manomet

Soaring Solutions. Grounded Science.

Resiliency Assessment Framework:

Monitoring the Impacts of Climate Change on Working Forests

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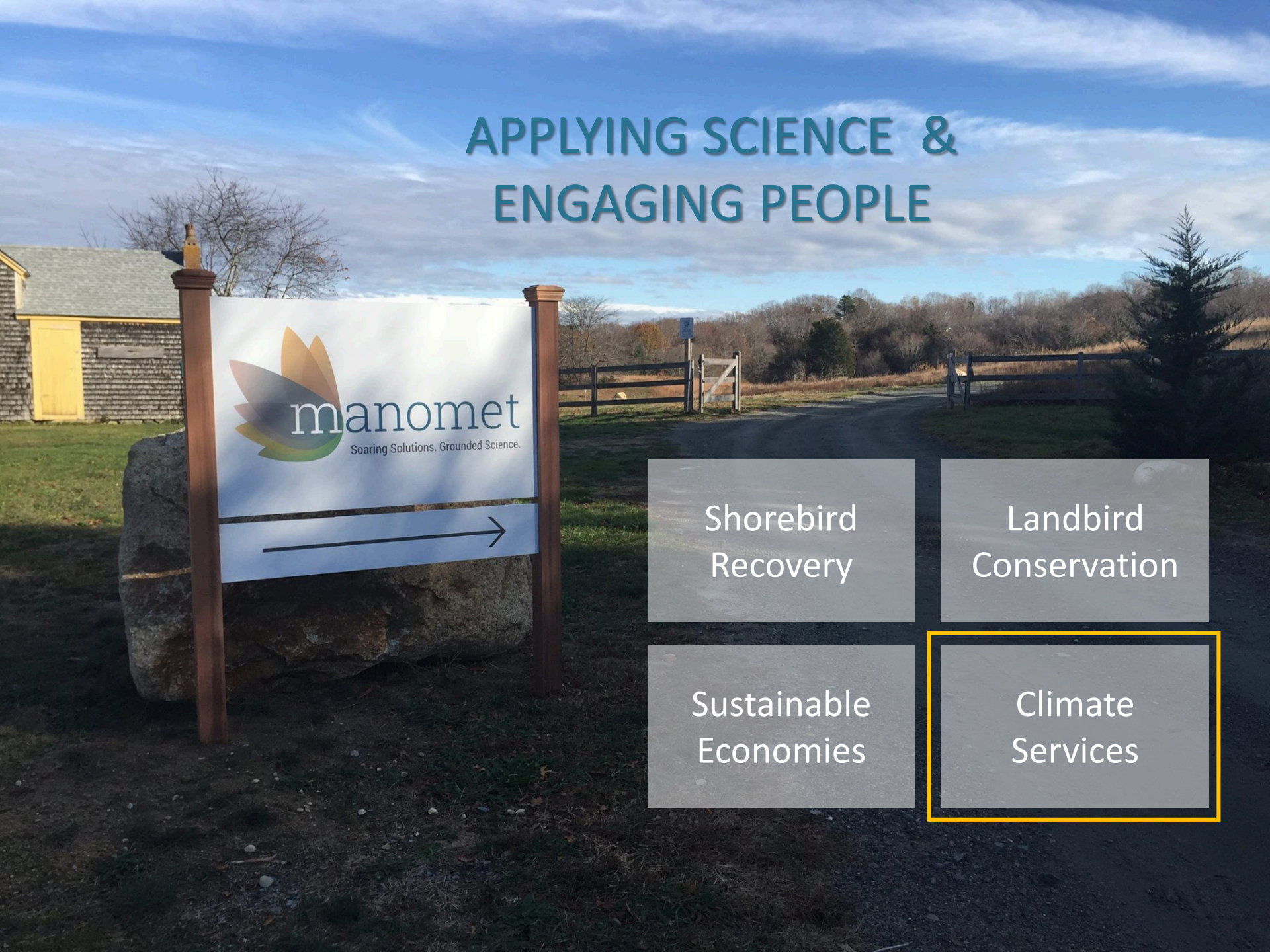
Climate Services

APPLYING SCIENCE & ENGAGING PEOPLE



Shorebird Recovery

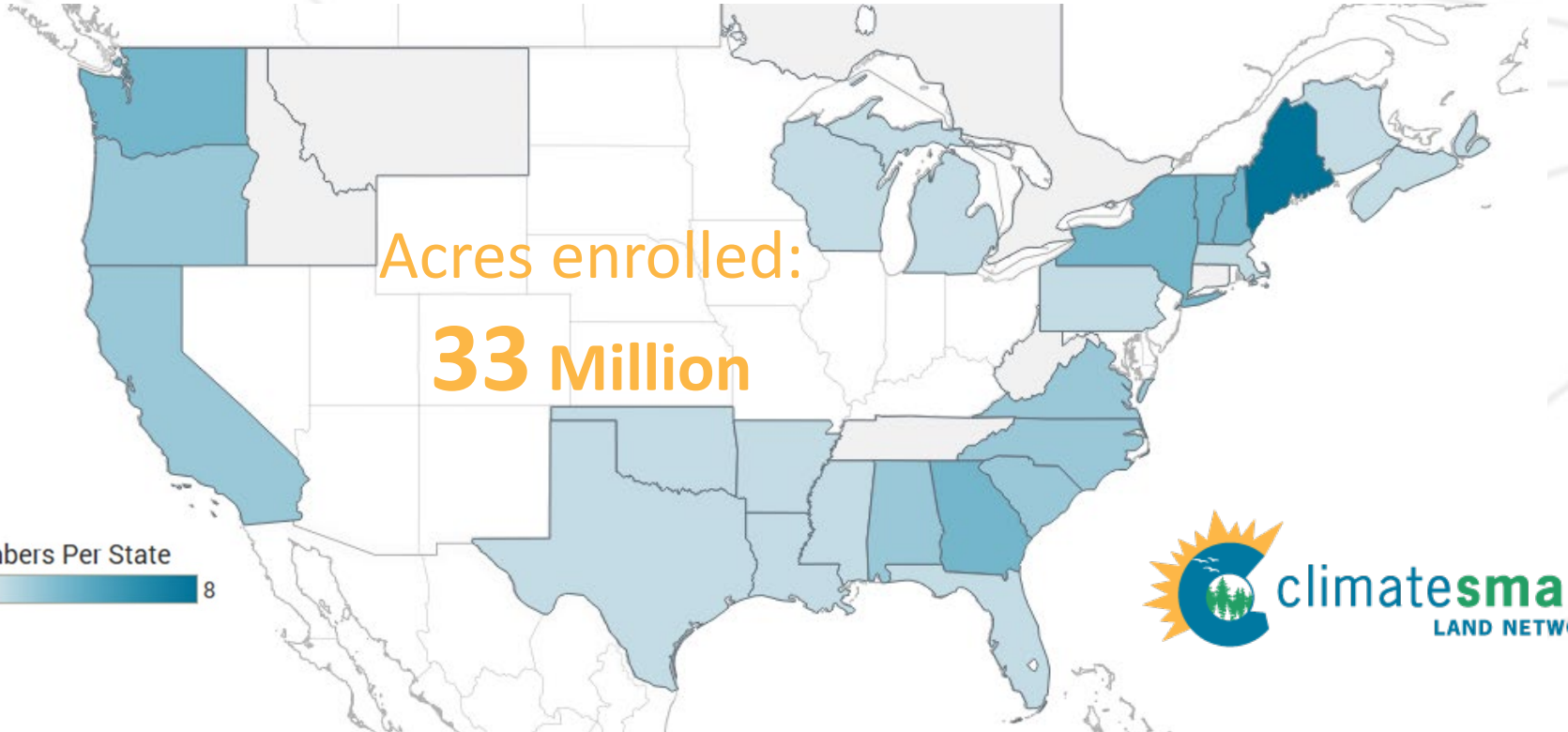
Landbird Conservation

Sustainable Economies

Climate Services

Climate Smart Land Network

- Hancock Timber Resources Group
- J.D.Irving, Limited Woodlands
- Resource Management Service, LLC
- The Lyme Timber Company
- Maine Woodland Owners
- Greenwood & Arcadia Plantations
- New England Forestry Foundation
- Acadian Timber
- LandVest Timberland Division
- Hama Hama Company
- Baskahegan Company
- Wagner Forest Management, Ltd.
- Green Diamond Resource Company
- Weyerhaeuser



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LAND NETWORK

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Resiliency Assessment Framework

- Why
- How
- Future Directions

Watershed Services

Source: https://upload.wikimedia.org/wikipedia/commons/thumb/0/0a/Seneca-creek-stream_ForestWander.JPG/1024px-Seneca-creek-stream_ForestWander.JPG

Carbon Sequestration and Storage

Source: https://upload.wikimedia.org/wikipedia/commons/thumb/8/8c/Creek_and_old-growth_forest-Larch_Mountain.jpg/1024px-Creek_and_old-growth_forest-Larch_Mountain.jpg

Risks to Forests

Source: http://www.fws.gov/news/blog/images/medicinebownf1.jpg

Problem Statement

- Working forests have an important role to play in maintaining ecosystem services
- Modeling provides general guidance on future conditions but is rarely sufficient to support local management decisions
- Managing forests in a dynamic climate will require monitoring of variables beyond those typically tracked in relation to growth and yield

Objectives

- Identify a set of metrics that balance utility and level of effort
- Leverage existing monitoring practices
- Link monitoring data to planning and management

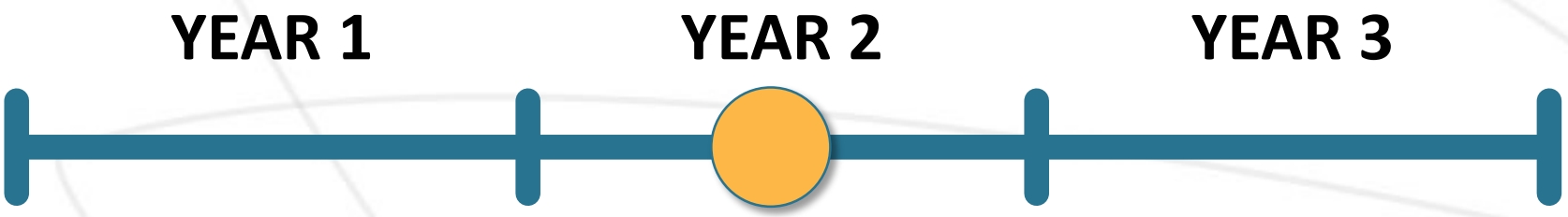
Approach

Two-tiered approach:

(1) locally relevant metrics

(2) an assessment of the larger regional context

Project Timeline



Site-specific Monitoring

- Identify study sites
- Collect information about current monitoring & inventory
- Develop and test local metrics
- Develop draft of mgmt. plan module

Regional Context

- Assess forest health & productivity trends with USFS FIA
- Develop regional synoptic report
- Explore use of remotely-sensed information for trend detection

Management Plan Module

- Integrate local metrics and regional trend assessments into forest management plan module

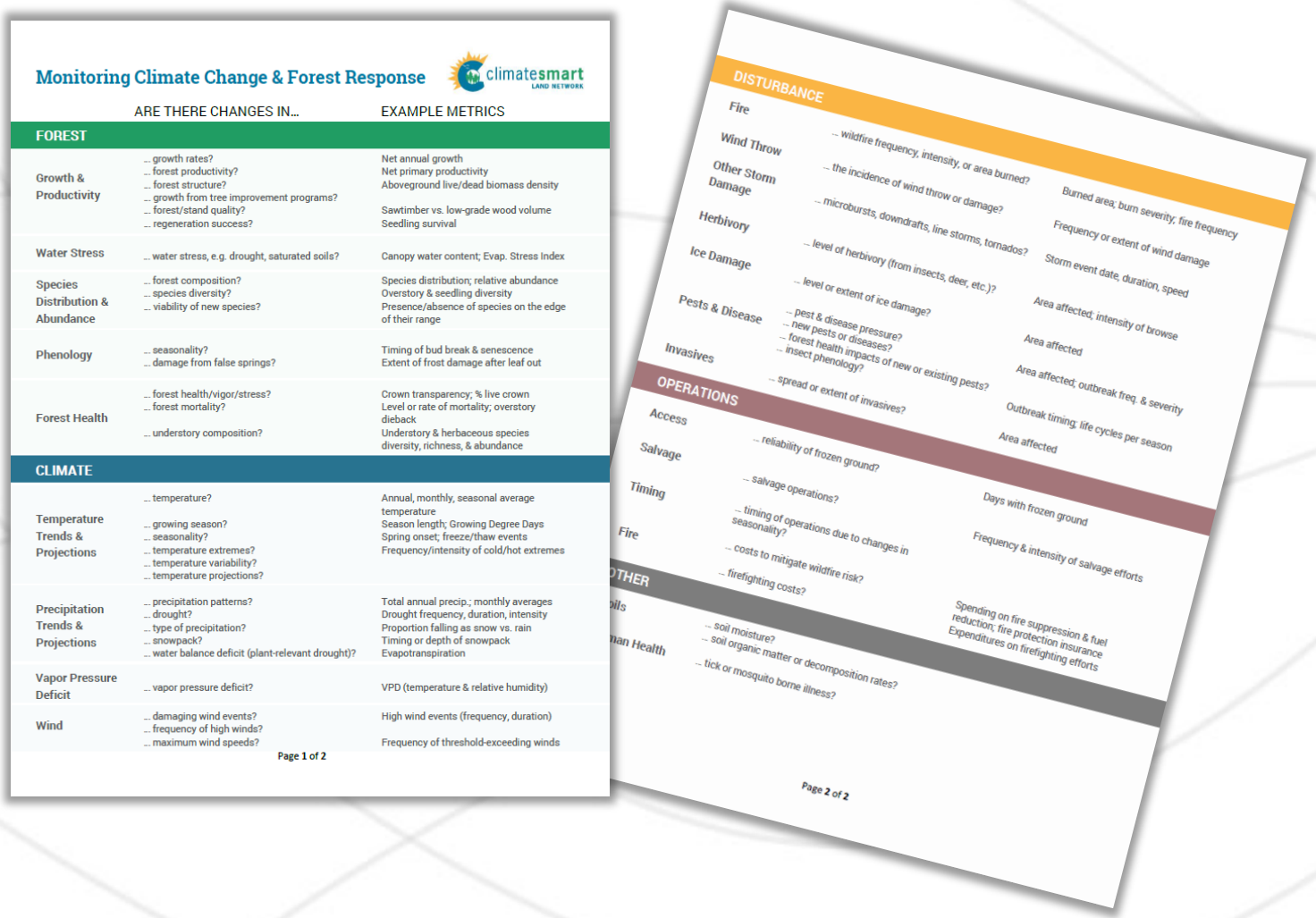
Study Sites

Framework Development

Forest Response & Operational **IMPACTS**

&

Climate & Disturbance **DRIVERS**



Monitoring Climate Change & Forest Response

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	ARE THERE CHANGES IN...	EXAMPLE METRICS
FOREST		
Growth & Productivity	... growth rates? ... forest productivity? ... forest structure? ... growth from tree improvement programs? ... forest/stand quality? ... regeneration success?	Net annual growth Net primary productivity Aboveground live/dead biomass density Sawtimber vs. low-grade wood volume Seedling survival
Water Stress	... water stress, e.g. drought, saturated soils?	Canopy water content; Evap. Stress Index
Species Distribution & Abundance	... forest composition? ... species diversity? ... viability of new species?	Species distribution; relative abundance Overstory & seedling diversity Presence/absence of species on the edge of their range
Phenology	... seasonality? ... damage from false springs?	Timing of bud break & senescence Extent of frost damage after leaf out
Forest Health	... forest health/vigor/stress? ... forest mortality? ... understory composition?	Crown transparency; % live crown Level or rate of mortality; overstory dieback Understory & herbaceous species diversity, richness, & abundance
CLIMATE		
Temperature Trends & Projections	... temperature? ... growing season? ... seasonality? ... temperature extremes? ... temperature variability? ... temperature projections?	Annual, monthly, seasonal average temperature Season length; Growing Degree Days Spring onset; freeze/thaw events Frequency/intensity of cold/hot extremes
Precipitation Trends & Projections	... precipitation patterns? ... drought? ... type of precipitation? ... snowpack? ... water balance deficit (plant-relevant drought)?	Total annual precip.; monthly averages Drought frequency, duration, intensity Proportion falling as snow vs. rain Timing or depth of snowpack Evapotranspiration
Vapor Pressure Deficit	... vapor pressure deficit?	VPD (temperature & relative humidity)
Wind	... damaging wind events? ... frequency of high winds? ... maximum wind speeds?	High wind events (frequency, duration) Frequency of threshold-exceeding winds

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DISTURBANCE		
Fire	... wildfire frequency, intensity, or area burned?	Burned area; burn severity; fire frequency
Wind Throw	... the incidence of wind throw or damage?	Frequency or extent of wind damage
Other Storm Damage	... microbursts, downdrafts, line storms, tornados?	Storm event date, duration, speed
Herbivory	... level of herbivory (from insects, deer, etc.)?	Area affected; intensity of browse
Ice Damage	... level or extent of ice damage?	Area affected
Pests & Disease	... pest & disease pressure? ... new pests or diseases? ... forest health impacts of new or existing pests?	Area affected; outbreak freq. & severity
Invasives	... insect phenology? ... spread or extent of invasives?	Outbreak timing; life cycles per season Area affected
OPERATIONS		
Access	... reliability of frozen ground?	Days with frozen ground
Salvage	... salvage operations?	Frequency & intensity of salvage efforts
Timing	... timing of operations due to changes in seasonality?	
Fire	... costs to mitigate wildfire risk?	Spending on fire suppression & fuel reduction; fire protection insurance
	... firefighting costs?	Expenditures on firefighting efforts
OTHER		
oils	... soil moisture? ... soil organic matter or decomposition rates?	
an Health	... tick or mosquito borne illness?	

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Framework Development

- Commonalities across sites
- Anecdote or informal observation
- Info from outside sources
- Potential data gaps
- Priorities of each partner

Preliminary Findings

Monitoring Climate Change & Forest Response

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Preliminary Findings

How is forest health changing?

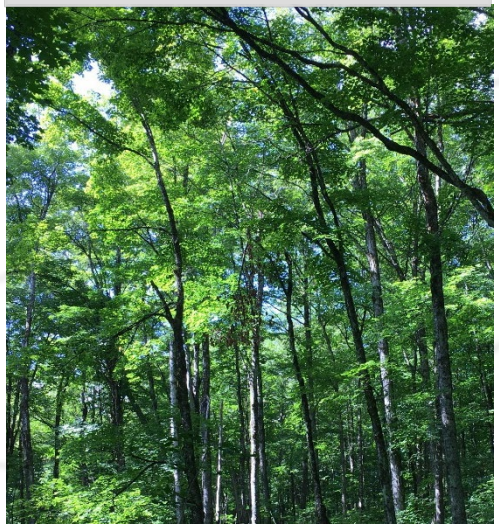
- Crown condition
- Insect/disease damage
- Tree Mortality

How is relative tree species abundance changing?

- Regeneration success
- Species abundance

How are growth rates changing by species (or species group)?

- Net annual growth
- Ingrowth vs. mortality



Next Steps

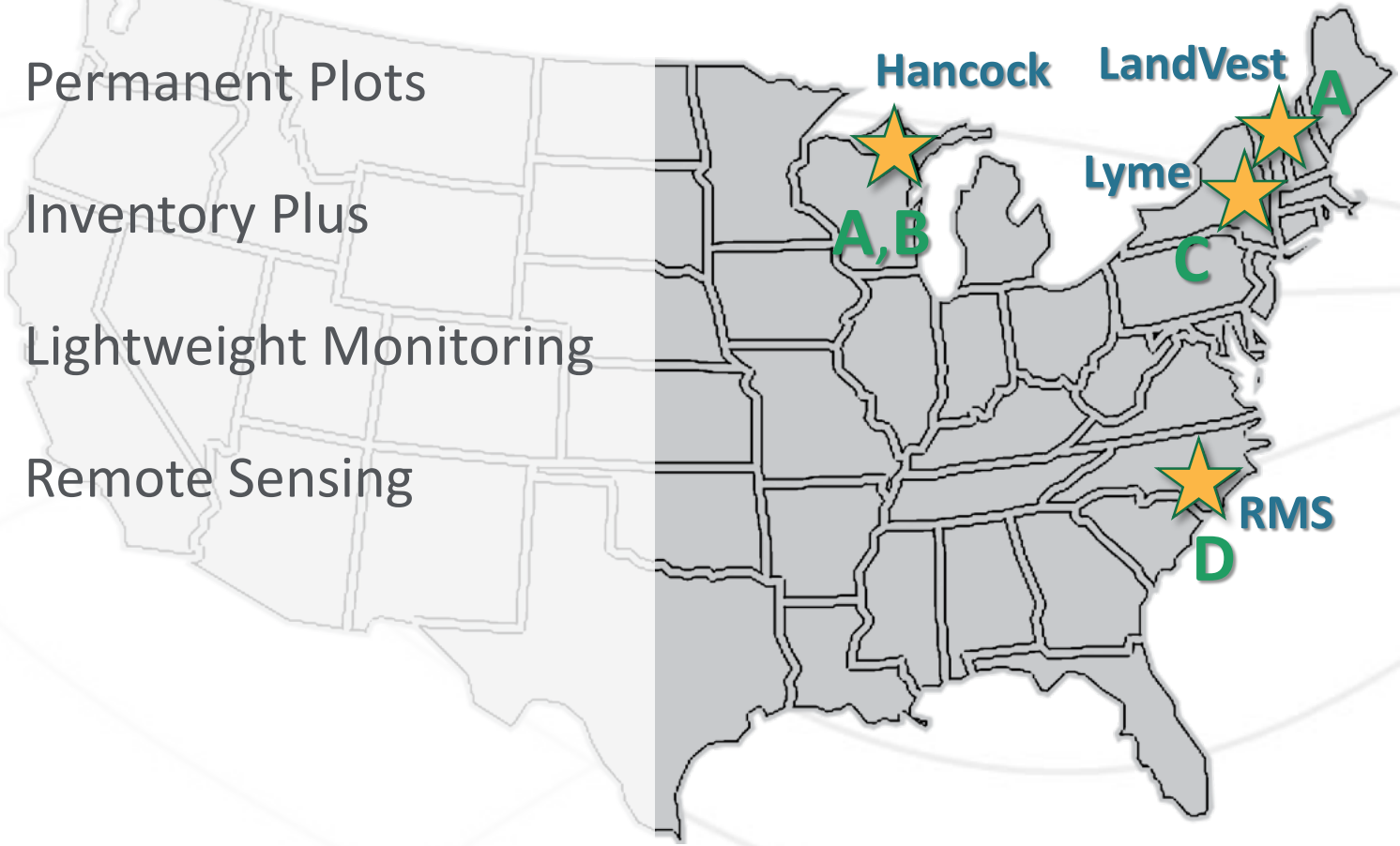
These questions can be assessed at different levels:

A. Permanent Plots

B. Inventory Plus

C. Lightweight Monitoring

D. Remote Sensing

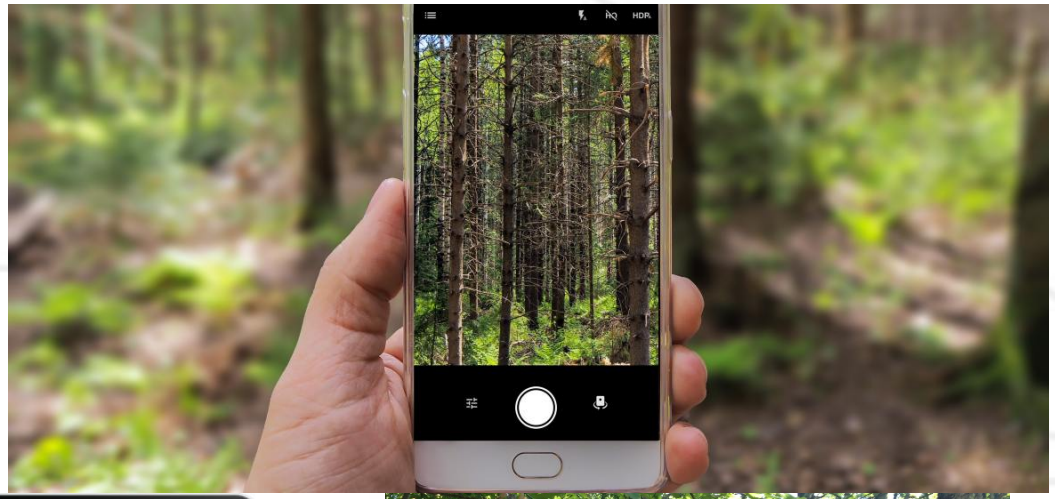


Permanent Plots

Image credit: Maria Thi Mai on Flickr

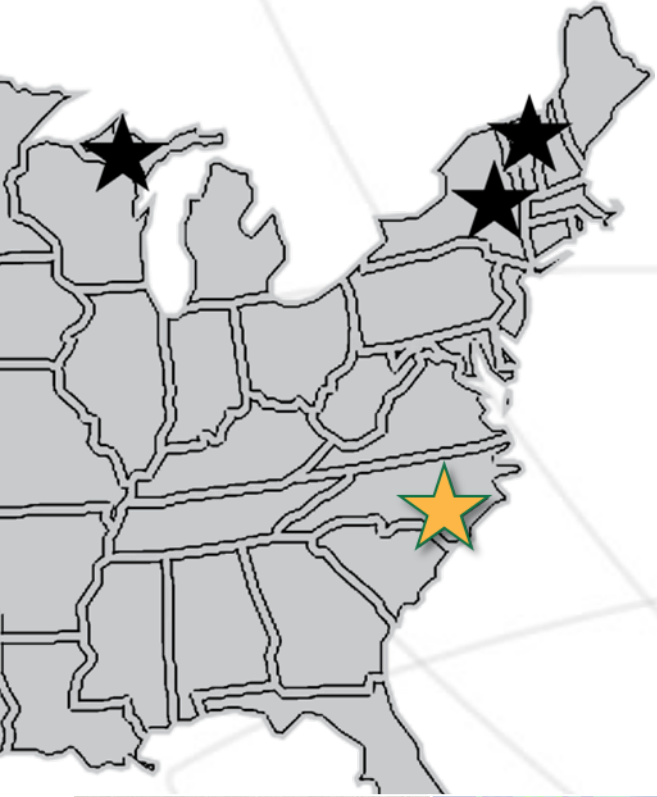
Image credit: NASA/Kate Ramsayer on Flickr

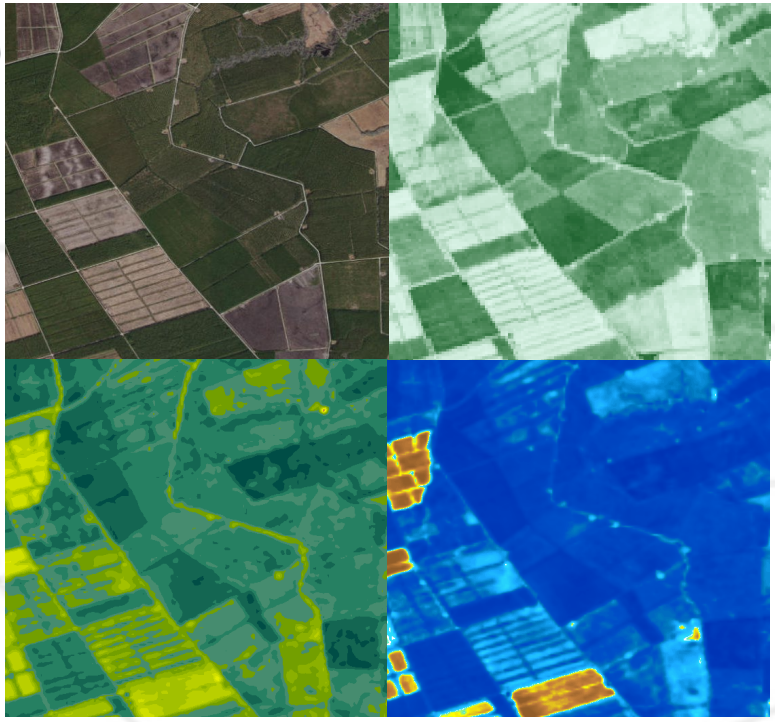
Lightweight Monitoring

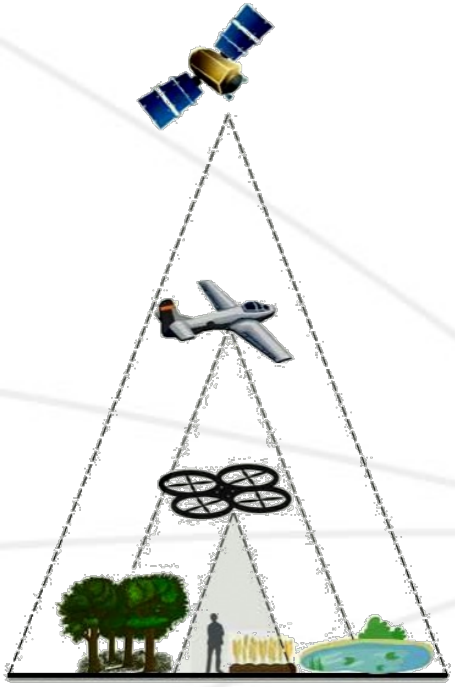


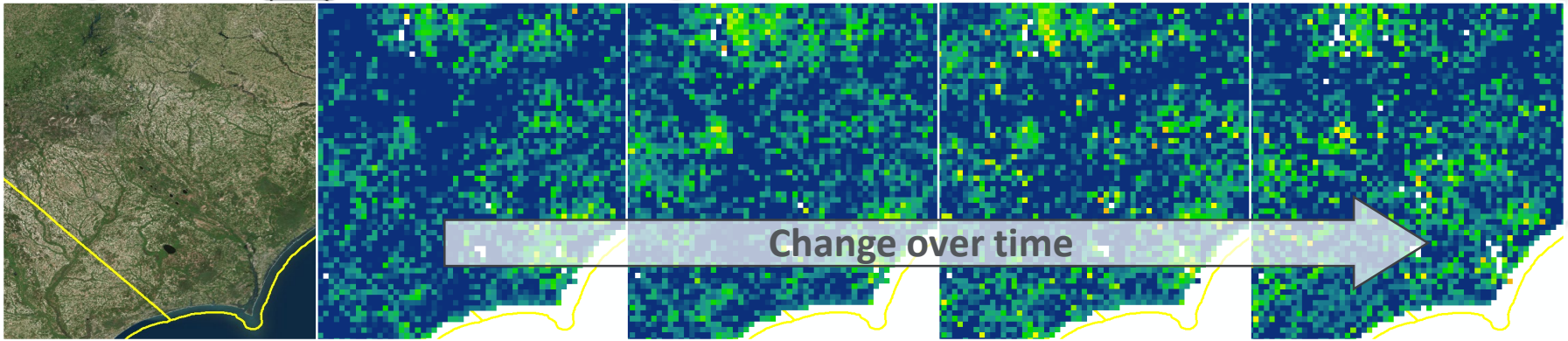
- Tree vigor/forest canopy health
- Pests and pathogens
- Browse
- Invasive plants

Remote Sensing









Next Steps

- ✓ LOCAL:
  - Refine and vet metrics & assessment levels with project partners

- ✓ REGIONAL CONTEXT:
  - Manomet compiling data for regional snapshots from USFS FIA & remote sensing

Questions?

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