# VERMONT'S ECOLOGY AND ENVIRONMENT

## An introduction to town planning for natural resources

VERMONT
AGENCY OF NATURAL RESOURCES

Agency of Natural Resources

# About the Training

## Caring for Natural Resources:

**Vermont's Ecology and Environment**

provides the scientific concepts and context behind the natural resources planning issues we face.

## Caring for Natural Resources:

**Taking Action In Your Community**

will show how to bring these natural resource issues into land use planning at the municipal and regional levels through real case studies.

# Outline

**Context**

- Historical and Current
- Social, Economic, Ecological

**Ecology & Scale**

- Landscape, Community, Fine

**Whole Communities**

- The Planning Process
- Tools in moving forward

# Public Trust

We **ALL** have a share in wildlife and water resources

# What is Conservation?

*Conservation is a state of harmony between men and land. By land is meant all of the things on, over, or in the earth…Its parts, like our own parts, compete with each other and co-operate with each other. The competitions are as much a part of the inner workings as the co-operations. You can regulate them – cautiously – but not abolish them.*

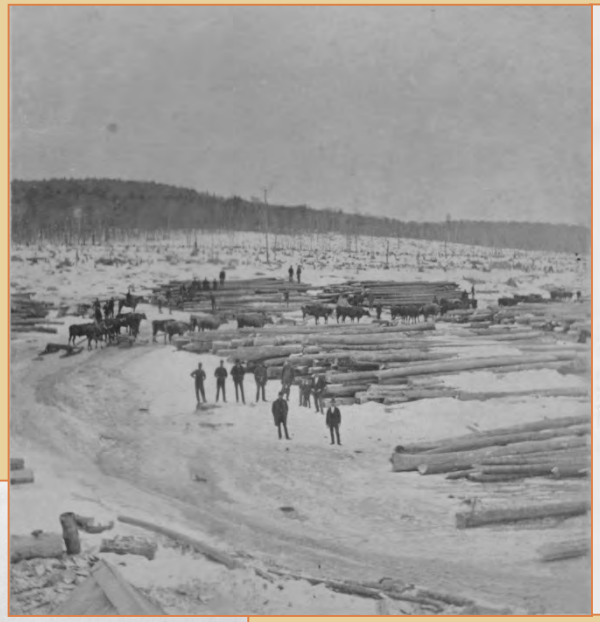
**~ Aldo Leopold, "Conservation" Round River, 1953, pp. 145**

# Vermont's Natural History

Canaan, VT 1915

# Resources Create Economy

## Fur Trade
## Logging

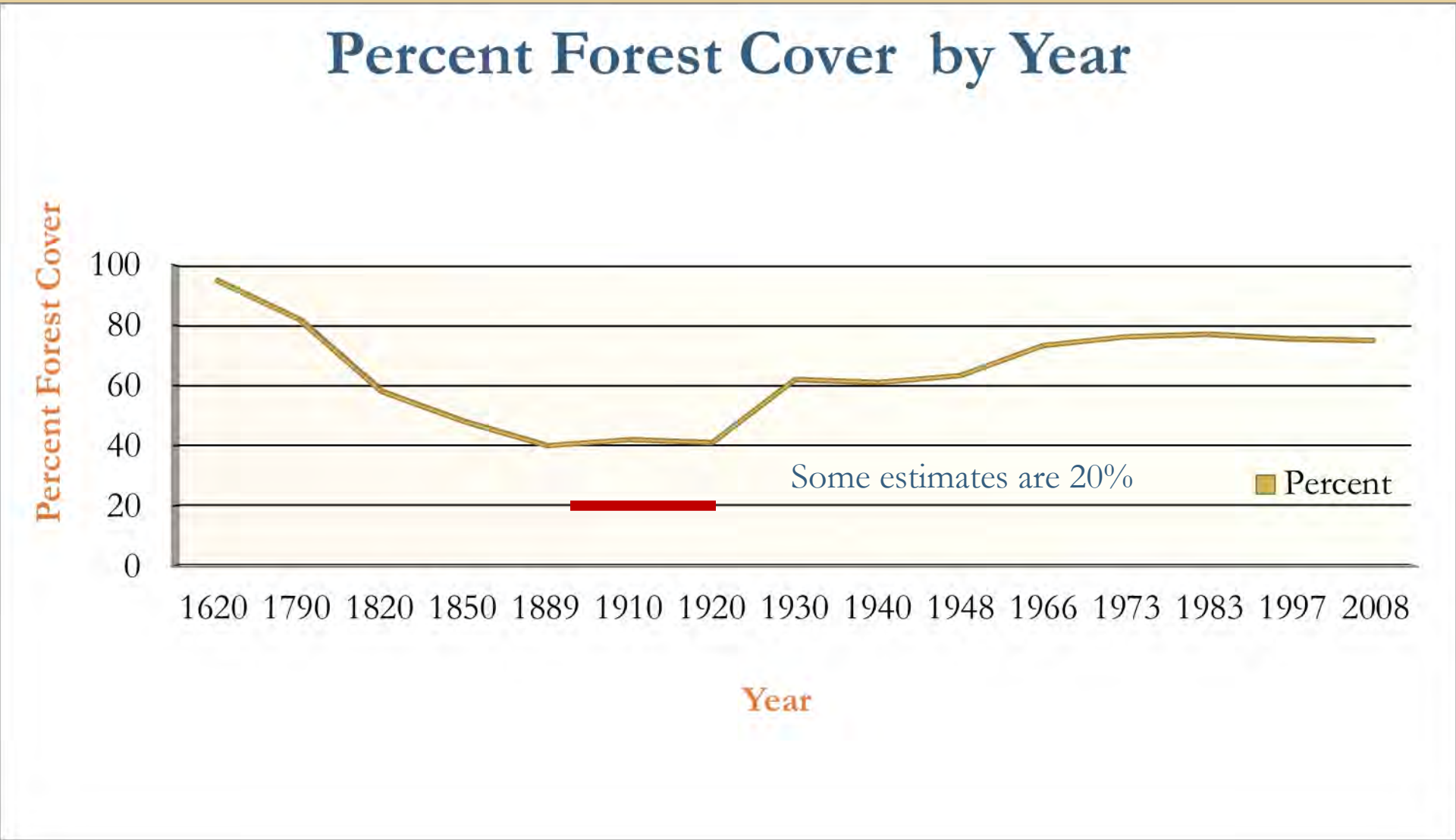


GROUP OF SPANISH MERINO SHEEP.

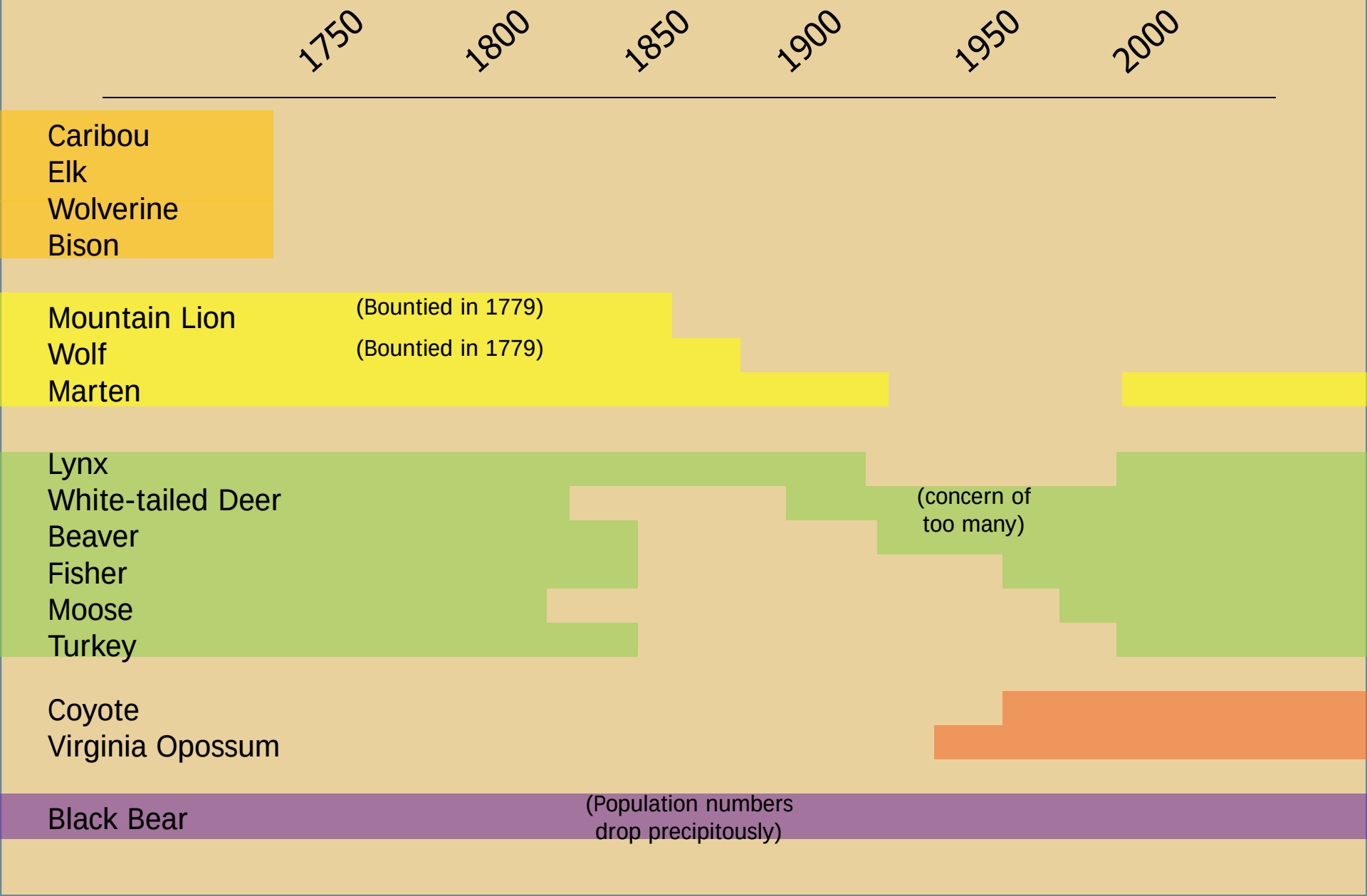
## Economy turned to Agriculture

- 1820 – 1850: Sheep Era
- 1850 – 1900: Dairy Butter and Cheese

# Today Vermont is 76% Forested

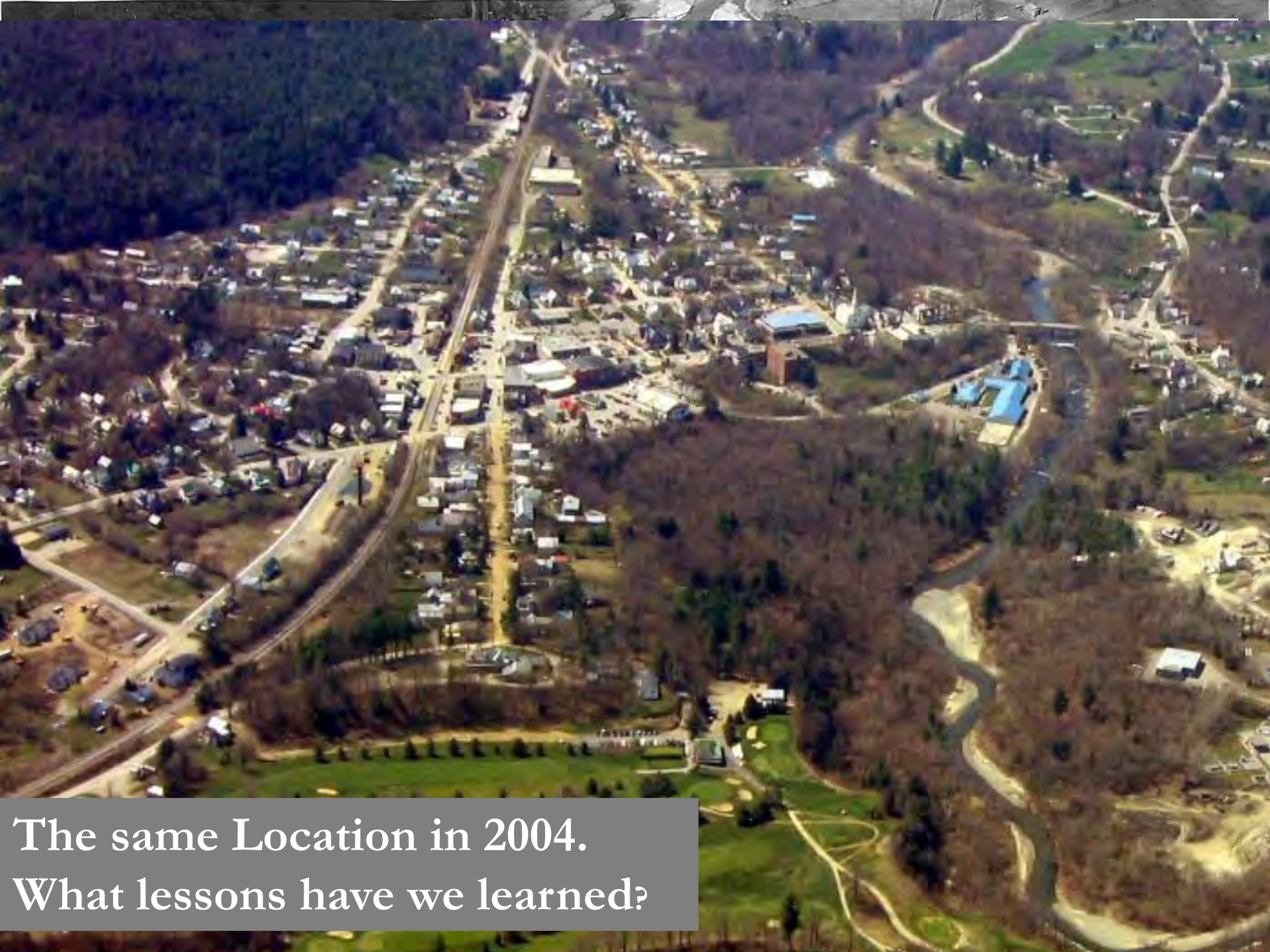


# Wildlife History



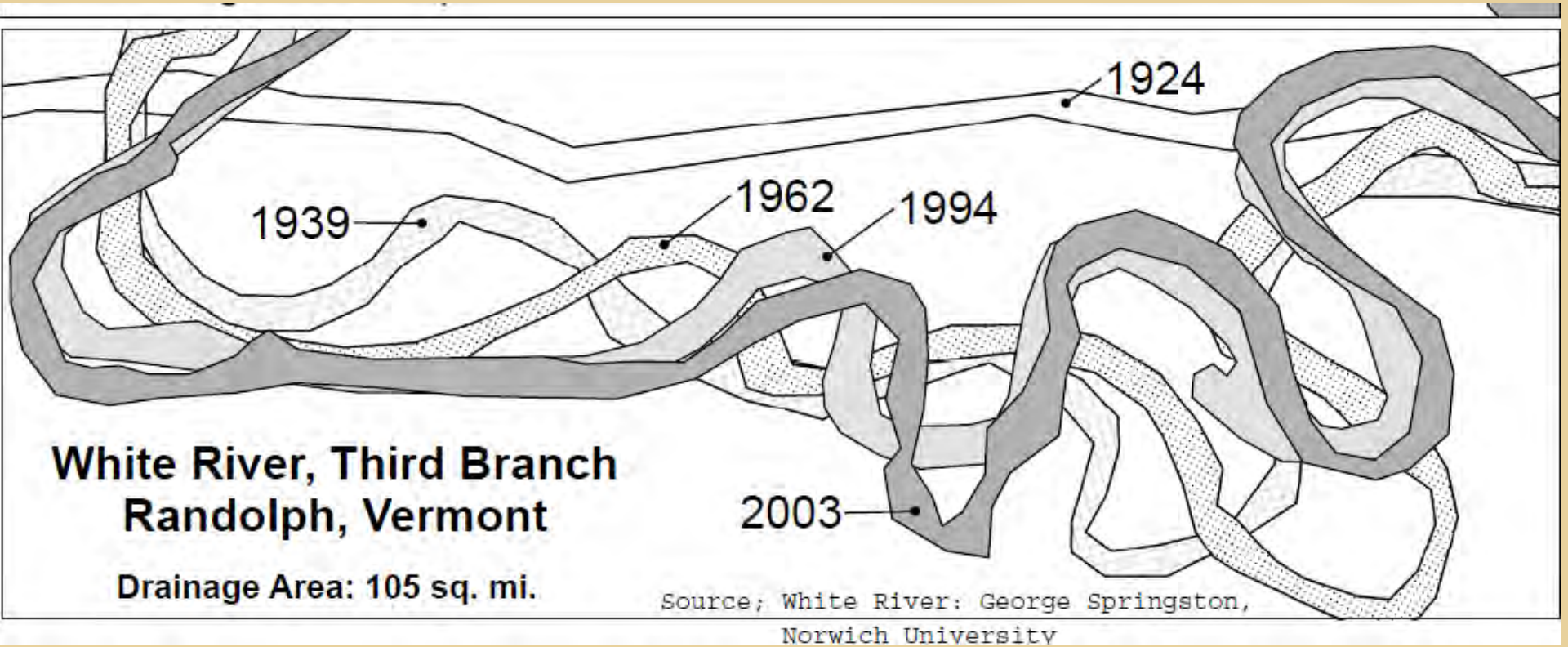
# Erosion and Flooding follow Deforestation

Above: Bradford 1896 Below: Bradford 1913



The same Location in 2004.
What lessons have we learned?

# Stable Does Not Mean Static!



# Forest Cover Across the State

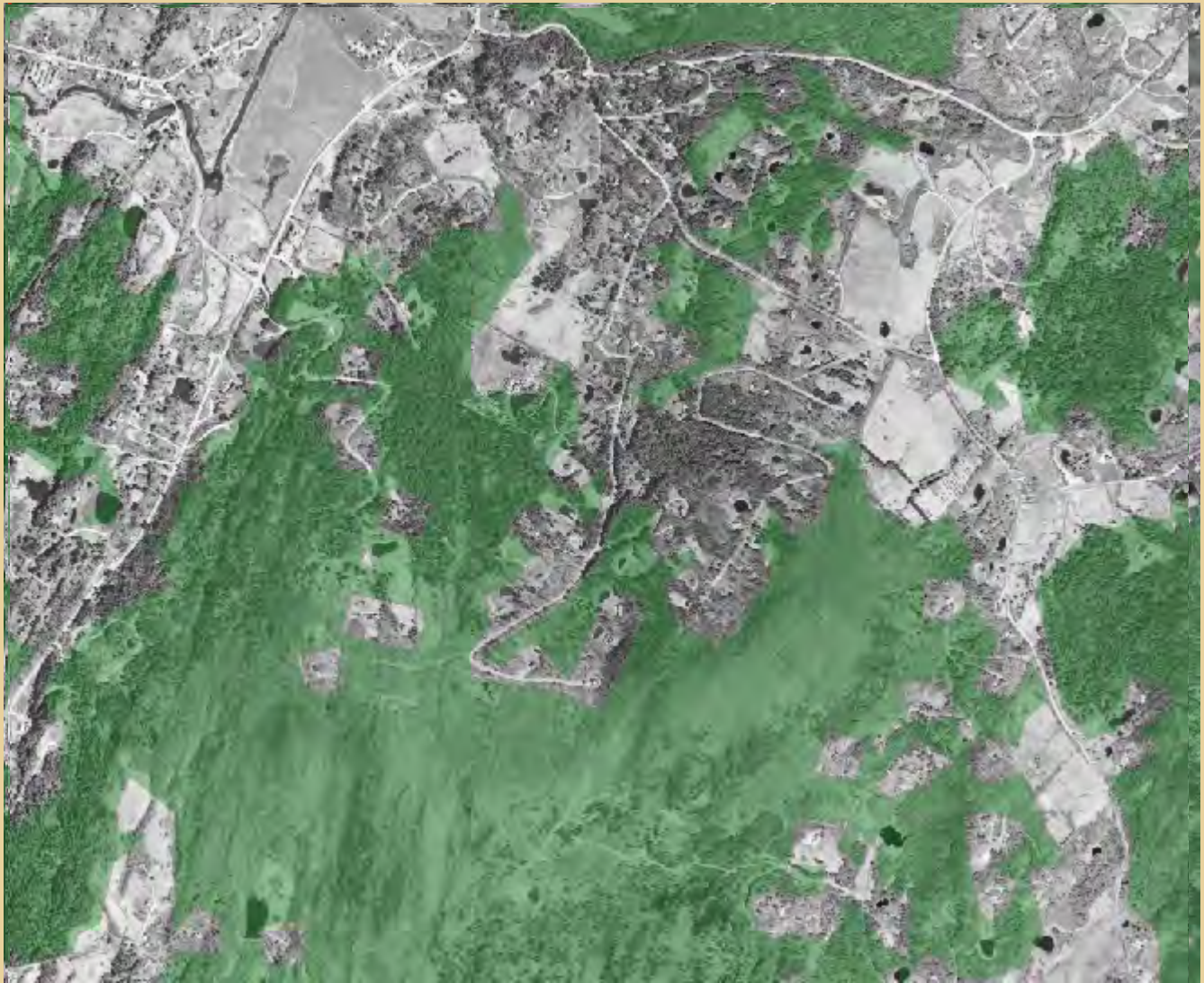
Forest (71%)
Non-Forest (21%)
Water (8%)

# Losing Forest

- Vermont designated one of "America's most endangered places."
- Rate of development is 2.5 times rate of population growth.
- 1997 - 2007, **75 square miles** were developed in VT (7X the area of Burlington).
  *Vermonters for a Sustainable Population*

# Losing *FOREST*, if not *TREES*

1974 – Forest cover



# Changing Growth Patterns

**St. Albans Vermont, 2002**

"Photo from Above and Beyond."
Campoli, J., Humstone, E.,
& MacLean, A. 2002.

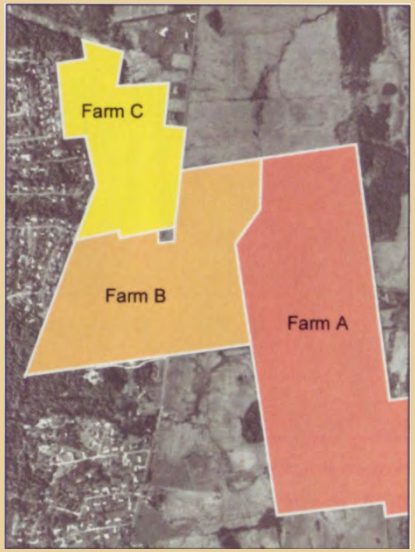
# Sprawl

Dispersed, auto-dependent development outside of compact urban and village centers, along highways, and in rural countryside.

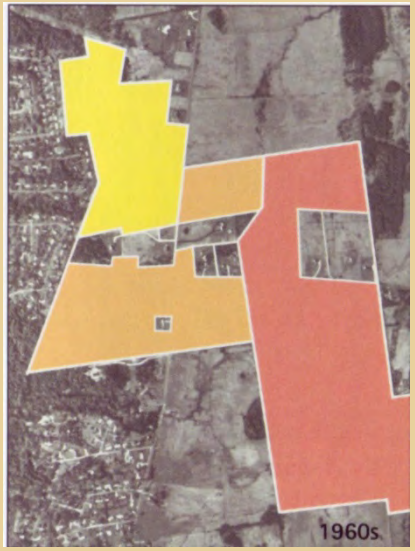
**(SmartGrowth Vermont)**

"Photos from Above and Beyond." Campoli, J., Humstone, E., & MacLean, A. 2002.

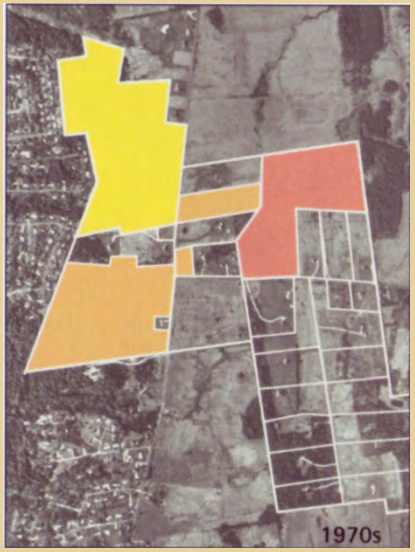
# Parcelization



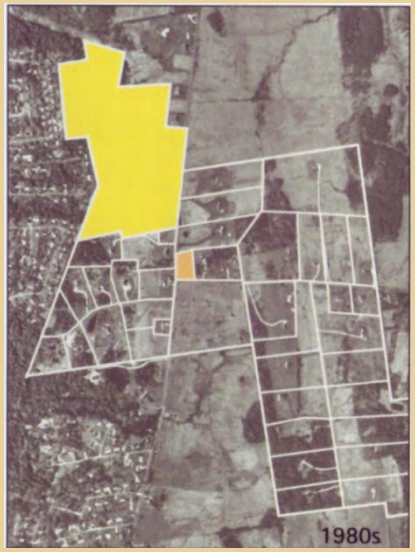

**1950s**




**1960s**




**1970s**




**1980s**

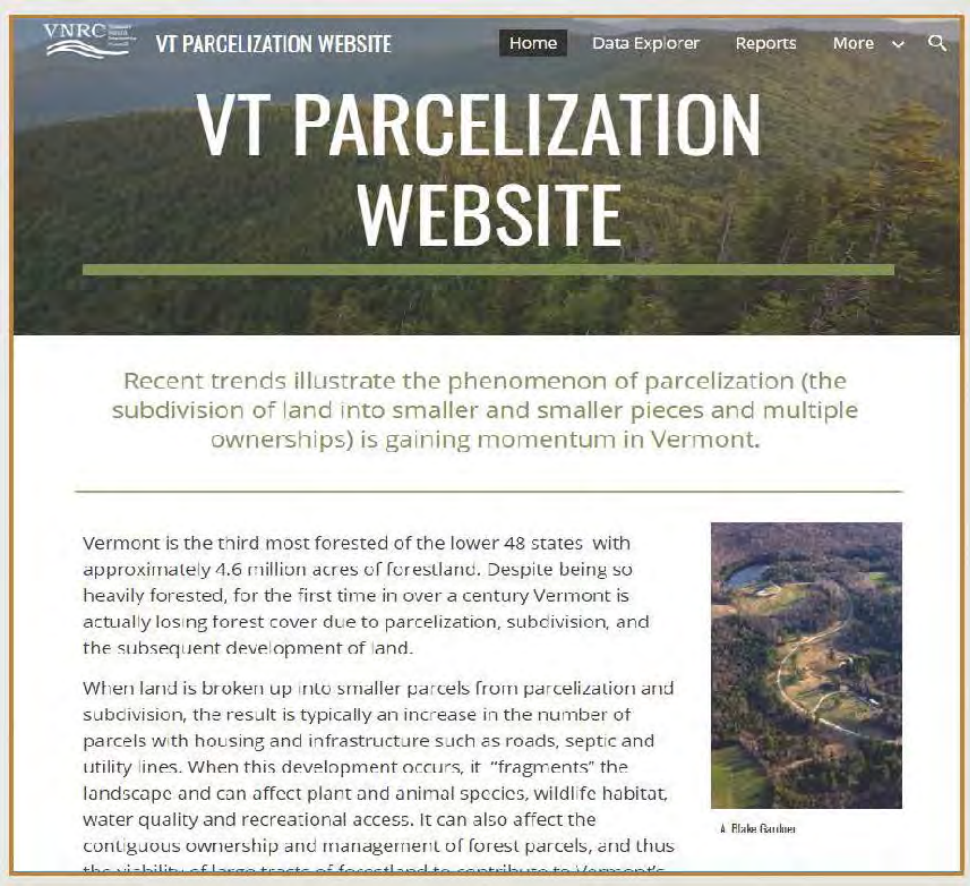

**1990s**

"Above and Beyond: " 2002. Campoli, J., Humstone, E., & MacLean, A. Planners Press. Chicago, Illinois.

# Parcelization Website

Available at: [vtforesttrends.vnrc.org](vtforesttrends.vnrc.org)

- Explore parcelization data at the town, county, regional, or statewide level using different tools.
- Generate geographically-specific reports.
- Download raw data.
- Download parcilization reports.



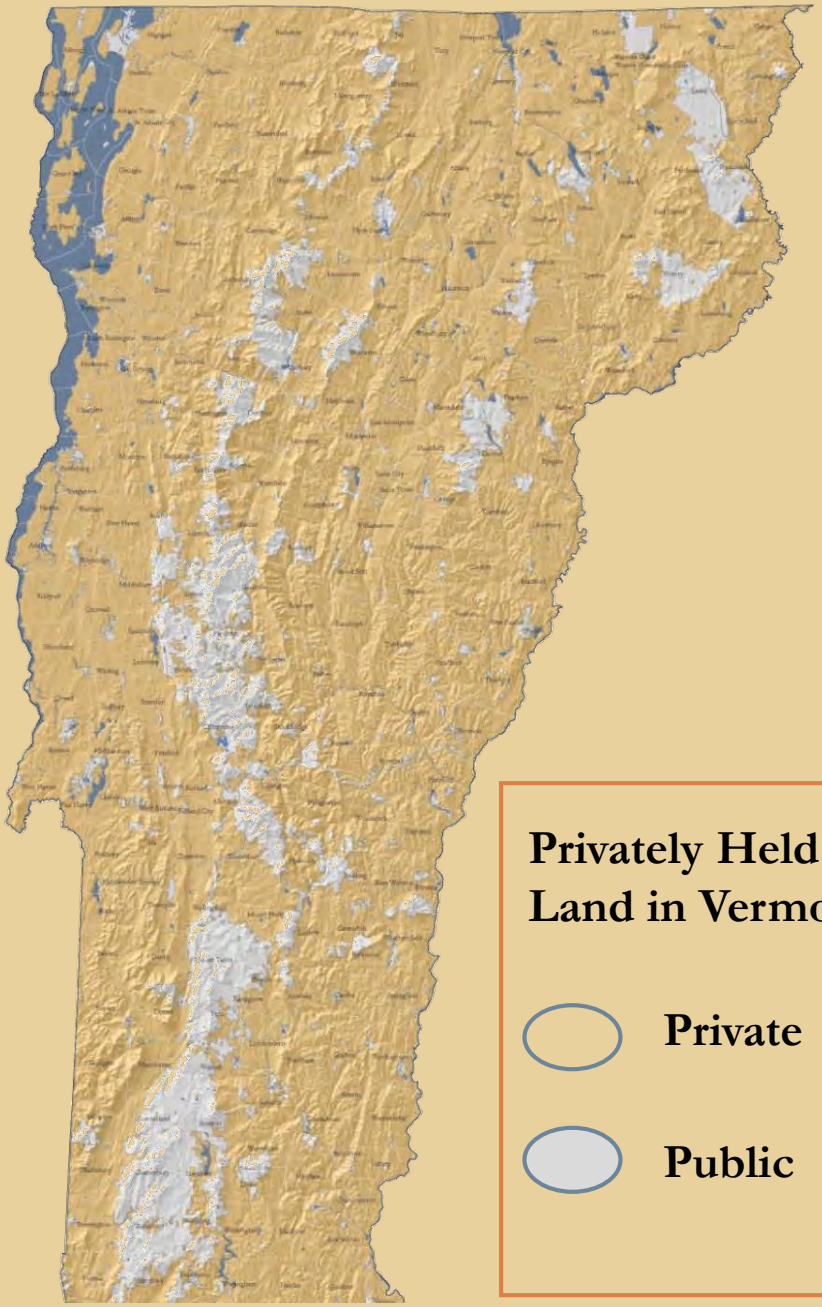
# Parcelization & Fragmentation

- Residential development is occurring at low densities in rural areas
- Not in compact existing centers or planned growth centers
- 4 out of 381 subdivisions trigger Act 250

# Land-based Culture?

- Fewer jobs tied to the land
- Land based economy has shifted to tourism and recreation

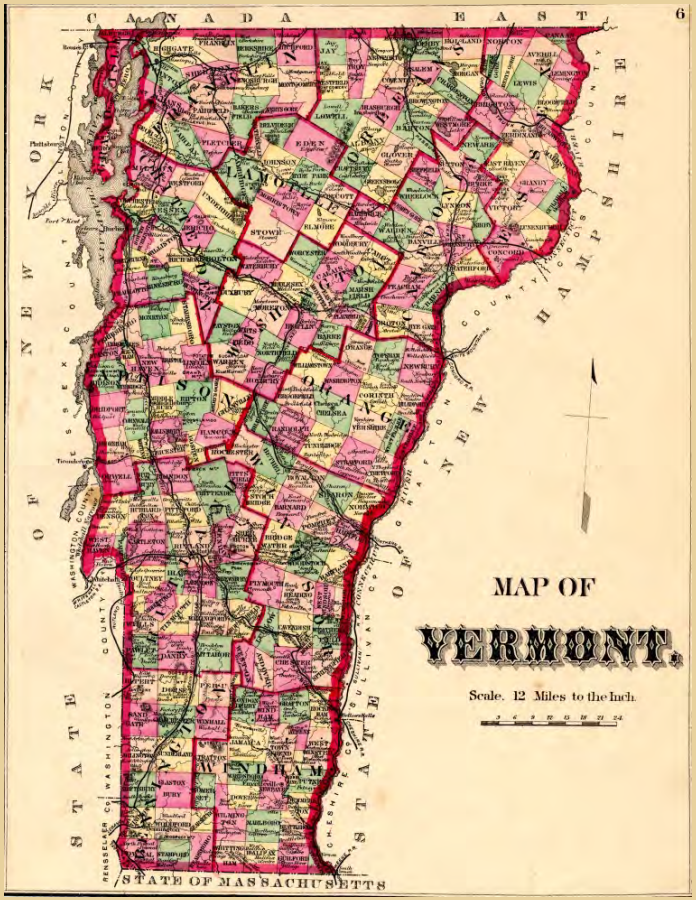
"Church Supper" 1933 by Paul Sample



**Privately Held Land in Vermont**

**Private**

**Public**




# 81% of Land in Vermont is Privately Owned

# Auto Dependent Employment

- 625,741 people in VT
- 67.9% or 424,899 Vermonters are in the workforce
- Of the working Vermonters 75% or 318,600 drive alone
- Most drive 10 – 25 miles each way

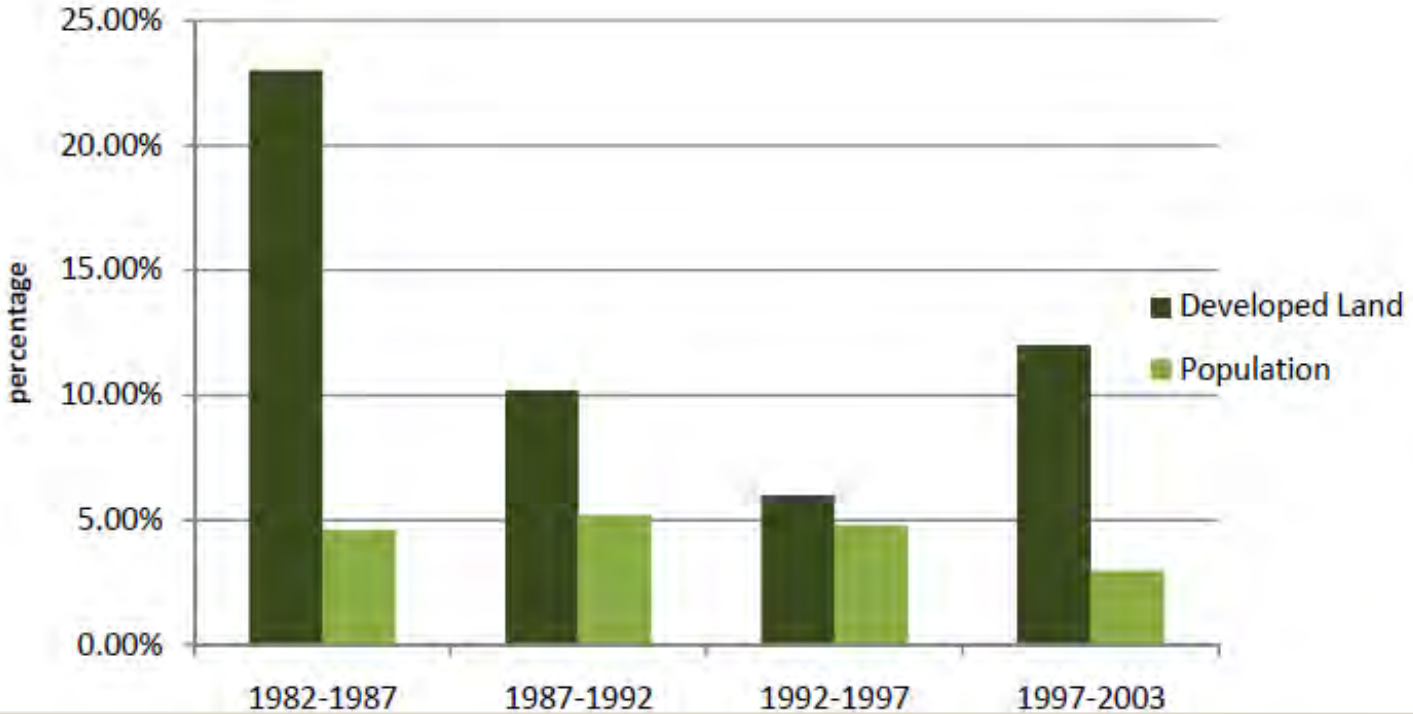
| How People Get to Work: 2011 | |
|---|---|
| Drive Alone | 74.3% |
| Car Pool | 9.9% |
| Public Transportation | 1.4% |
| Work at Home | 6.2% |

# Population and Housing Trends

By 2030, Vermont's population is expected to increase by **14%** with an additional **86,000** residents.

## Development Outpaces Population

Since 2000, there have been approximately 1,400 new households annually.




U.S. Census, 2010. Vermont Housing Finance Agency, 2009. Transition Vermont, 2009

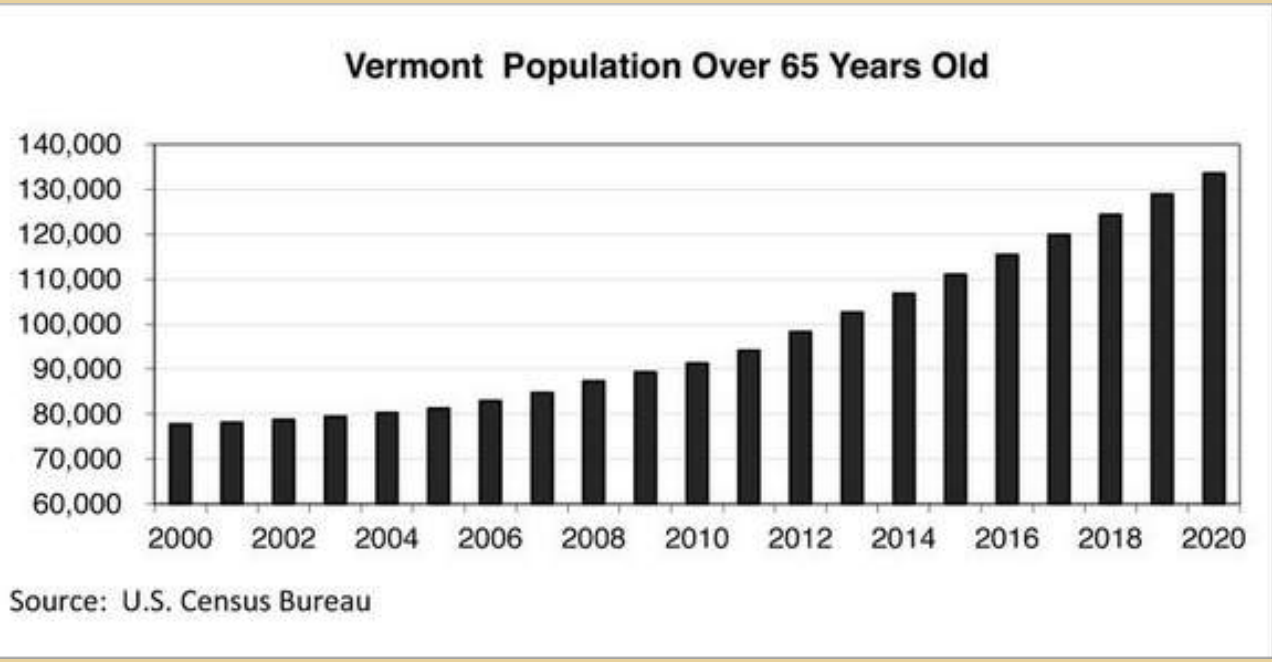
# Aging population

In 2030,

25% of Vermonters will be > 65.

This is the fastest growing age group in VT .

**What are the implications for housing and transportation?**



# Trends in Recreation

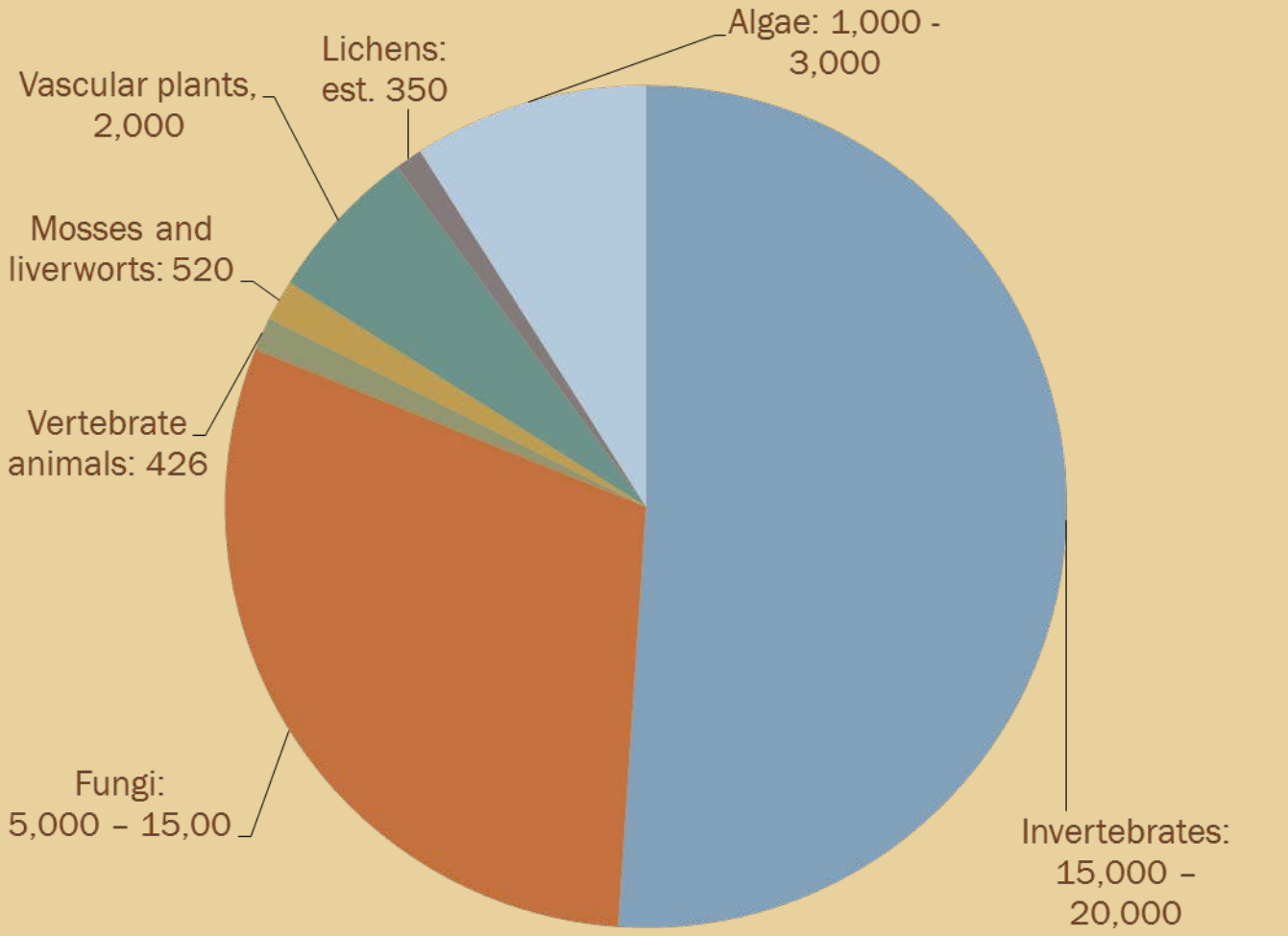
- Trail-based recreation is on the rise
- More people mountain biking and riding all-terrain vehicles
- The sale of hunting and fishing licenses declining nationally

# Economic Contributions

- Outdoor recreation supports 35,000 jobs
- $4.1 million from hunting, fishing and wildlife watching
- $187 million annually in state tax revenue
- $2.5 billion annually in retail sales and services

# Biological Diversity in Vermont

- There are between 24,000 – 43,000 species in Vermont.
- Most species we know **little** about



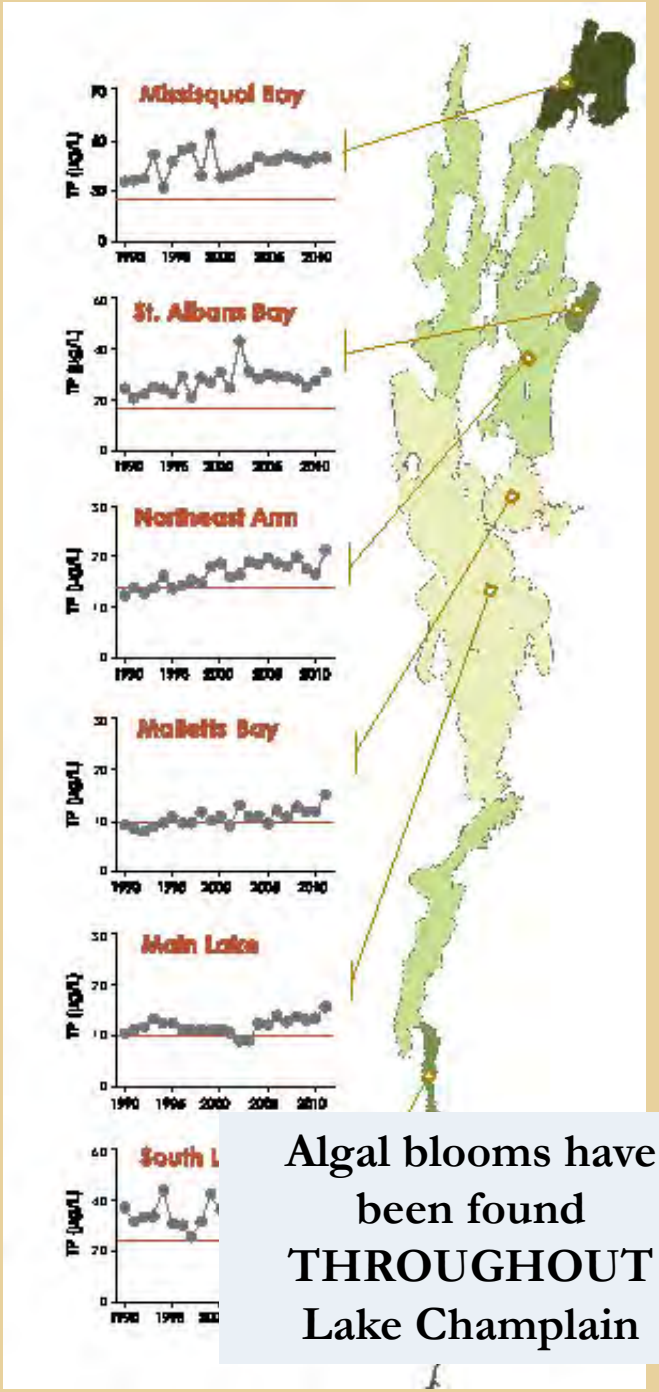
# Loss of Wetlands

Fragmentation hurts ecological function

# Invasive Species on the Rise

- **2/3 of VT's trees are at risk to 3 invasive tree pests**
- Non-native plants are outcompeting native ones, reducing biodiversity
- Water quality and recreation are impacted by aquatic invasives

# Pollution




Algal blooms have been found **THROUGHOUT** Lake Champlain

Phosphorus Concentrations in Lake Champlain affects water quality, recreation, transportation and aesthetics

# Changes in Precipitation

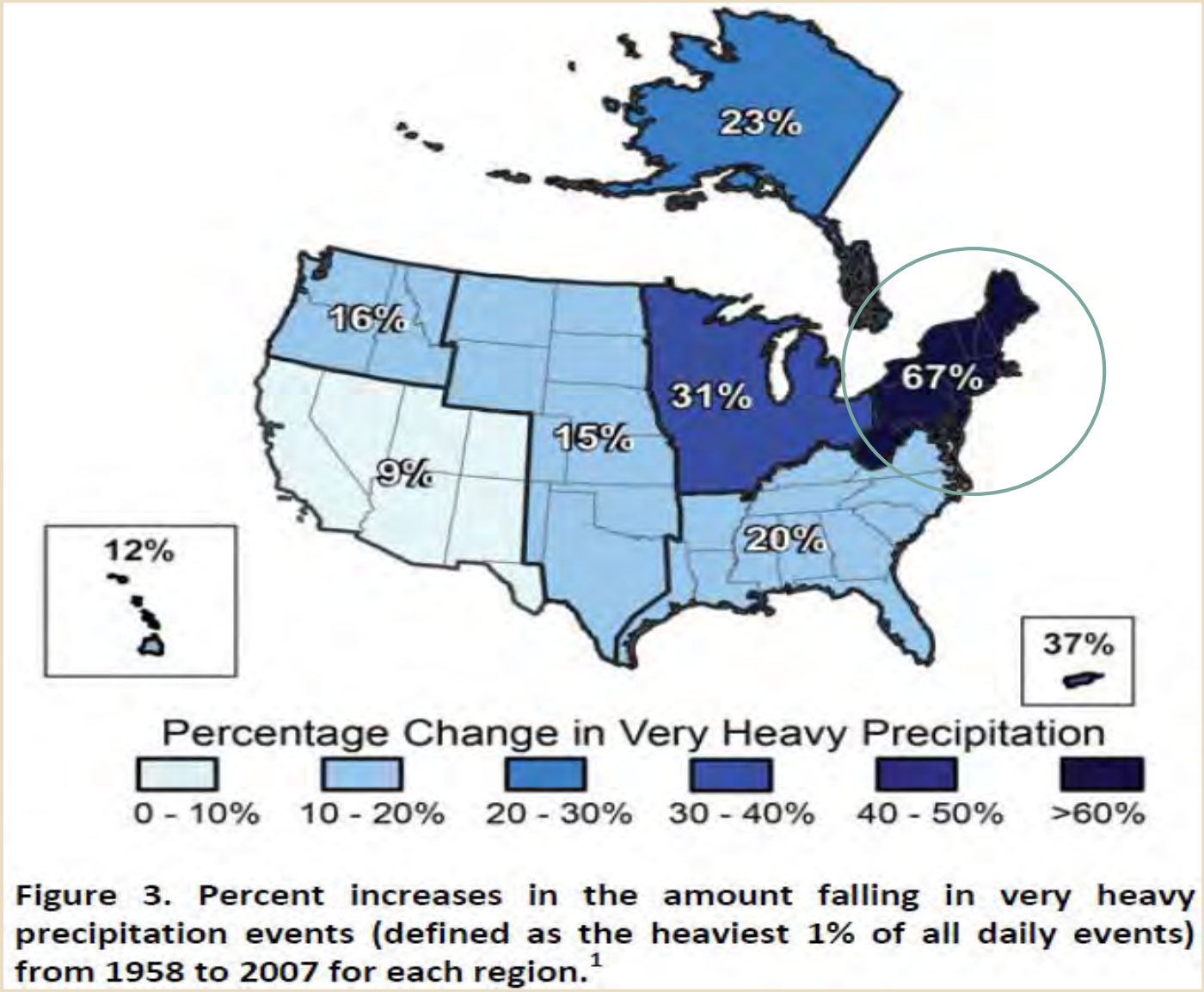
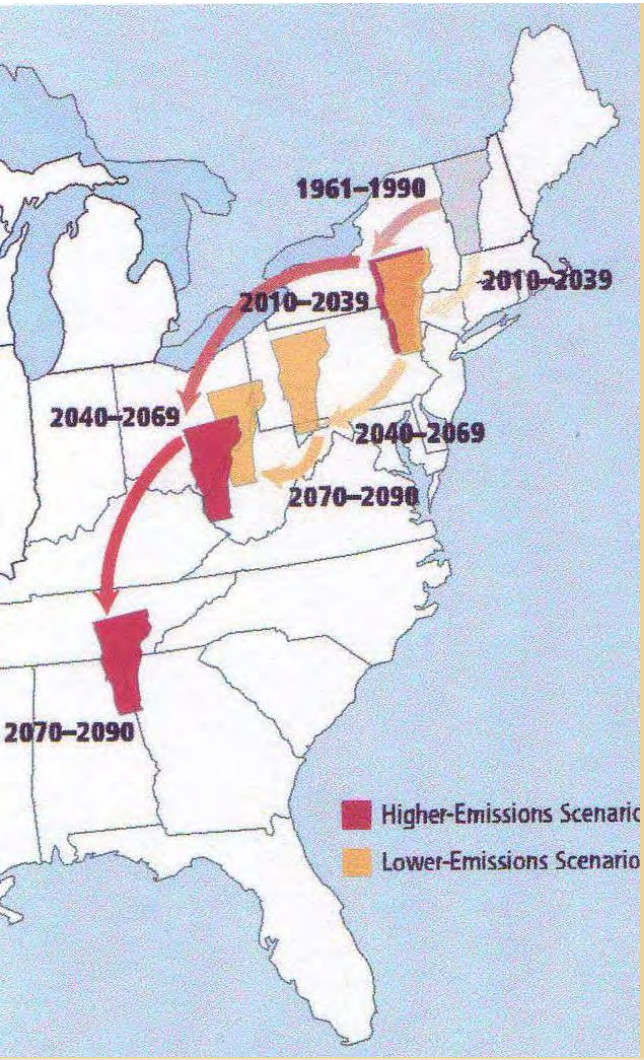



**Figure 3. Percent increases in the amount falling in very heavy precipitation events (defined as the heaviest 1% of all daily events) from 1958 to 2007 for each region.[1]**

Map: Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy, October 5, 2010.

# Climate Change Forecasts




- Temperatures have increased 1.8°F since 1970.
- **Projected:** 9-13°F of additional rise by late-century.
- Precipitation has increased 15-20% over the past 50 years with 67% of this falling in heavy precipitation events.
- **Projected:** Winter precipitation will increase 20-30% with less snow & more rain.
- **Projected:** Short-term summer droughts will occur 2x as often.

From Union of Concerned Scientists – *Confronting Climate Change in the Northeast* (NECIA 2007)

# Resilience

A Resilient Landscape has space for dynamic natural processes

A Resilient Community can learn from mistakes and adapt


ACTIVITY
1

# Two Frameworks

## Ecological

- Ecological scales
  - Landscape
  - Natural Communities
  - Species

**Natural Heritage Elements**

## Planning

- Functional planning scales
  - Landscapes
  - Communities (villages and towns)
  - Sites (e.g. specific parcels or building site)

# Vermont Conservation Design

Vermont Conservation Design assigns an overall **priority rank** to lands and waters most important for maintaining **ecological function.**

# Landscape Level Elements

- Considering patterns or concepts
- Viewing your town from 35,000 feet above
- Seeing your town in a larger context

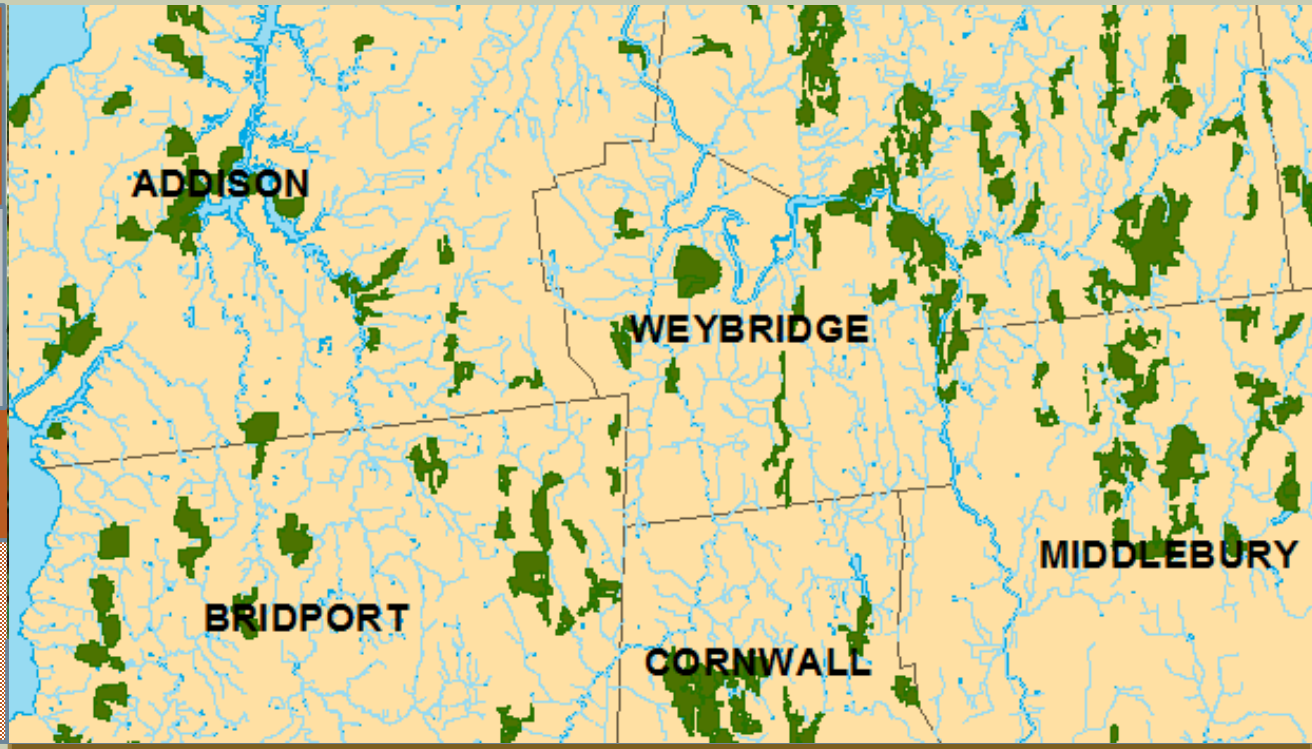
# The Physical Landscape

Western Exposure

Flat Topography

Clay Soils

Limestone Bedrock



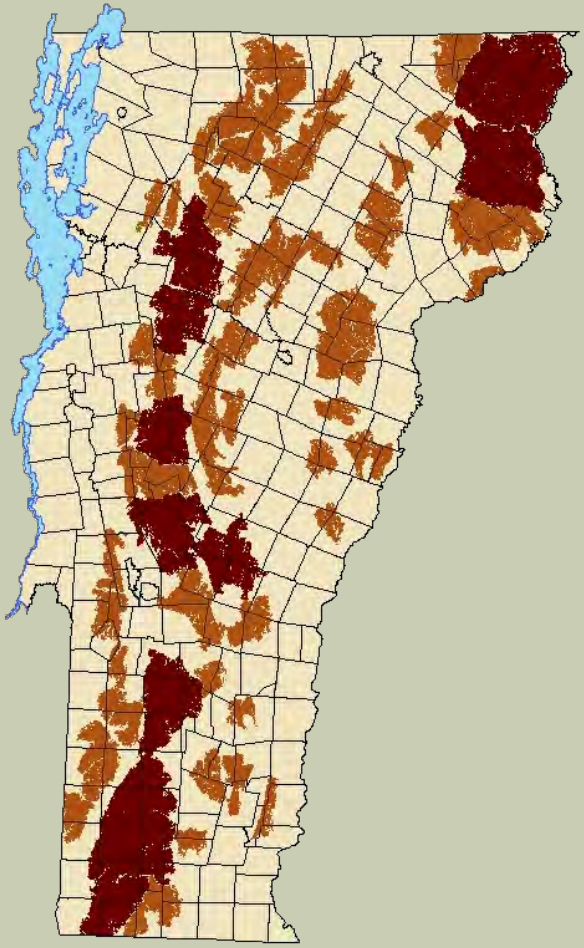

Physical landscape and biological world are connected.

# Watersheds

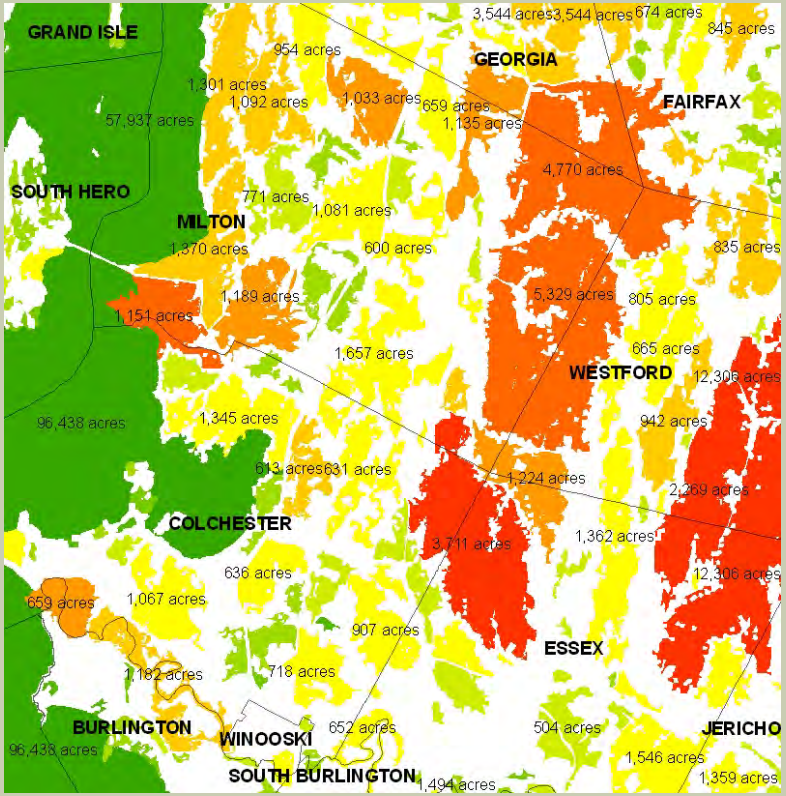

Missisquoi
Saint-Francois
Lake Champlain
Lamoille
Passumpsic
Connecticut
Winooski
Otter Creek
White
Connecticut
Hudson
-Hoosic
Deerfield

# Forests

# Forest Blocks



Areas of natural cover surrounded by roads, development and agriculture



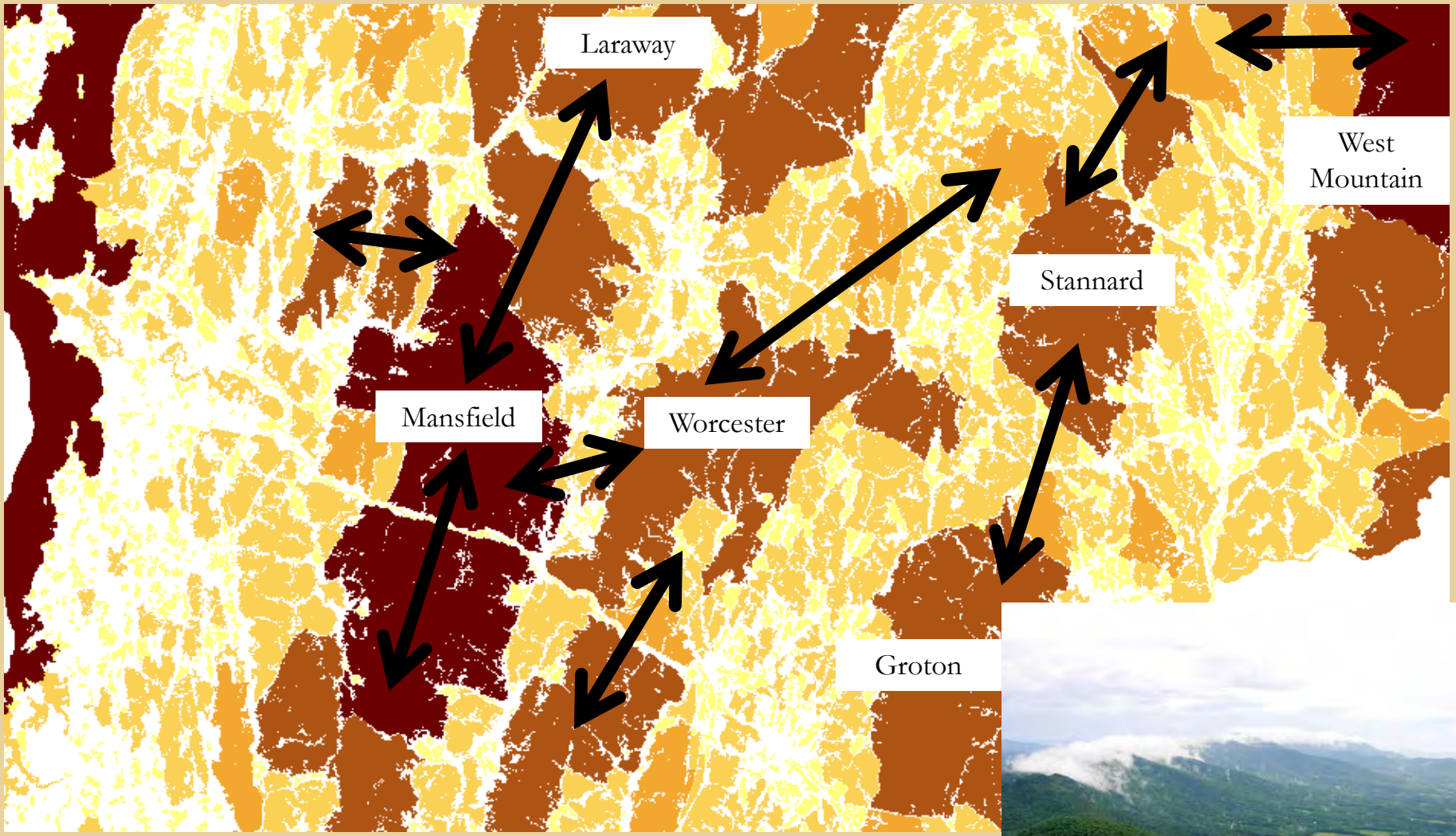

- Interior forest habitat and intact ecological processes

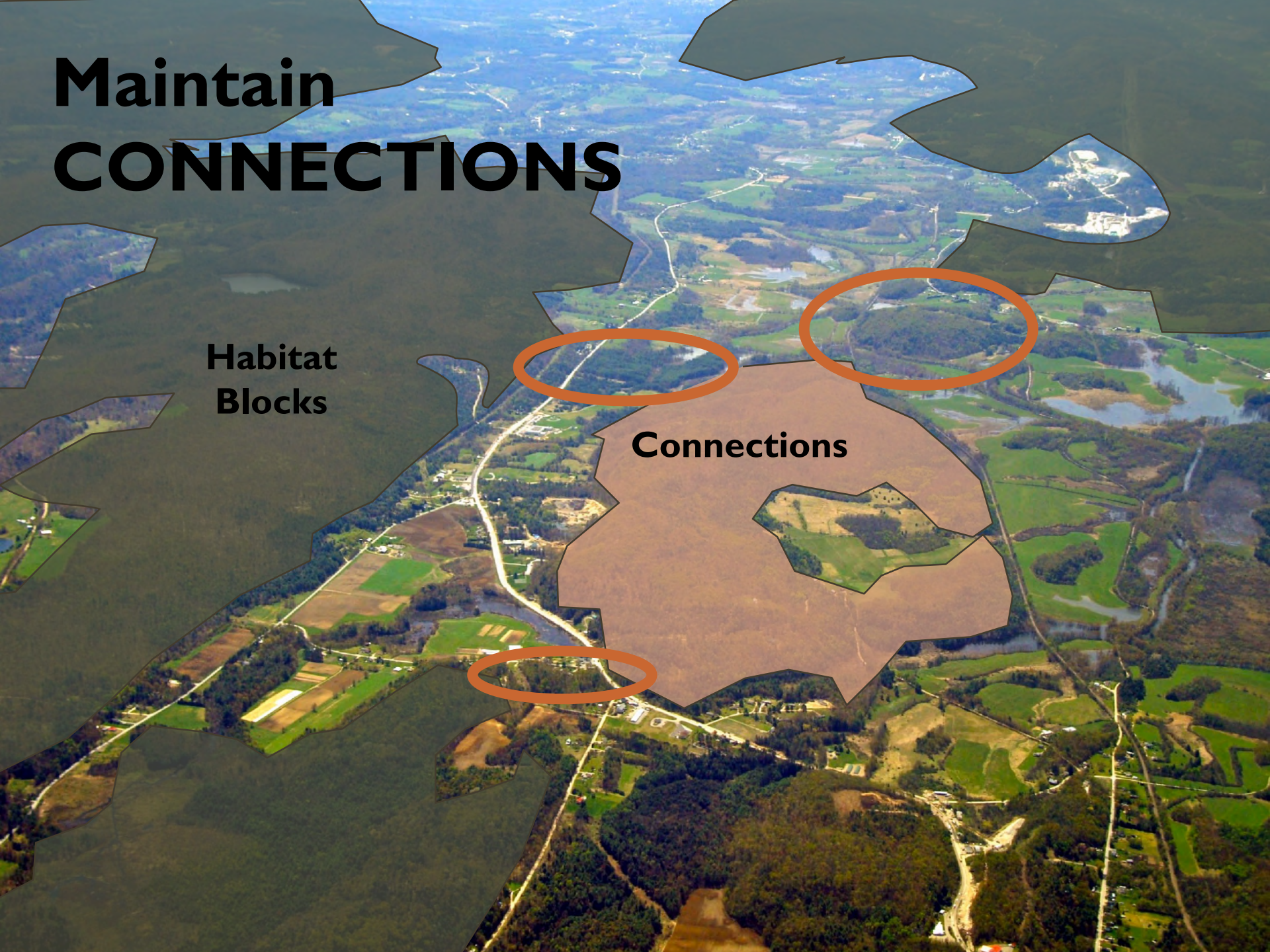
# Wildlife present in Forest Patches

| Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|
| *Undeveloped* | *500-2500 acre blocks* | *100-500 acre blocks* | *20-100 acre blocks* | *1-20 acre blocks* |
| Raccoon | Raccoon | Raccoon | Raccoon | Raccoon |
| Hare | Hare | Hare | Hare | |
| Coyote | | | | |
| Small rodent | Small rodent | Small rodent | Small rodent | Small rodent |
| Porcupine | Porcupine | Porcupine | Porcupine | |
| Bobcat | | | | |
| Cottontail | Cottontail | Cottontail | Cottontail | Cottontail |
| Beaver | Beaver | Beaver | Beaver | |
| Black bear | | | | |
| Squirrel | Squirrel | Squirrel | Squirrel | Squirrel |
| Weasel | Weasel | Weasel | Weasel | |
| Mink | Mink | Mink | | |
| Fisher | | | | |
| Woodchuck | Woodchuck | Woodchuck | Woodchuck | |
| Deer | Deer | Deer | | |
| Muskrat | Muskrat | Muskrat | Muskrat | Muskrat |
| Moose | Moose | | | |
| Red fox | Red fox | Red fox | Red fox | Red fox |
| Songbirds | Songbirds | Songbirds | Songbirds | Songbirds |
| Sharp-shinned hawk | Sharp-shinned hawk | Sharp-shinned hawk | | |
| Bald eagle | Bald eagle | | | |
| Skunk | Skunk | Skunk | Skunk | Skunk |
| Cooper's hawk | Cooper's hawk | Cooper's hawk | | |
| Harrier | Harrier | Harrier | | |
| Broad-winged hawk | Broad-winged hawk | Broad-winged hawk | | |
| Goshawk | Goshawk | | | |
| Kestrel | Kestrel | Kestrel | | |
| Red-tailed hawk | Red-tailed hawk | | | |
| Horned owl | Horned owl | Horned owl | | |
| Raven | Raven | | | |
| Barred owl | Barred owl | Barred owl | | |
| Osprey | Osprey | Osprey | | |
| Turkey vulture | Turkey vulture | Turkey vulture | | |
| Turkey | Turkey | Turkey | | |
| Reptiles | Reptiles | Reptiles | Most Reptiles | Most Reptiles |
| Garter snake | Garter snake | Garter snake | Garter snake | |
| Ring-neck snake | Ring-neck snake | Ring-neck snake | Ring-neck snake | |
| Amphibians | Amphibians | Most Amphibians | Most Amphibians | Most Amphibians |
| Wood frog | Wood frog | Wood frog | | |

From Above and Beyond." Campoli, J., Humstone, E., & MacLean, A. 2002.

# Connecting the Blocks




Maintain
CONNECTIONS
Habitat
Blocks
Connections

# Area Dependent Mammal Species

Bobcat
19-26
square miles

Moose 2-20 square miles

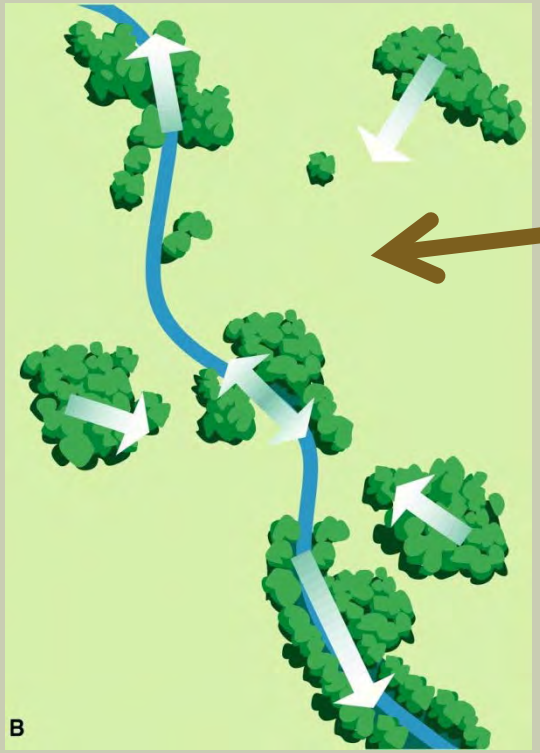
Black Bear
30+ square
miles

Fisher 7-15 square miles

River Otter
15-30 linear
miles

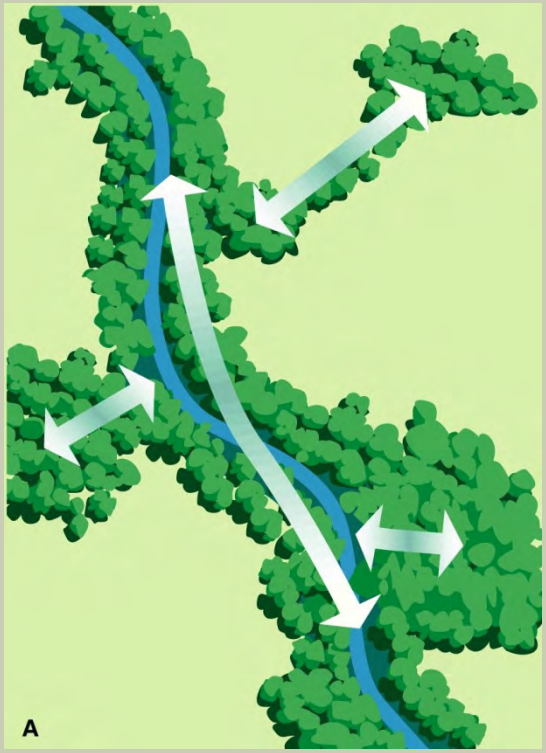
*(DeGraaf & Rudis 1986)*

# Connectivity: Wildlife




Barriers to animal movement

- Roads
- Development
- Agriculture




- Habitats isolated

- Habitats are connected
- River banks provide travel corridor

# Connectivity: Aquatic

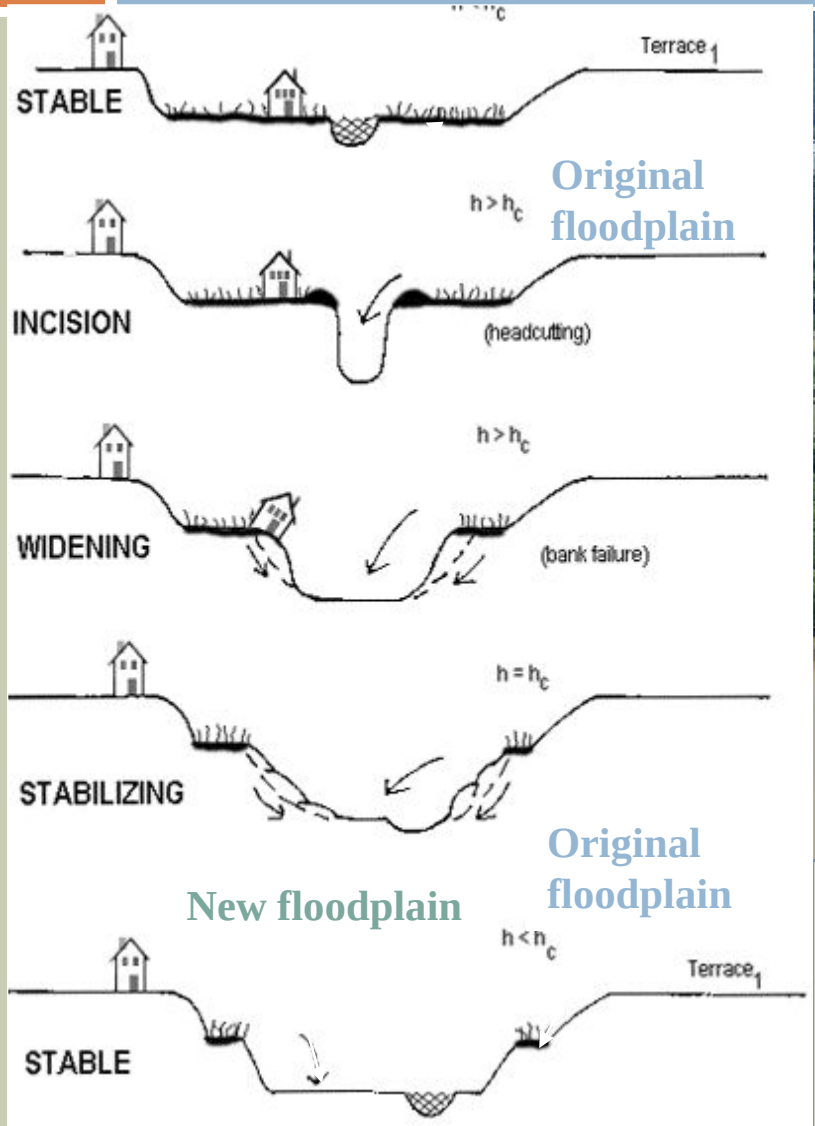
Culvert is a barrier

Culvert allows for
Aquatic Organism Passage

Poorly installed crossing structures:

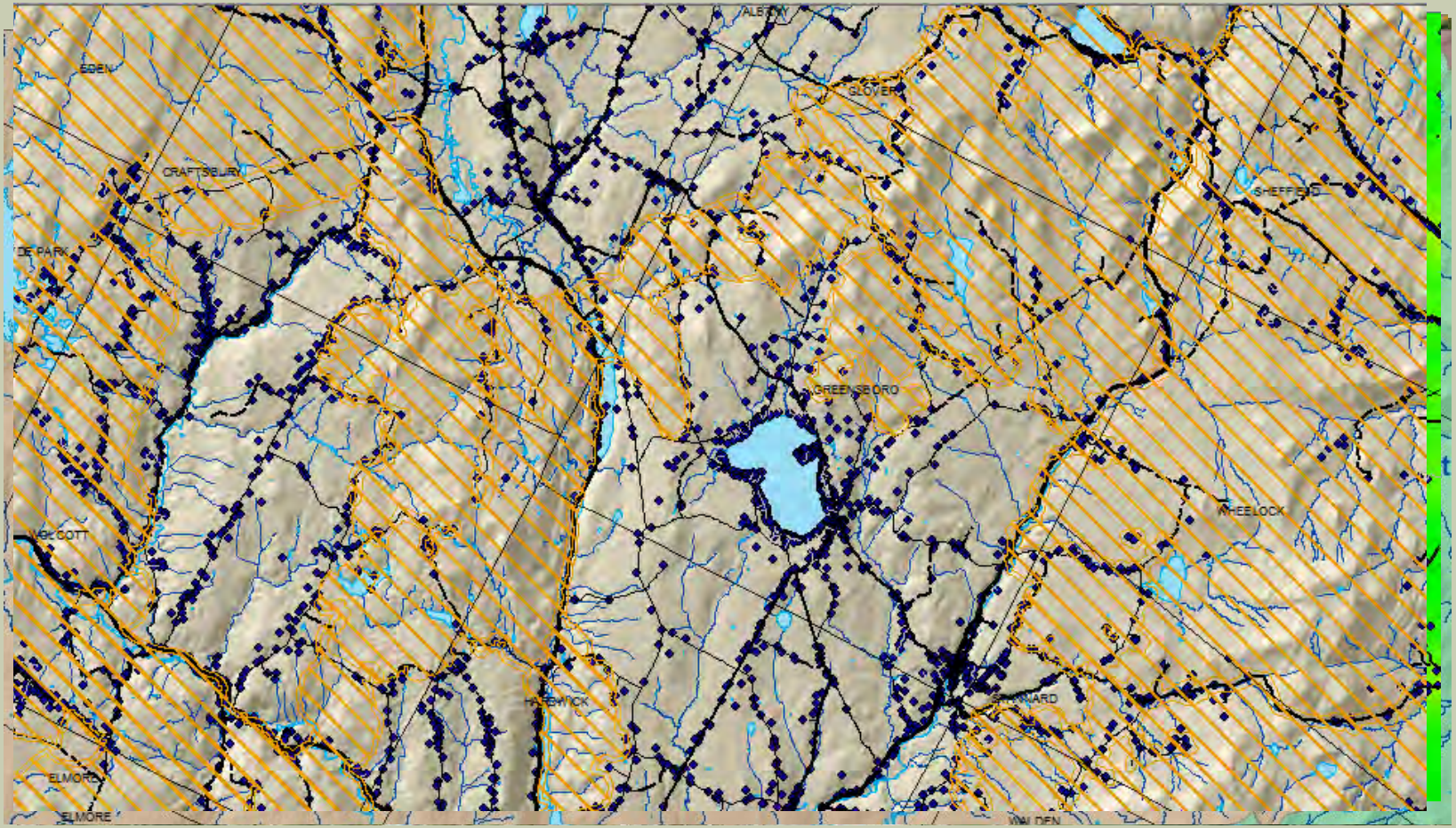
- Fragment aquatic habitats
- Limit recreational opportunity
- Increase sediment build-up

# Connectivity: Aquatic



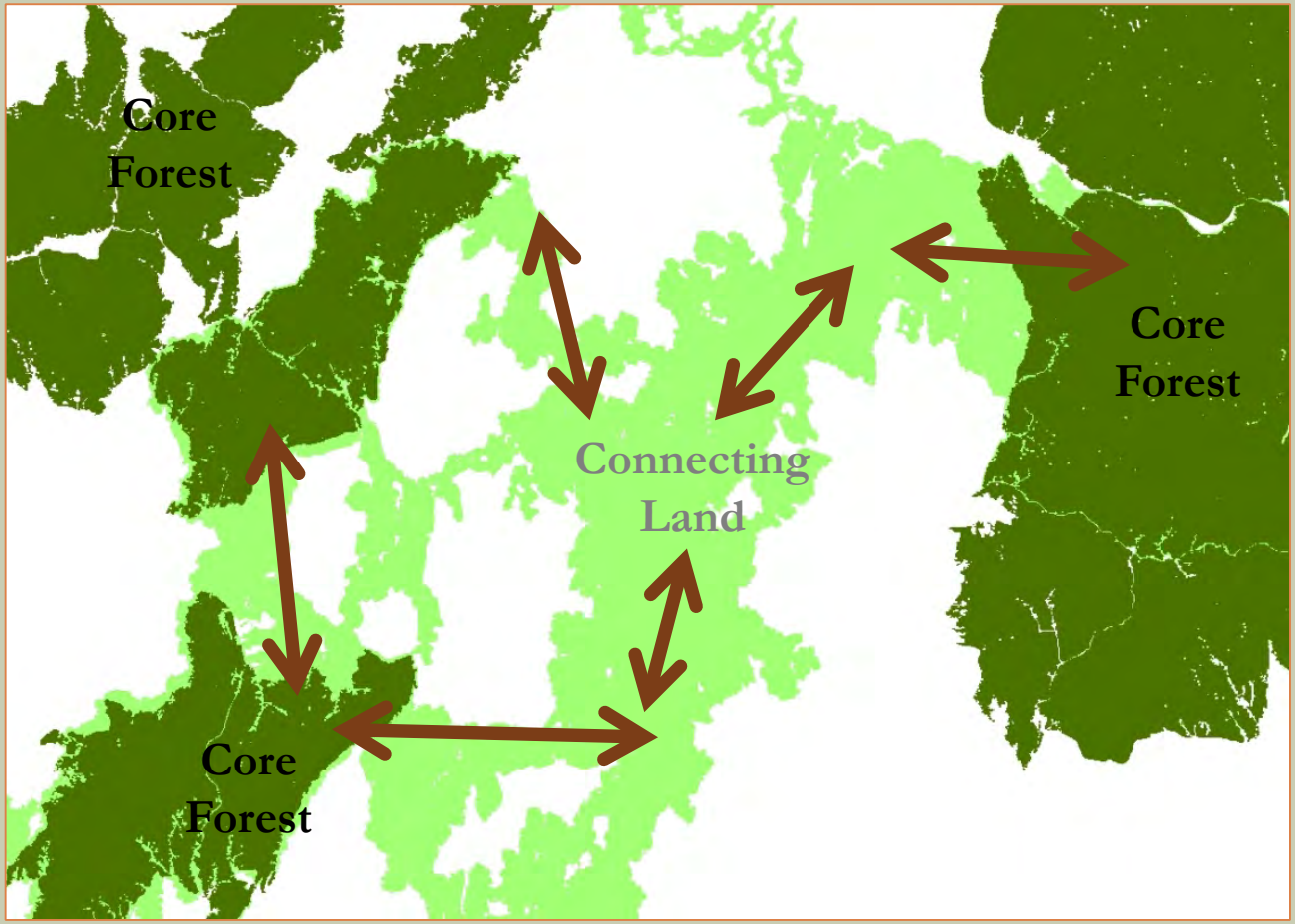

Otter Creek, Pittsford, VT, September 3, 2011
Photo:Lars Gange Mansfield Heliflight

# Overlapping Networks




Overlapping networks

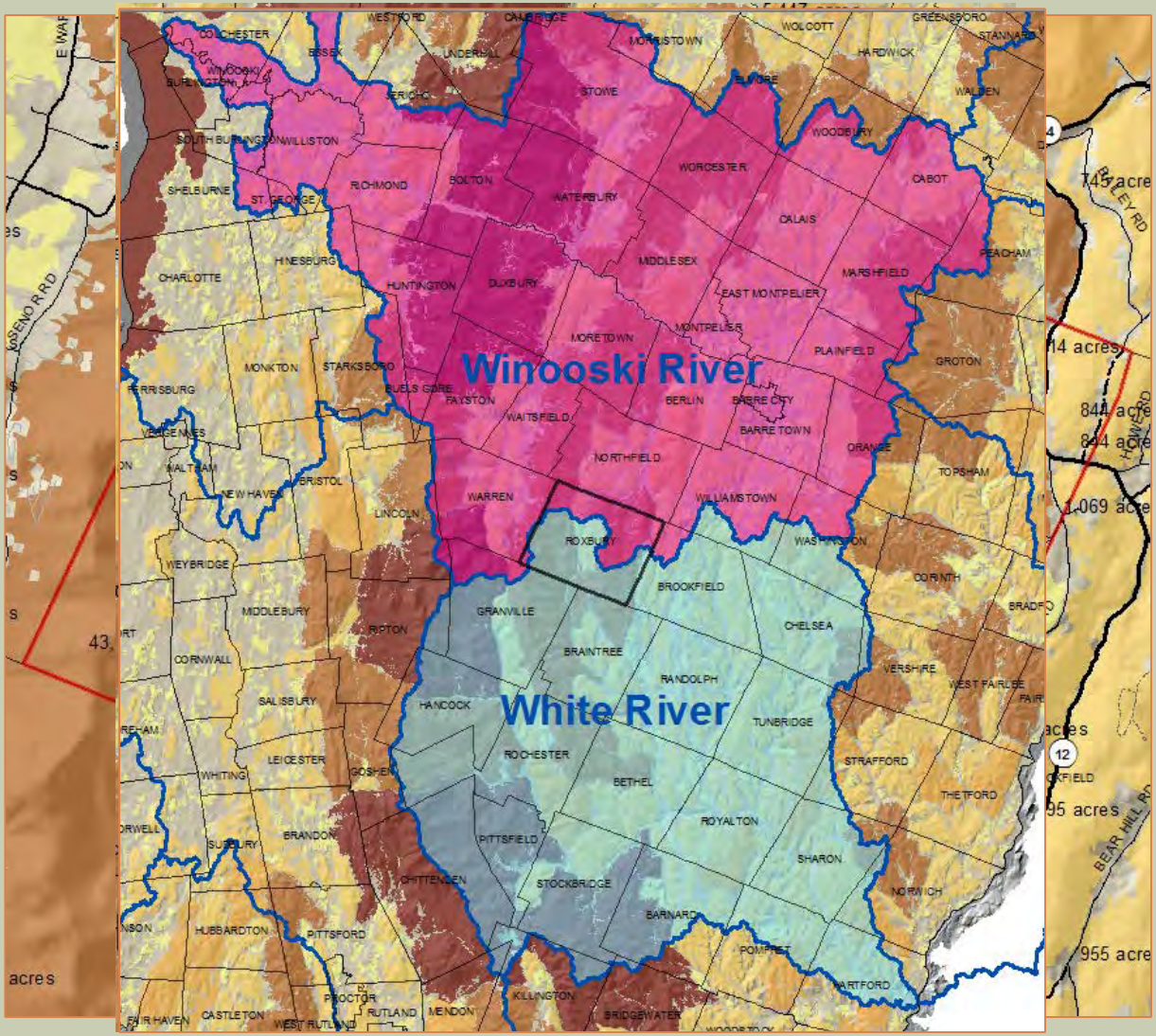
# Connectivity: Ecosystem Resiliency




- Plants & Animals are adjusting their ranges
- Many will use this network

**Maintaining & Enhancing habitat connectivity allows for plant and animal migration**

# Case study: Roxbury, VT




## Forest Blocks

- Large blocks in upper elevations, west and east.
- Route 12a as a barrier
- Development on class 4 roads within habitat blocks

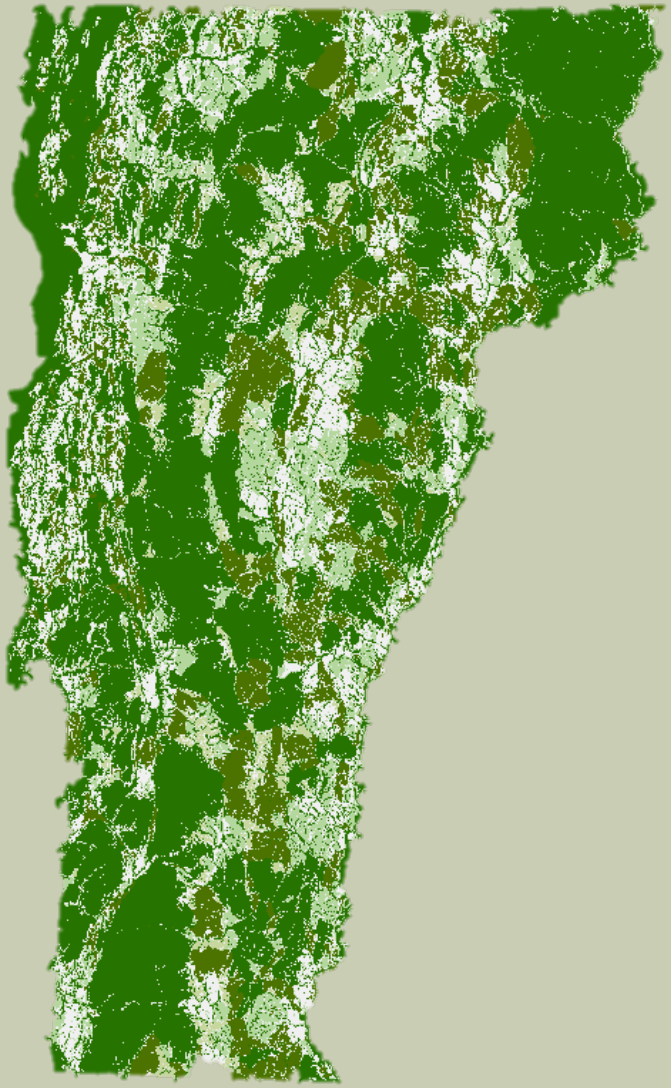
## Regional perspective

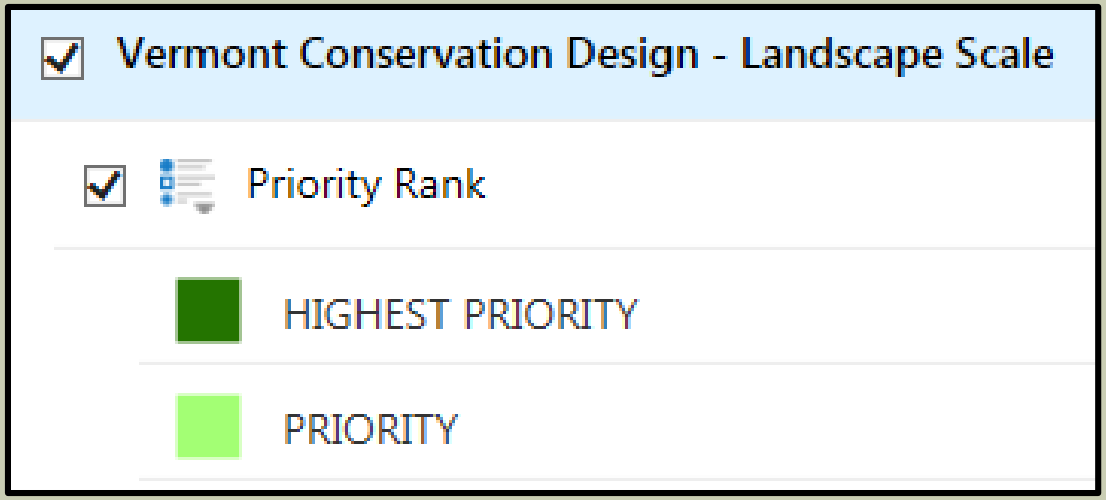
- Shows larger pattern of Northfield Range
- Connections west to Greens

## Watershed Boundaries

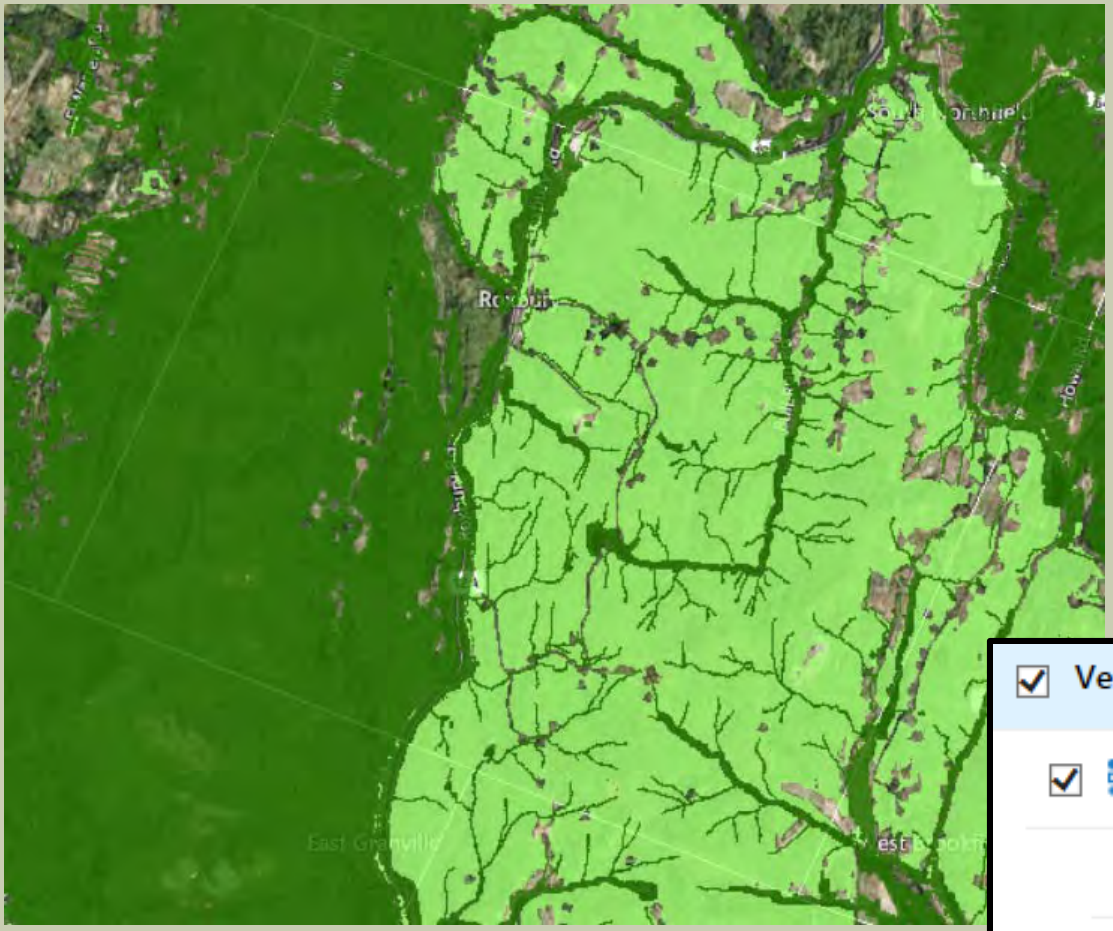
- Headwaters for Winooski River & White River
- Species differences

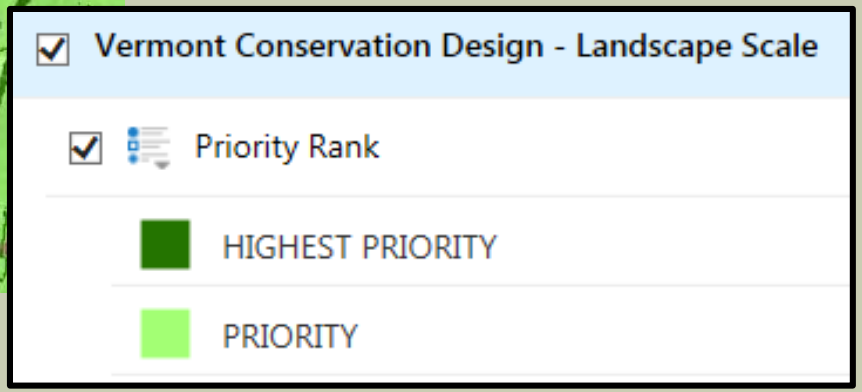
# Vermont Conservation Design





# Vermont Conservation Design





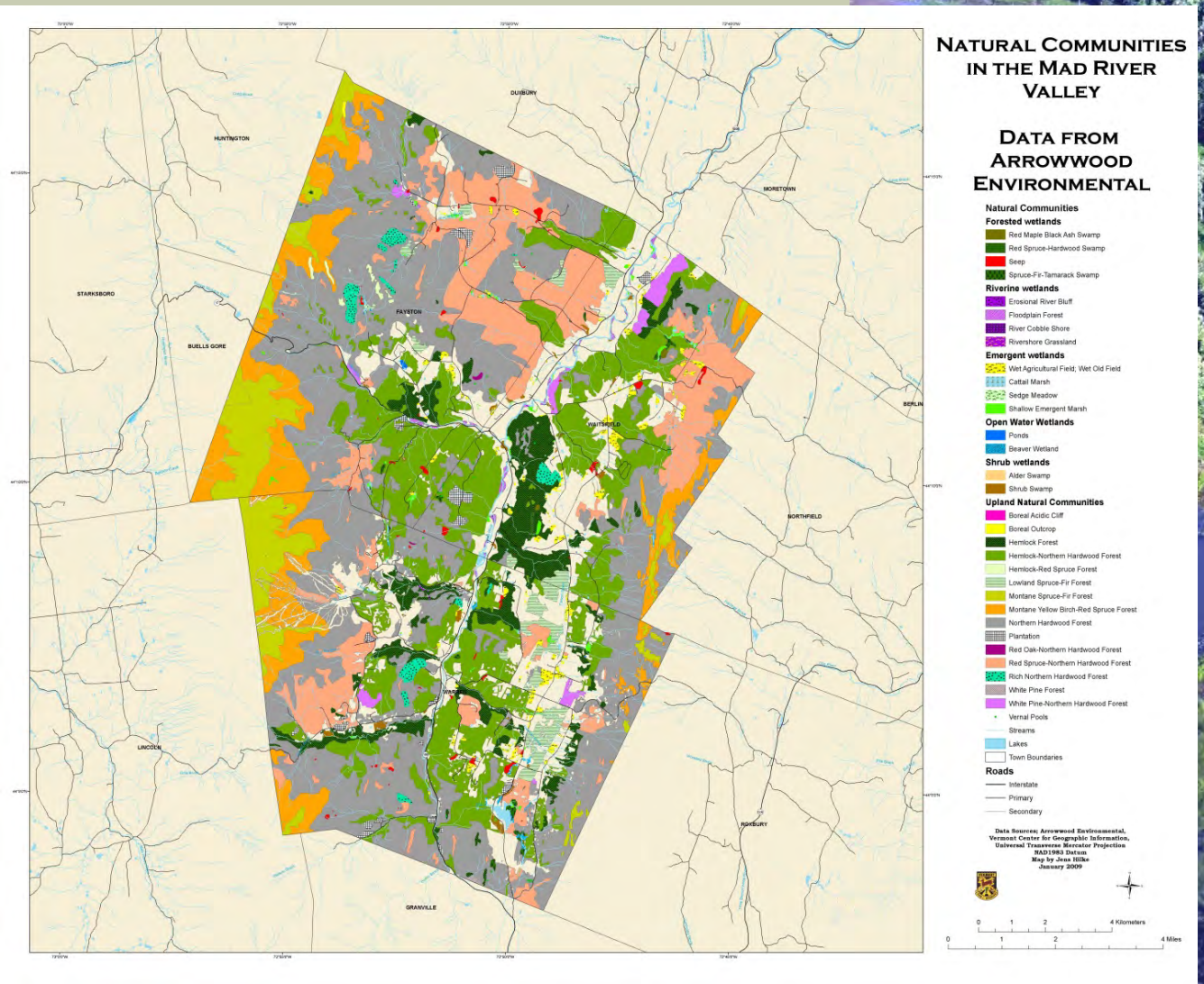
# Landscape Scale: planning & management

- Manage for FUNCTION
- Maintain connections
- Set lower standards for bigger-scale items

# Community Level Elements

The Community Level is the most useful scale for town planning

# Natural Communities




## Natural Communities in the Mad River Valley

### Data from Arrowwood Environmental

**Natural Communities**

**Forested wetlands**
- Red Maple Black Ash Swamp
- Red Spruce-Hardwood Swamp
- Seep
- Spruce-Fir-Tamarack Swamp

**Riverine wetlands**
- Erosional River Bluff
- Floodplain Forest
- River Cobble Shore
- Rivershore Grassland

**Emergent wetlands**
- Wet Agricultural Field; Wet Old Field
- Cattail Marsh
- Sedge Meadow
- Shallow Emergent Marsh

**Open Water Wetlands**
- Ponds
- Beaver Wetland

**Shrub wetlands**
- Alder Swamp
- Shrub Swamp

**Upland Natural Communities**
- Boreal Acidic Cliff
- Boreal Outcrop
- Hemlock Forest
- Hemlock-Northern Hardwood Forest
- Hemlock-Red Spruce Forest
- Lowland Spruce-Fir Forest
- Montane Spruce-Fir Forest
- Montane Yellow Birch-Red Spruce Forest
- Northern Hardwood Forest
- Plantation
- Red Oak-Northern Hardwood Forest
- Red Spruce-Northern Hardwood Forest
- Rich Northern Hardwood Forest
- White Pine Forest
- White Pine-Northern Hardwood Forest
- Vernal Pools
- Streams
- Lakes
- Town Boundaries

**Roads**
- Interstate
- Primary
- Secondary

Data Sources; Arrowwood Environmental, Vermont Center for Geographic Information, Universal Transverse Mercator Projection NAD1983 Datum
Map by Jess Hilke
January 2009

0 1 2 4 Kilometers
0 1 2 4 Miles

# Rivers

- Physical landscape creates the setting
- Human and natural communities respond to that setting

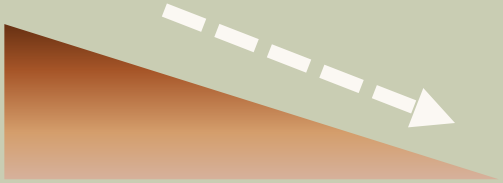
## Erosion

## Inundation

# Dynamically Stable

**Rivers Maintain:**

Slope



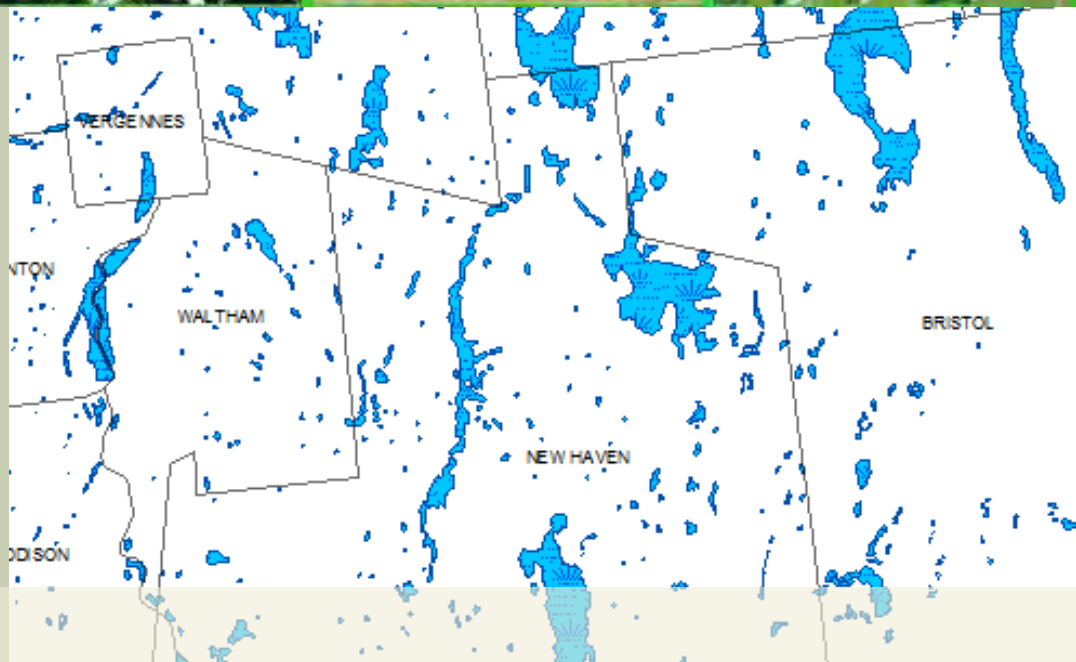
Profile

Pattern

**Stable is not Static**

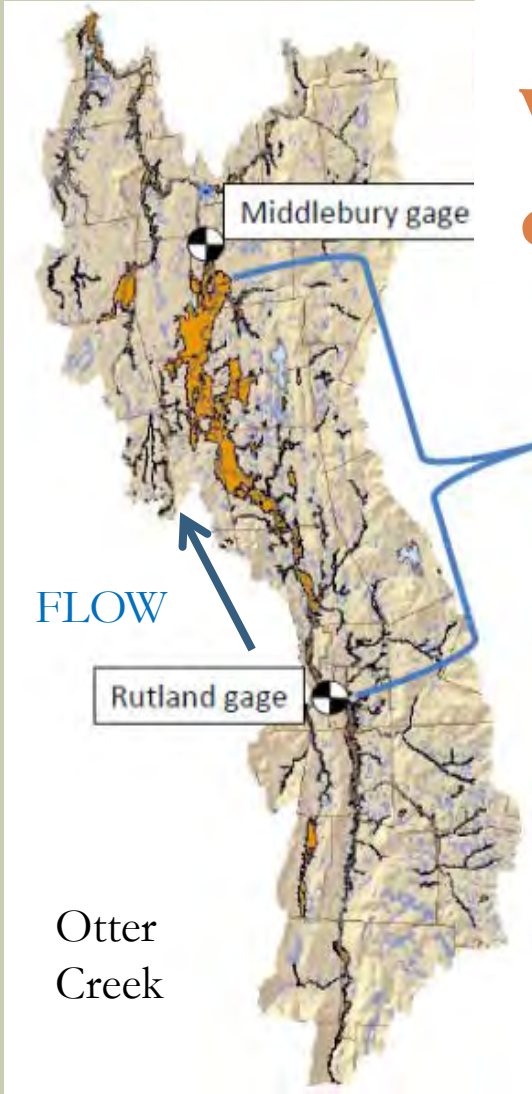
# Riparian Habitats


# Wetlands




Vermont Significant Wetland Inventory

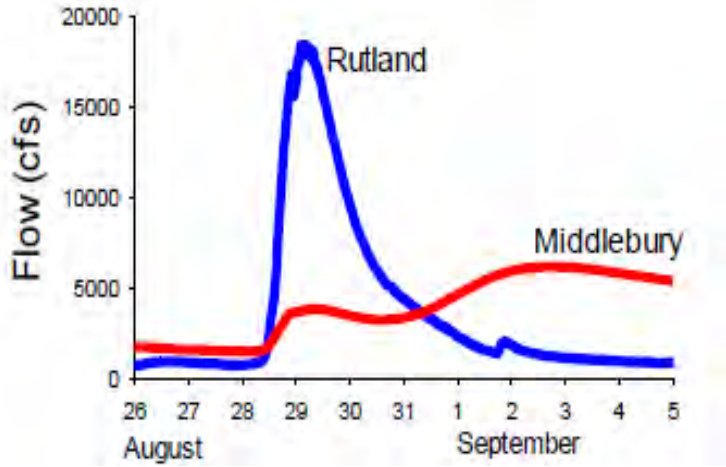
# Wetlands & Floodplains at Work




## Wetlands & floodplains protect downstream communities!

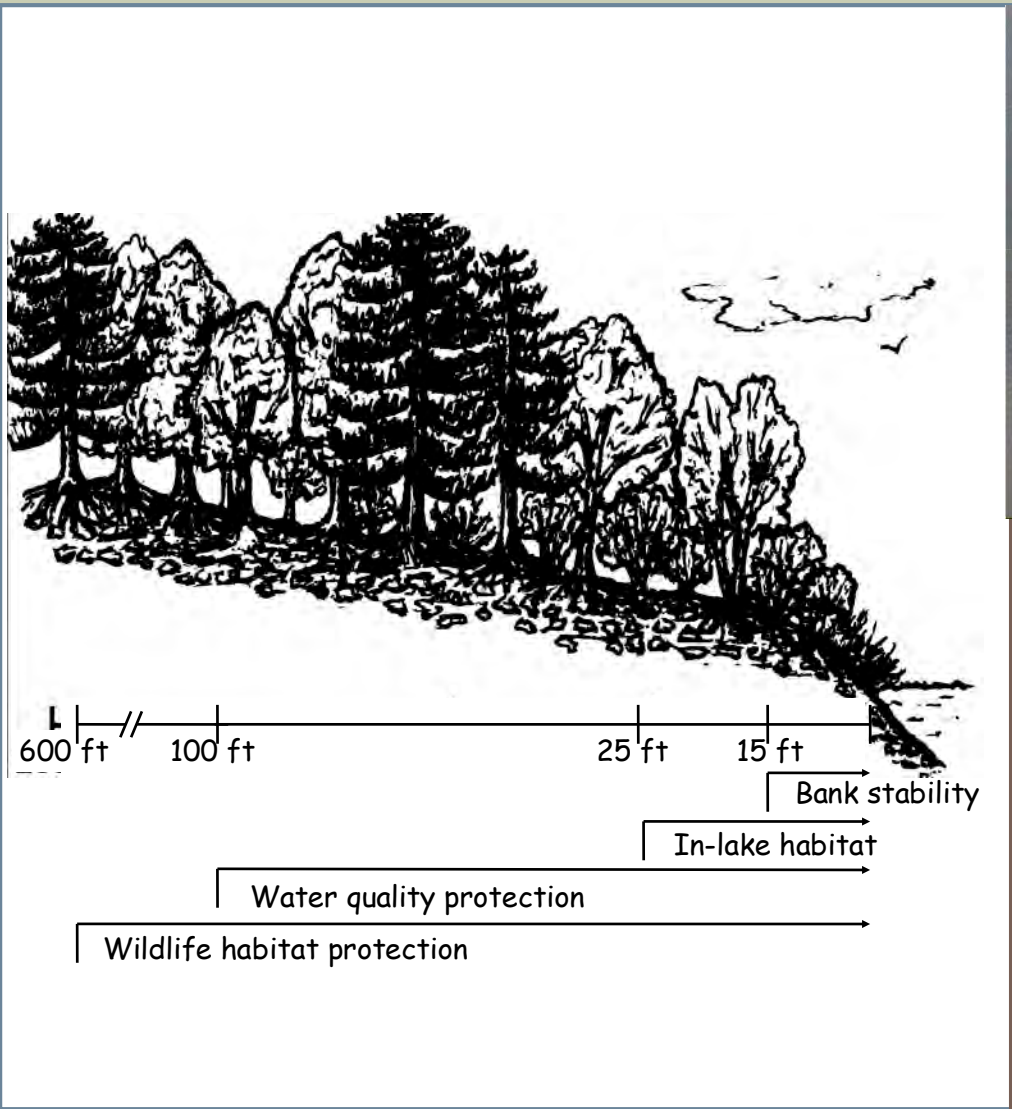
Floodplains

Wetlands



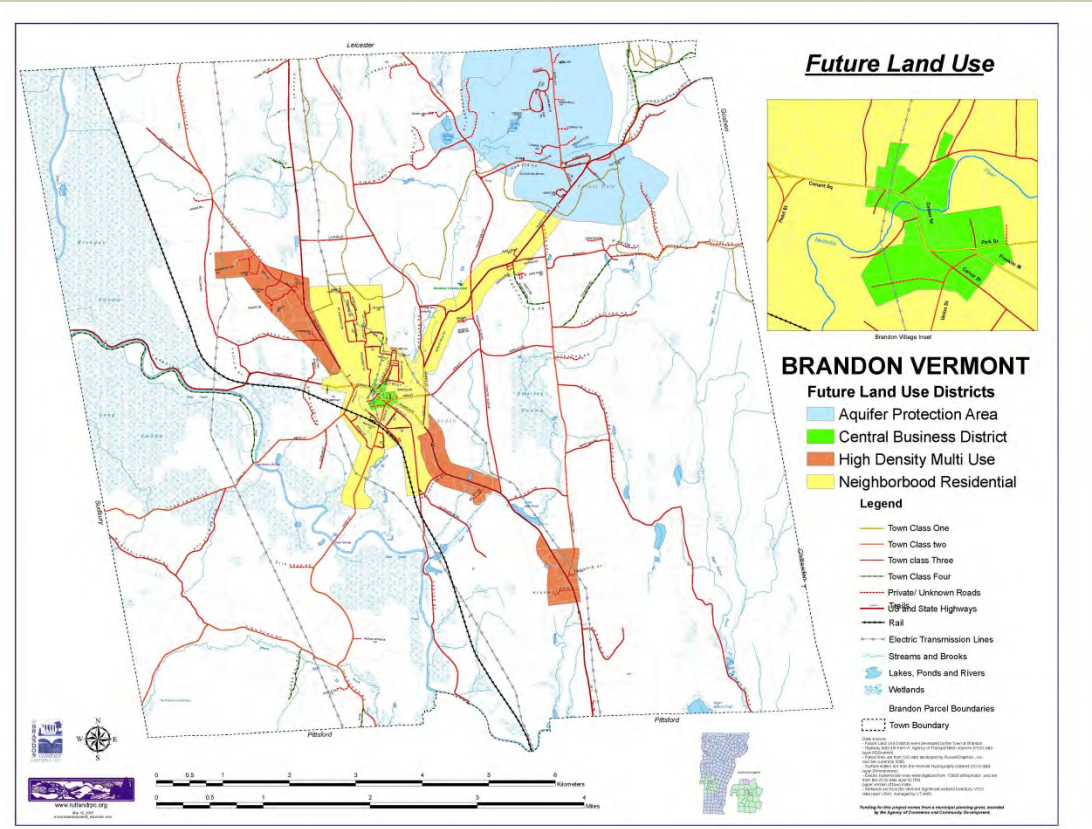

Hydrograph during Irene

# Lakes have Floodplains TOO!

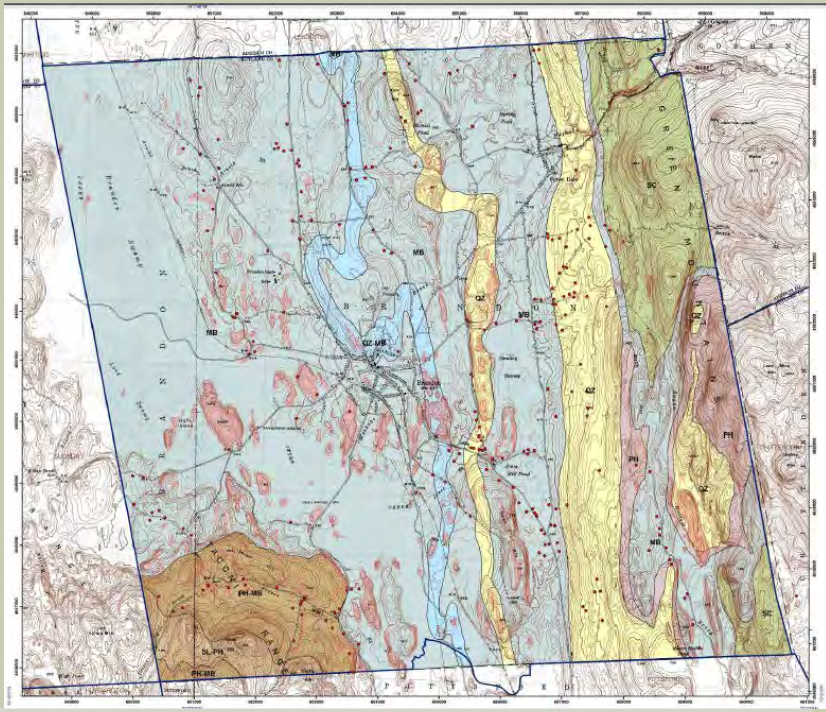




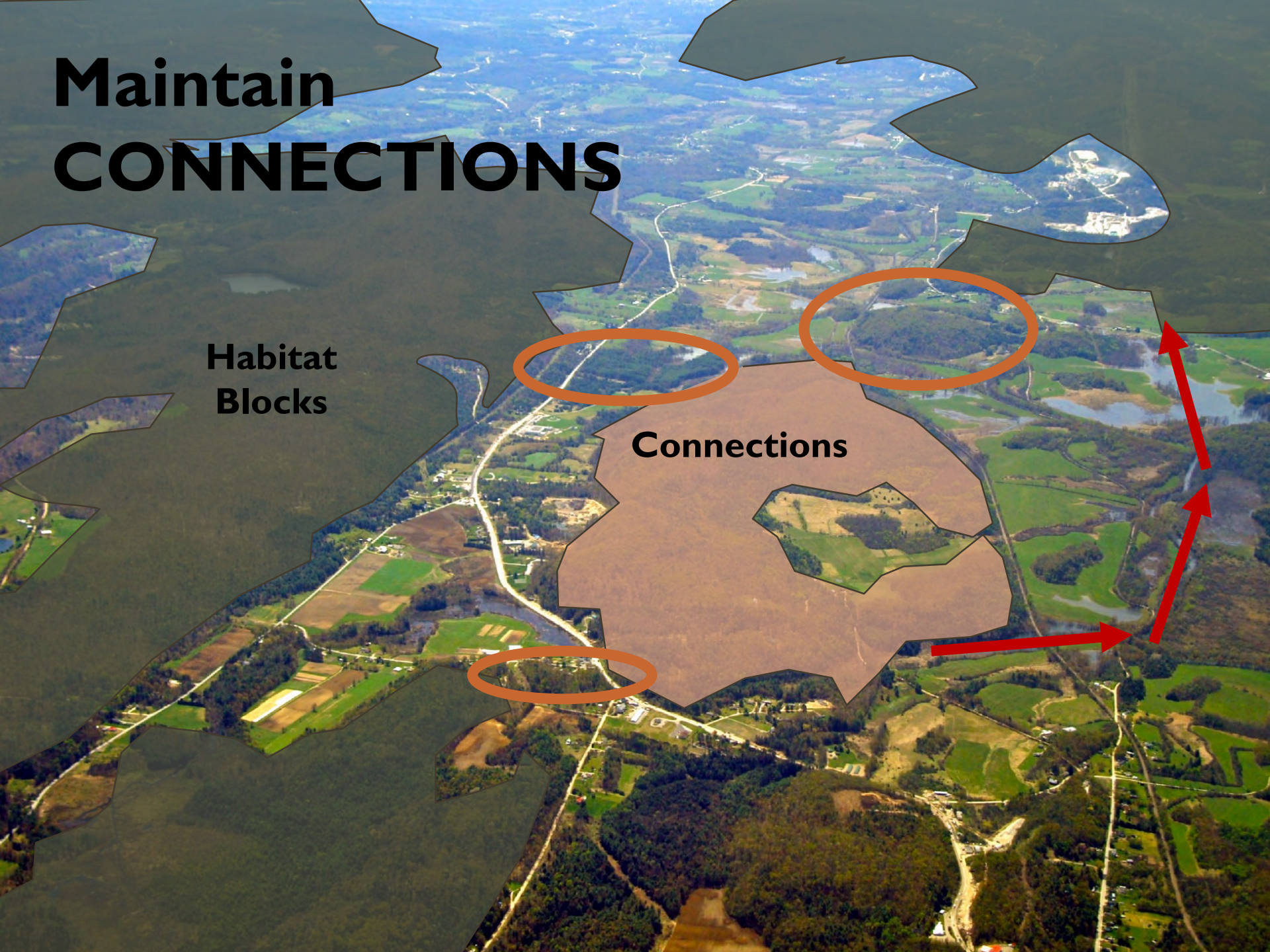
# Source Protection Area




Brandon's Town Plan includes "well head protection areas"

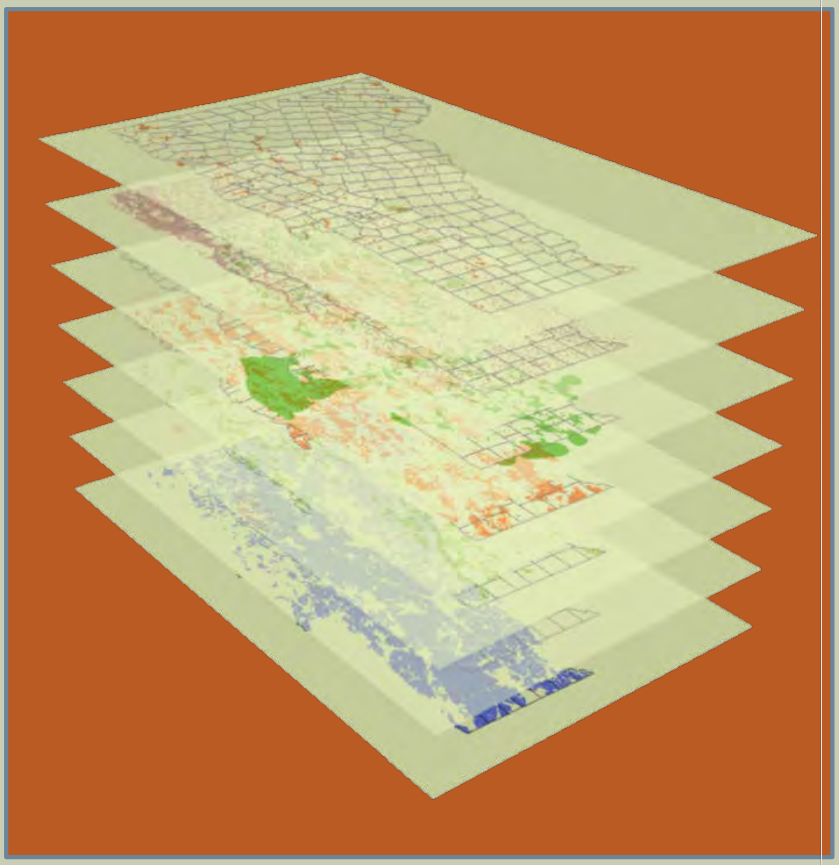


VT Geological Survey , Surficial Geology and Hydrogeology of Brandon, VT. De Simone, 2008


Maintain
CONNECTIONS
Habitat
Blocks
Connections

# Community Scale planning & management

- Community scale has some flexibility
- Standards need to be tailored to resource
  - e.g. Overlay districts for dynamic systems across existing zoning



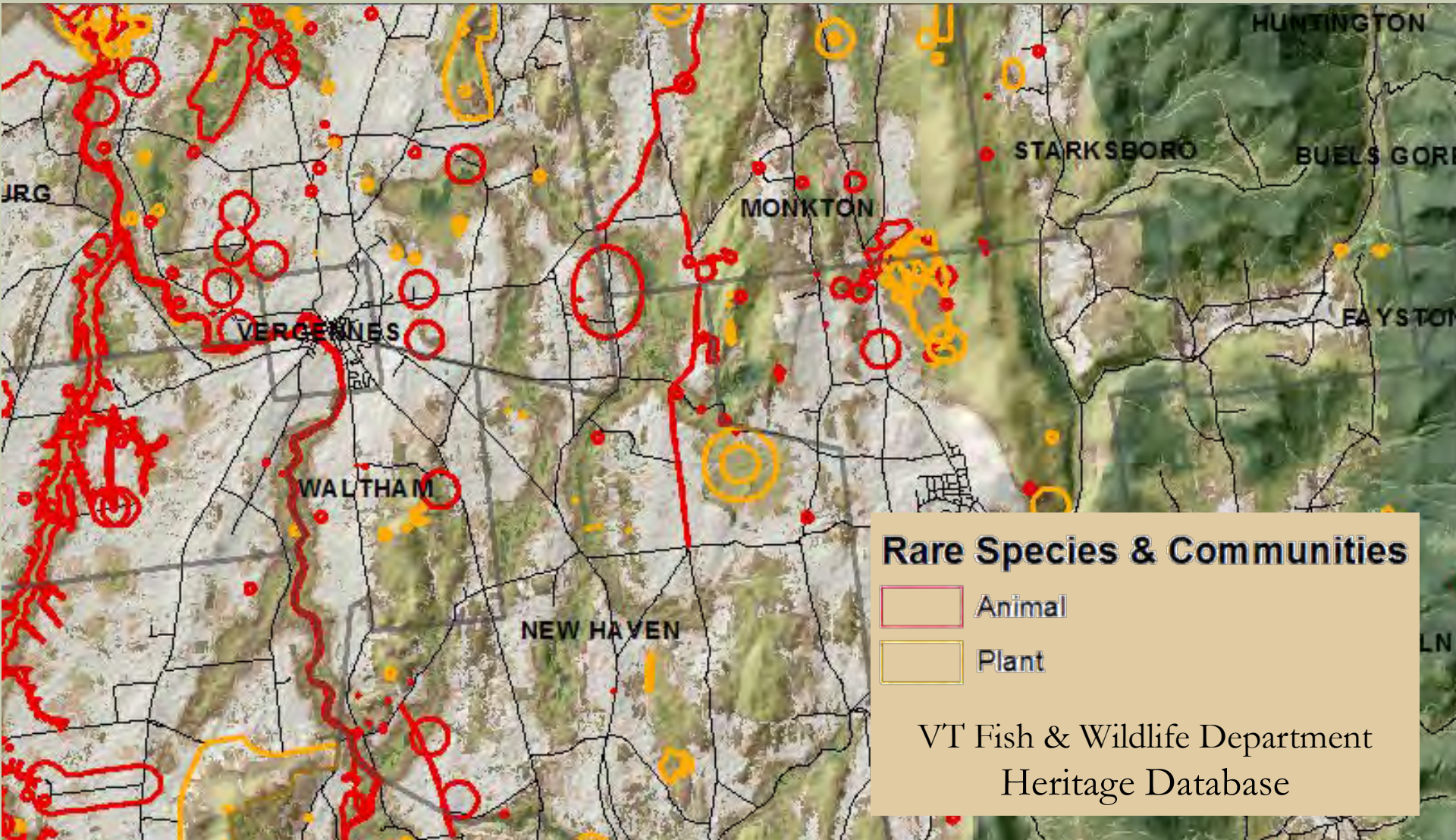
# Fine Scale Elements

Some elements "fall through the cracks" of the coarse filter
Can occur in small areas

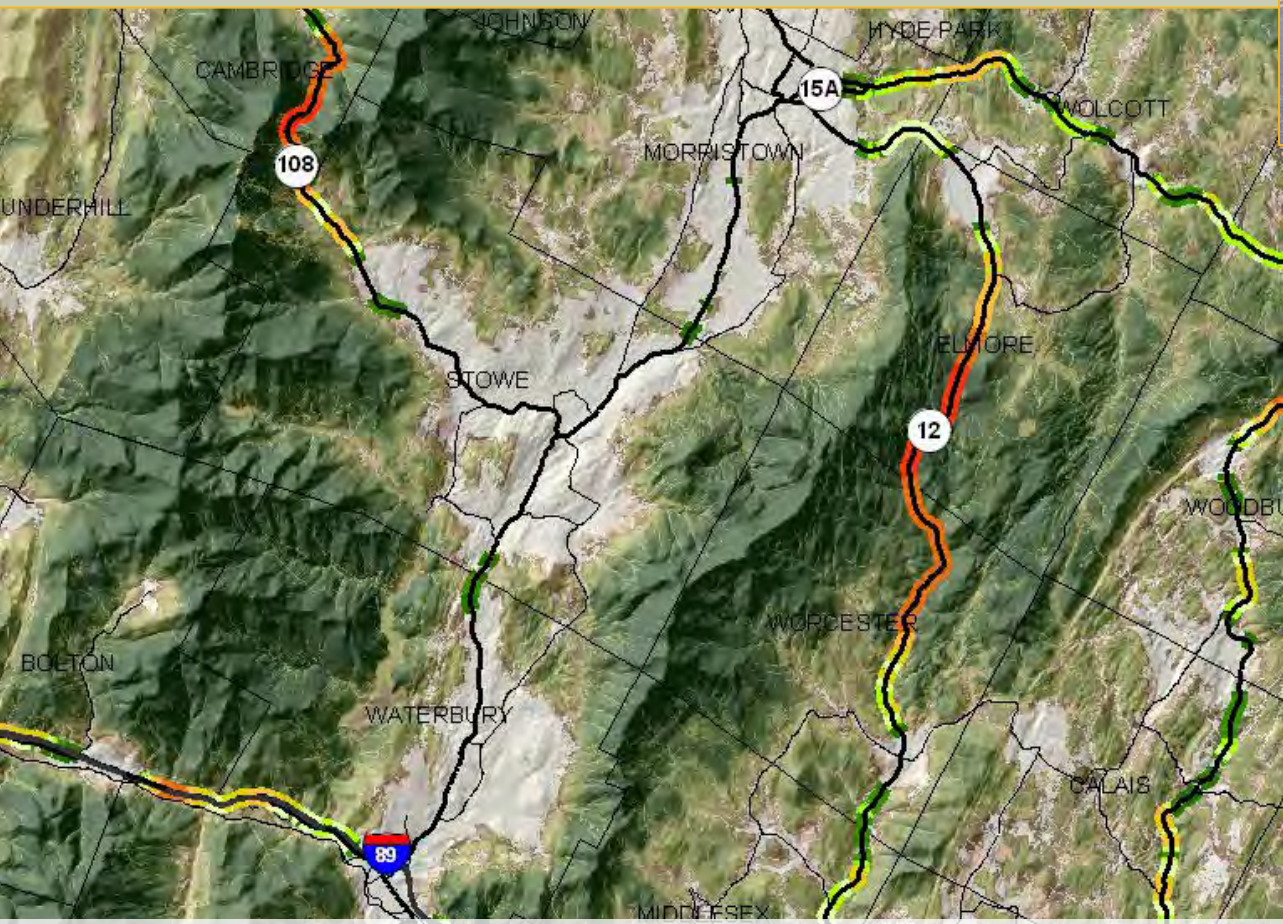
Esqua Bog

Cobblestone tiger beetle

# Rare Species

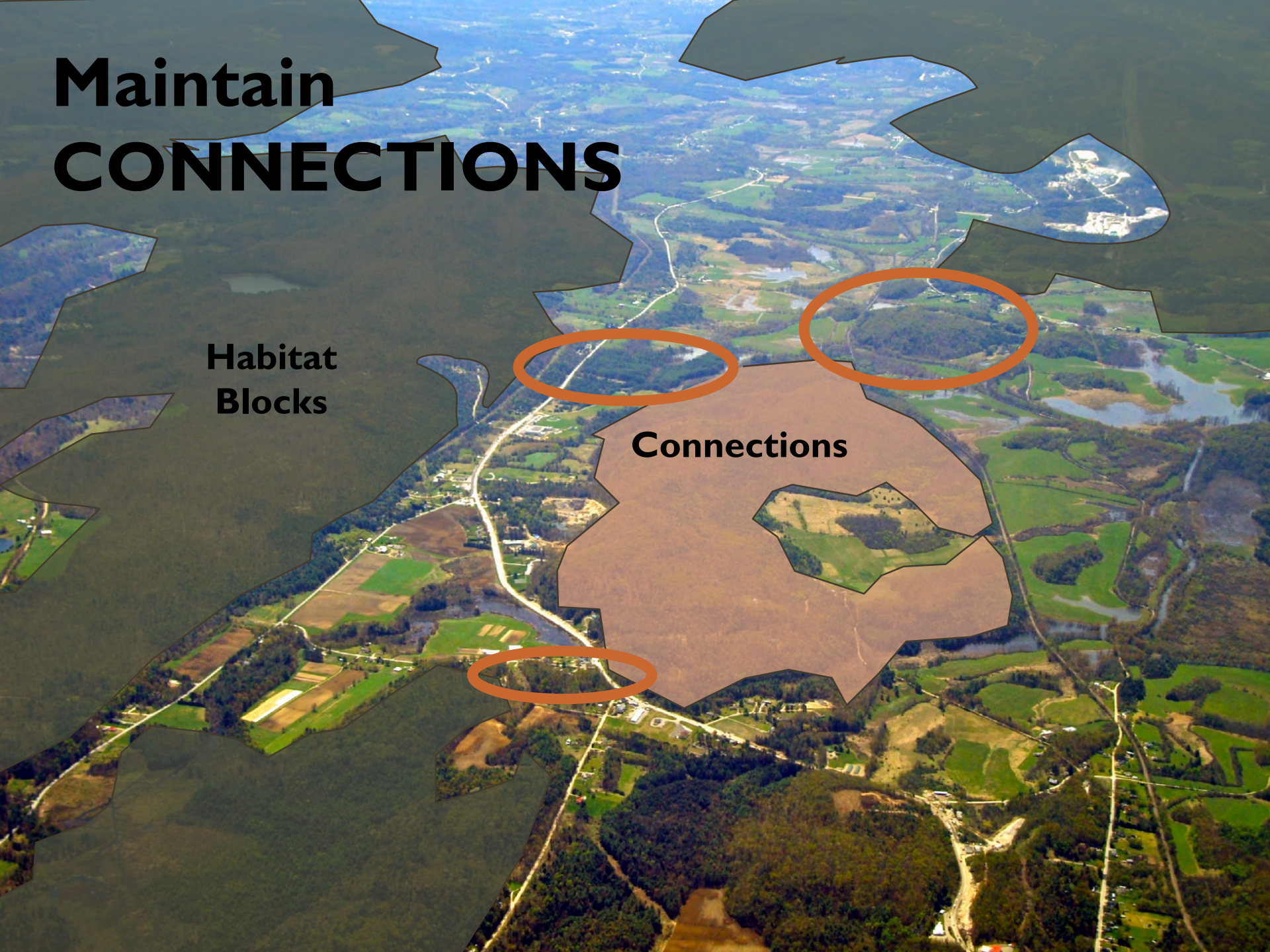


# Wildlife Crossings




## Where are wildlife likely to cross?

Based on trees, wetlands on both sides of a road

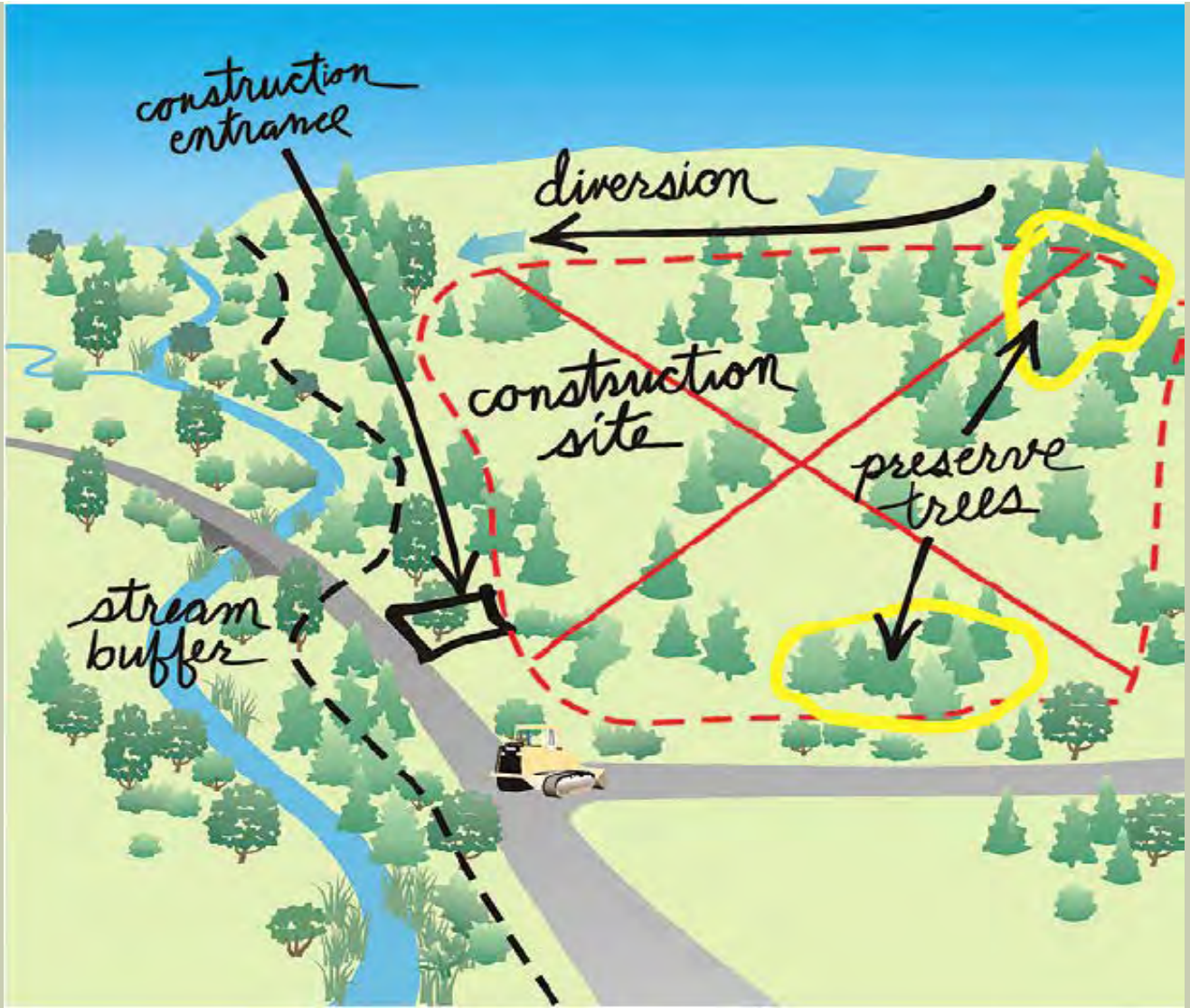

Maintain
CONNECTIONS
Habitat
Blocks
Connections

# Local River Channel Management

- Increases speed of river
- Causes downstream erosion
- Should only be used when absolutely necessary

# Stormwater: Low Impact Development

- Minimize Disturbance
- Manage runoff
- Stabilize property
- Establish vegetation



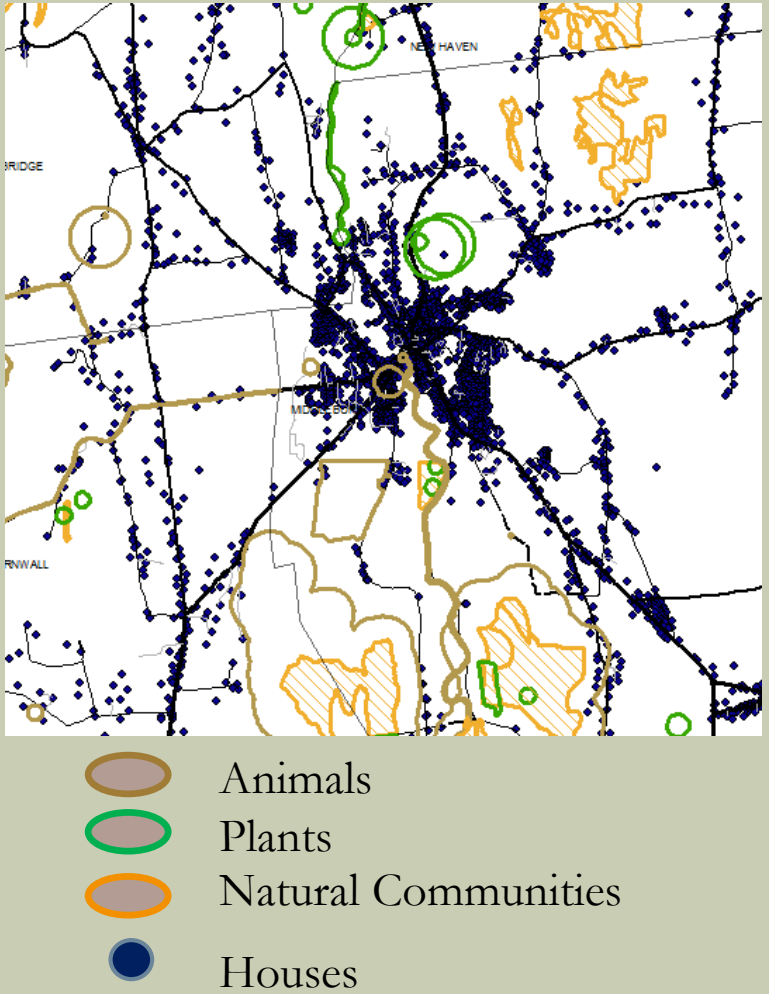
# Even in the Village Center

**Scale, Design, Connectivity, Values and Functions change with increased grey infrastructure**

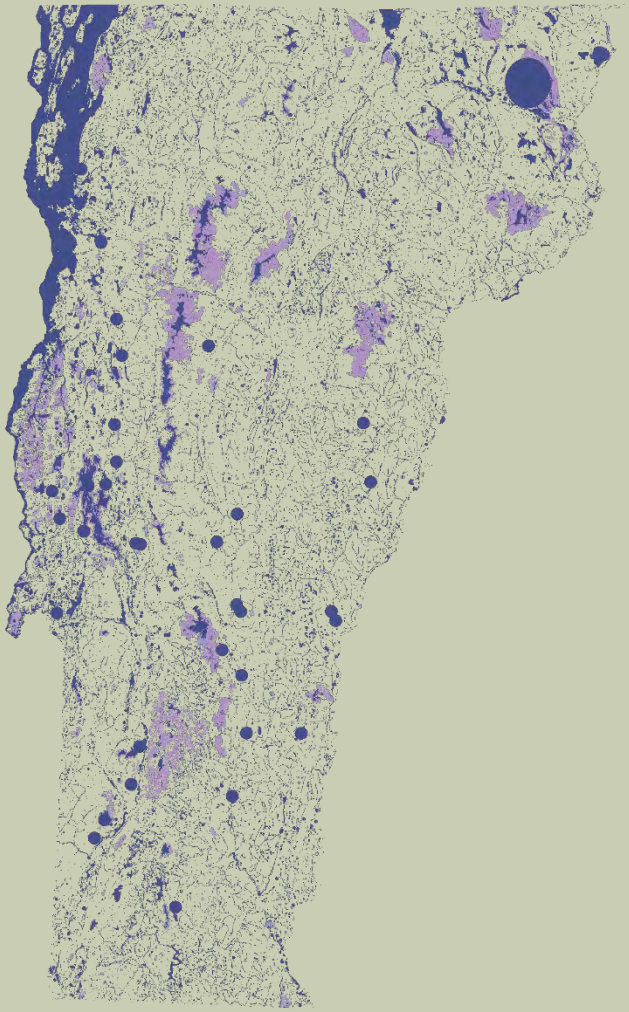
# Species Scale planning & management

- Can occur close to development
- Have ecological importance
- Often little flexibility in management
- High regulatory standards often appropriate

Rare plants and animals around Middlebury



# Vermont Conservation Design



**Species and Community Scale Priorities**

HIGHEST PRIORITY

PRIORITY

**Based on:**

Rare and uncommon species

Significant natural communities

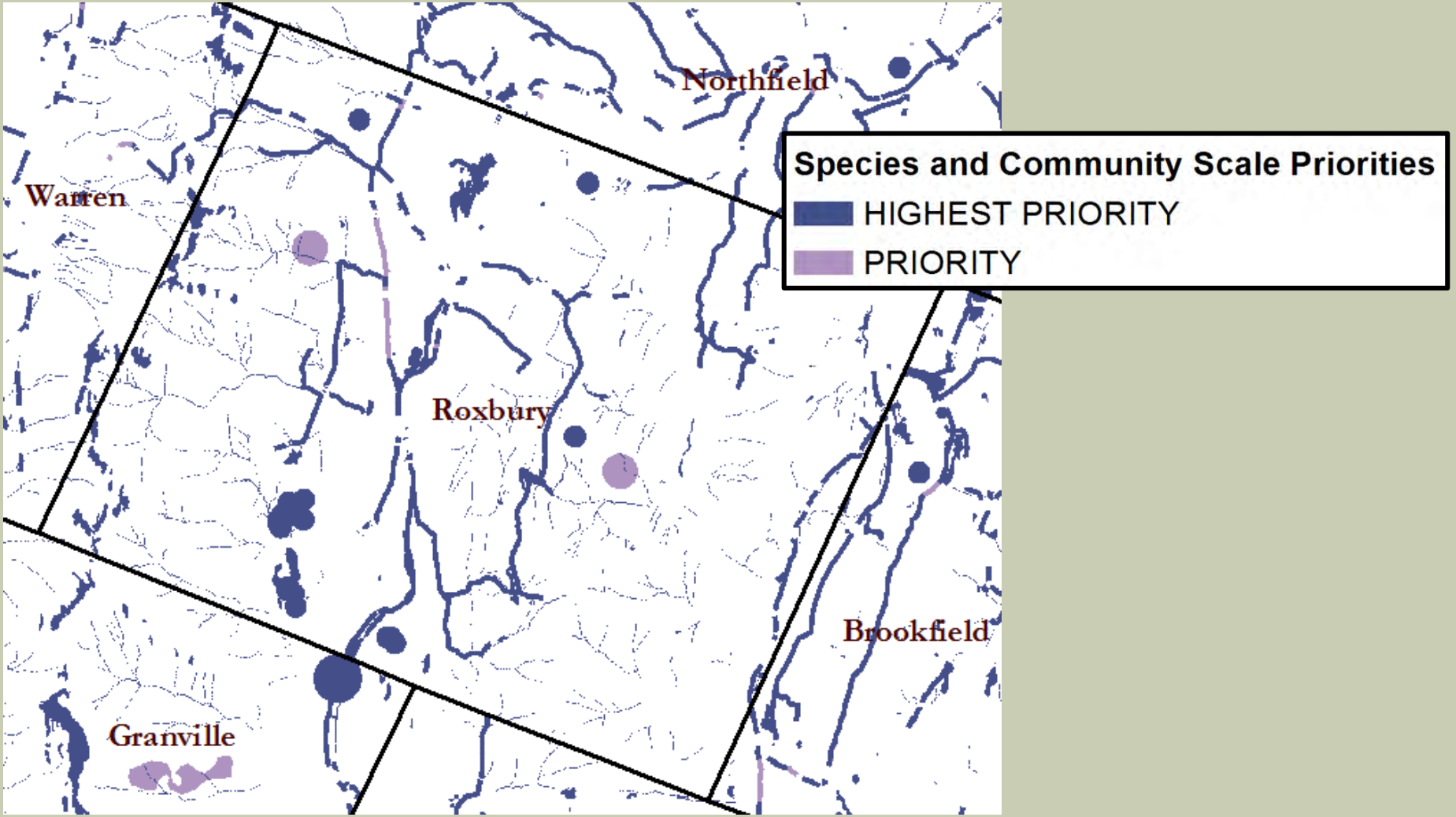
Vernal pools & wetlands

Wildlife road crossings

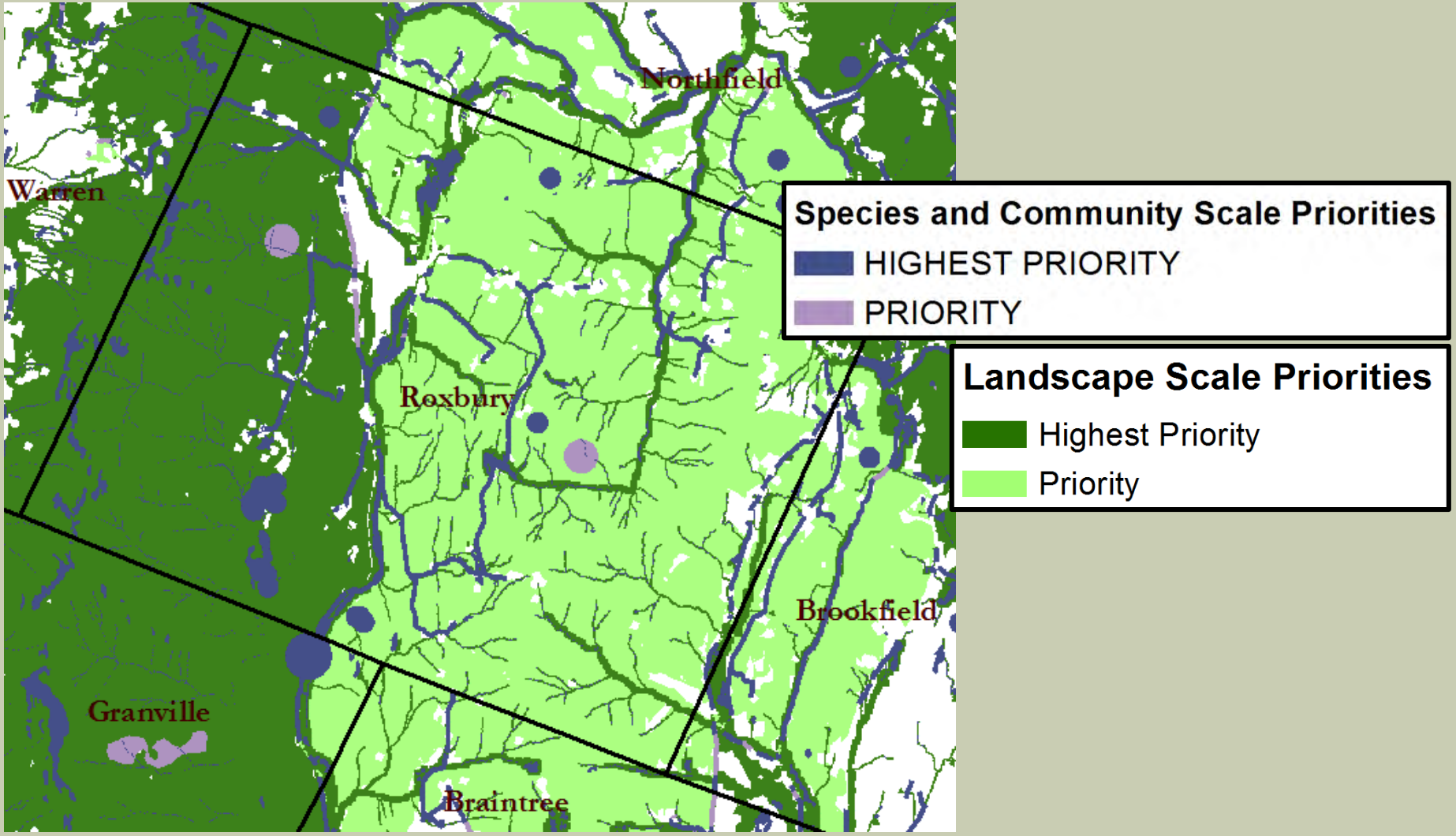
Grasslands & shrublands

Mast stands

# Vermont Conservation Design



# Vermont Conservation Design



# Case Study

Uplands
- Forest Cover
- Stormwater
- Land Use

Streams
- Species diversity
- Instream habitat
- Water quality

**Algal Blooms in Lake Champlain**

Wetlands & Floodplains
- Connection to floodplain
- Deposition of nutrients & sediments
- Retention of water
- Riparian vegetation

Lake
- Toxic Algae
- Species composition
- Invasives
- Lakeside habitat

The natural world is inter-connected

Land Use Planning
- Local
- Regional
- International

Recreation

Land management

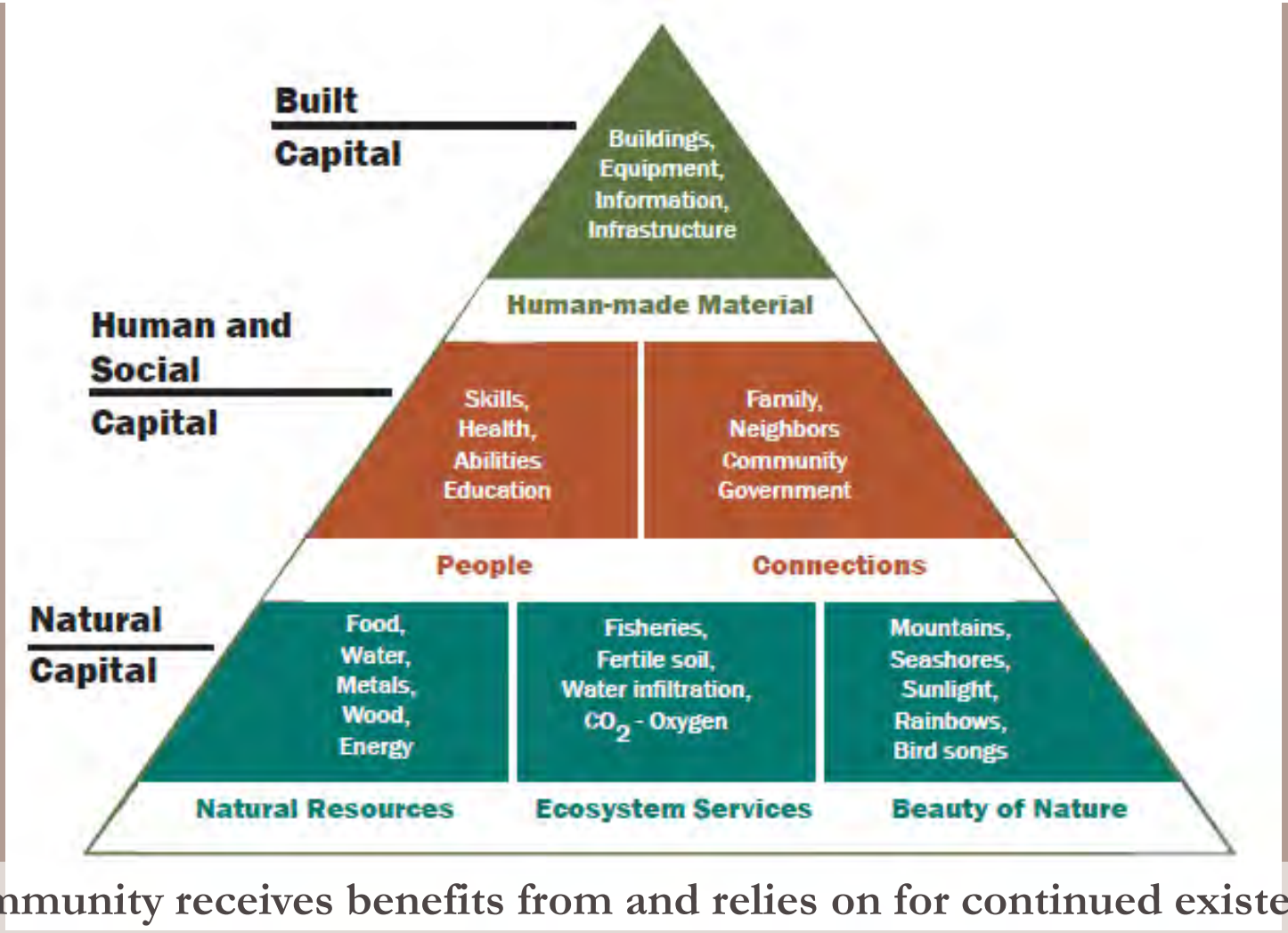

ACTIVITY
2

# Whole Communities

# Planning for **Green Infrastructure**

- Green infrastructure is an interconnected system of green spaces that perform needed and valuable functions for long-term sustainability.

# Community Capitol

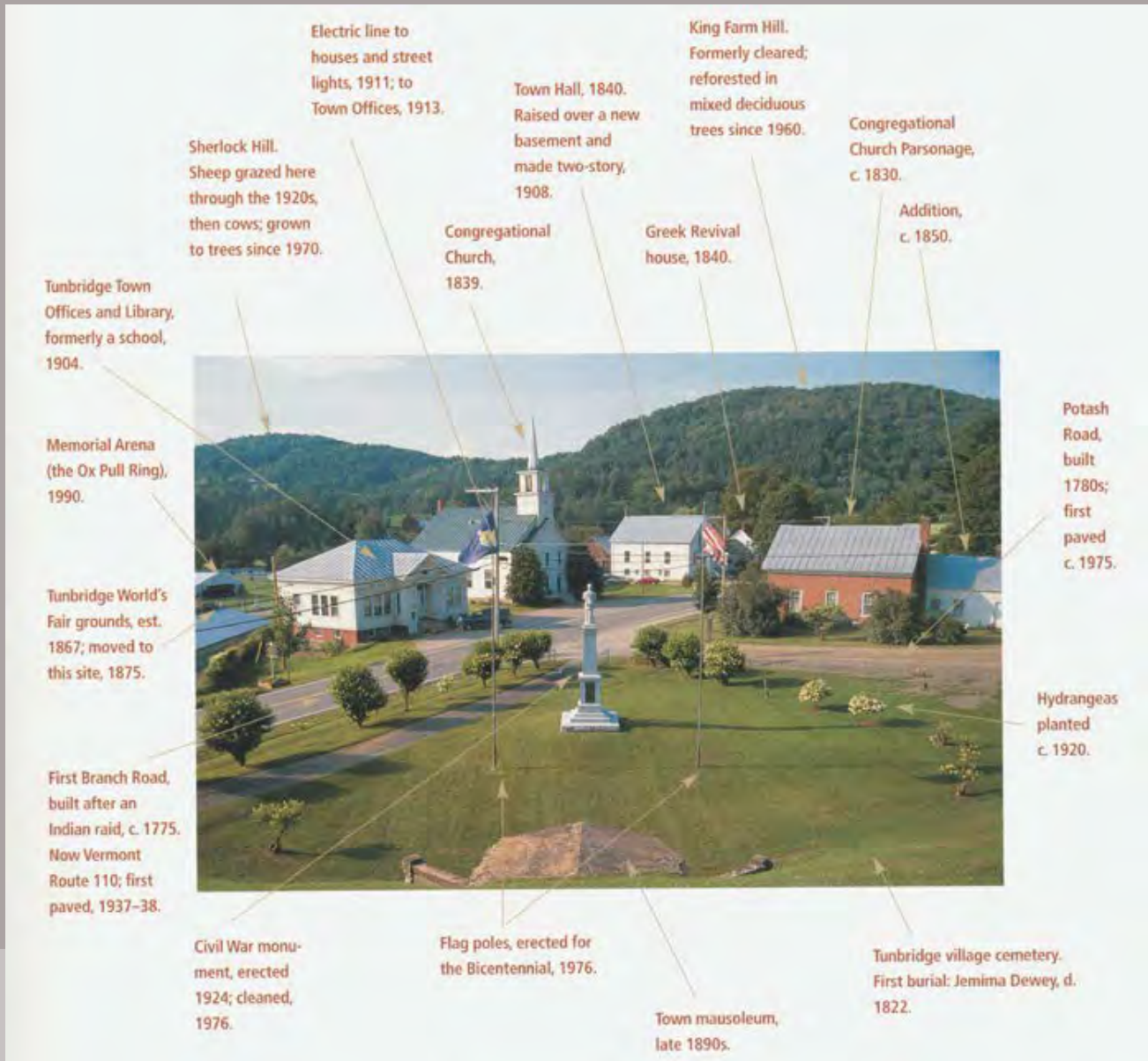



Community receives benefits from and relies on for continued existence.

An investment is to manage in a way so it improves it value.

# Every Community is Unique

## Tunbridge Village
*1760-1999*

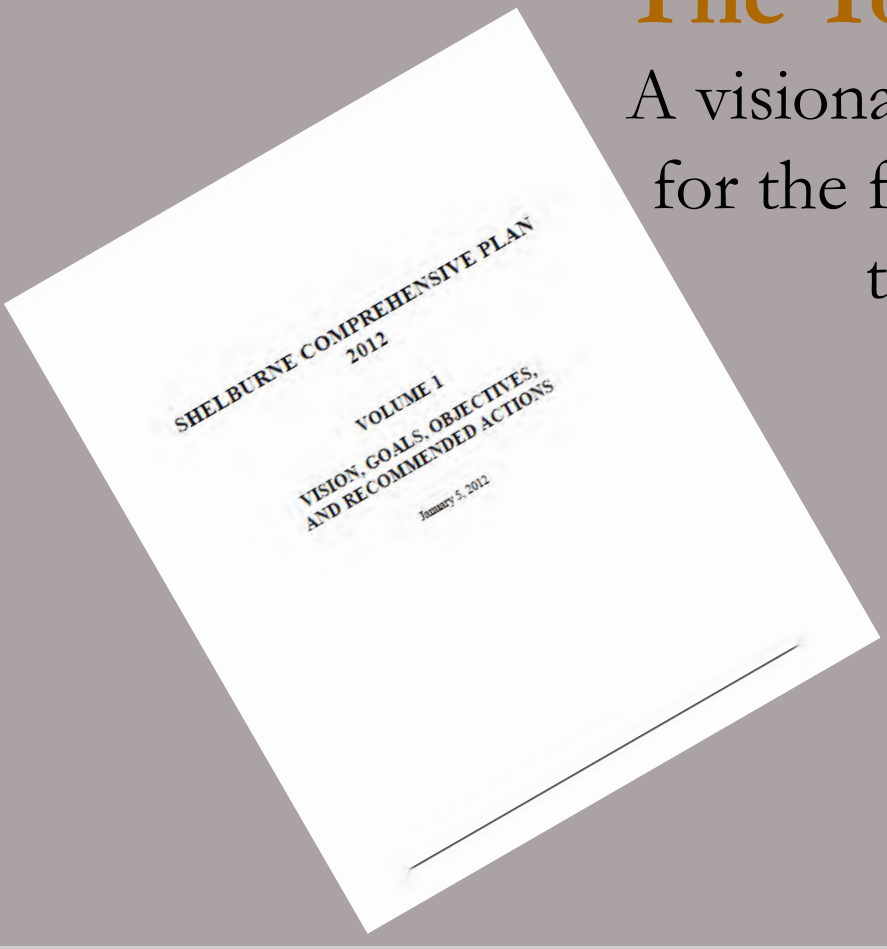



Jan Albers,
Hands on the Land

# It All Comes Together

## The Town Plan:

A visionary document for the future of the town.



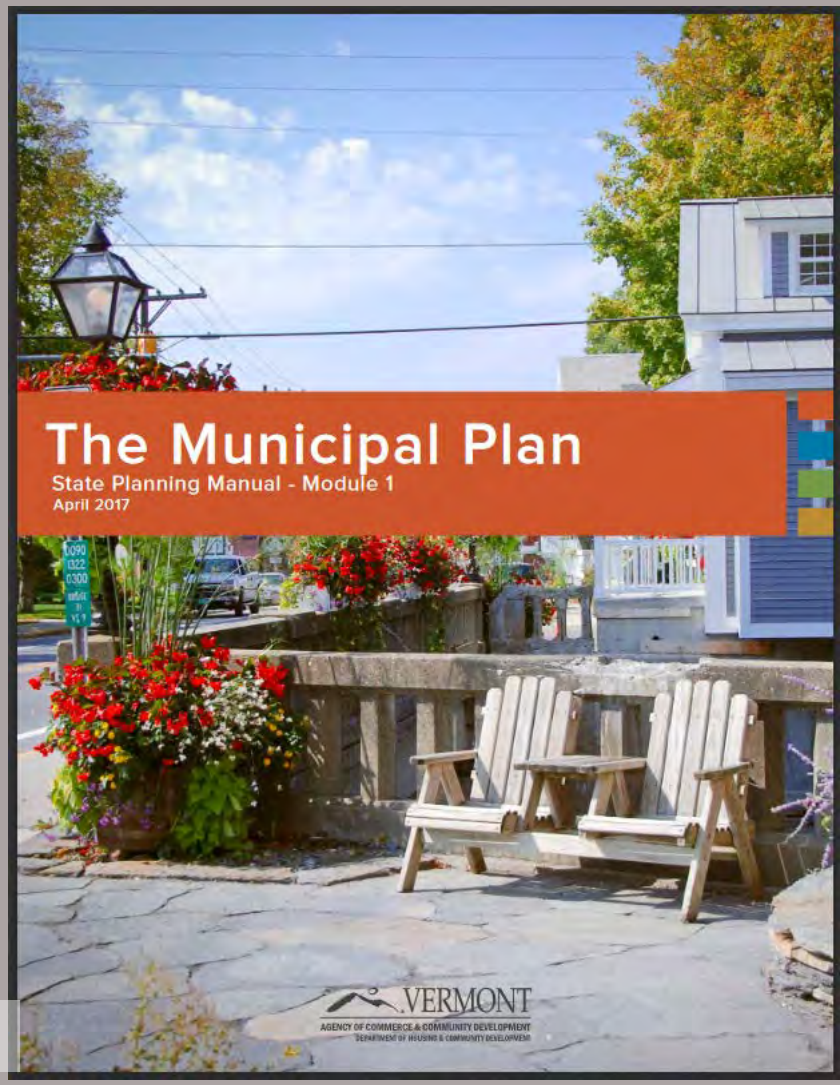


Public Process | Trends | Various Plan Elements | Maps

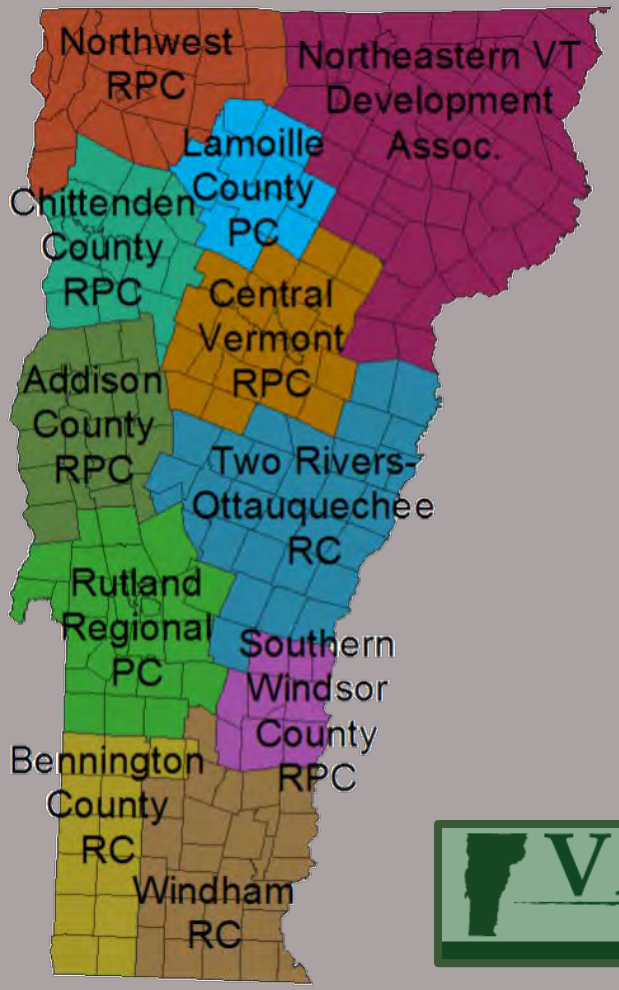
# Legal Framework of Town Planning

## Planning is local

- 24 V.S.A. Chapter 117: Vermont Planning & Development Act
- 4 Process Goals and 14 Planning Goals
- No statewide land use planning



# Regional Planning Commissions

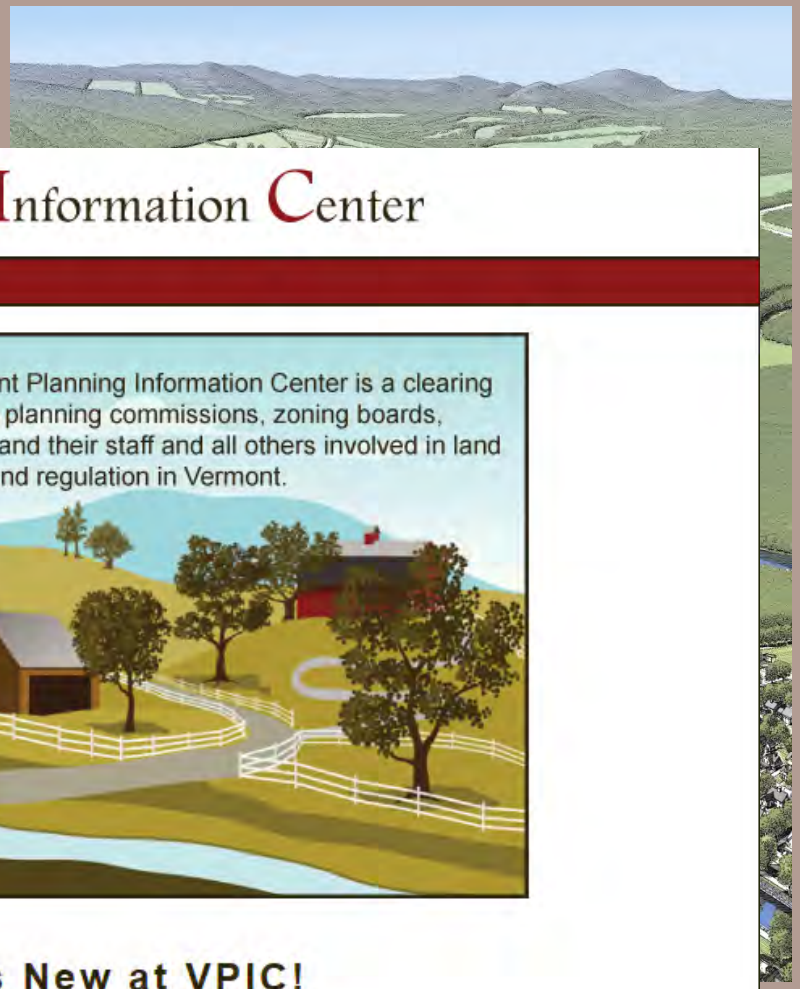



- Regional Plan
- Technical Assistance
- Data Repository

VAPDA
Vermont Association of Planning & Development Agencies

# Smart Planning

www.vpic.info



Vermont Planning Information Center

- Home
- New Resources
- Planning & Zoning
- Technical Assistance
- Grant Funding
- Frequently Asked Questions
- Calendar of Events
- About Us
- Search VPIC

Welcome... The Vermont Planning Information Center is a clearing house of information for planning commissions, zoning boards, development review boards, and their staff and all others involved in land planning and regulation in Vermont.

**What's New at VPIC!**

For new data and information click **here**.

# Working Together

To encourage citizen participation at all levels of the planning process.

## Roles & Responsibilities

- Planning Commission
- Town planner
- Conservation Commission
- Selectboard
- Development Review Board
- Zoning Administrator
- Town manager

# Working Lands

Agriculture and Forest Land: Economy & Ecology

# Transportation

## Roads

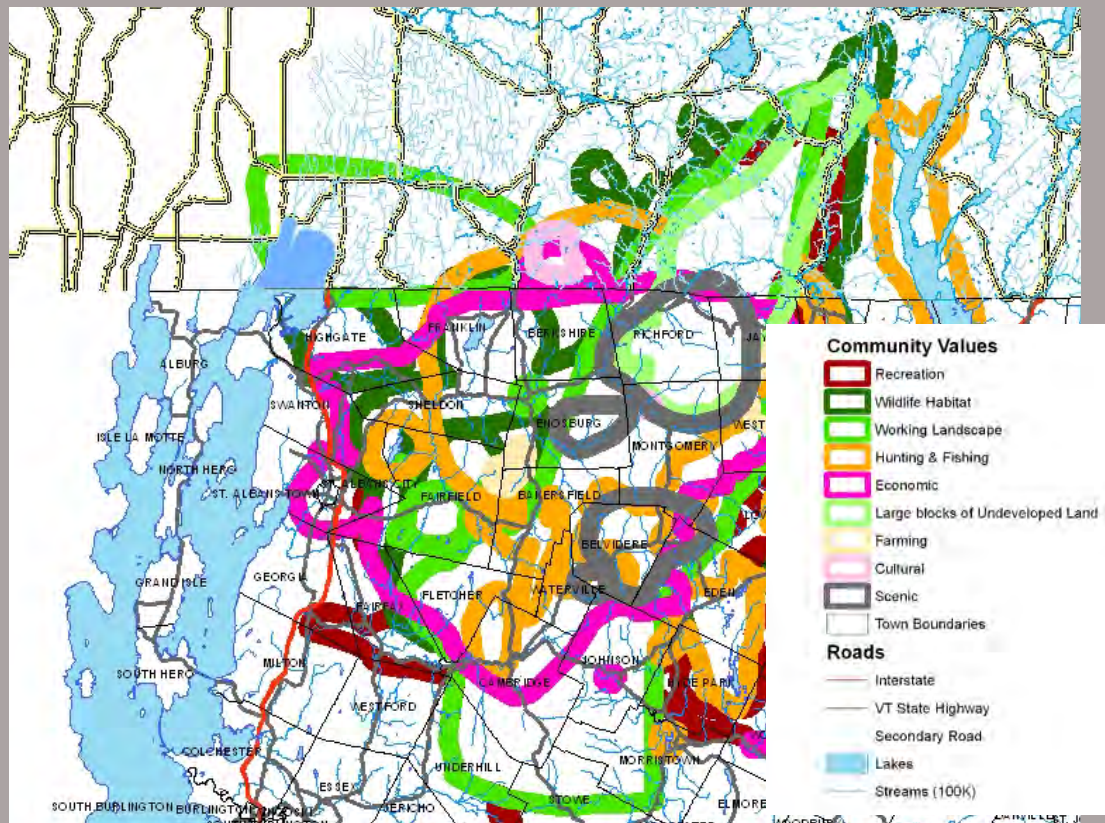
- Vector for development
- Implications for water, wildlife & air

# Community Engagement


Creating and re-affirming a shared vision

## Ask the Community

- Community Survey
- Value Mapping



# Compact Village and Urban Centers

Residential development is occurring outside of villages and growth centers

# Ready for Growth Downtown?

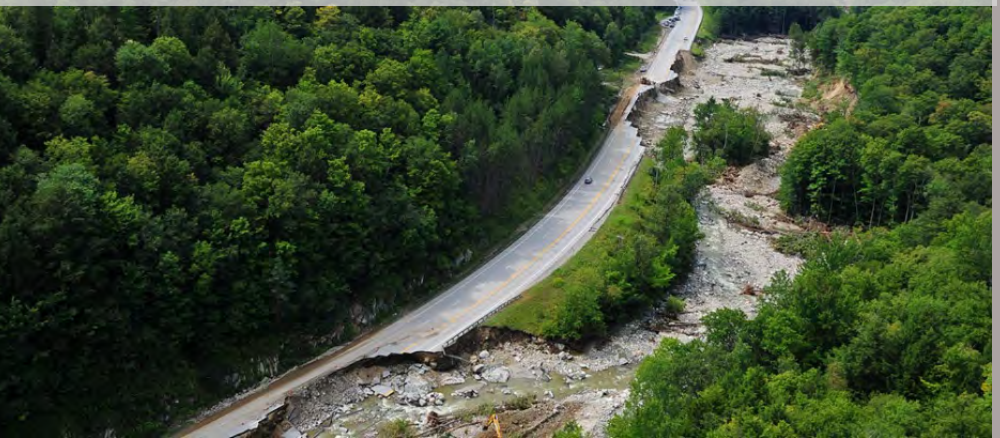
Financial Resources need to be in place to support growth where appropriate

# Planning for Development

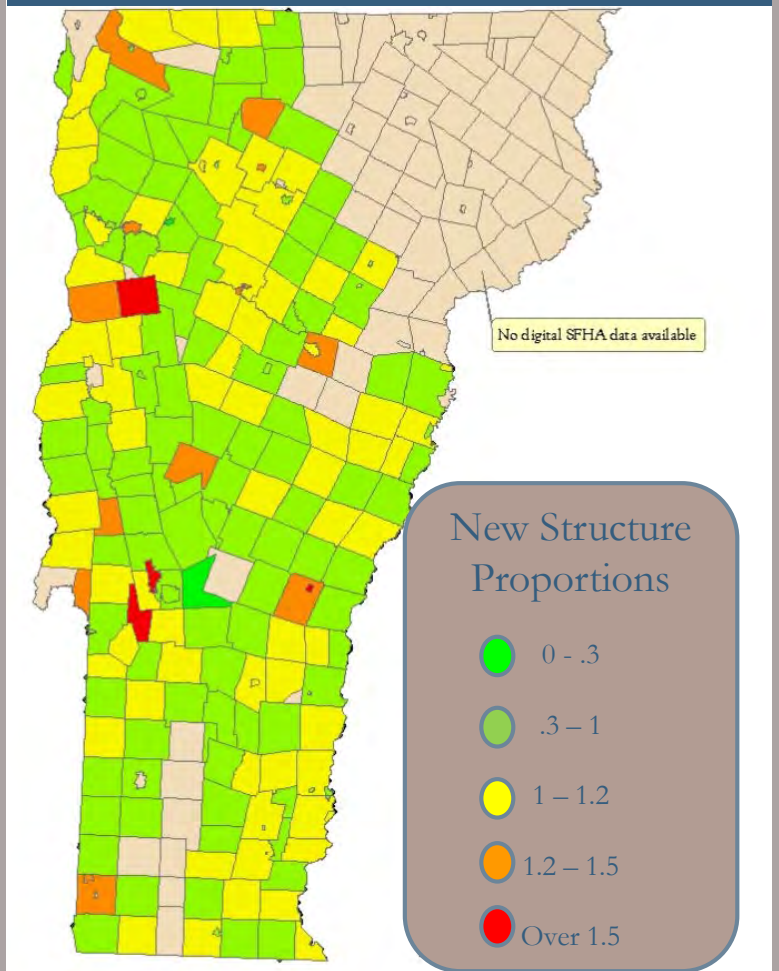
# Poor Land Use Planning

## COSTS US ALL

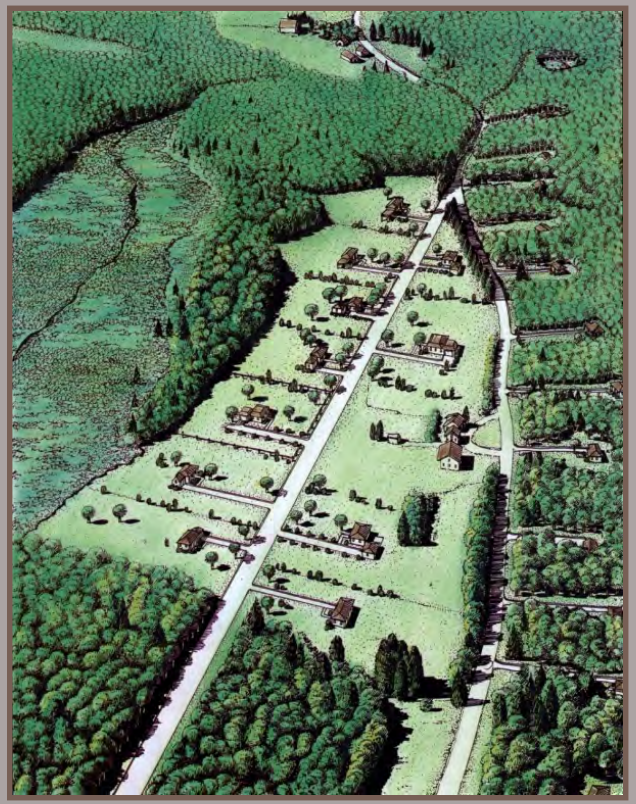
Tropical Storm Irene 2011



**Changes in the # of structures in floodplains from 2008 to 2010**



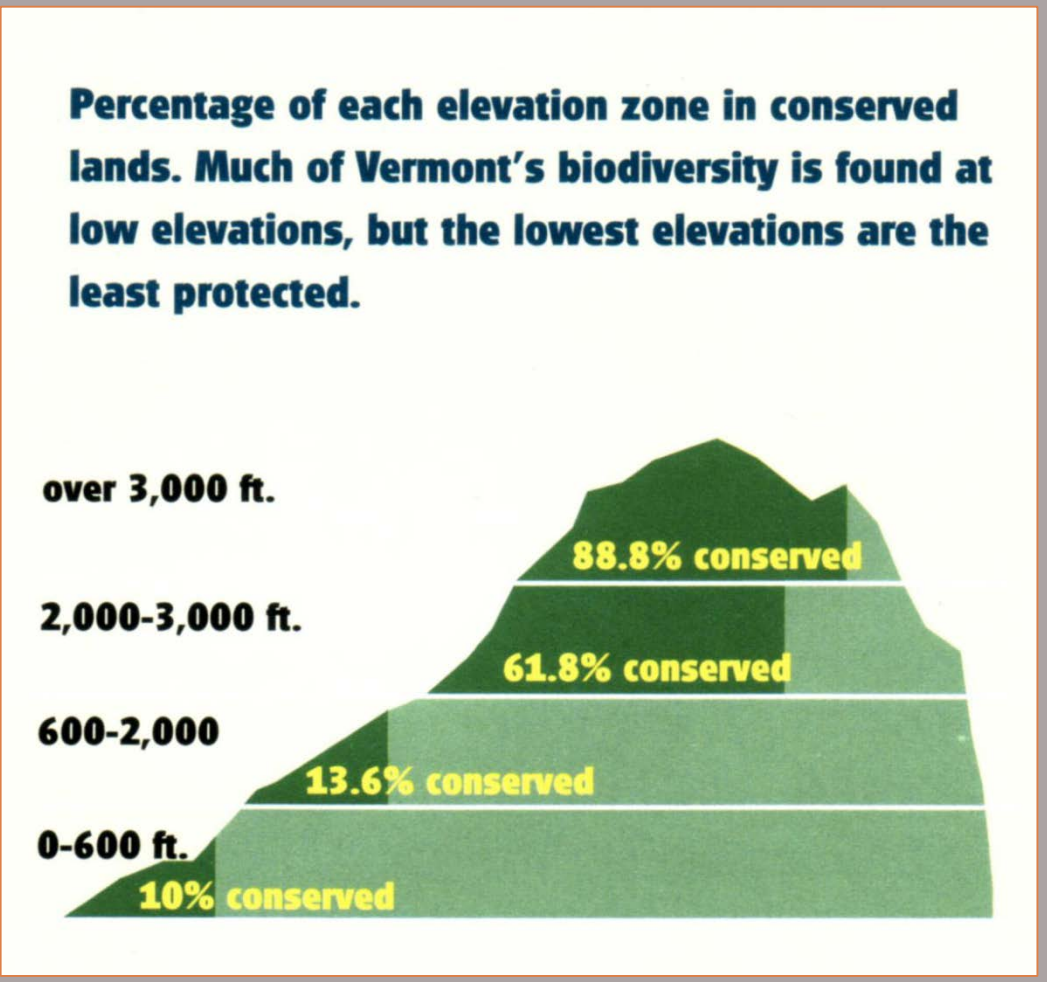
# Where is the 'Right Place' For Development?



Multi-functionality | Connectivity | Habitability | Resiliency | Identity | Return on Investment

Pictures: Dealing with Change in the Connecticut River Valley: A Design Manual for Conservation and Development.

# Conserved Land by Elevation




Does conservation in your town adequately address?

- Elevation zones
- Bedrock & Surficial geology zones
- Diversity in the physical landscape

# Planning and Property Rights

- A careful balance and key consideration for planning
- Good land use planning considers property rights as well as other community goals

# Many Ways of Moving Forward

## Range of options

**Landowner**

- Education
- Landowner Management decisions
- Incentive Programs
- Management Agreements
- Conservation Easements
- Land Acquisition

**Municipal**

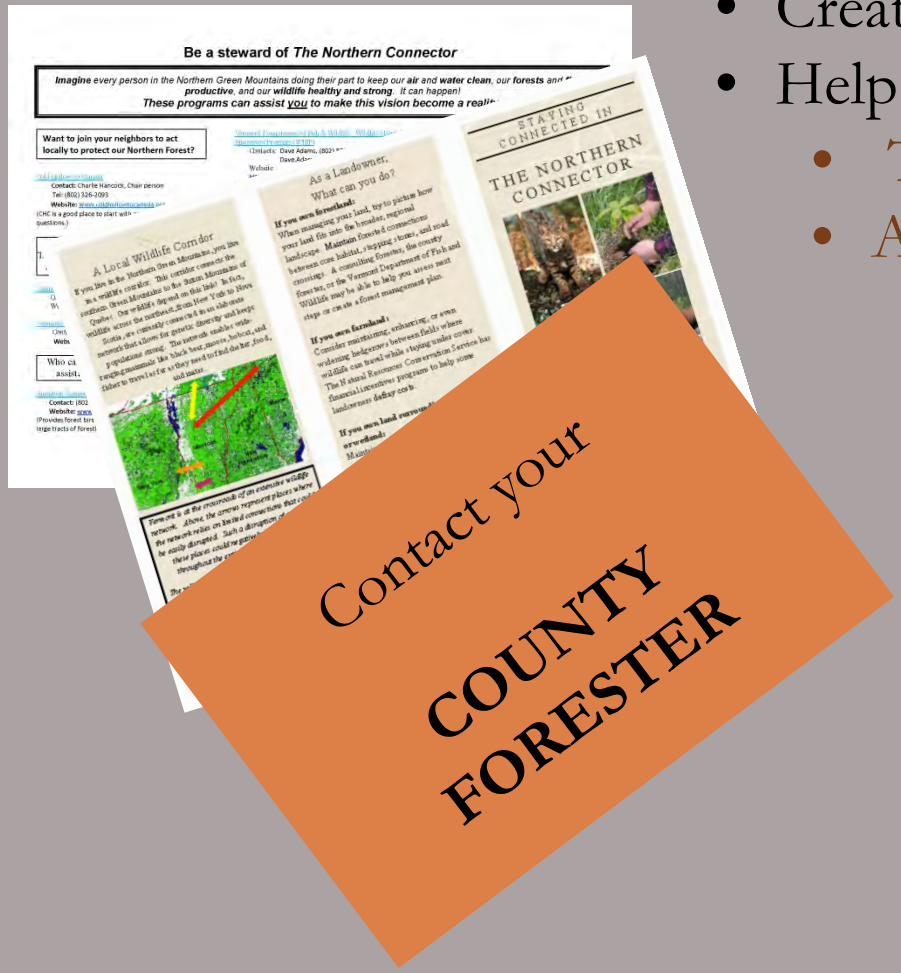
- Education & Outreach
- Inventory
- Town Plan
- Bylaws
- Zoning

**No one tool is right for every landowner or town**

# Non-Regulatory Approaches

- Use Value Appraisal (Current Use)
- Conservation easements and land trusts
- Site design around mapped natural resource features – biological inventories, management plans
- Landowner Cooperatives
- Compact, village-style development
- Town Forests

# Outreach to Landowners

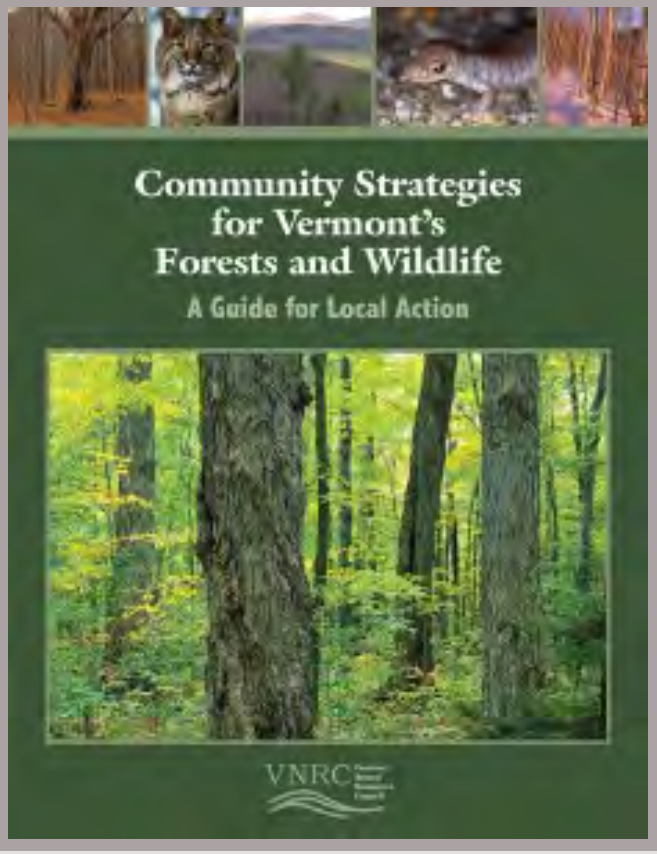



- Create a menu of options for landowners
- Help landowners understand:
  - Their stewardship responsibilities
  - A Vermont land ethic

# Regulatory Approaches

- Conservation/forest zoning districts
- Overlay districts
- Subdivision regulations
- Planned Unit Developments
- Clustering and conservation subdivisions

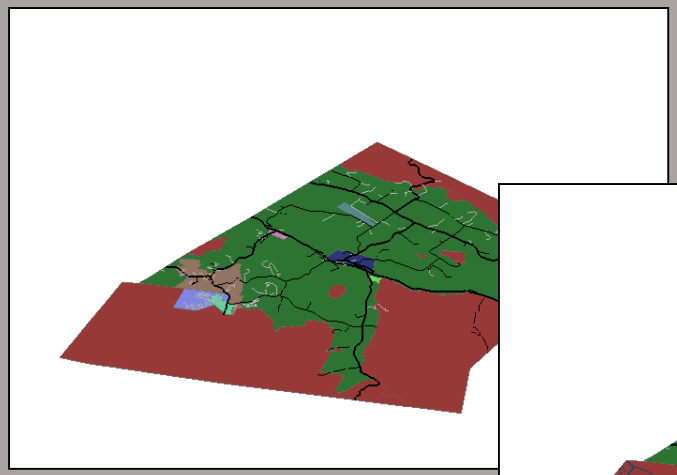
VNRC Vermont Natural Resources Council



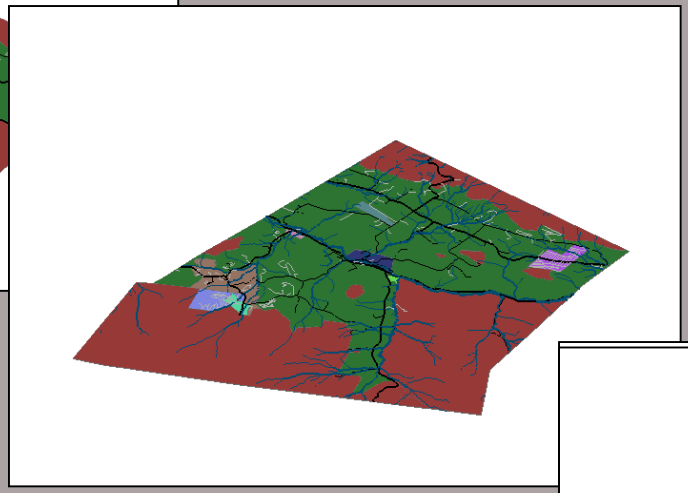
# Subdivision regulations

- Control the pattern of development and help towns plan for infrastructure – but can also help protect natural resources
- Guides parcel size and configuration – can help minimize forest fragmentation
- Manages and mitigates impacts of development (e.g., fragmentation, erosion control, traffic, etc.)
- May include design guidelines or standards to promote conservation

# Overlay districts - example

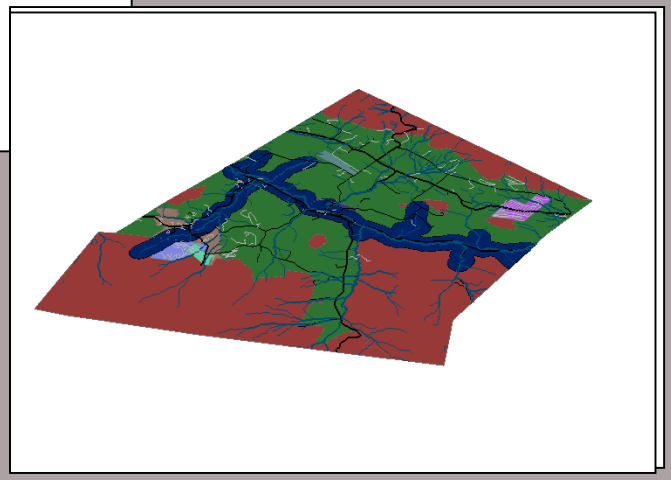


Zoning Districts assign different uses to different areas



An Overlay District also cuts across other zoning districts

Example – Fluvial Erosion Hazard area



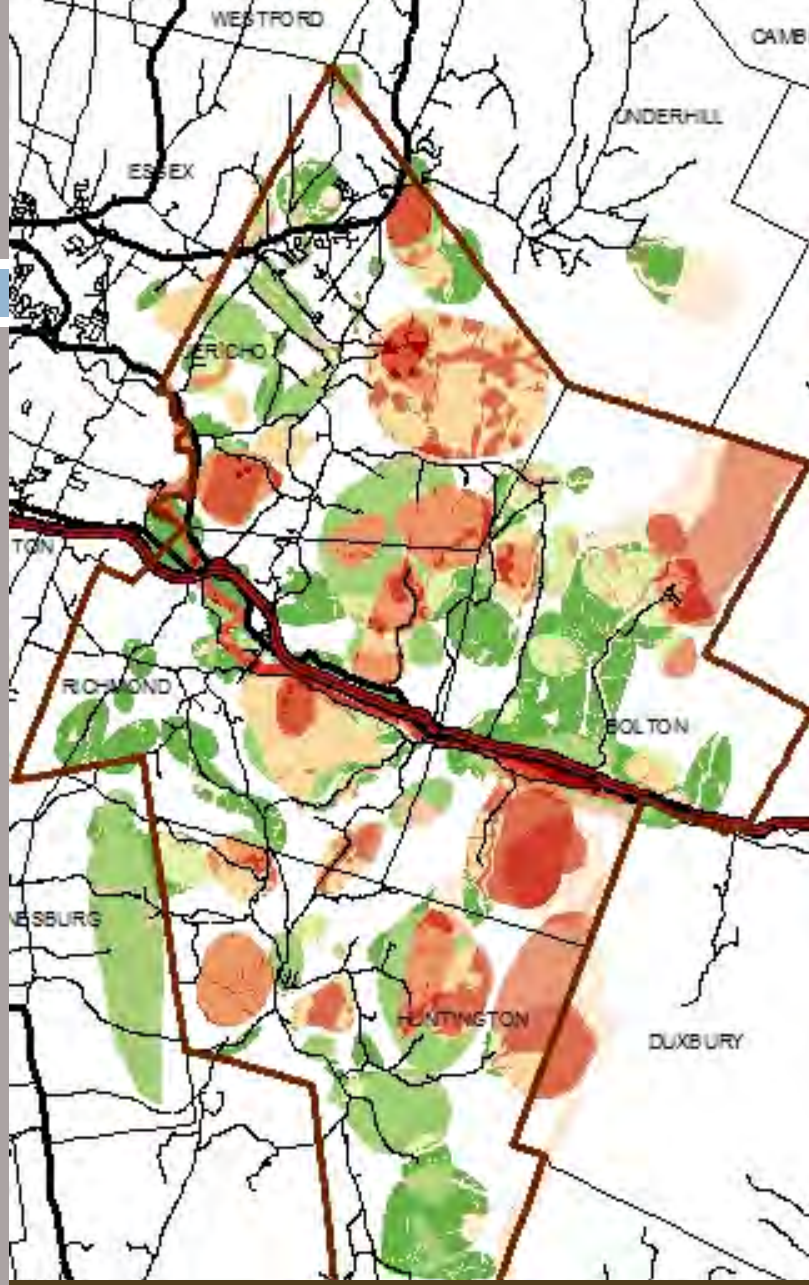
Many natural resources cut across several zoning districts.

In this example – Look for the main branch of the river

# Science to Action

A $40,000 grant from ECOS, through the Chittenden County Regional Planning Commission

- **Steering Committee** (CCRPC, Conservation Commissions, VTFWD, VNRC)
- **Technical Assistance** to Planning Commissions (VNRC, VT FWD)
- **Natural Resource Inventory** (Arrowwood)
- **Community Values Mapping** (Steering Committee)
- **Outreach** (Steering Committee, Conservation Commissions)
- **Plan and Bylaw changes** (Planning Commissions, Selectboard)




Community Values Map for Richmond, Jericho, Bolton, Huntington

# Learn More!

## Caring for Natural Resources: Taking Action In Your Community

*Exploring the many ways to move forward*

# Thank You

# ACTIVITY 3