Managing Your Forest with Climate Change in Mind

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VermontWoodlands

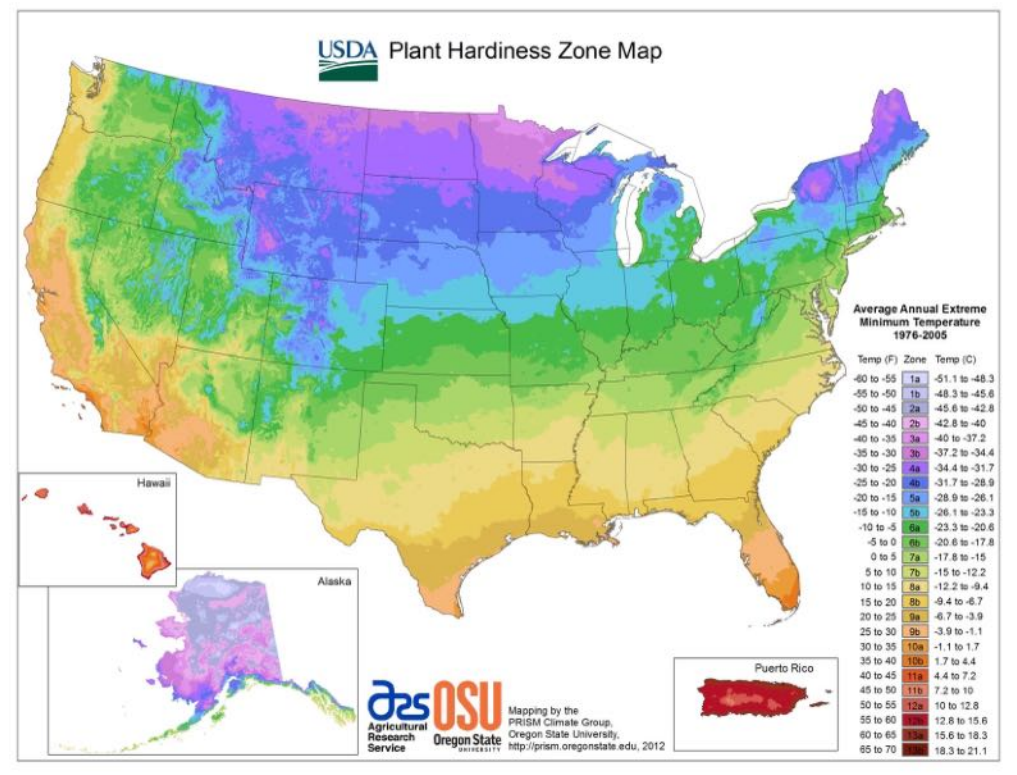
FORESTS, PARKS & RECREATION VERMONT
AGENCY OF NATURAL RESOURCES

WILDLIFE RECREATION TREE FARM WATER WOOD

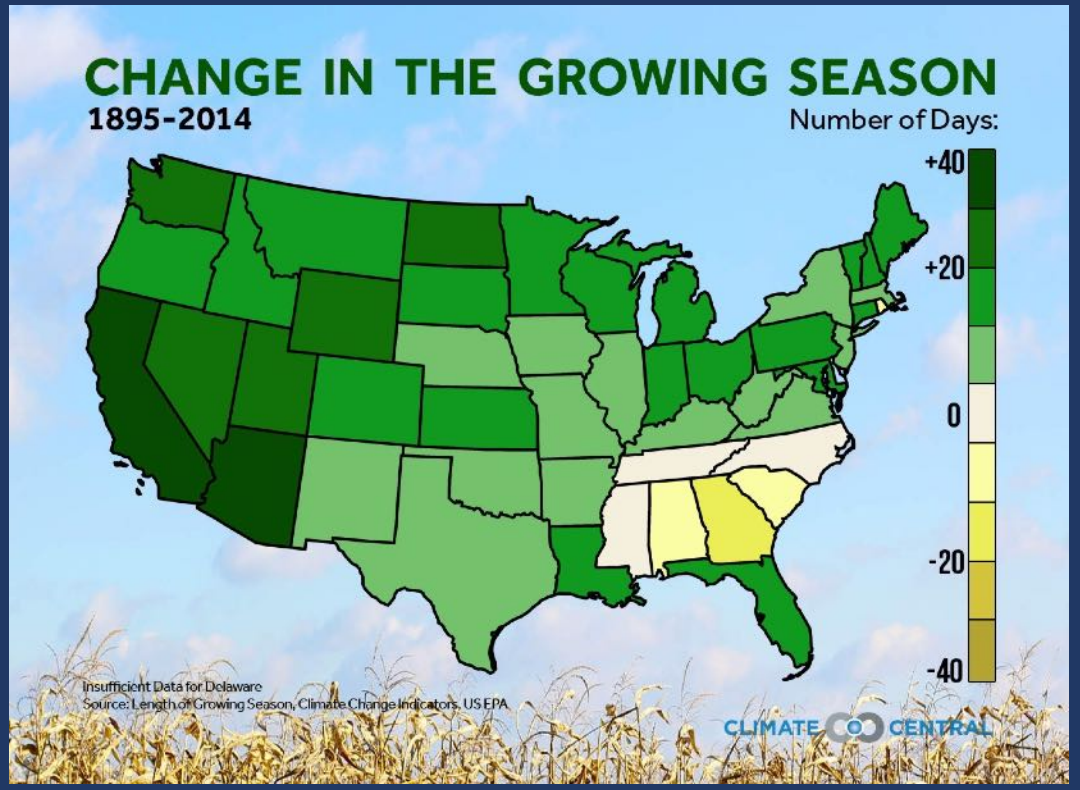
OPEN SPACE INSTITUTE

The climate is changing and bringing more uncertainty to the future conditions of forests

Drawings by: Kati Ripaldi



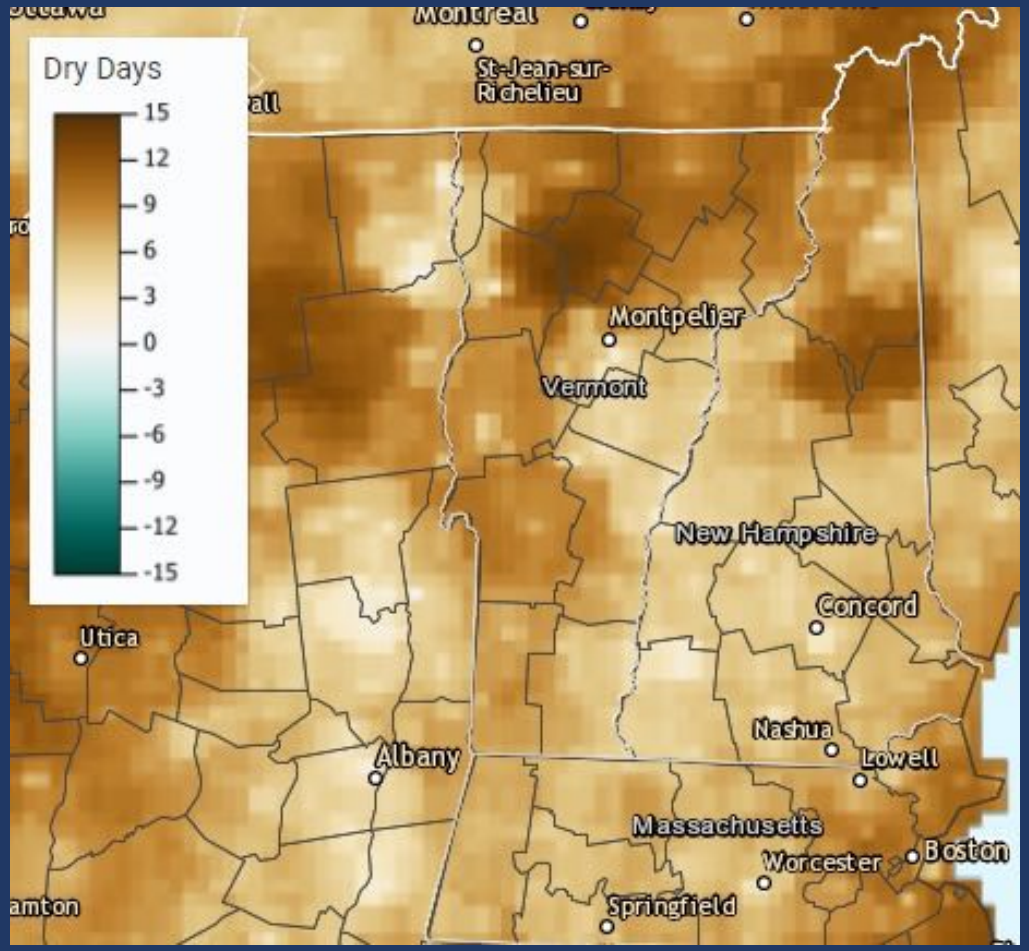
Fewer cold winter nights



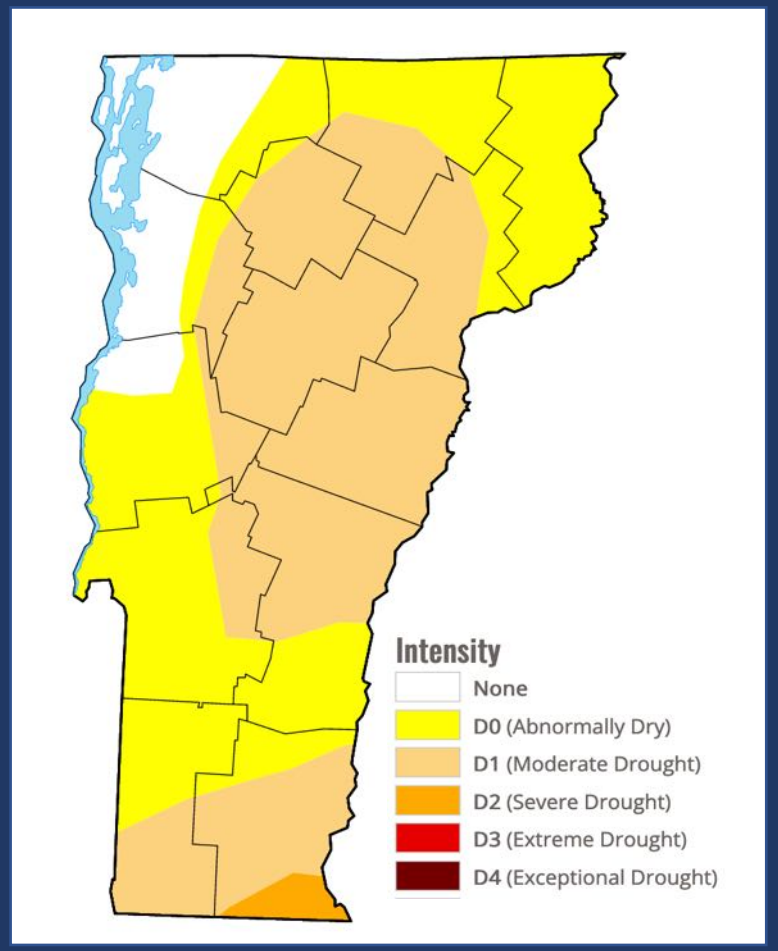
Longer growing season

More ice storms and heavy, wet snow

More heavy rainfall

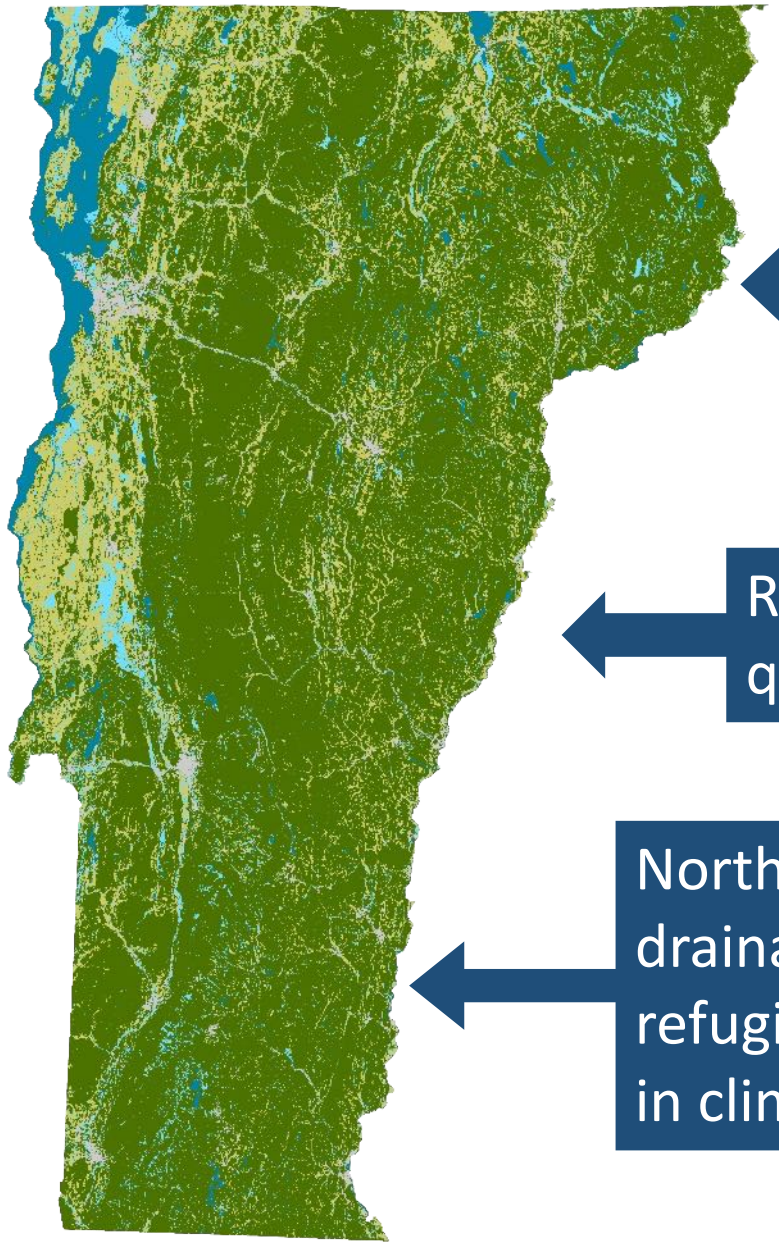


More variability in when rain falls



Greater chance of drought

Observed changes are not uniform throughout the state

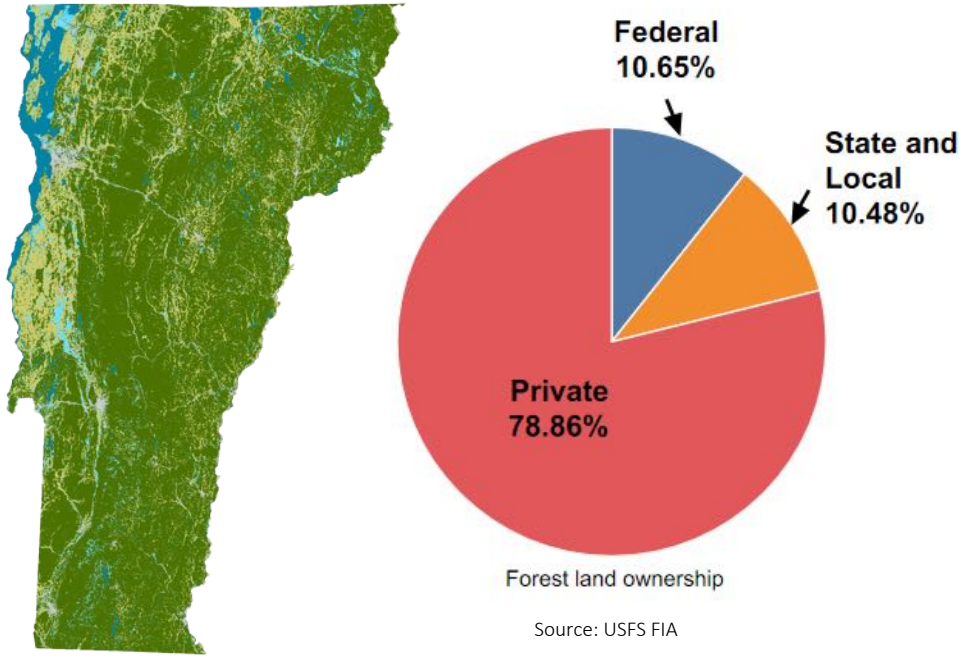


Higher elevation locations seeing larger increases in temperature

Rainfall patterns are quite variable

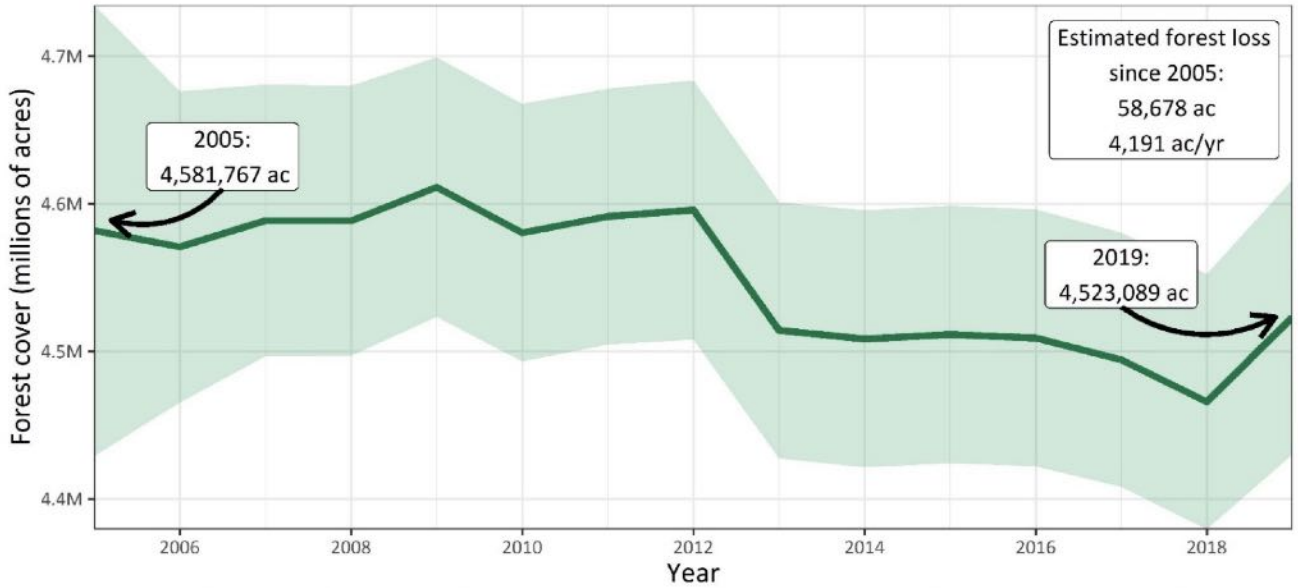
North-facing slopes, cold-air drainages are possible refugia from rapid changes in climate

Because VT's forest are majority privately owned, all landowners have an important role to play



Source: USFS FIA

79% privately owned



73% forest cover
Declining over time

As a landowner, you can make decisions to reduce the vulnerabilities and advance the resilience of your woods

Vulnerability is the degree to which a forest is susceptible to and unable to recover from climate change.

Certain forest conditions and disturbances can make a forest more or less vulnerable to climate change impacts.

Resilience is the ability of a forest to recover or adapt following disturbance or change.

12 Steps to Climate Resilience

Managing Your Forest with Climate Change in Mind

Get to know your land

1 Get to know your land

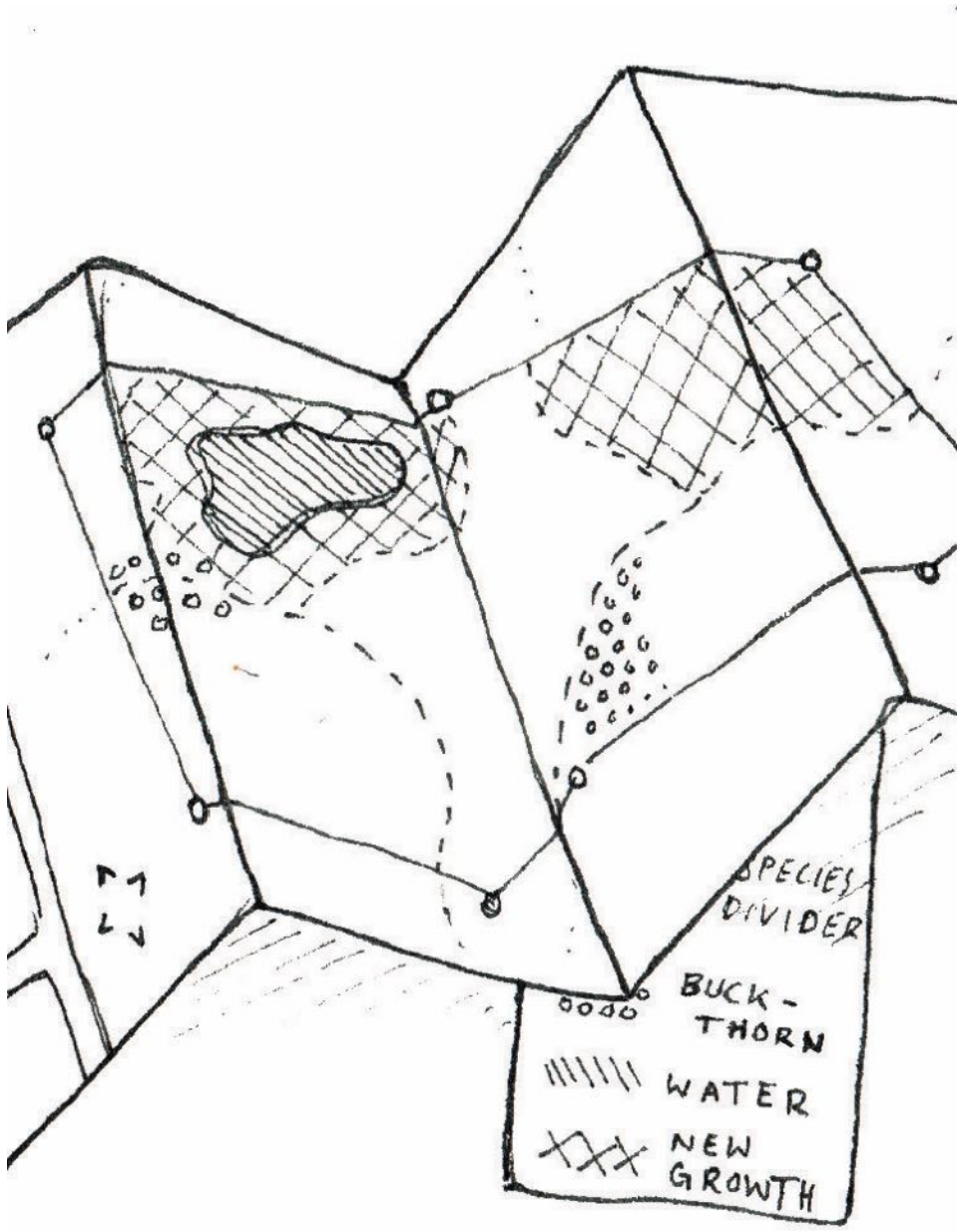
Climate change will affect each forest differently

Land use history, past management, disturbances, stressors, and site characteristics are unique to each forest

Resulting in different site conditions, forest structure, species compositions, tree vigor, tree ages, soils, water and nutrient availability, sunlight, etc.

1 Get to know your land

- First get to know the features and current condition of your woods
- One way to do this is to make a map of your land that includes locations of important features
  - Streams, wet areas, steep slopes, rocky areas
  - Roads and trails
  - Different forest types/species
  - Locations of old or young forests, invasive plants, or areas with signs of animal browse



Connect with a licensed forester

2 Connect with a licensed forester

- A forester can help you consider the best management actions to take to address forest health concerns and increase resilience to climate change

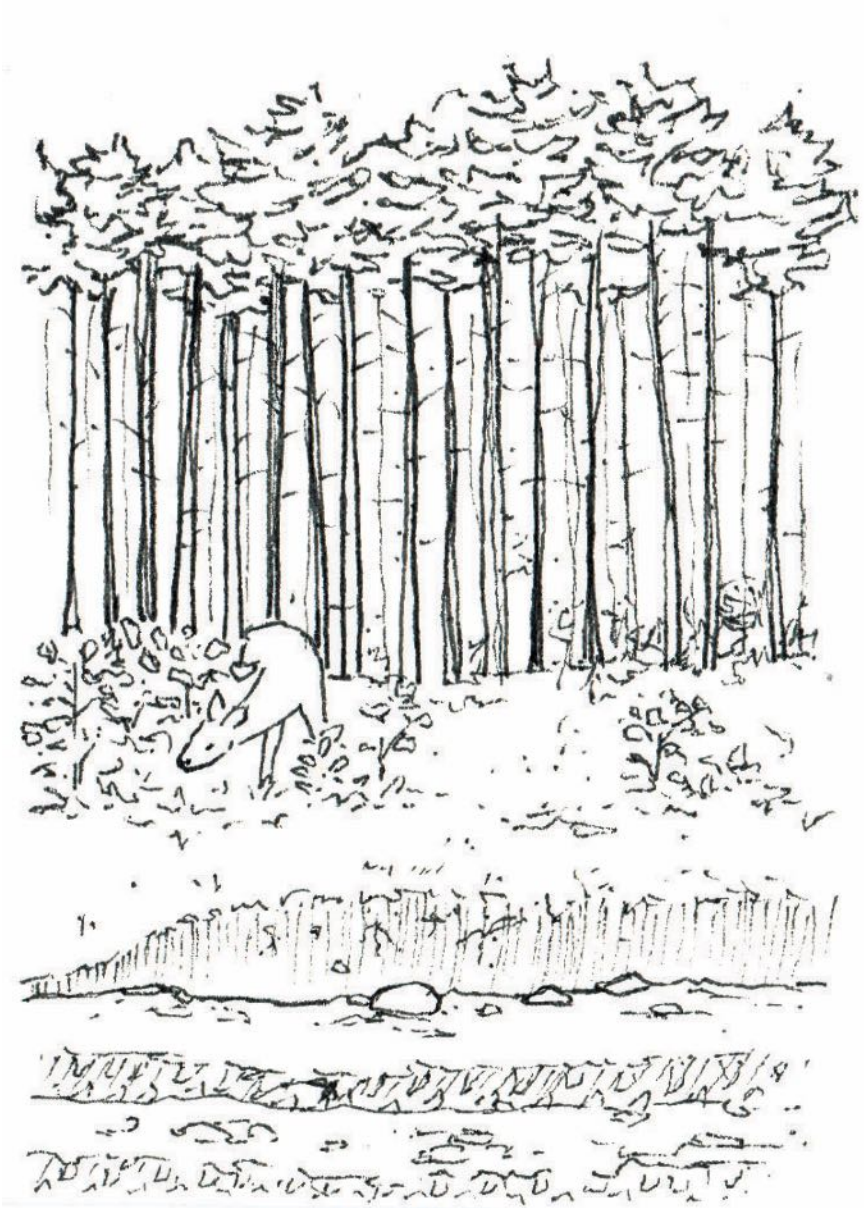
- Not sure who to talk to? Start with your FPR county forester
    - free consult regardless of parcel size

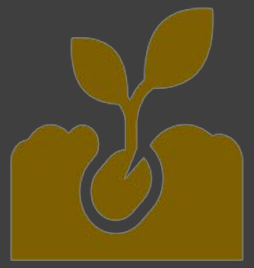
fpr.vermont.gov/forest/list-vermont-county-foresters

Identify vulnerabilities

3 Identify vulnerabilities

- Consider your land's vulnerabilities to climate change, weather events, insects and diseases, and other stressors in order to identify pathways you can take to achieve greater forest resilience
- Walking your woods with a forester is the best way to start to identify these conditions and understand what opportunities exist to improve the health and resilience
- Identifying vulnerable locations or conditions on your land is a critical step in long-term planning





Conditions that may affect tree regeneration and the future forest

Conditions of the overstory trees that suggest they are less resilient to extreme events and disturbances

Conditions of the forest that affect soils and water quality

Conditions that may affect tree regeneration and the future forest

- ❑ Invasive plants (especially populations that are expanding in size)
- ❑ Extensive animal browse on seedlings or saplings
- ❑ Only a few tree seedlings and saplings in the understory

Conditions of the overstory trees that suggest they are less resilient to extreme events and disturbances

- ❑ Unhealthy-looking trees
- ❑ Insect or disease damage
- ❑ Trees with small crowns
- ❑ Trees that are very close together
- ❑ Trees of a similar size
- ❑ Only a few species present

Conditions of the forest that affect soils and water quality

- ❑ Evidence of soil erosion or rutting
- ❑ Large areas of exposed soil that is not covered in leaf litter
- ❑ A lack of deadwood in various stages of decay, including standing dead trees and dead logs on the forest floor

4

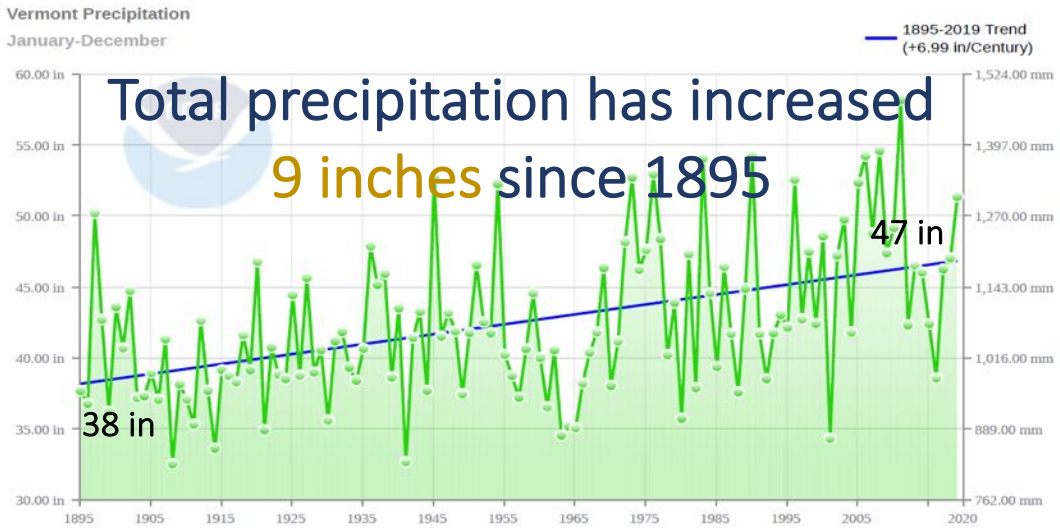
Slow, spread, and sink water

4 Slow, spread, and sink water

Vermont is getting more rain, sometimes in stronger storm events

Heavy rain can wash away leaf litter, cause soil erosion, and result in nutrient losses.

This impacts negatively affect streams, lakes, and ponds as well as the forest.



4 Slow, spread, and sink water

- On roads and trails, divert water off the traveled surface and into depressions or flat areas where it can be absorbed slowly
- Ensure culverts, drainages, and bridges can accommodate extreme flows and are clear of debris
- Leave deadwood on the forest floor to help slow and retain water
- Walk the woods during or immediately after heavy rainfall to identify problems

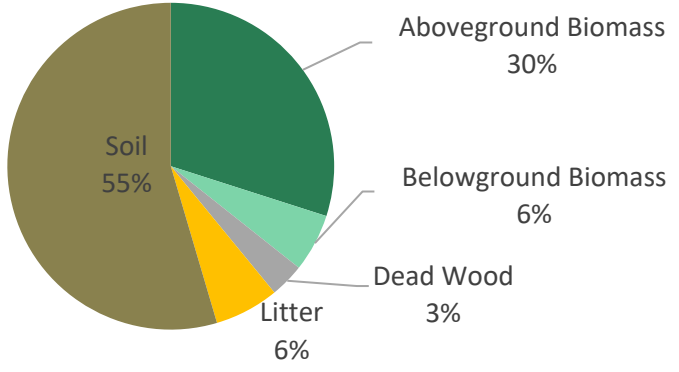
Protect soils and water

5 Protect soils and water

Climate change will bring more variability in soil and water dynamics

It is much easier and cost affective to protect soils and water rather than trying to fix issues

In VT forests, soil contains >50% of the stored carbon



5 Protect soils and water

- Avoid wet or mucky areas
- Select equipment with the smallest impact
- Do work in the winter or on dry ground
- Use bridges, logs, or branches to reduce soil compaction
- Fix or close out old logging roads and trails
- Maintain plants and trees along waterways/wetlands and on steep slopes

Focus on regeneration

6 Focus on regeneration

All forests need trees of different ages

Past land use means most VT forests have one age class of trees (Some have two, very few are multi-aged)

Heavy deer browse in recent years has resulted in lack of sufficient regeneration

Successful regeneration requires sunlight and space in the canopy

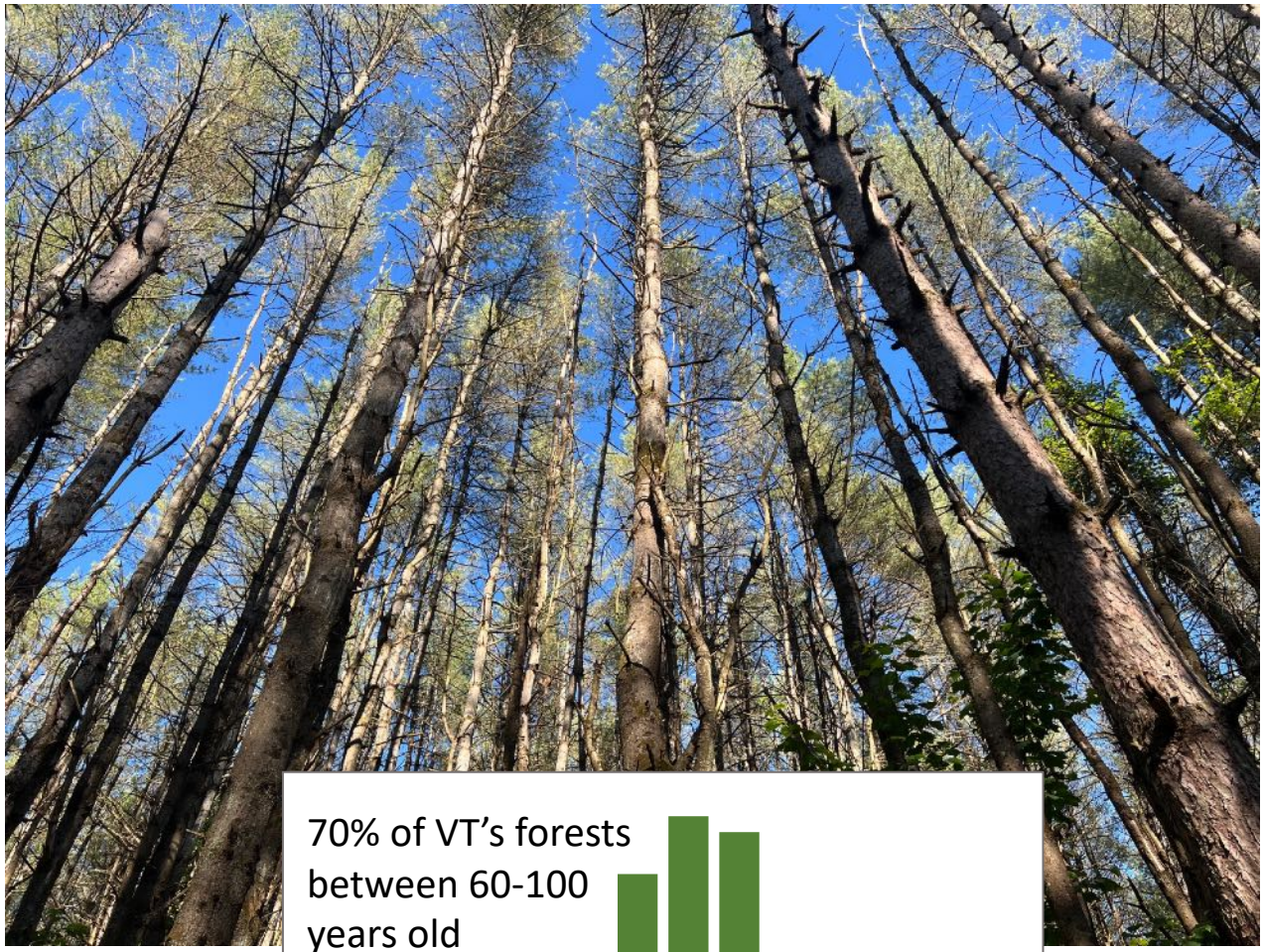
6 Focus on regeneration

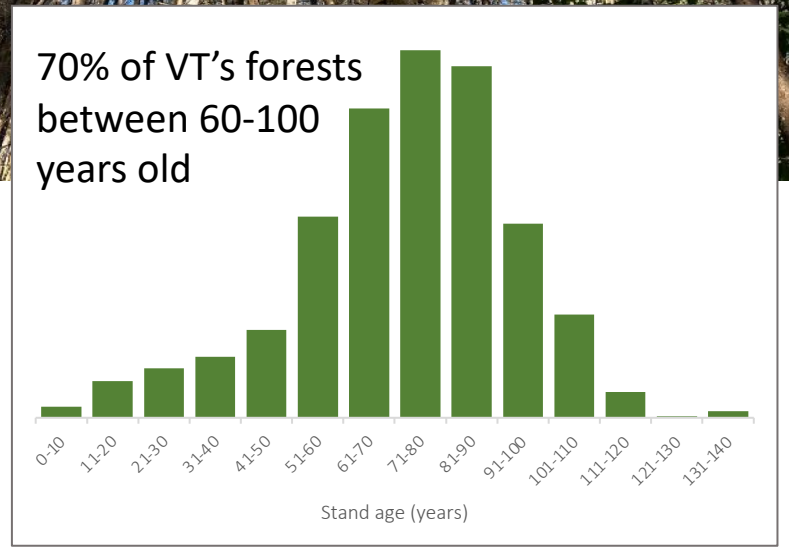
- Retain various large, healthy trees that can produce the next generation's seed
- Create gaps in the canopy to provide space and light for successful regeneration
- Some species need certain conditions to establish -- talk to your forester about how to create them
- If young tree survival is low, control competition from invasive plants or beech suckers, or use protection from animal browse
- Where natural regeneration is lacking, consider planting trees once you consult with a forester

Create complexity

7 Create complexity

Past land use has created more uniform and homogenous forests in Vermont



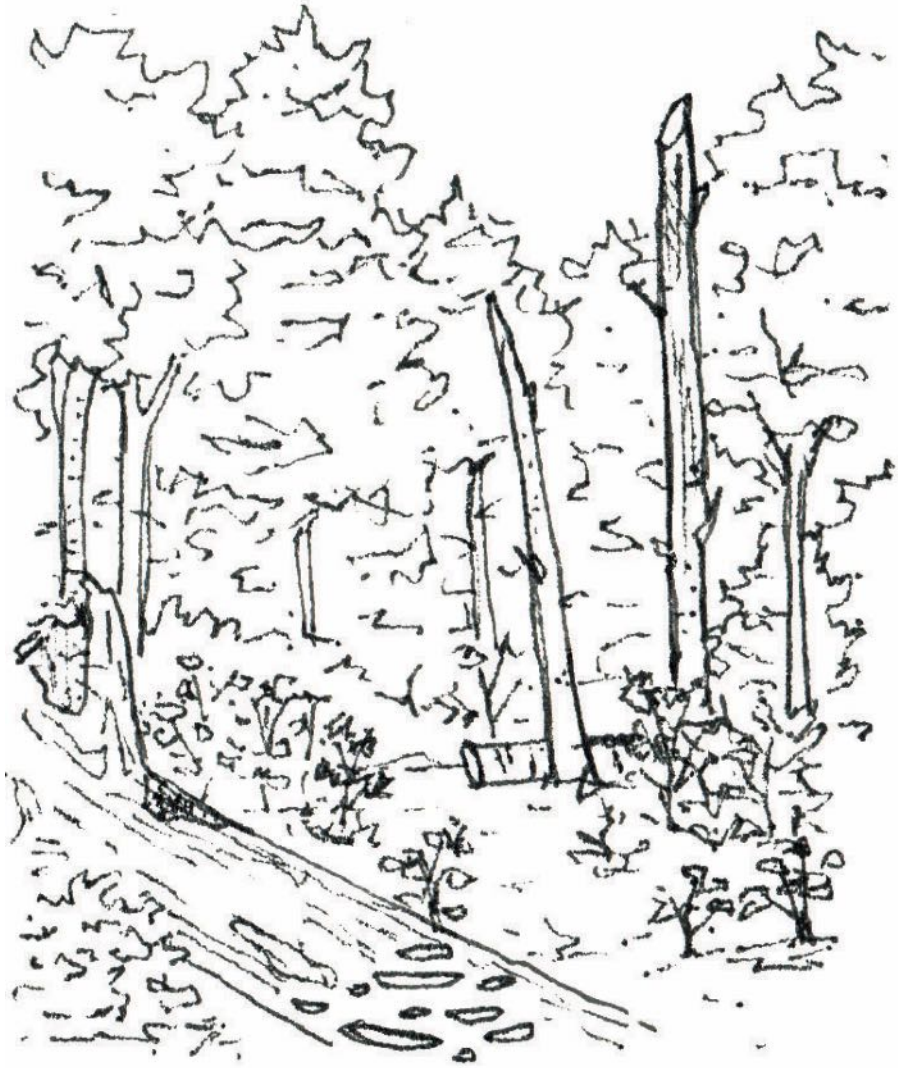


7 Create complexity

Forests with more species and trees of many sizes, ages, and conditions (including dead standing and downed trees) with irregular gaps in the canopy are more resilient to climate change

7 Create complexity

- Talk to your forester about increasing the number of species or creating more variation in your woods
- Retain old, large trees and dead logs, or create some during a timber harvest
- Analyze the larger landscape: are there similar or different conditions in areas adjacent to your property? Your forester can help you consider the larger context your land plays



Increase deadwood

8 Increase deadwood

Because of Vermont's land use history, most forests have much less deadwood than than old growth forests

8 Increase deadwood

Standing dead trees and downed logs promote forest resilience by protecting soils, retaining water, cycling nutrients, and guarding regeneration

And they provide food and shelter for many organisms

8 Increase deadwood

- Where appropriate, keep dead trees and logs where they are
- Use forest management to increase deadwood, both standing and on the ground
- Trees can be felled and left in place, pushed over with equipment to create tip-ups, or girdled and left standing where it does not pose a hazard
- Think about ways to increase deadwood across a range of sizes and conditions
- Keep old trees that will be a future source of deadwood

Manage other stressors

9 Manage other stressors

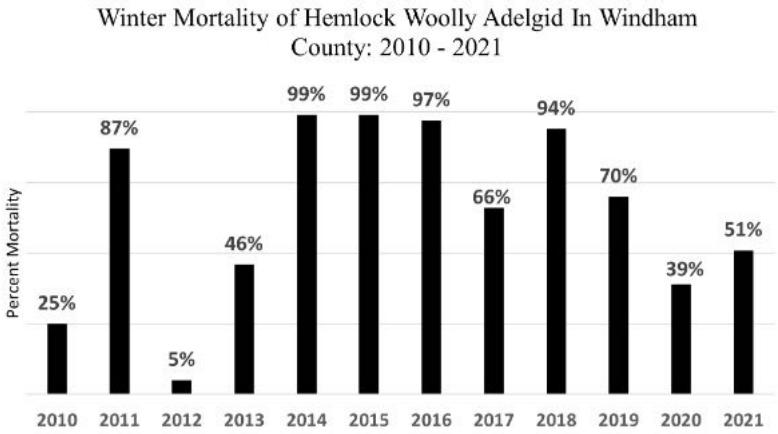
Along with climate change, forests face many stressors




9 Manage other stressors

Climate change may make many of these stressors more impactful

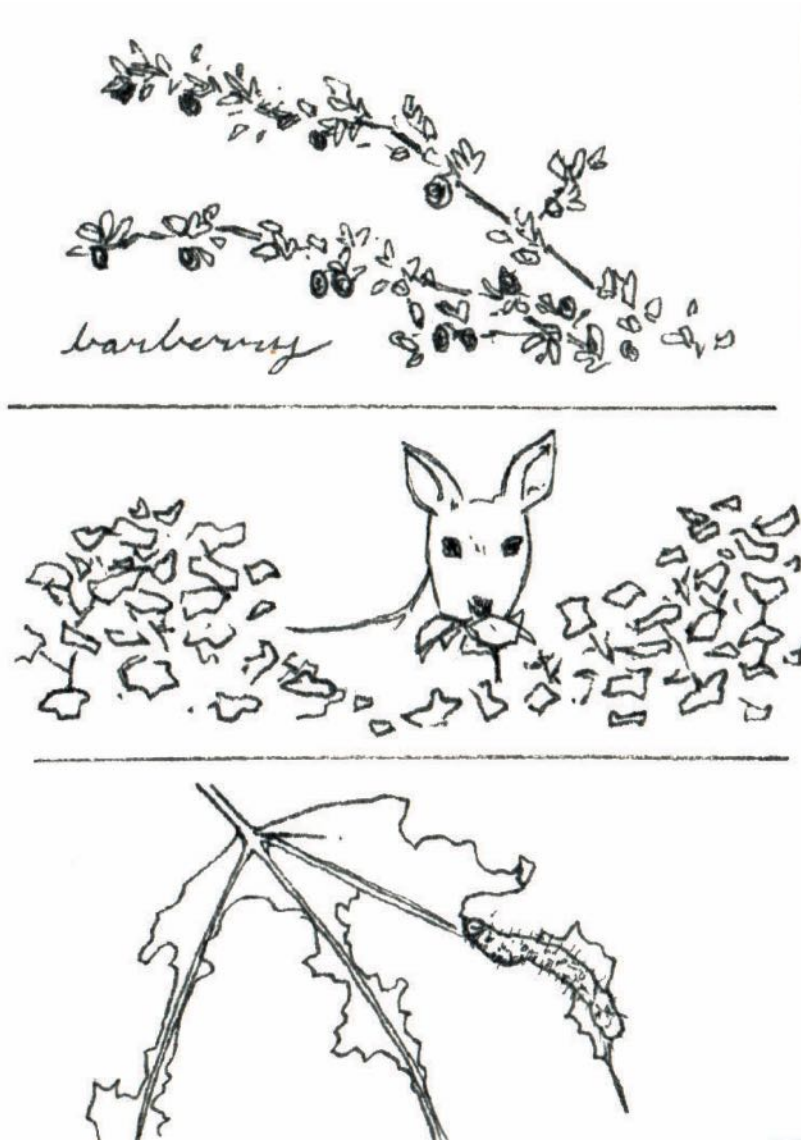
Many forest pests, like hemlock woolly adelgid, are controlled by low winter temperature



Source: VT FPR March 2021 Forest Health Observations

9 Manage other stressors

- Promote healthy and vigorous trees
- Control or eradicate invasive plants
- Monitor and manage animal browse
- Use dead tree branches or fences to protect young trees from animal browse and/or increase hunting pressure
- Maintain a diversity of species
- Talk to your forester about management for specific issues

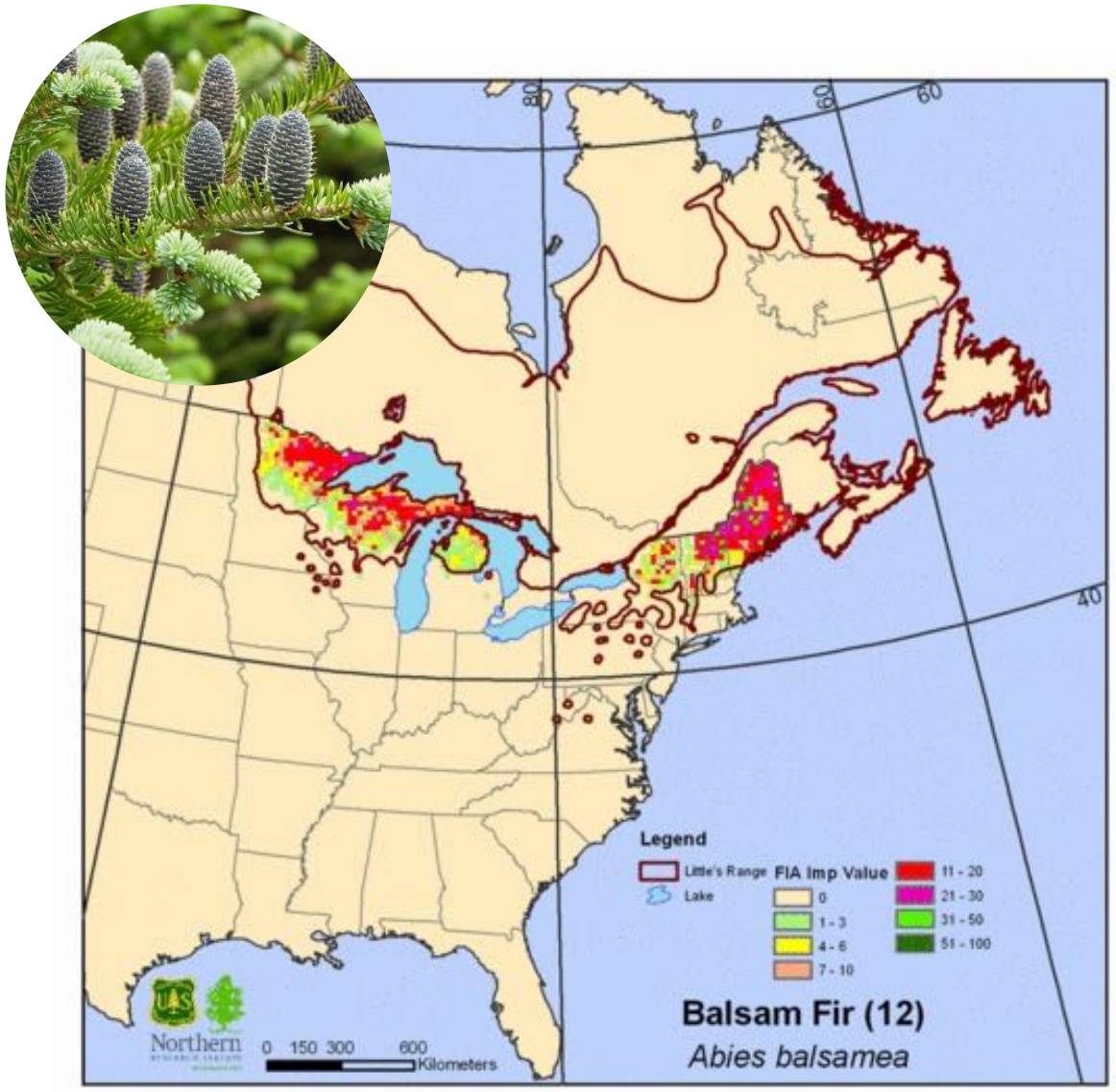


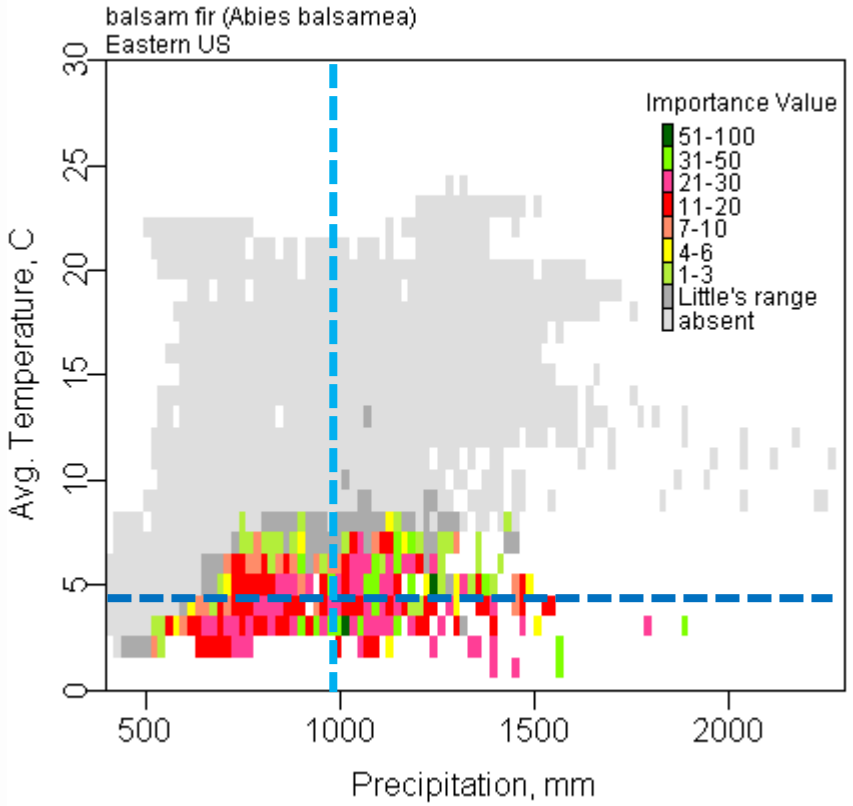
Favor future-adapted species

10 Favor future-adapted species

The future climate will be more stressful to trees adapted to cold climates

But cold-adapted species that are abundant and exist in a range of sites have a greater ability to adapt

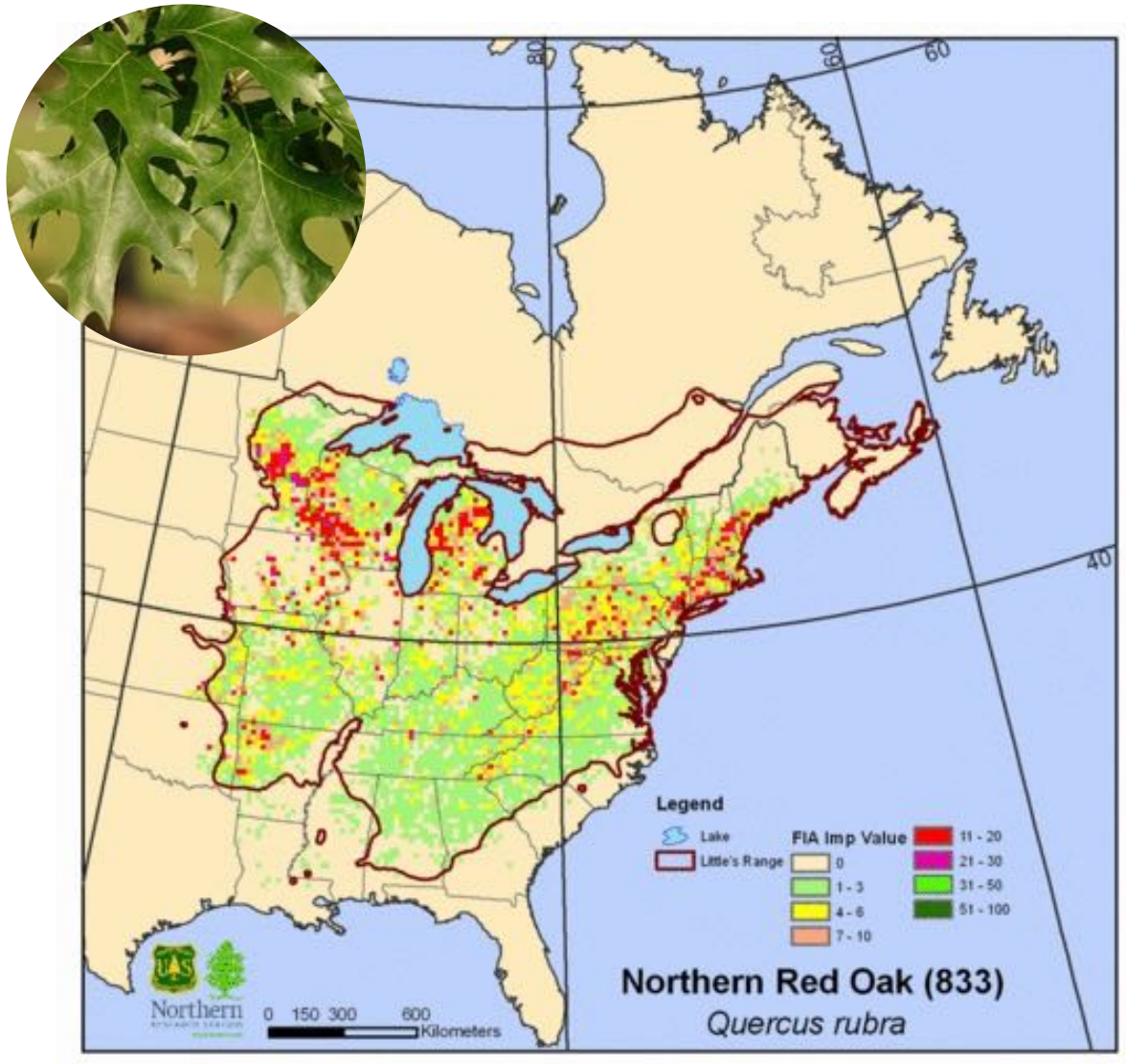


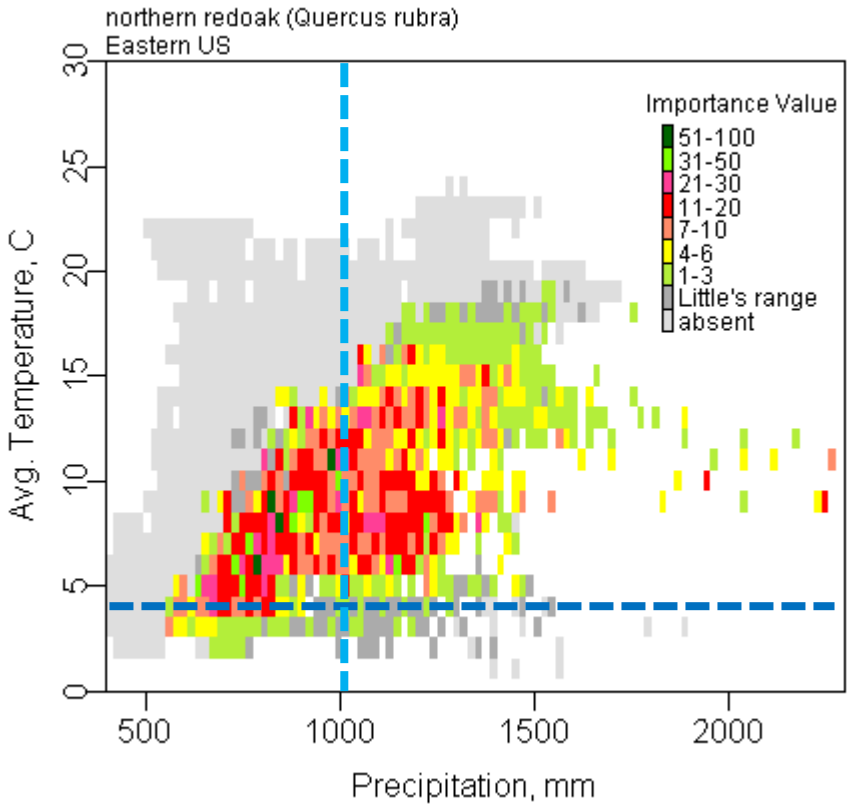


Ave Temp in 2021
Ave Temp in 1895

Ave Precip in 1895
Ave Precip in 2021

Source: USFS





Ave Temp in 2021
Ave Temp in 1895

Ave Precip in 1895
Ave Precip in 2021

Source: USFS

10 Favor future-adapted species

Suitable habitat in VT projected to decline

- Balsam fir
- Black, red, and white spruce
- Northern white-cedar
- Larch/tamarack
- Yellow and grey birch
- Black ash
- Sugar* and striped maple

Suitable habitat in VT to remain the same

- Paper birch
- Eastern hemlock
- Green ash
- Silver maple
- Red pine
- Eastern cottonwood

Suitable habitat in VT projected to expand

- American elm
- White ash
- Quaking aspen
- Red maple
- Eastern white and pitch pine
- American basswood
- Red and white oak
- Black walnut
- Eastern cottonwood
- Shagbark, bitternut, and pignut hickory
- Black cherry
- Sycamore
- Hackberry
- Blackgum

Source: USFS Climate Change Tree Atlas (data for Vermont)
Species projections do not include impacts from insects/diseases

10 Favor future-adapted species

- Favor trees that can withstand a wide range of conditions
- Favor trees that can tolerate disturbances
- On warm sites, favor species adapted to warmer conditions, like oaks, hickories, and pines
- On dry sites, favor more drought-adapted species
- Retain healthy, vigorous trees already adapted to your site and its vulnerabilities
- A forester can help evaluate your woods and which species may be best suited for conditions now and in the future

11

Protect the rare, unique, or significant

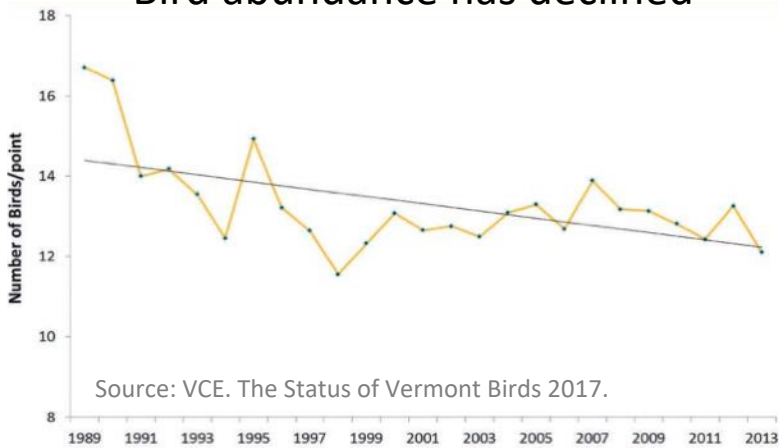
11 Protect the rare, unique, or significant

We face a biodiversity crisis from habitat degradation and loss

Keeping forests as forests is critically important

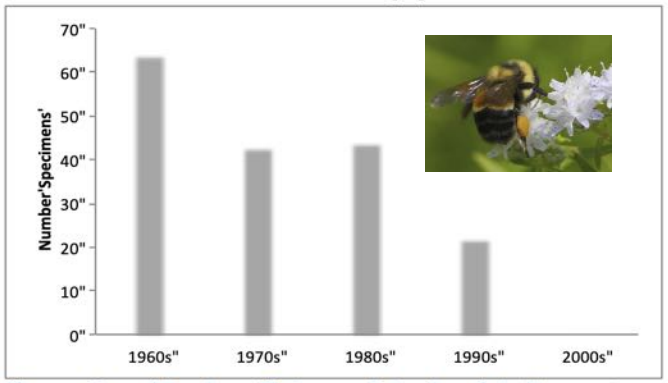
Source: Google Maps (2021)

Bird abundance has declined



Source: VCE. The Status of Vermont Birds 2017.

Bumblebees have declined



The number of *Bombus affinis* records by decade in Vermont.

Source: McFarland K, Richardson L, Zahendra S. Vermont Bumble Bee Survey 2012-2014.

11 Protect the rare, unique, or significant

- Keep forest as forest though estate planning, conservation easements, or other strategies
- Protect
  - Rare or uncommon plants or natural communities
  - Special places
  - Wildlife habitat features
  - Streams, seeps, wetlands, and vernal pools
- Use management to improve wildlife habitats

12

Monitor and plan for the unexpected

12 Monitor and plan for the unexpected

Climate change will bring more unexpected events

Each forest has unique conditions that affect the severity of impact and future trajectory

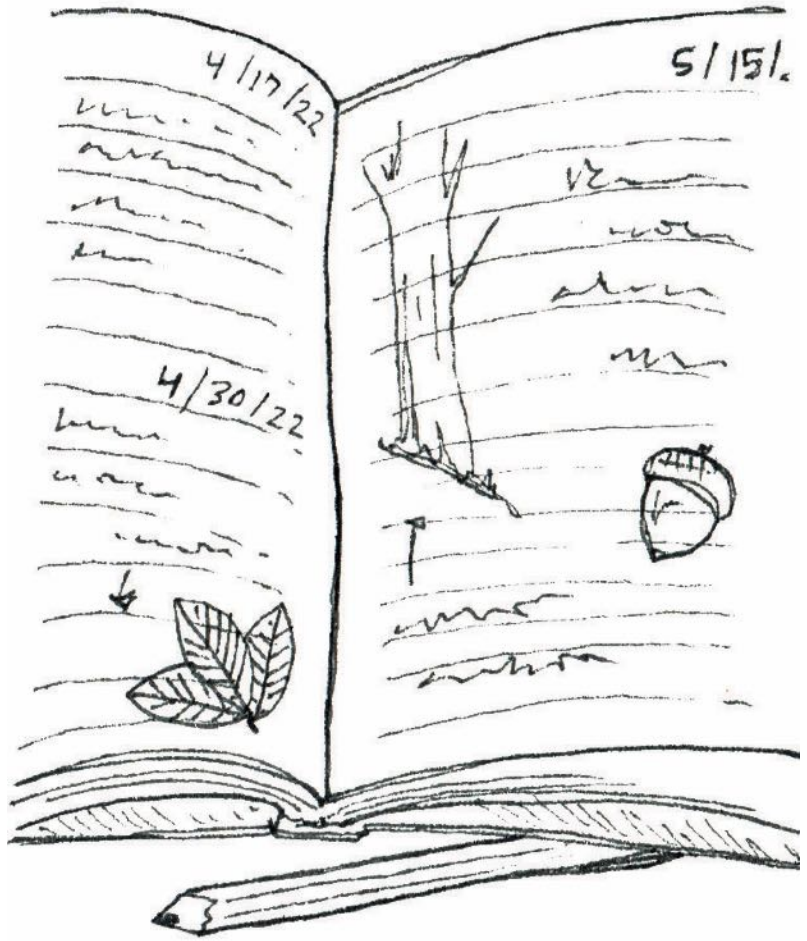
12 Monitor and plan for the unexpected

Monitor events, seasonal observations, stressors, and management outcomes

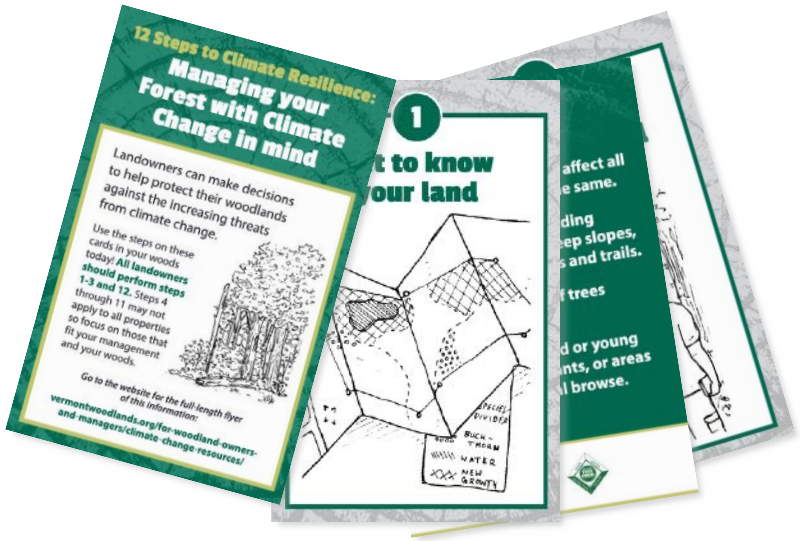
Management to increase species and age diversity can reduce the impact of an unexpected event

Talk to a forester about disturbances or pests that may affect your forest

Take advantage of resources and technical assistance available



12 Steps pocket cards

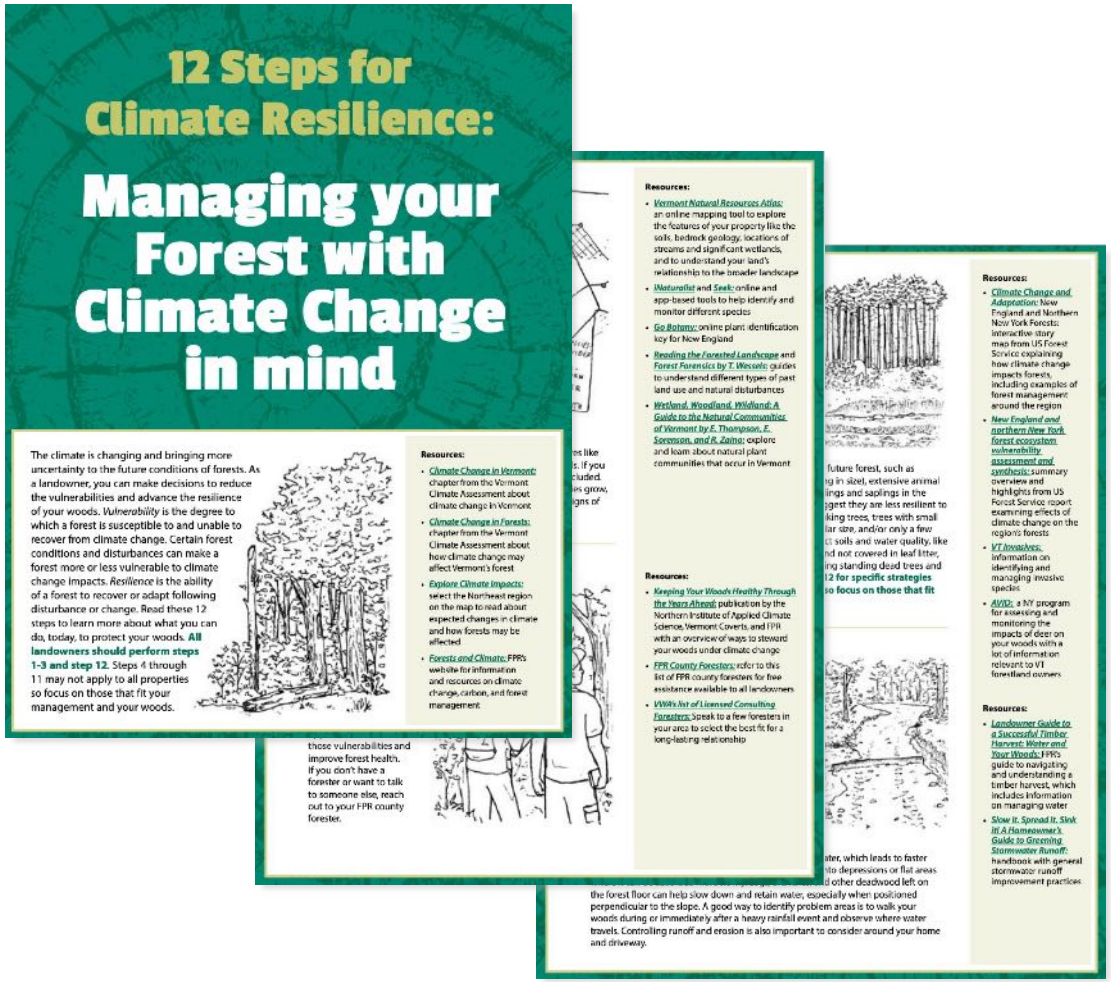


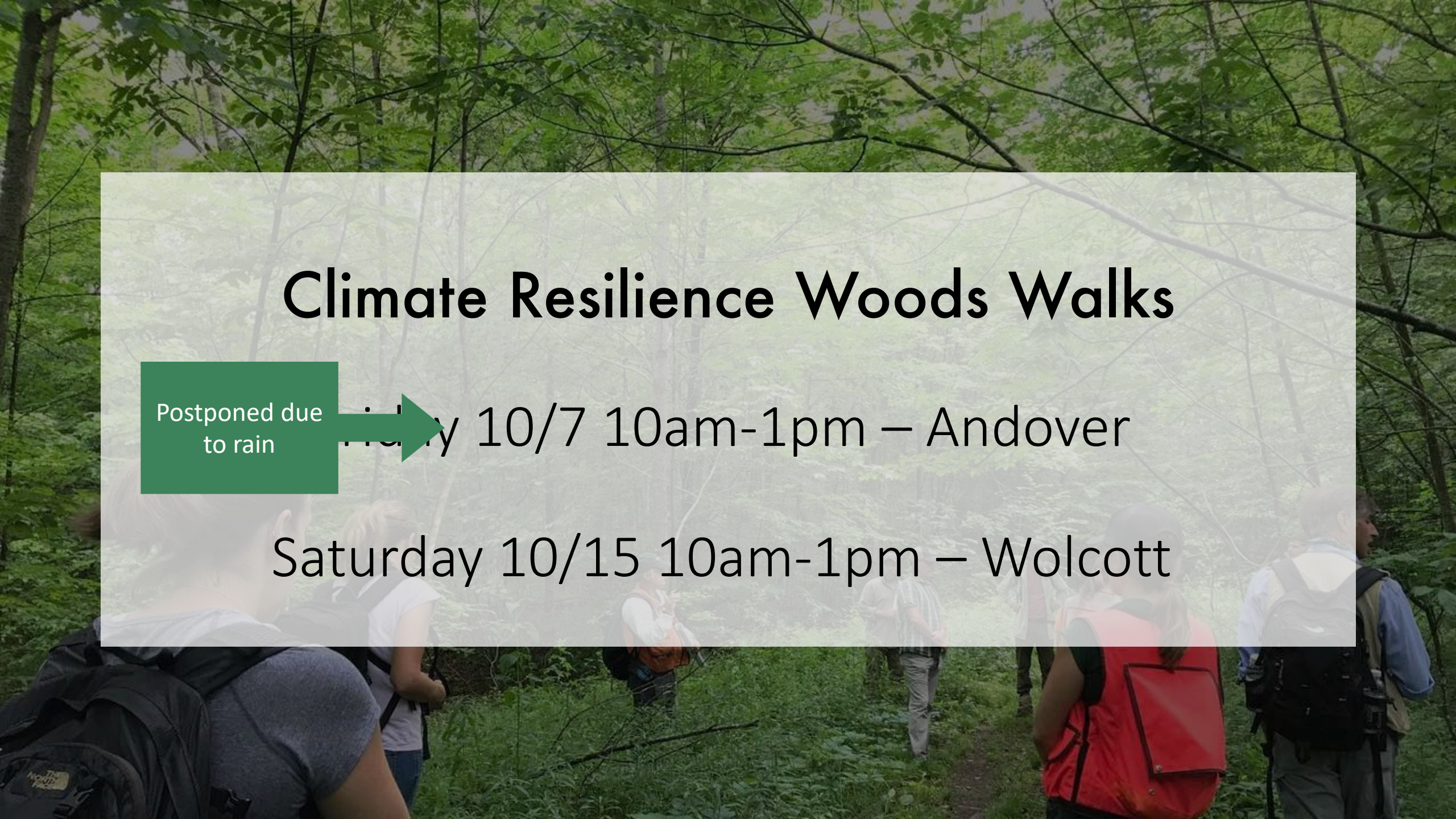
Climate change resources on VWA's site

https://www.vermontwoodlands.org/for-woodland-owners-and-managers/climate-change-resources/

12 Steps flyer

with links to additional resources





Climate Resilience Woods Walks

Postponed due to rain

Friday 10/7 10am-1pm – Andover

Saturday 10/15 10am-1pm – Wolcott

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