



FOREST FRAGMENTATION

A report to the Vermont Legislature
16 April 2015

Michael Snyder, Commissioner
Department of Forest, Parks and Recreation



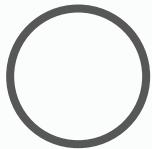
ACKNOWLEDGMENTS



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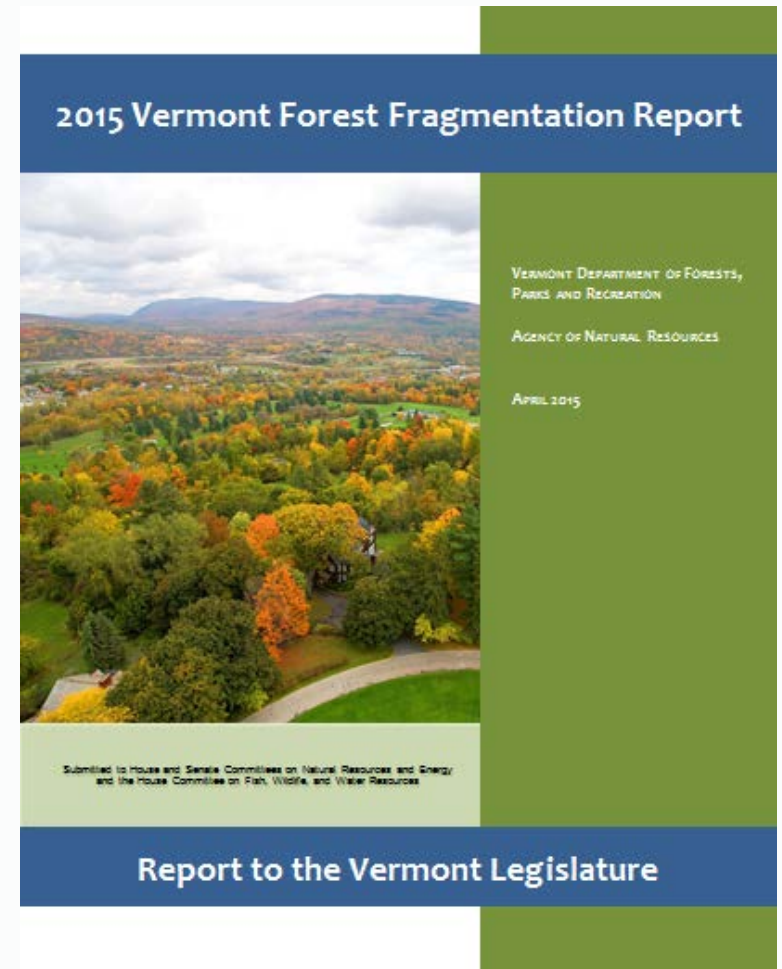
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Recognition is given to

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Danielle Fitzko, Vermont Department of Forests, Parks and Recreation
Susan Morse, Keeping Track





ACT 118 of 2014

AN ACT RELATING TO FOREST INTEGRITY



Forests of Vermont are a unique and valuable resource



Large areas of contiguous forest are essential



Fragmenting forest reduces their value

A REPORT

assessing the current and projected effects of fragmentation on Vermont's forestland and recommendations for how to protect their integrity.



THE FORESTS OF VERMONT

FOREST A biological community dominated by trees but also consisting of other plants, animals, and microorganisms, the associated physical environment and their combined interactions and processes.



LANDSCAPE HISTORY



Pre-settlement forest –
ca. 1700

LANDSCAPE HISTORY



Early homestead clearing—
ca. 1740

LANDSCAPE HISTORY

Height of forest clearing and agriculture –
ca. 1830



LANDSCAPE HISTORY

Farm abandonment — ca.
1850



LANDSCAPE HISTORY

"Old-field" white pine forest on abandoned farmland – ca. 1910



LANDSCAPE HISTORY

"Old-field" white pine is succeeded by hardwoods – ca. 1915



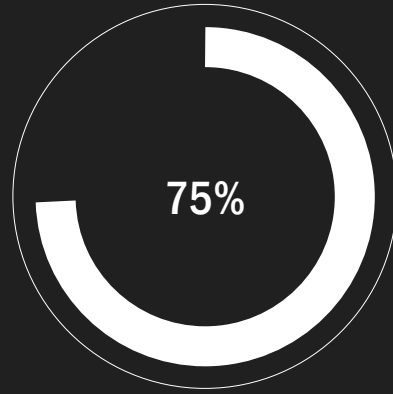
LANDSCAPE HISTORY



Vigorously growing forest of hardwoods – ca.
1930



FOREST COVER



5 DEVELOPED

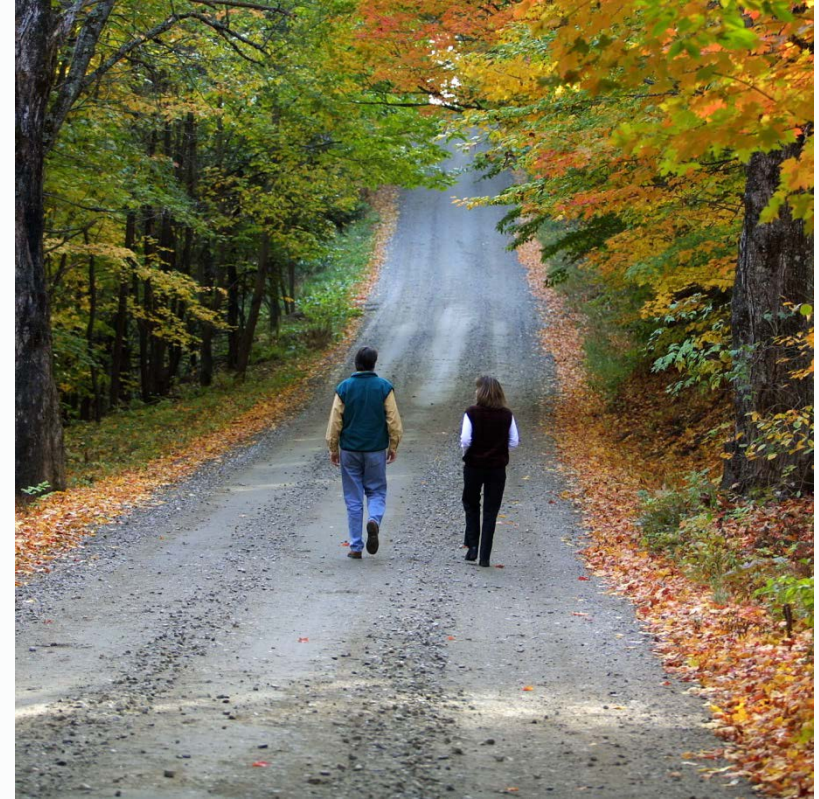
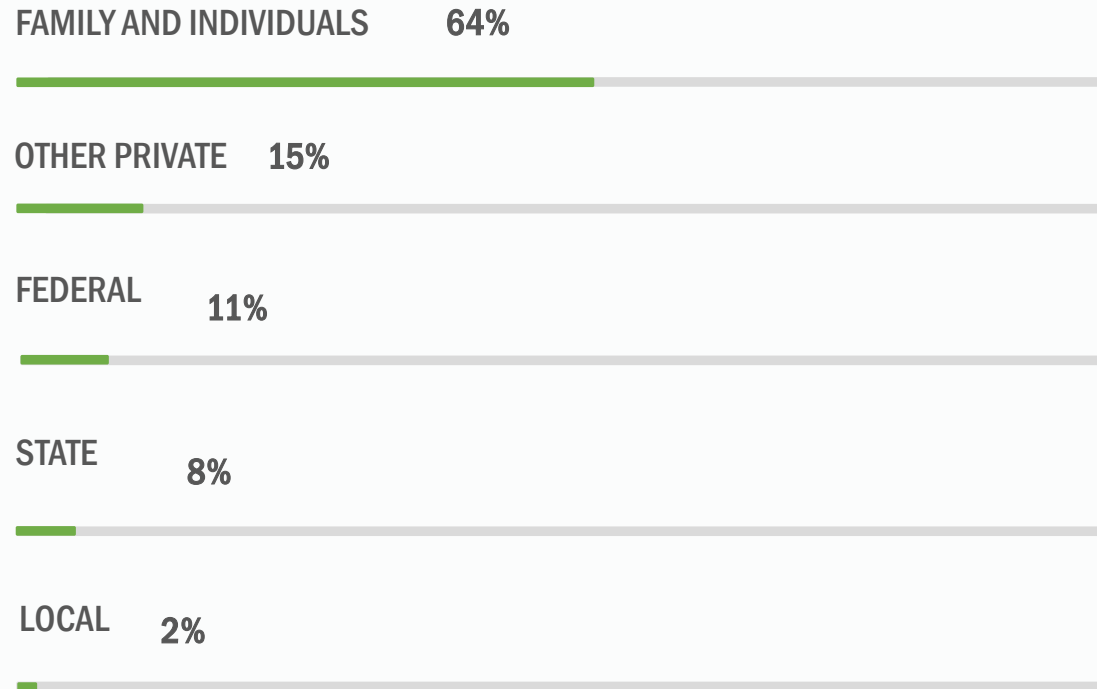
20 AGRICULTURE

75 FORESTED



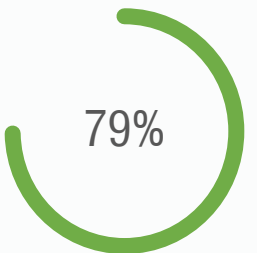
Future changes in Vermont's forestland base will depend on the pace of the land development, particularly in the northwestern and southern parts of the state.

OWNERSHIP OF FORESTS IN VERMONT

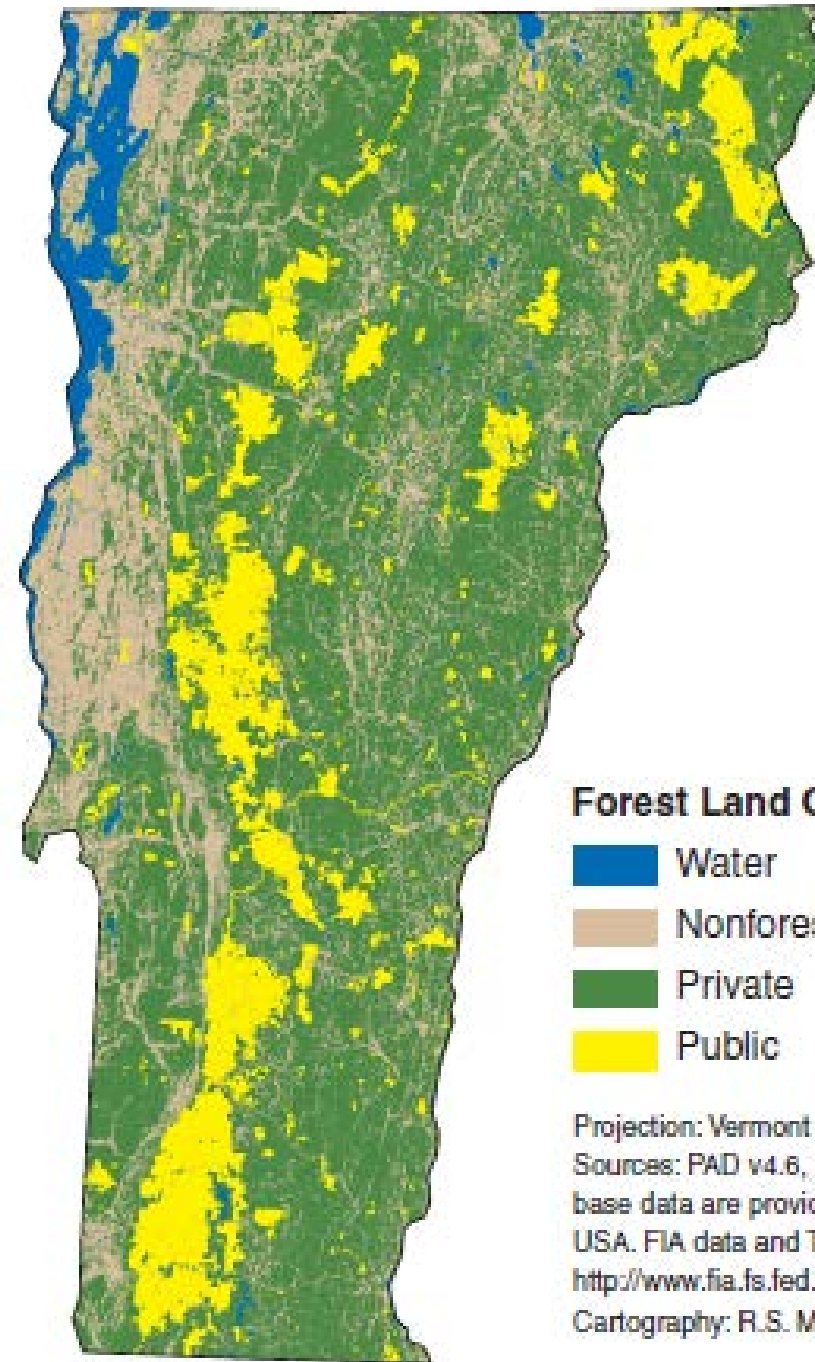


PRIVATE LANDOWNERS

own 3.6 million acres



FOREST COVER AND OWNERSHIP



Forest Land Ownership

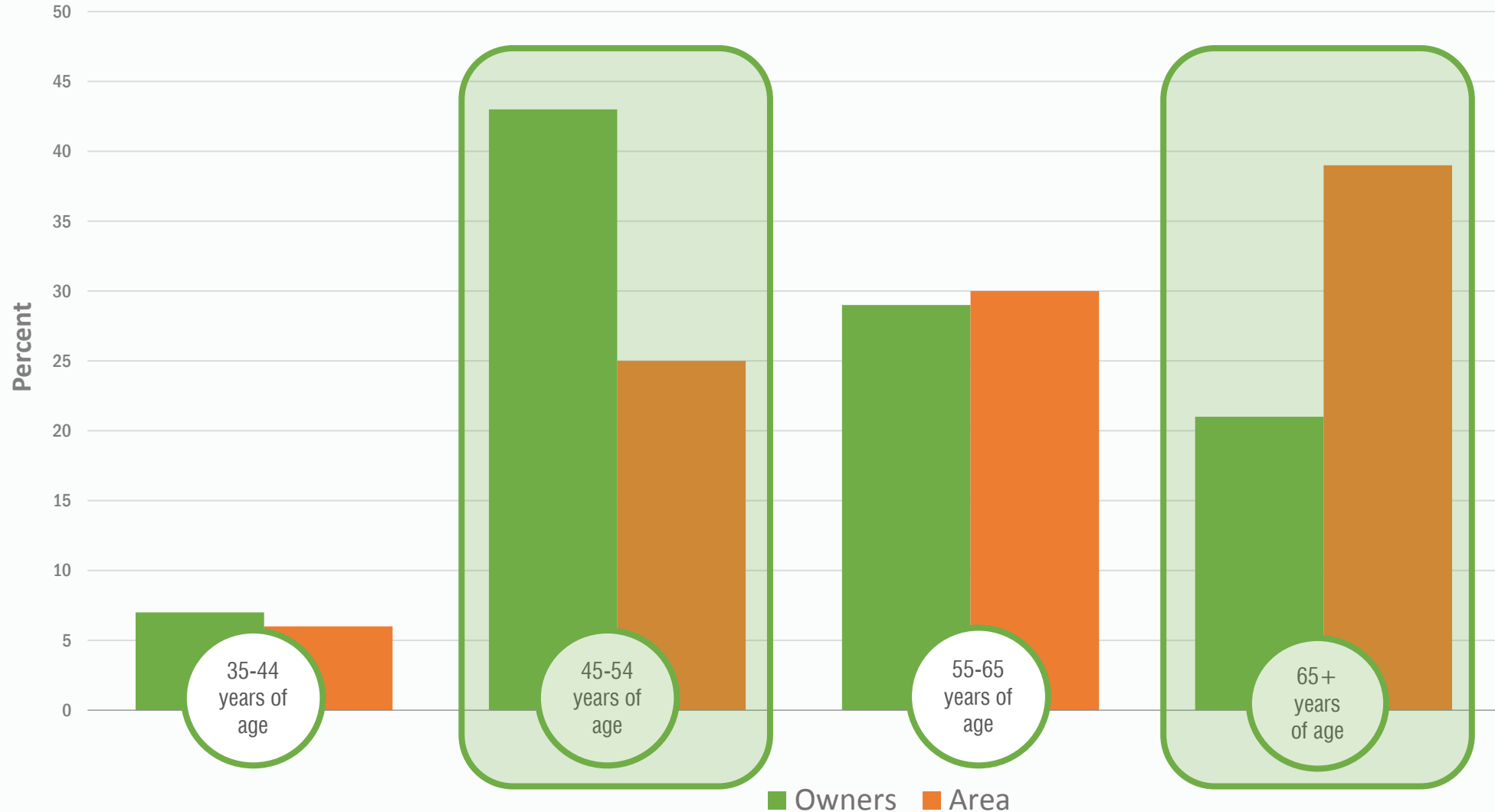
- Water
- Nonforest
- Private
- Public

Projection: Vermont State Plane, NAD83.

Sources: PAD v4.6, 2007. NLCD 2001. Geographic base data are provided by the National Atlas of the USA. FIA data and Tools are available online at <http://www.fia.fs.fed.us/tools-data/>

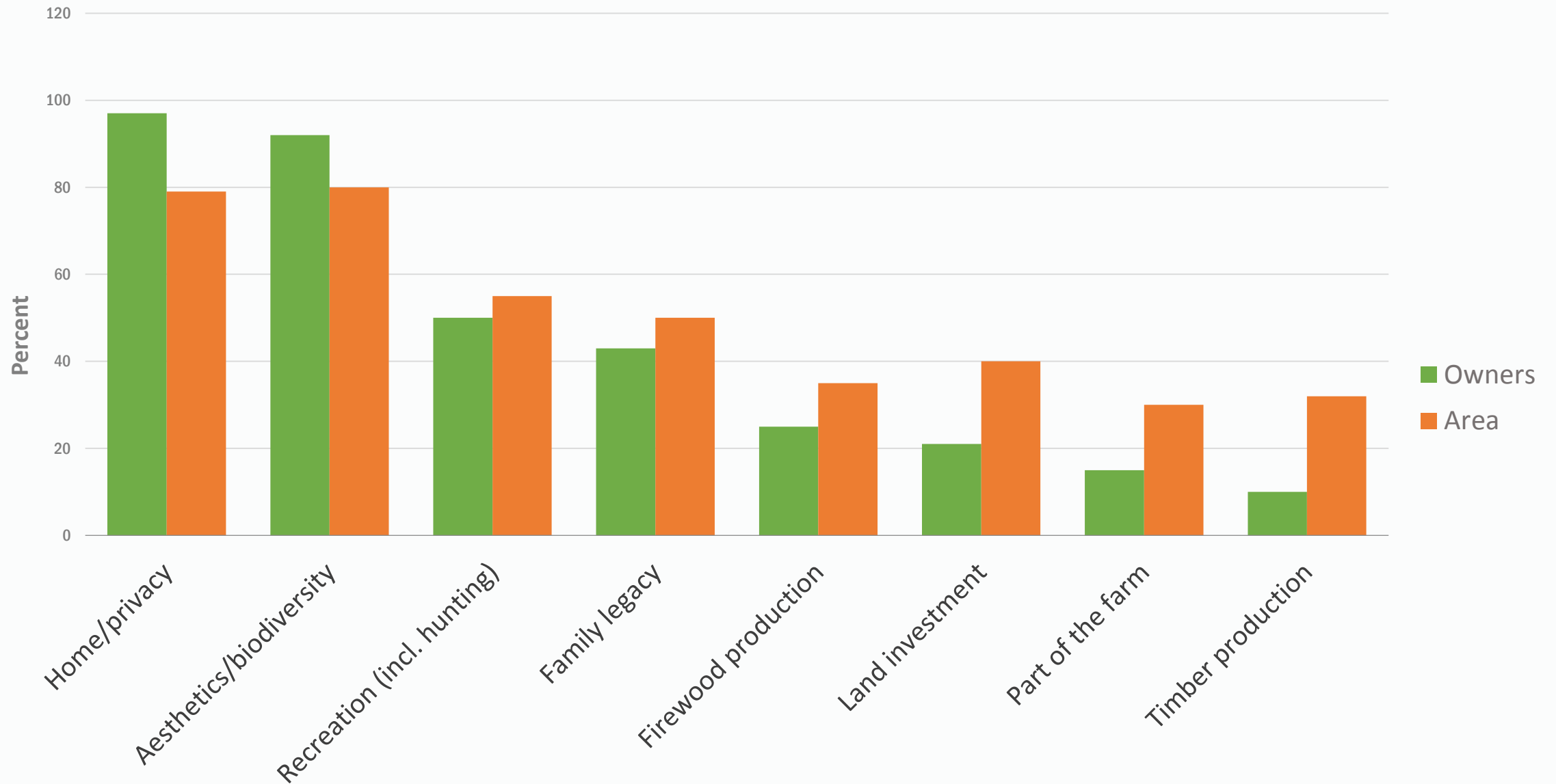
Cartography: R.S. Morin, Apr. 2011

AREA AND OWNERS OF VERMONT'S FORESTS BY AGE CLASS

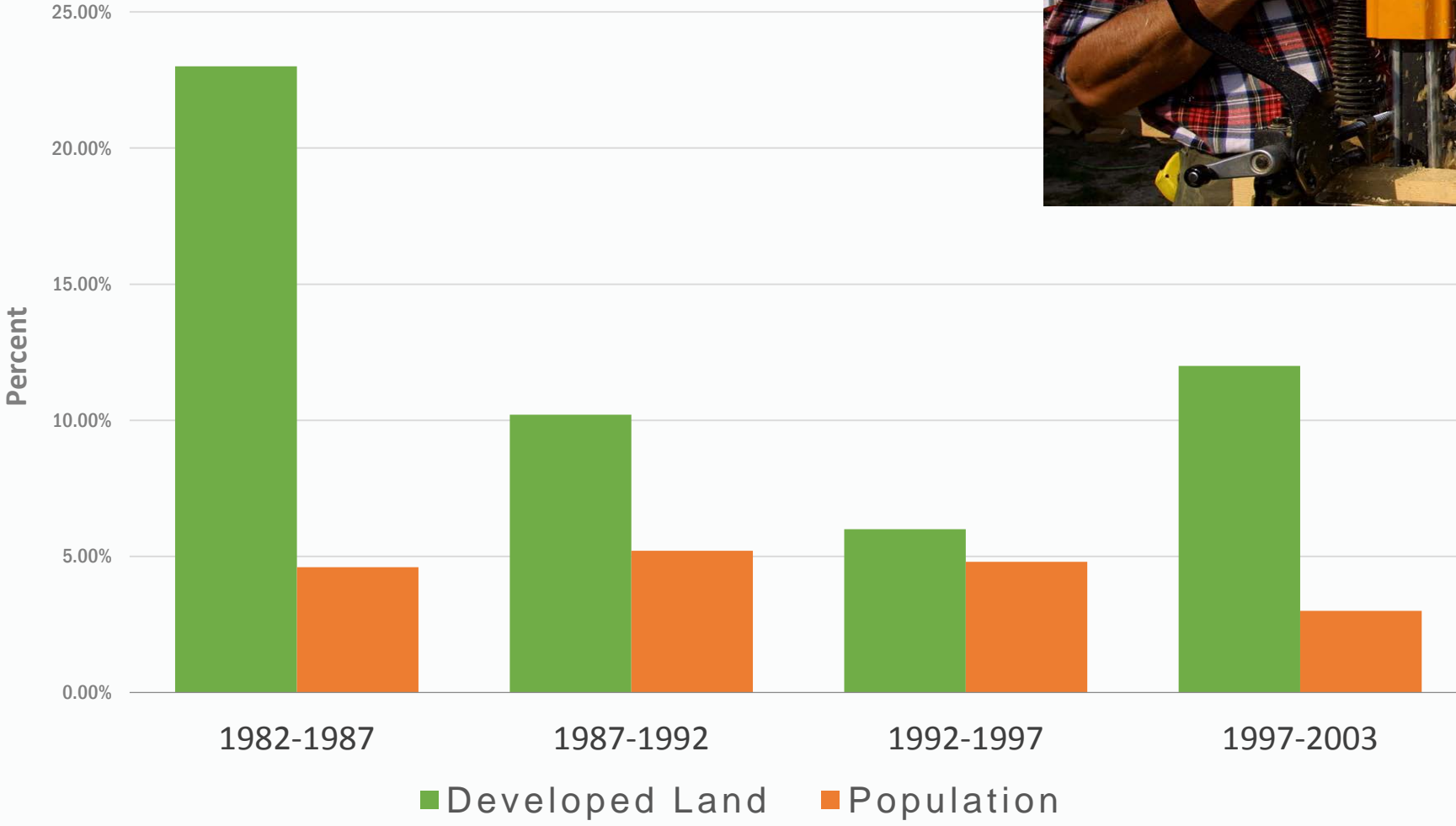


THE number of landowners is increasing, parcel sizes are decreasing and the age of owners is increasing.

AREA AND OWNERS OF FAMILY FORESTS BY REASON OF OWNING FORESTS



POPULATION AND HOUSING TRENDS



Rate of development
EXCEEDS rate of population

ALTHOUGH many municipalities value local forests, towns have **LIMITED PLANNING STRATEGIES** for addressing the maintenance of forestland



FOREST VALUES



VERMONT'S
FORESTS
WORK FOR ALL



Forest Products Economy

- \$1.4 billion in economic output to Vermont's economy
- Employs 10,555 people
- 8% of the state's manufacturing value



Economics of Scenery, Fall Foliage, Tourism and Recreation

- \$1.9 billion in annual sales from forest-based recreation
- 46% attributed to fall foliage
- 704 million in wildlife-based recreation activities
- 37,000 tourism jobs, accounts for 11.5% of state employment
- 10,050 forest-based recreation jobs
- 4,400 hunting and fishing jobs



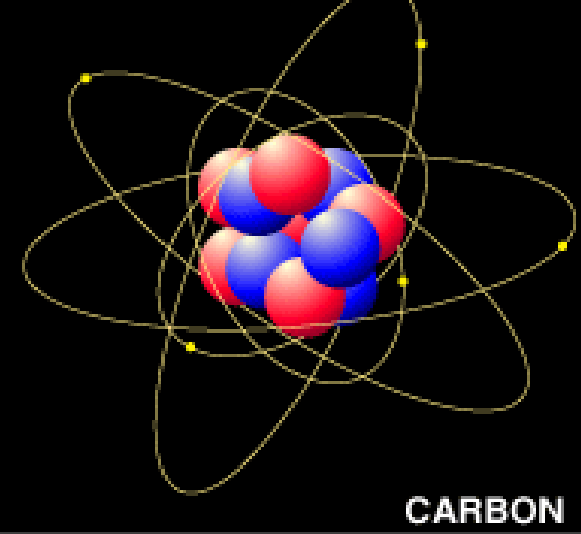
Flood Protection, Clean Water Supply, and Clean Air

- Tempers frequency, intensity, and extent of flooding
- Lowers peak flows and volumes of runoff
- Filters water's impurities
- Removes significant amount of fine particulate matter from the air
- Reduces the need for costly infrastructure to clean water and air



Wildlife and Biodiversity

- Food resources
- Cover including shelters and structures
- Shading and cooling efforts to temper moisture fluctuations
- Space to access food, breeding areas, and safe travel pathways
- Habitats to sustain diverse populations of plants and animals



Climate Change Mitigation

- Remove and store massive amounts of greenhouse gas emissions
- Sequester 8 MMTCO_{2e} per year, almost as much as our emissions
- \$16 million in air pollution removal

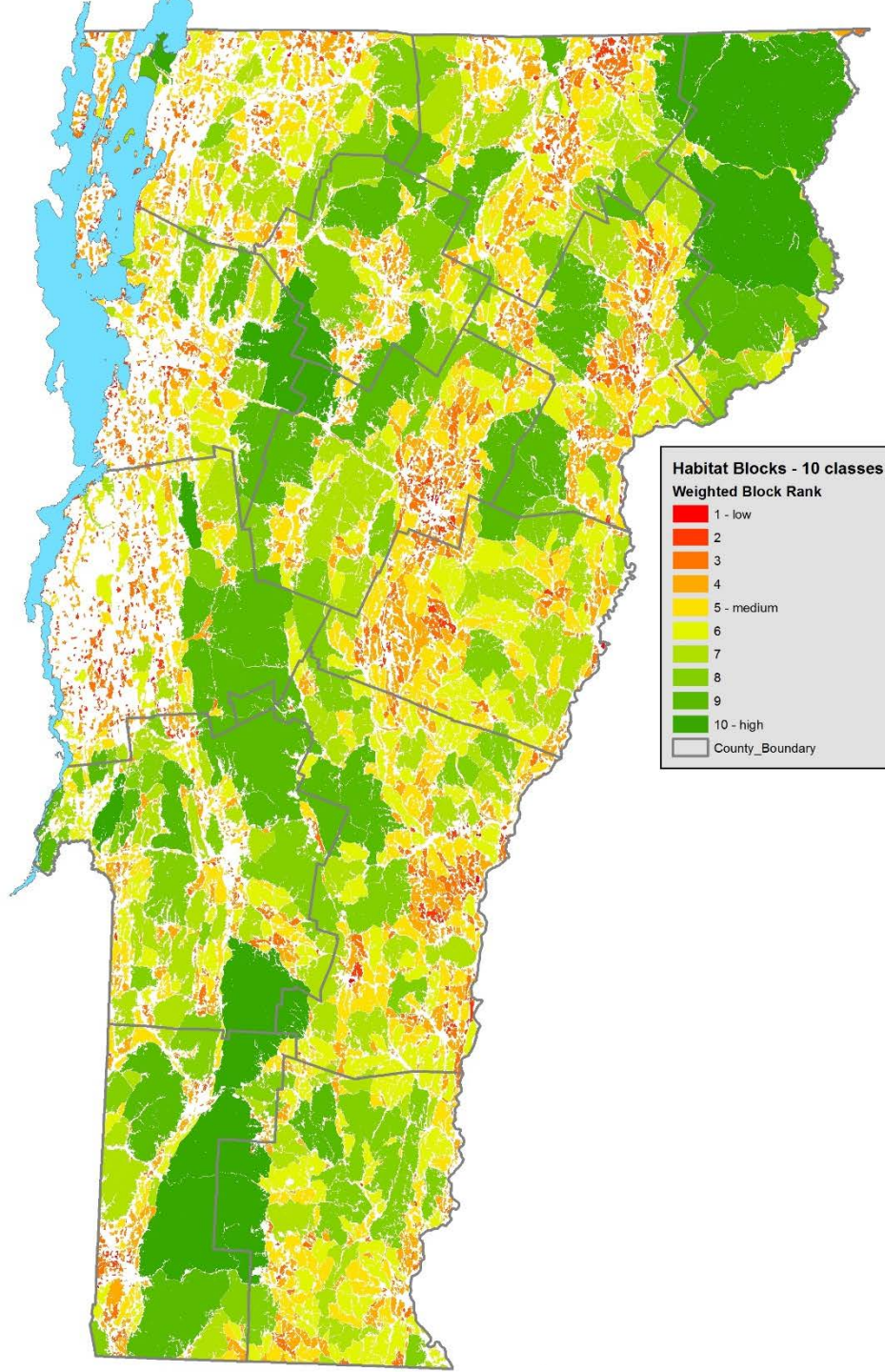


Human Health, Quality of Life, and Cultural Heritage

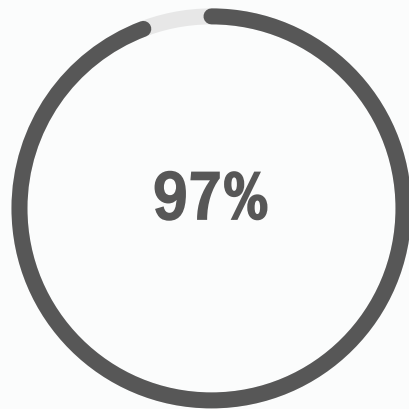
- Improve human health including improved mood, blood pressure, and immune system
- Contributes to quality of life
- Working landscape and recreation heritage is valued by Vermonters

FOREST BLOCKS

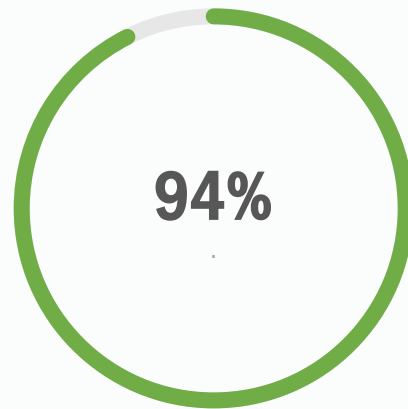
Large areas of contiguous forest and other natural habitats, often spanning multiple ownerships and frequently un-fragmented by roads, development, or agriculture. Vermont's forest blocks are primarily forests, but can also include wetlands, rivers and streams, lakes and ponds, cliffs, and rock outcrops.



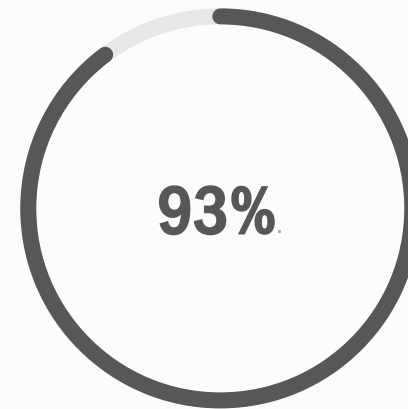
VERMONTERS SUPPORT THE WORKING LANDSCAPE



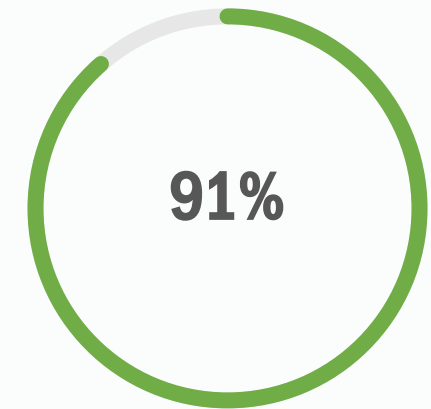
Value the working landscape and heritage



Proud of living in Vermont



Value Vermont's spirit of independence



Value the privacy in Vermont

FOREST HEALTH AND INTEGRITY

HEALTHY FORESTS

are highly resilient and capable of self-renewal. They maintain forest processes and are structurally complex, ecologically productive, and composed of diverse native plants and animals.



FOREST INTEGRITY

measures the ability to support and maintain biological communities, to support physical elements of the ecosystem, and to support ecological processes.

MAINTAINING FOREST INTEGRITY requires **connected forests** to facilitate mobility of organisms and grow capacity **to maintain forest health.**

FOREST FRAGMENTATION



"A Snapshot of the Northeastern Forests," USDA Forest Service publication, October 2005

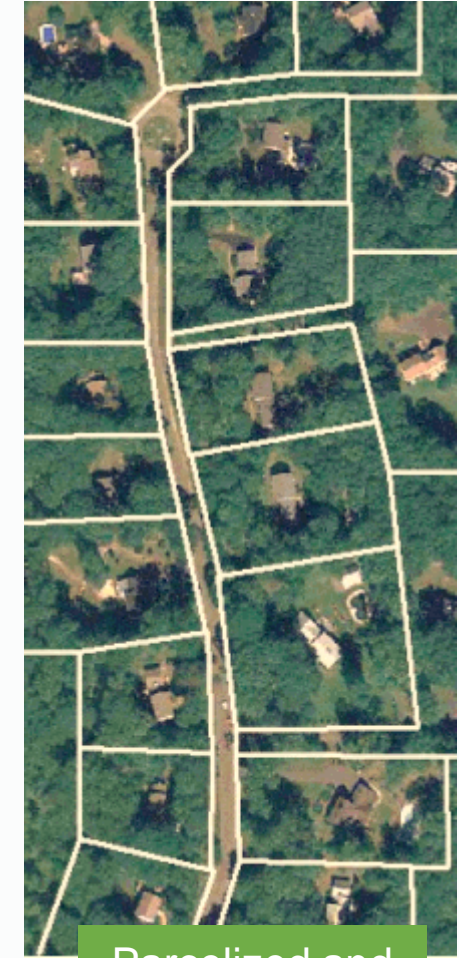
FOREST FRAGMENTATION TERMINOLOGY



Intact



Parcelized

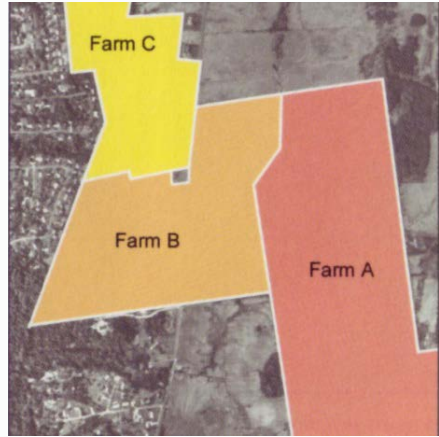


Parcelized and
Fragmented

FROM
ONE
TO
MANY
OWNERS



PARCELIZATION



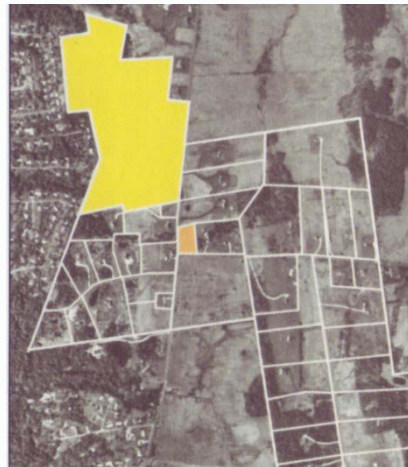
1950s



1960s



1970s



1980s



1990s

FRAGMENTATION



1966

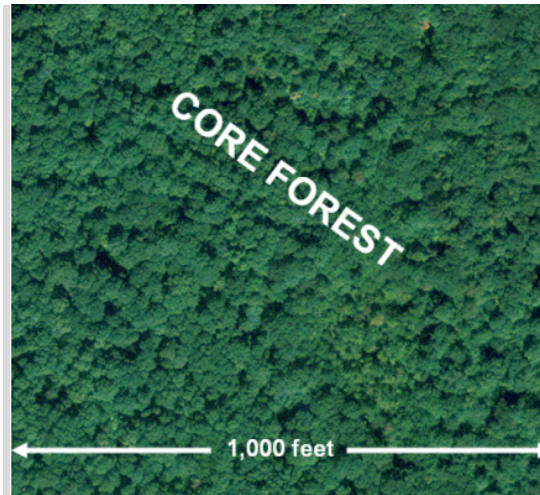


2003

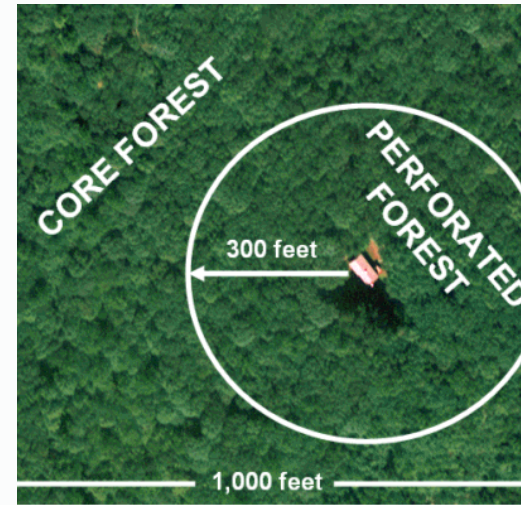
LANDSCAPE CHANGE OVER TIME



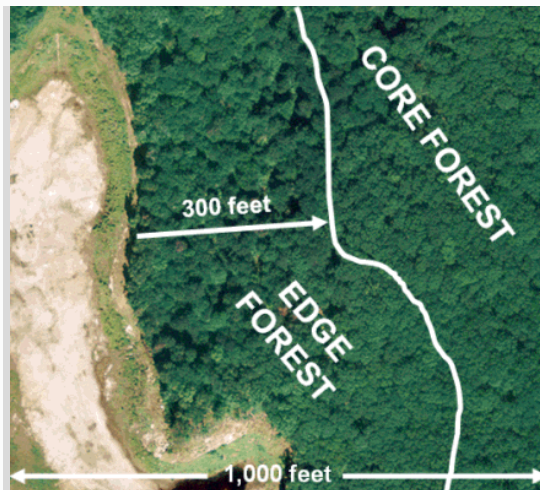
FOREST FRAGMENTATION CATEGORIES



Core Forest



Perforated Forest



Edge Forest



Patch Forest

DRIVERS OF FOREST PARCELIZATION AND FRAGMENTATION



PARCELIZATION



FRAGMENTTION



DRIVERS

- Escalating property values and land prices
- Increased property taxes
- Conveyance of land from aging landowners
- Exurbanization

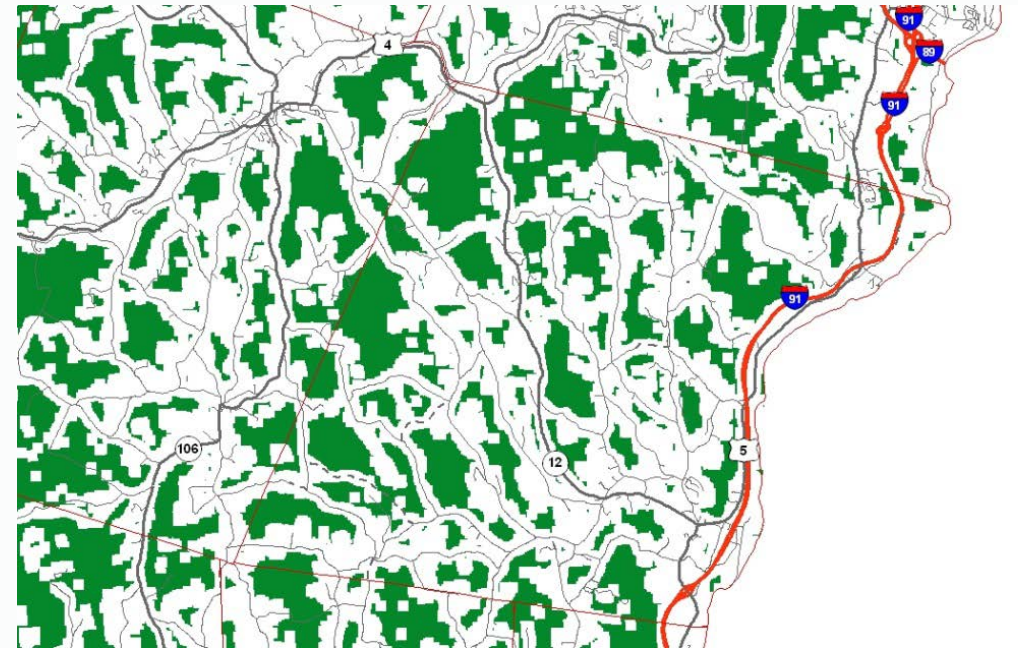
MECHANISMS OF FRAGMENTATION



PATTERNS MATTER

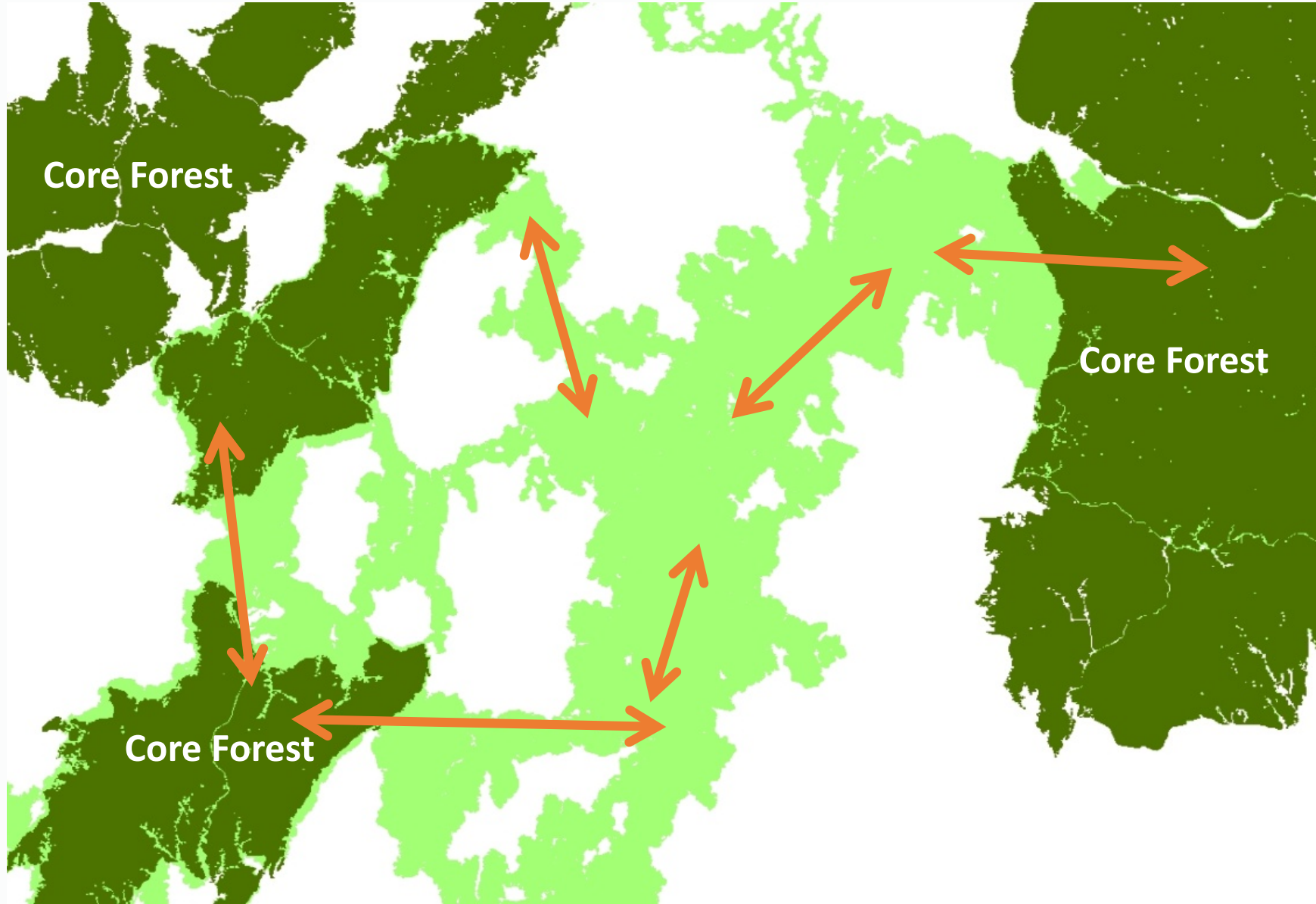


Less fragmented forest in rural community

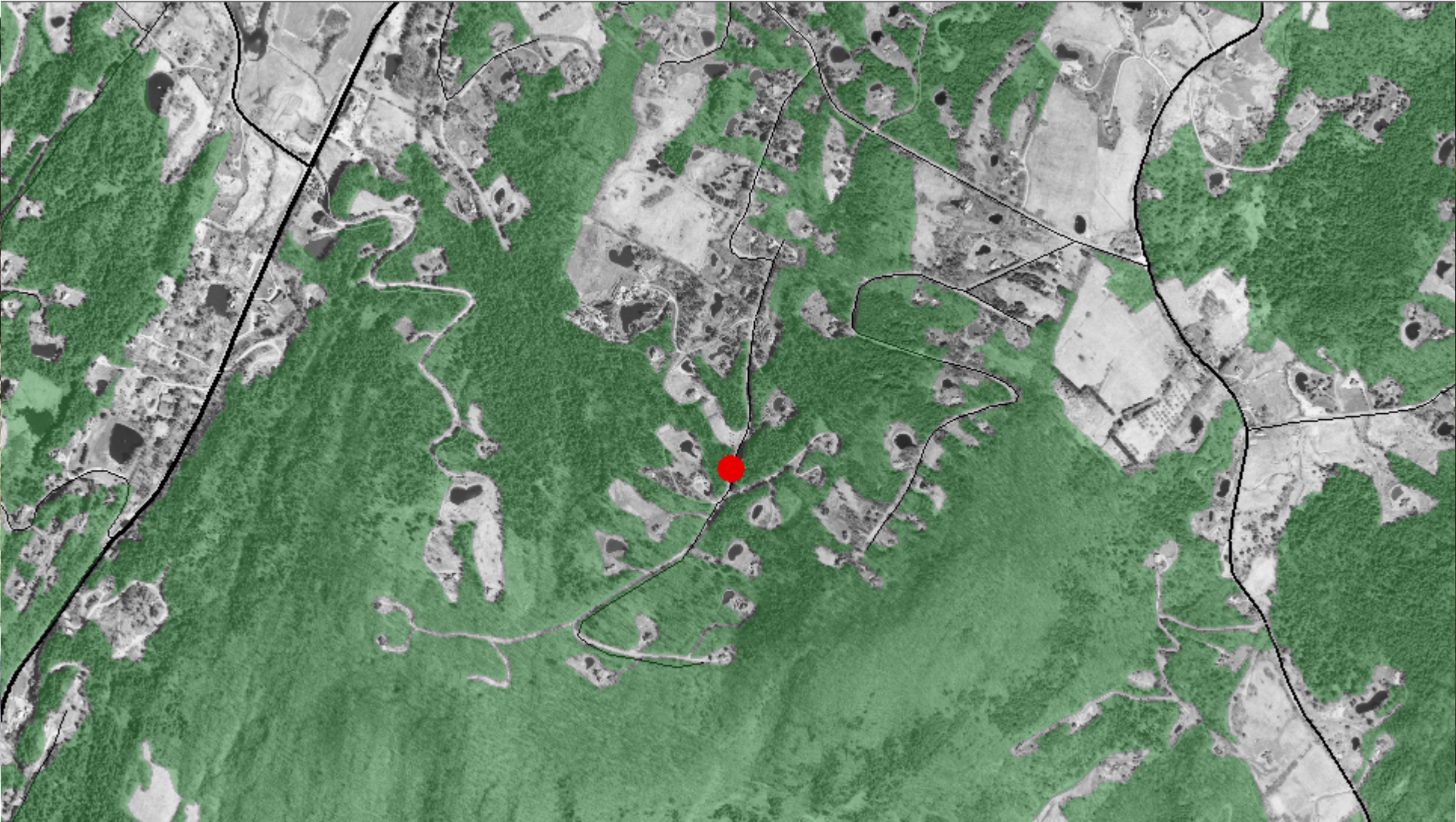


More intensely fragmented in a rural community

CONNECTIVITY



LOOKS WOODED FROM THE ROAD



2000

West Jamaica Road
Jamaica, VT



2003

West Jamaica Road
Jamaica, VT





EDGE
EFFECT



ISOLATION
EFFECT

IMPACTS AND EFFECTS OF FRAGMENTATION

Loss of biodiversity



Increase of incidence of invasive plants, pests, and pathogens



Reduces water quality



Reduces natural resilience

Impact to wildlife

IMPACTS OF FOREST FRAGMENTATION

Forest
products
economy



- Practicing forestry becomes operationally impractical, economically non-viable, and culturally unacceptable
- Continued flow of forest goods and services depends on maintained, healthy forests
- Dependent on private forestland for wood supply

IMPACTS OF FOREST FRAGMENTATION

Forest
products
economy

Scenery, fall
foliage,
tourism, and
recreation



- Degrades the recreational experience
- Increased likelihood of land-use conflicts
- Decline in public access to private lands for forest-based recreation including hunting and fishing

IMPACTS OF FOREST FRAGMENTATION

Forest products economy

Scenery, fall foliage, tourism, and recreation

Clean water and flood protection



- Less soil infiltration and water filtration
- Increased water flow and erosive power
- Transportation of sediments and pollutants
- Warming of water and discharge into streams
- Reduced groundwater recharge
- Deprivation of water for some areas by ditch interception
- Increased evaporation

IMPACTS OF FOREST FRAGMENTATION

Forest products economy

Scenery, fall foliage, tourism, and recreation

Clean water and flood protection

Clean air and climate mitigation



- Releases carbon stored in soils and vegetation
- Reduced capacity to sequester and store carbon
- Reduced capacity to filter fine particulates and other pollutants in the atmosphere
- Reduced capacity to buffer severe weather impacts

IMPACTS OF FOREST FRAGMENTATION

Forest products economy

Scenery, fall foliage, tourism, and recreation

Clean water and flood protection

Clean air and climate mitigation

Wildlife and biodiversity



Photo © Susan C. Morse

- Mortality from road construction and vehicle collisions
- Modification of animal behavior
- Impacts interior-dependent species like salamanders, goshawks, bats, and flying squirrels
- Disruption of the physical environment
- Alteration of the chemical environment
- Spread of exotic species

IMPACTS OF FOREST FRAGMENTATION

Forest products economy

Scenery, Fall Foliage, Tourism, and Recreation

Clean water and flood protection

Clean air and climate mitigation

Wildlife and biodiversity

Human health, quality of life, and cultural heritage



- Reduces human health benefits from forests
- Increased incidence of Lyme disease
- Loss of rural nature valued by Vermonters
- Threatens the cultural underpinnings of what makes Vermont indeed Vermont



FUTURE OF VERMONT'S FORESTS

Livable communities, functioning natural systems, and quality of life rely on maintaining large blocks of contiguous forests across Vermont's landscape.

**Decisions and actions
made today will
influence Vermont's
forests for years to
come.**

POLICY OPTIONS

■ EDUCATION AND OUTREACH

■ CONSERVATION

■ LANDOWNER INCENTIVES

■ LAND USE PLANNING

■ SUSTAINABLE FORESTRY AND
VERMONT FOREST ECONOMY



The people of Vermont have much to gain from building on recent progress by recommitting to land conservation, re-visioning land-use planning and policy efforts, and promoting a sustainable forest economy.

EDUCATION AND OUTREACH

County Foresters

Forest Roundtable



The state has a network of existing outreach and service providers that already deliver this message

Tools for tracking forest land-use change

Increasing our education and outreach to Vermont's forest landowners

Engagement with schoolchildren



Staying Connected

Vermont Farm and Forest Viability Program

CONSERVATION

INCREASE

the economic benefits that flow to landowners who maintain forestland in large continuous blocks



ENHANCED FOREST CONSERVATION

- Strategic conservation projects
- Investments that facilitate the intergenerational transfer of large blocks of forestland

PARCELS THAT ARE

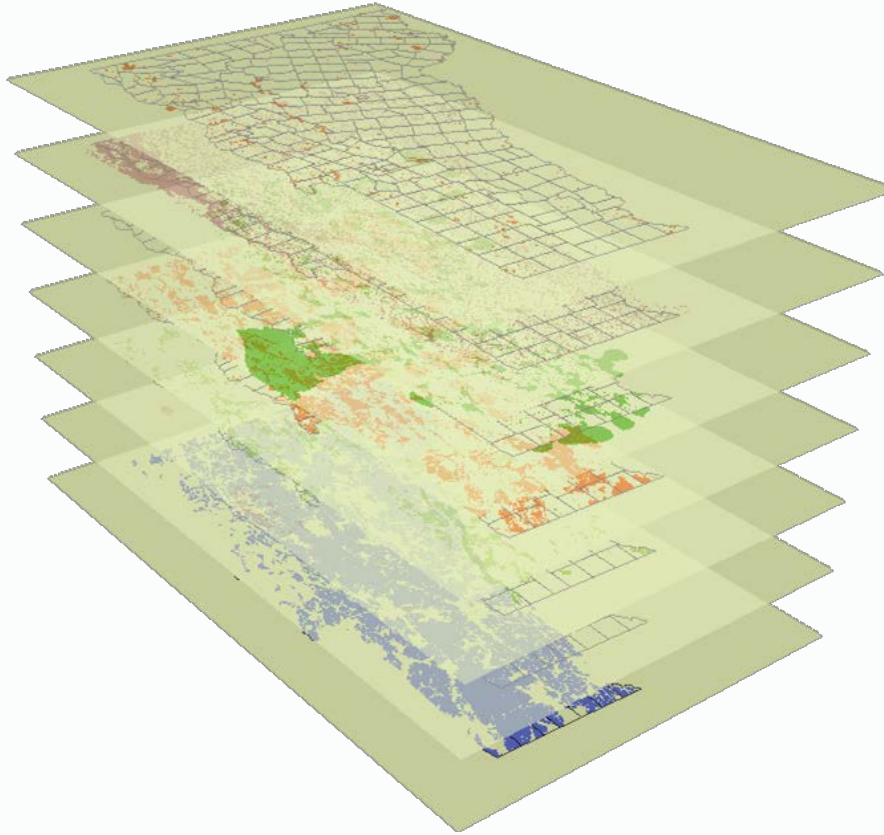
Located within or adjacent to existing blocks conserved of forestland • Rank high in Forest Block Assessment • Meet US Forest Service Working Forest Legacy goals • Provide important climate adaptation and regional connectivity functions • Provide a high level of ecosystem services



LANDOWNER INCENTIVES

- Maintaining Use Value Appraisal (Current Use)**
- Lessen the impact of estate taxes and provide succession planning**
- Monetizing ecosystem services**

LAND-USE PLANNING



- **Local Land-Use Planning Tools and Strategies**
- **Section 248 and Forest Fragmentation Consideration**
- **Act 250 Updates for Forest Integrity**

SUPPORT Vermont's historic settlement pattern of compact communities surrounded by working farms and forest blocks with modernized land-use strategies that include a focus on forest integrity



Create new markets within the industry and beyond Vermont

Develop local markets



Sustain a viable workforce

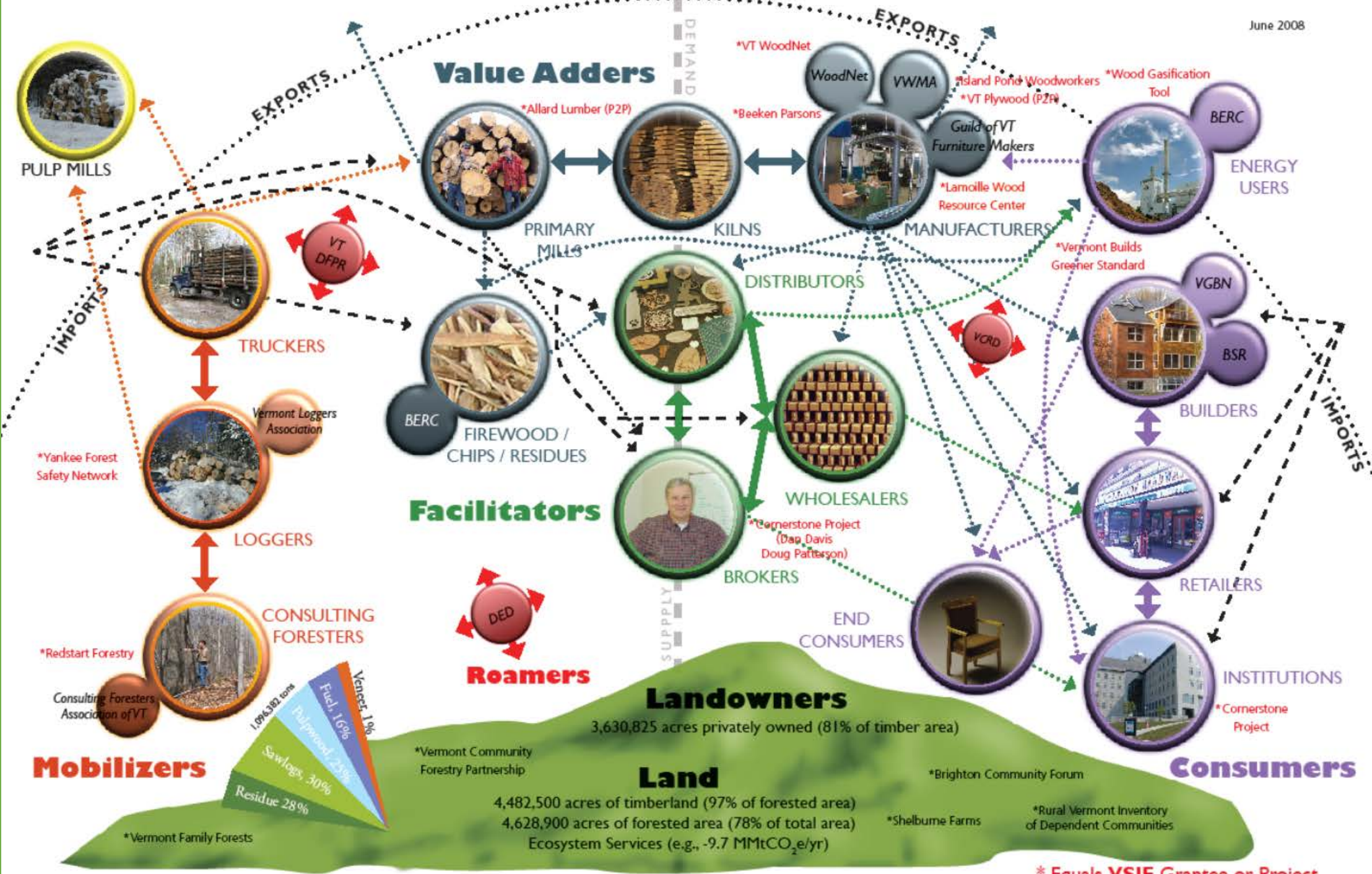


Working Land Enterprise Initiative

SUPPORT SUSTAINABLE FORESTRY AND VERMONT FOREST ECONOMY

ENSURE that forest landowners can get economic value from their forested land through policies that promote sustainable forestry and develop and create markets for Vermont forest products

FOREST ECONOMY SYSTEM ANALYSIS



* Equals VSJF Grantee or Project

FINAL RECOMMENDATION

Stakeholder process to evaluate
policy options and recommend
strategies to support forest integrity



“

To keep every cog and wheel is the
first precaution of intelligent tinkering.

”

Aldo Leopold





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THANK YOU