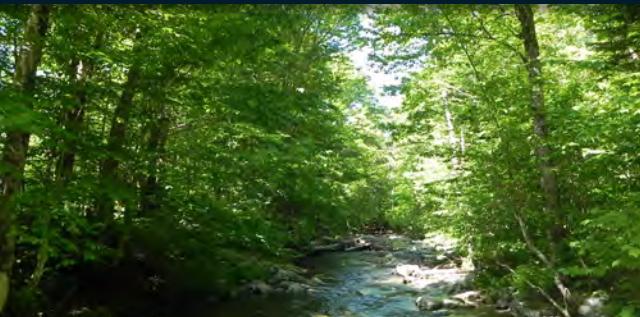


Climate Change & Connecticut Forests:

Management Options for Adaptation and Mitigation



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www.niacs.org / www.forestadaptation.org

Northern Institute of Applied Climate Science



Climate

Carbon



Provides practical information, resources, and technical assistance related to forests and climate change

Chartered by USDA Forest Service, universities, non-profit and tribal conservation organizations



Michigan
Technological
University



UNIVERSITY OF MINNESOTA



AMERICAN FORESTS



The
UNIVERSITY
of VERMONT

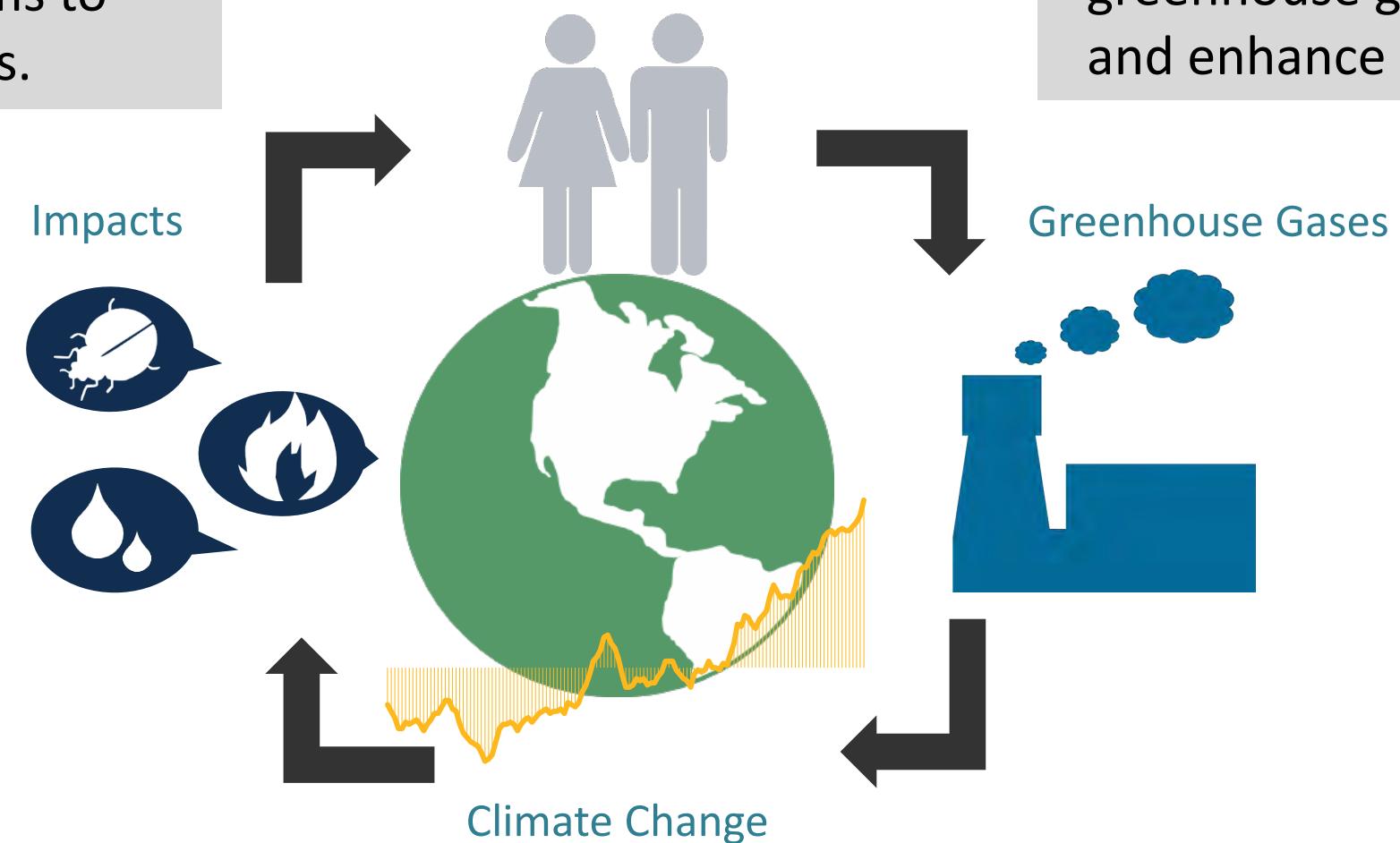
Climate Responses

Adaptation

Actions to reduce the vulnerability of systems to climate change effects.

Mitigation

Actions that reduce greenhouse gas emissions and enhance carbon sinks.



Effects on Forests

Vulnerability assessment, story map, and additional resources from NIACS:

www.forestadaptation.org/new-england

Even more resources, search by state in Resource Library:

www.adaptationworkbook.org/resources



Effects on Forests

SHIFTING SEASONS | SHIFTING SPECIES | SHIFTING STRESSORS

Effects on Forests

SHIFTING SEASONS | SHIFTING SPECIES | SHIFTING STRESSORS

THE GOOD:

Longer growing
seasons.



THE BAD:

Shorter, warmer
winters.



THE UGLY:

More extreme
events.



NY DEC

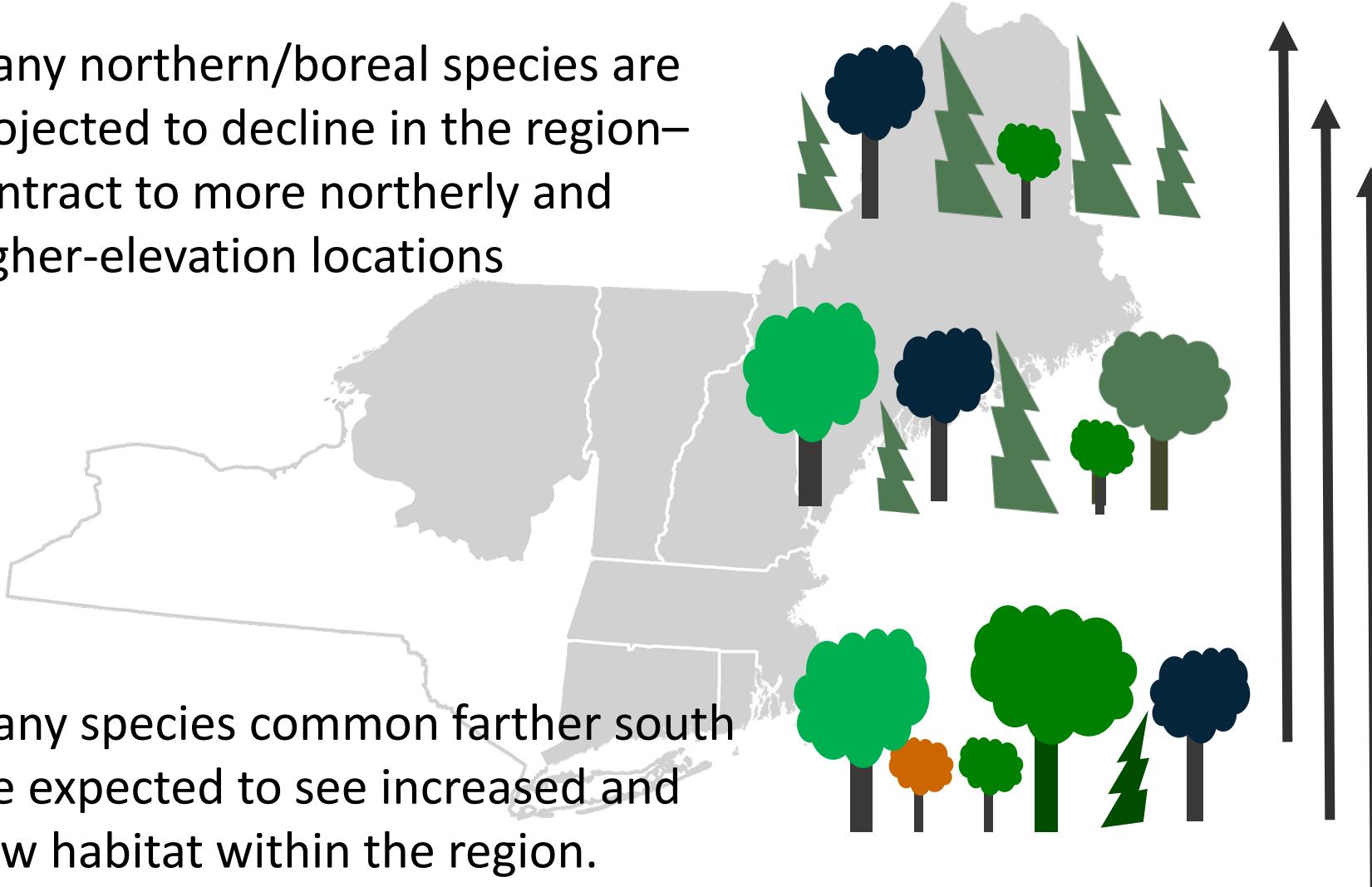
Effects on Forests

SHIFTING SEASONS | **SHIFTING SPECIES** | SHIFTING STRESSORS

Effects on Forests

SHIFTING SEASONS | **SHIFTING SPECIES** | SHIFTING STRESSORS

Many northern/boreal species are projected to decline in the region—contract to more northerly and higher-elevation locations



Effects on Forests

SHIFTING SEASONS | SHIFTING SPECIES | SHIFTING STRESSORS

Declining Habitat

- Balsam fir
- Black ash
- Striped maple
- Sycamore

Persisting Habitat

- American basswood
- Atlantic white cedar
- Bitternut hickory
- Black locust
- Eastern cottonwood
- Eastern redcedar
- Gray birch
- Northern red oak
- Pitch pine
- Sassafras
- Shagbark hickory
- Sugar maple
- Scarlett oak
- Yellow birch
- White oak



Increasing Habitat

- American beech
- Blackgum
- Black cherry
- Black oak
- Chestnut oak
- Pignut hickory
- Yellow-poplar

New habitat

- Bald cypress
- Black hickory
- Chinkapin oak
- Eastern redbud
- Loblolly pine
- Shortleaf pine
- Southern red oak
- Virginia pine

Effects on Forests

SHIFTING SEASONS | SHIFTING SPECIES | SHIFTING STRESSORS

Effects on Forests

SHIFTING SEASONS | SHIFTING SPECIES | SHIFTING STRESSORS

**Climate change is a
“threat multiplier”**

- Chronic stress
- Disturbances
- Insect pests
- Forest diseases
- Invasive species

**Interactions make all the
difference.**

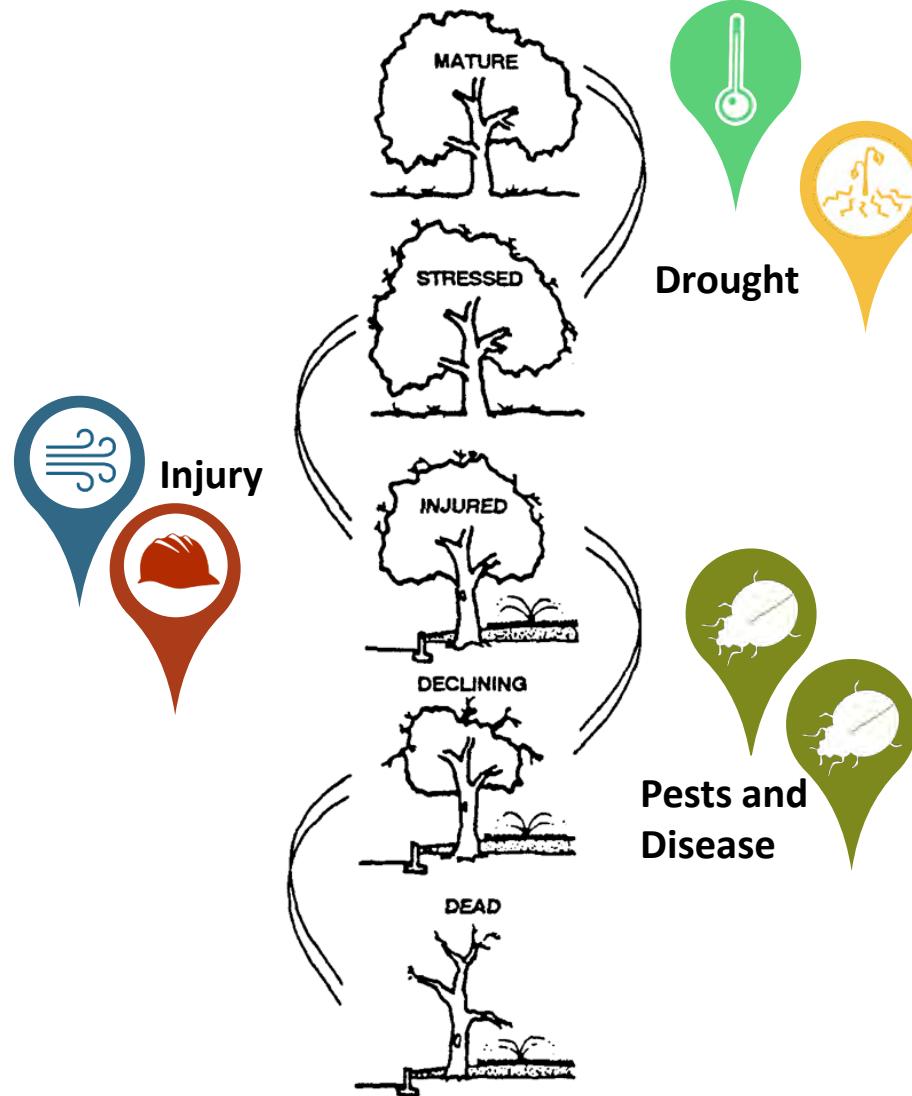


Image: Bartlett Tree Experts

Responding to Climate Change

Responding to Climate Change

If you want a single “answer” for how to respond to climate change, it’s

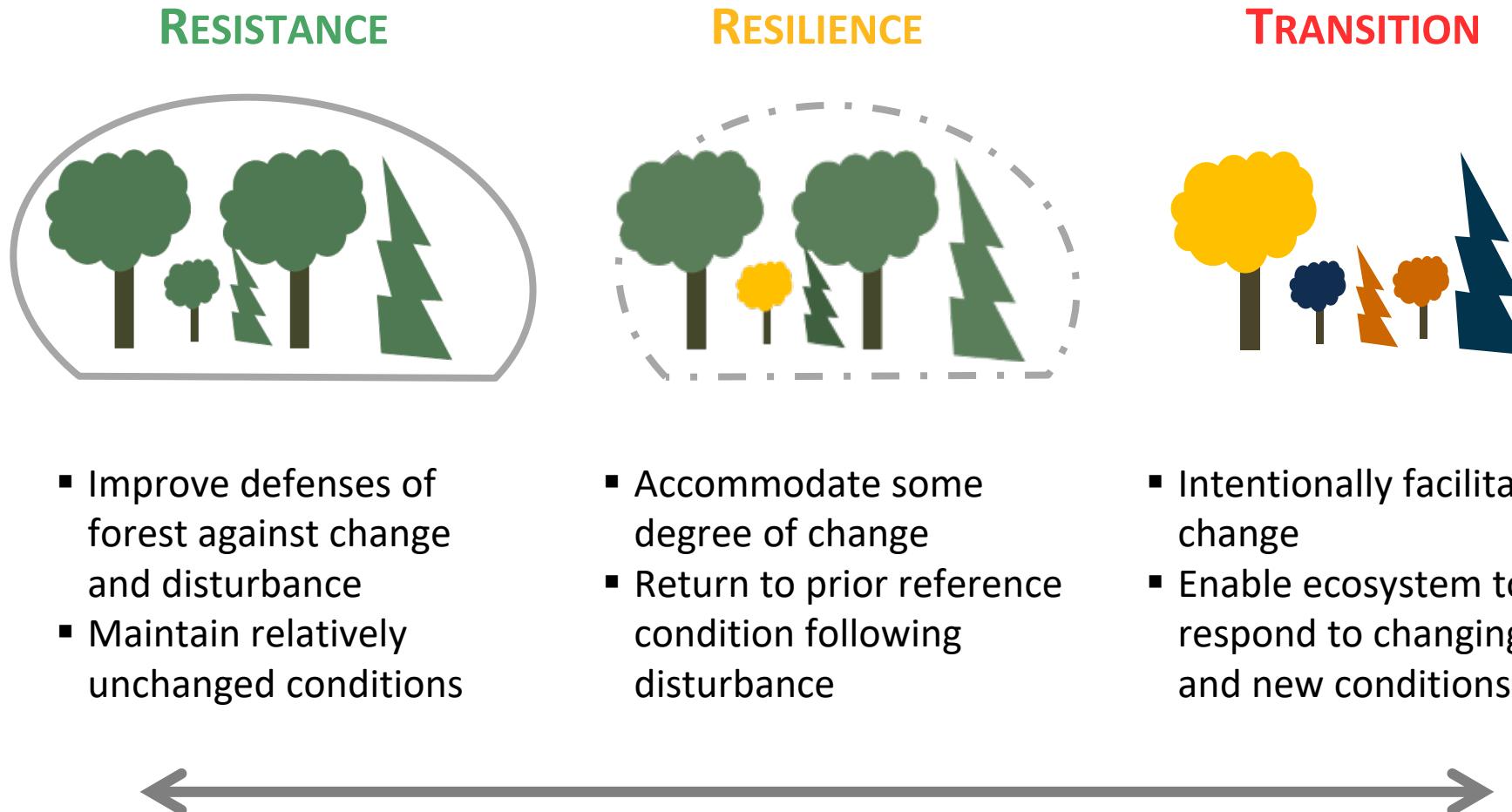
Responding to Climate Change

If you want a single “answer” for how to respond to climate change, it’s

“It depends”

It depends on **where** you are working and **what** you’re trying to achieve.

Adaptation Options



Adaptation Options



Northern New England:



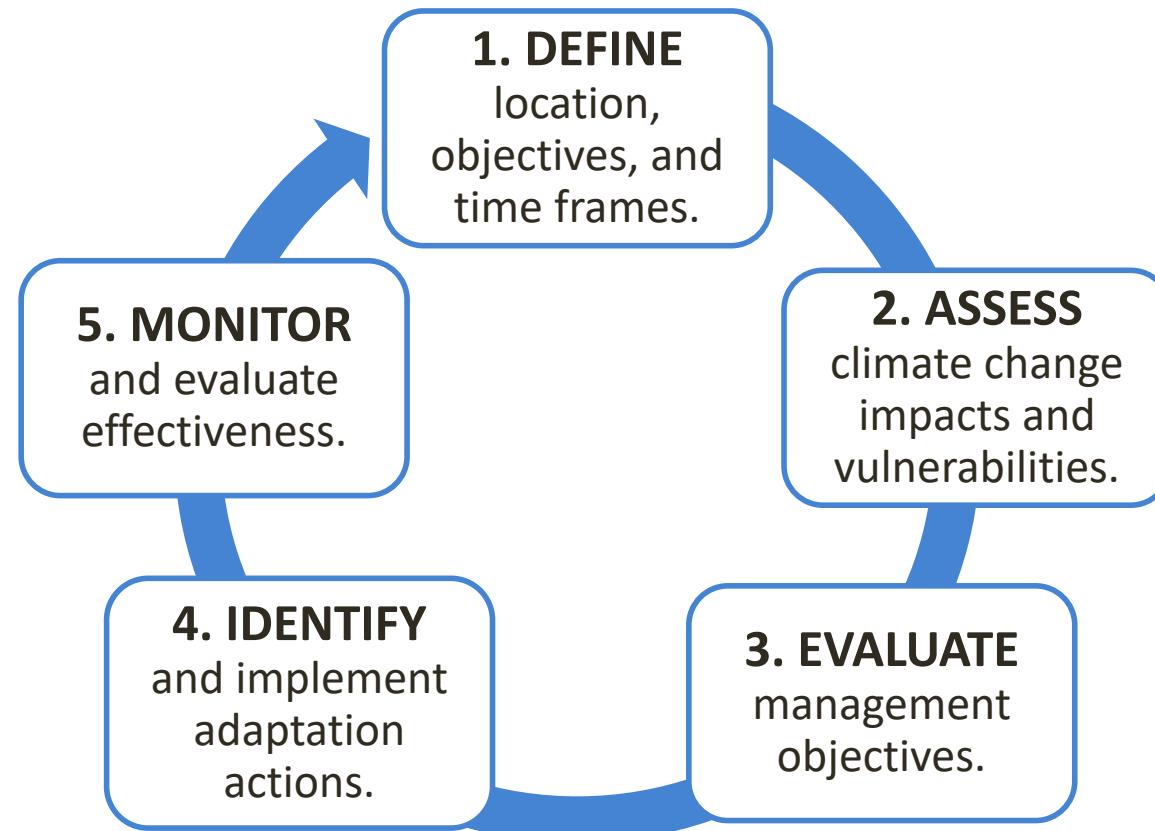
Southern New England:



Responding to Climate Change

Adaptation Workbook provides **structured process** to integrate climate change considerations into management planning and activities

- Supports diverse goals and objectives for public, private, & tribal lands
- Menus of adaptation strategies and approaches for forest ecosystems, urban forests, carbon mitigation, etc.
- Does not make recommendations



Adaptation Strategies and Approaches

A “menu” of possible actions that allows you to decide what is most relevant for a particular location and set of conditions.

Published:

- Forestry
- Urban Forestry
- Agriculture
- Forested Watersheds
- Tribal Perspectives
- Forest Carbon
- Recreation

In Preparation:

- Wetlands
- Wildlife Management
- Ocean Coastal Ecosystems
- Great Lakes Coastal Ecosystems
- Fire Management
- Grasslands

Brunch Classics			
Lemon Ricotta Pancakes	15	AJ's Omelet	14
Whipped Mascarpone Maple Berries		Feta Cheese, Spinach, Mushrooms	
Cornflake Crusted French Toast	15	Eggs Florentine	15
Berries, Maple Syrup		Spicy Cappuccino, House-Made Cheddar Biscuit, Spinach	
Bacon, Egg & Cheese	14	Porchetta Hash	16
Bacon, Two Eggs, Taleggio Cheese, Ciabatta		Poached Egg, Calabrian Chili Hollandaise	
Avocado Toast	15	Chia Pudding	14
Poached Eggs, Tomatoes, Chili Flakes, Sea Salt		Chia Seeds, Toasted Coconut, Banana, Strawberry	
Chicken Parmigiana	22	Farmhouse Breakfast	14
Spokey Marinara, Fresh Mozzarella		Two Eggs, House-Made Cheddar Biscuit, Chicken Sausage	
Squid Ink Fettuccine Vongole	22	Chicken Kale Caesar	16
Little Neck Clams, Garlic, White Wine, Butter, Chili		Chicken, Kale, Croutons	

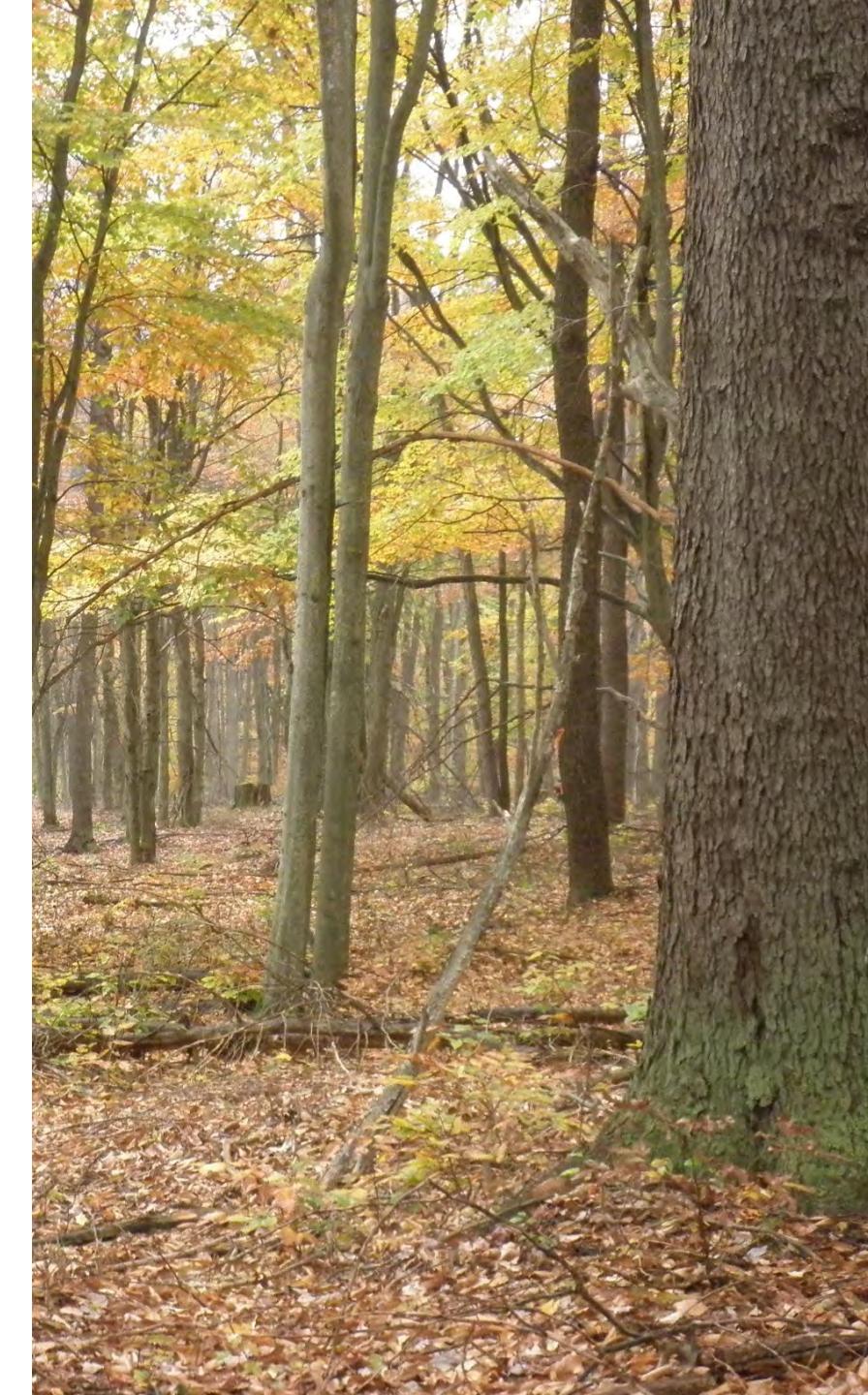
Create Your Own Pasta		
Shapes		Sauces
Rigatoni	14	Marinara
Semolina, All-Purpose Flour, Olive Oil		San Marzano Tomatoes, Garlic, White Wine, Basil, Chili
Cavatelli	15	Arrabbiata
All-Purpose Flour, Durum Flour, Eggs, Ricotta		All-Purpose Flour, Durum Flour, Eggs, Ricotta
Tagliatelle	15	Broken Meatball
All-Purpose Flour, Durum Flour, Eggs		House Tomato Sauce with the Addition of Broken Meatballs
Gluten-Free Rigatoni	16	Sunday Sauce
Gluten-Free All-Purpose Flour, Olive Oil, Eggs		House Tomato Sauce with Short Rib, Sausage, Veal
Spaghetti	15	Roasted Garlic Pecorino
Semolina, Durum Flour, Olive Oil		Semolina, Durum Flour, Olive Oil
Four Cheese Herb Ravioli	18	Carbonara
Fontina, Ricotta, Parmesan, Pecorino		Pancetta, Eggs, Peas, Pecorino

Sides			
Pecorino Truffle Fries	8	Bloody Mary	10/45
Potato Hash	6	Vodka, Spiced Fresh DOP Tomato Juice, Horseradish	
Racon	6	Cointreau Spritz	12/55
Turkey Sausage	6	Cointreau Spritz, Aperol, Creme de Peche, Sparkling Wine	
Field Greens	7	Green Side	12/55
Two Eggs Any Style	6	Reyka Vodka, Green Juice, Lemon	
Beignets	8	Morning Derby	12/55
Baked Goods	10	Bourbon, Grapefruit, Ginger, Carrot Juice	

Brunch Cocktails		
Bloody Mary	10/45	
Vodka, Spiced Fresh DOP Tomato Juice, Horseradish		
Cointreau Spritz	12/55	
Cointreau Spritz, Aperol, Creme de Peche, Sparkling Wine		
Green Side	12/55	
Reyka Vodka, Green Juice, Lemon		
Morning Derby	12/55	
Bourbon, Grapefruit, Ginger, Carrot Juice		
Sangria	10/45	
Red Wine, Fresh Fruit, Pisco, Crème de Peche		
Firing Squad	12/55	
Milagro Tequila, Cointreau, Fresh Lime, Grenadine		
Tall Mimosa	12/55	
Reyka Vodka, Cointreau, Jake's Mimosa Juice, Sparkling Wine		



Forest /Urban Forest Adaptation Strategies



- Sustain fundamental ecological functions.
- Reduce existing biological stressors.
- Reduce impacts of severe disturbances.
- Maintain or create refugia.
- Enhance species and structural diversity.
- Promote ecosystem redundancy.
- Increase landscape connectivity.
- Enhance genetic diversity.
- Facilitate species transitions.
- Realign ecosystems after disturbance.

Example: MassConn Woods Outreach

- Protect water and soils on your land.
- Improve ability of your trees to resist bugs and disease.
- Maintain or improve the ability of forests to resist pests and pathogens
- Prevent and control non-native plants and weeds that already threaten native plants and animals.
- Manage damage to young trees from excessive deer browsing.
- Prepare for big weather events by promoting strong, healthy trees in your woodlot.
- Respond quickly after big disturbance events to help your woods bounce back.
- Promote a diversity of tree species and tree sizes.
- Protect rare or sensitive plant and animal communities.
- Consider how your current trees will react to future conditions and new species you might want to promote.
- Monitor your woods and the effect of different management tactics.



The screenshot shows a fact sheet titled "Keeping Your Woods Healthy Through the Years Ahead" from "My MassConn Woods". The title is at the top in a green header. Below the title is a section titled "Considerations for Your Woodlot" with a sub-section "Top Forest Stressors to Keep an Eye On". The main content is a table with two columns: "Top Forest Stressors to Keep an Eye On" and "Extreme Weather Vulnerabilities". The stressors listed are: Protect water and soils on your land, Improve ability of your trees to resist bugs and disease, Prevent and control non-native plants and weeds that threaten native plants and animals, Manage damage to young trees from excessive deer browsing, Prepare for big weather events by promoting strong, healthy trees in your woodlot, Respond quickly after big disturbance events to help your woods bounce back, Promote a diversity of tree species, Promote a diversity of tree sizes, Protect rare or sensitive plant & animal communities, Consider how your current trees will react to future conditions and which tree species you might want to promote, and Monitor your woods and the effect of different management tactics. The "Extreme Weather Vulnerabilities" column is currently empty.

Example: MassConn Woods Outreach

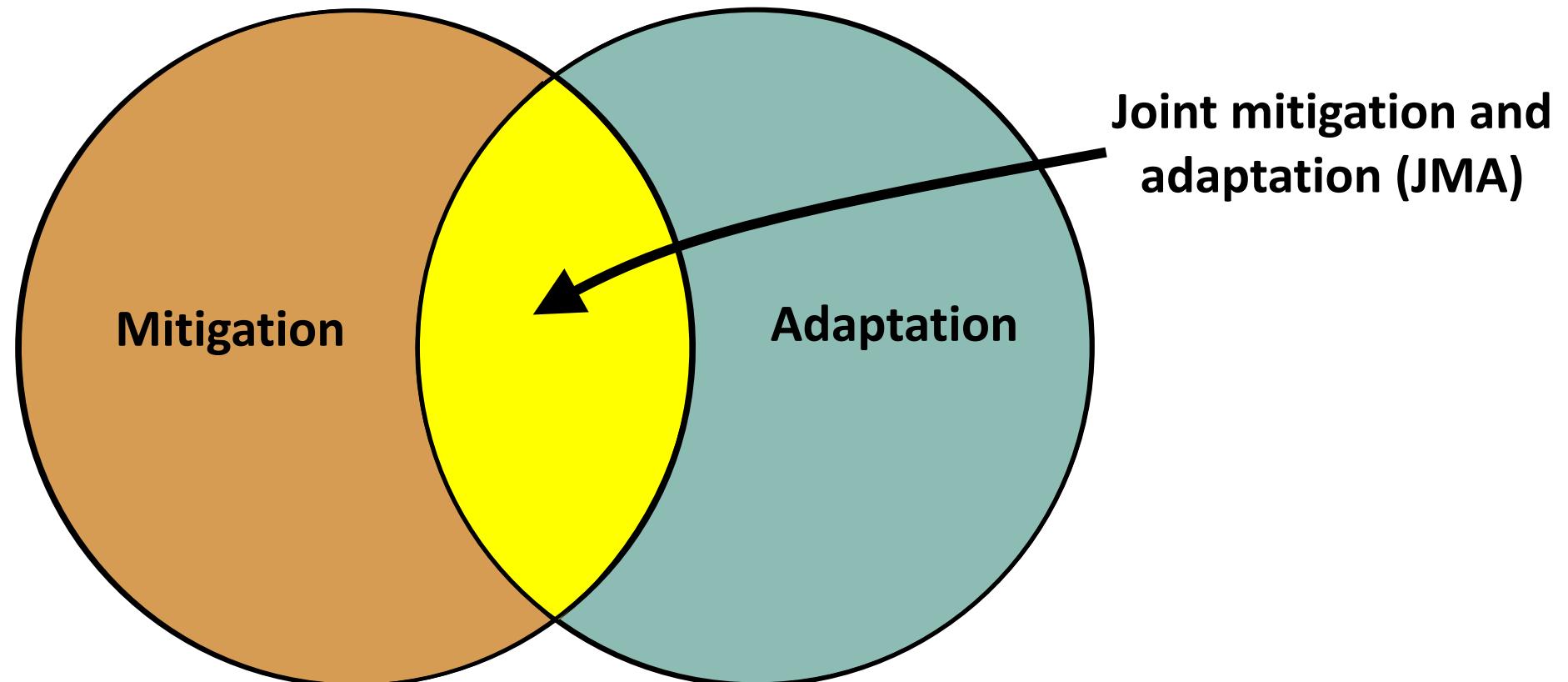
- Climate adaptation visits by NIACS-trained foresters (NEFF, AFF, MassConn partnership)
- 102 private owner visits completed on total ownership of 8,100 acres since 2016
 - Within CT: 43 parcels of 3,270 combined acres
- Demonstrations on private and CT DEEP forest lands



KENEY PARK, HARTFORD: 128-acre area
NIACS Adaptation Workbook in progress – NEFF FS grant

Adaptation + Forest Carbon

Integrating climate mitigation and adaptation is needed for
resilient carbon sequestration



Adaptation + Forest Carbon

FIRST REDUCE STRESSORS

- Avoid forest conversion to nonforest land uses
- Reduce impacts on soils and nutrient cycling
- Prevent carbon losses for wildfire or natural disturbances
- Improve the ability to withstand pests and pathogens
- Reduce impacts from invasive species
- Reduce risks associated with tree species or forest declines

THEN ENHANCE CARBON

- Reforest (convert back to forest)
- Increase tree cover in urban areas
- Integrate trees into agricultural systems
- Prioritize low-vulnerability sites for maintaining or enhancing carbon stocks
- Increase structural complexity
- Increase tree stocking in low-risk stands
- Alter species or structure to maximize carbon stocks
- Promote future-adapted species

Example: Audubon Vermont

- Green Mountain Audubon Center – Forest management plan update to include climate adaptation and carbon
- Integration with Forest Birds Initiative



Action	Bird Habitat Benefits	Adaptation Benefits	Mitigation Benefits
Maintain forest land as forest/ Maintain no harvest area	Habitat for forest birds; more large trees, snags, dead wood	Supports landscape connectivity	Allows trees to grow larger; forest retains carbon
Forest harvest, including group selection and gaps; retain snags	Improves structure used by a diversity of species; increases tree species diversity	Species and structural diversity increases resilience	Improves growth of remaining trees; more structure increases carbon storage
Promote or plant red oak in harvested areas	Oaks support many insects and animals	Oak is projected to have more habitat in the future	Reduces risk of carbon loss from species decline

Conclusions

- There is no single “answer” for responding to climate change. A portfolio approach is needed.
- Actions for adaptation and mitigation need to consider site conditions, landowner goals or desired outcomes, and climate risks.
- Management actions to maximize any single management objective above others (e.g., carbon) can increase risks. Work to optimize across a wide range of benefits.

