreach pamphlet, Umass Extension, Amherst, MA.

Combining Old-Growth Restoration Practices

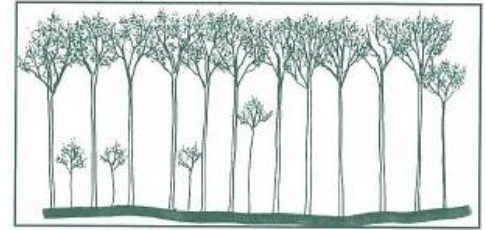


Figure C-a Woodlot before old-growth restoration practices

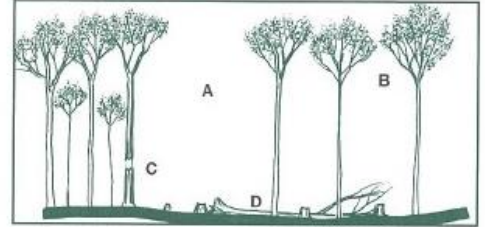


Figure C-b Immediately following a harvest using old-growth restoration practices. (A) Trees are cut and removed to create a 1/4-acre gap. (B) Full crowned canopy tree are thinned around to increase their size. (C) Poor quality tree girdled to create standing dead tree. (D) Tree felled to the ground and left in the woods to provide large downed logs.

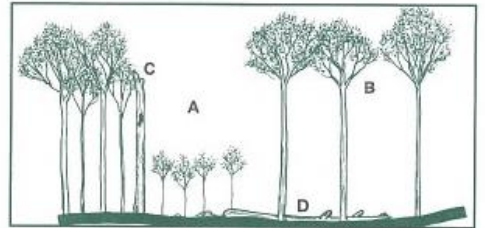


Figure C-c 15 years after harvest. (A) 1/4-acre gap is regenerated, diversifying tree sizes and ages. (B) Thinned trees grow larger. (C) Girdled tree is now a snag. (D) Large downed log shows sign of decay.

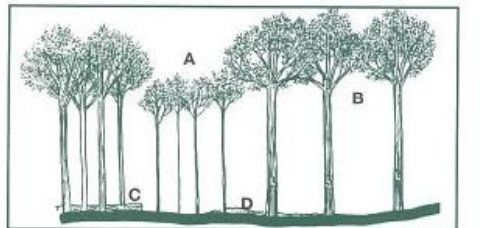


Figure C-d 30 years after harvest. (A) Gap is now sapling and pole-sized trees. (B) Thinned trees, designated with "L" for legacy tree, are large with big crowns. (C) Snag has fallen to the ground and now provides a new large downed log. (D) Large down log is well decomposed.

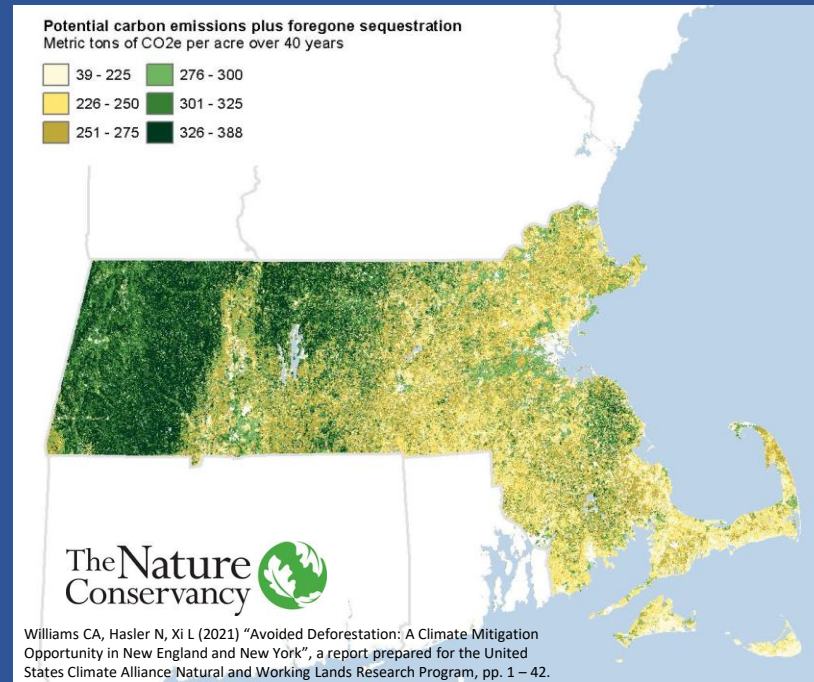


# Planning Solutions

- Addressing multiple and appropriate geographic scales
- Integration with other major plans (economic, conservation, etc.) and priority social and environmental initiatives
- Quantification of costs and benefits and scale of potential solution versus root causes
- Zoning and mission/intent for focal properties or regions
- Ecological potential

Joint Base Cape Cod (JBCC) has a large presence on the Upper Cape, located within four towns, supporting diverse activities throughout the Base, and is responsible for stewardship of the Upper Cape Water Supply Reserve. Given JBCC's economic and environmental footprint on Cape Cod, the Services based there should strive to balance their essential activities (training, intelligence, and other military preparedness operations) with climate change planning and emissions reductions. Agencies and Services at JBCC should continue comprehensive planning, including developing climate resilience plans that integrate the ongoing landscape-scale conservation management and mission activities.

Cape Cod Climate Action Plan  
[www.capecodcommission.org](http://www.capecodcommission.org)



# Key Objectives

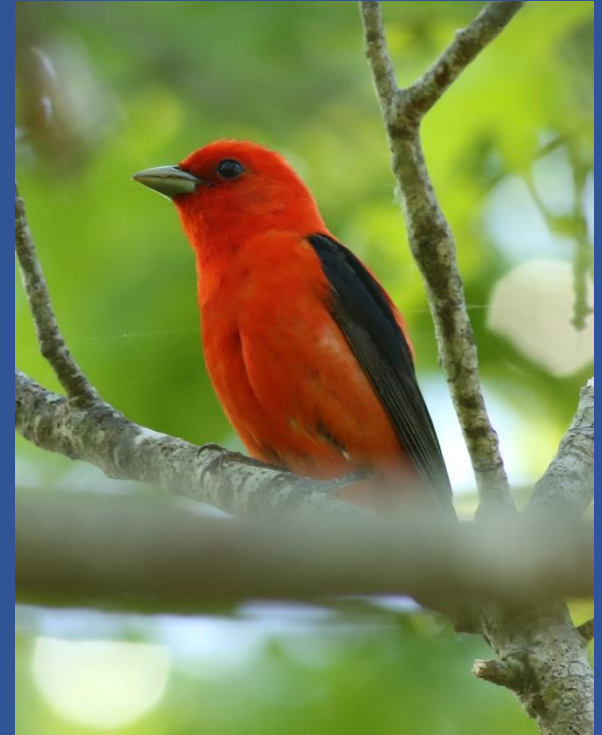
- Maximize diversity
  - Stand structural diversity at multiple scales
  - Age class diversity
  - Wildlife and plant species diversity
- Provide healthy natural communities that are regional or local conservation priority
- Increasing or stable populations of site/regional priority species (e.g., Species of Greatest Conservation Need)
- Decrease fire hazard (fuel loading, canopy continuity)
- Implement agency mission
- Maximize carbon storage while meeting other key objectives through best management practices, landscape level planning, and long-term ecosystem health





# Management Tools

- Conservation-guided forestry
  - Thinning and understory mowing for stand vigor
  - Prescribed fire preparation
  - Wildfire fuel hazard reduction
  - Proactive pest and pathogen avoidance
- Prescribed fire
- Diversity of prescriptions for fire and forestry informed by site condition and integrative planning
- Conservation BMPs and offsets for ranges, etc.



# Summary

- Climate resilience planning and implementation maximize carbon sequestration over short and long terms while:
  - Prioritizing ecosystem health and vigor in the face of ongoing and predicted threats
  - Integrating other conservation priorities (e.g., habitat and biodiversity)
  - Integrate land use planning and zoning into climate planning

