The Health of Vermont Lakes: Results of the 2007 National Lake Assessment

Kellie Merrell
Vermont Agency of Natural Resources

2 May 2012 – 8th National Monitoring Conference, Portland, OR

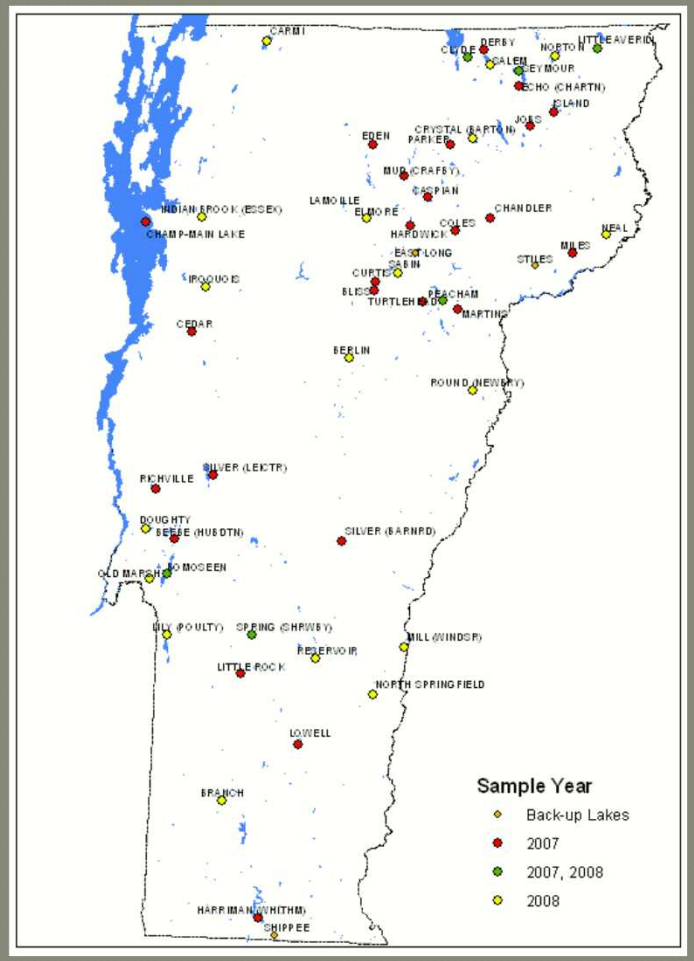
VERMONT
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Acknowledgements

- Neil Kamman, VTDEC
- Sarah Wheeler, McKalyn Garrity, Julia LaRouche, Eric Howe, VTDEC
- Mark Mitchell, VTDEC
- Steve Paulsen, Phil Kaufmann, Tony Olsen and Richard Mitchell, EPA

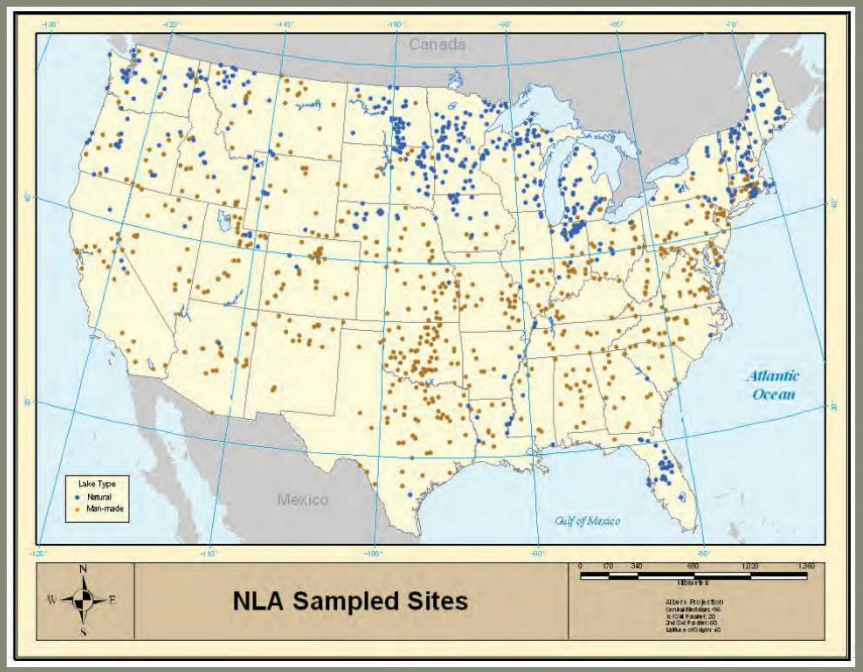
VT DEC Sampled 51 lakes



- 2007 and 2008
- 49 randomly selected
- 2 selected as reference lakes as part of the Ecoregional and National reference set.
- 2 reference lakes and 9 of the randomly selected 'original draw'
- 40 'overdraw' for state assessment

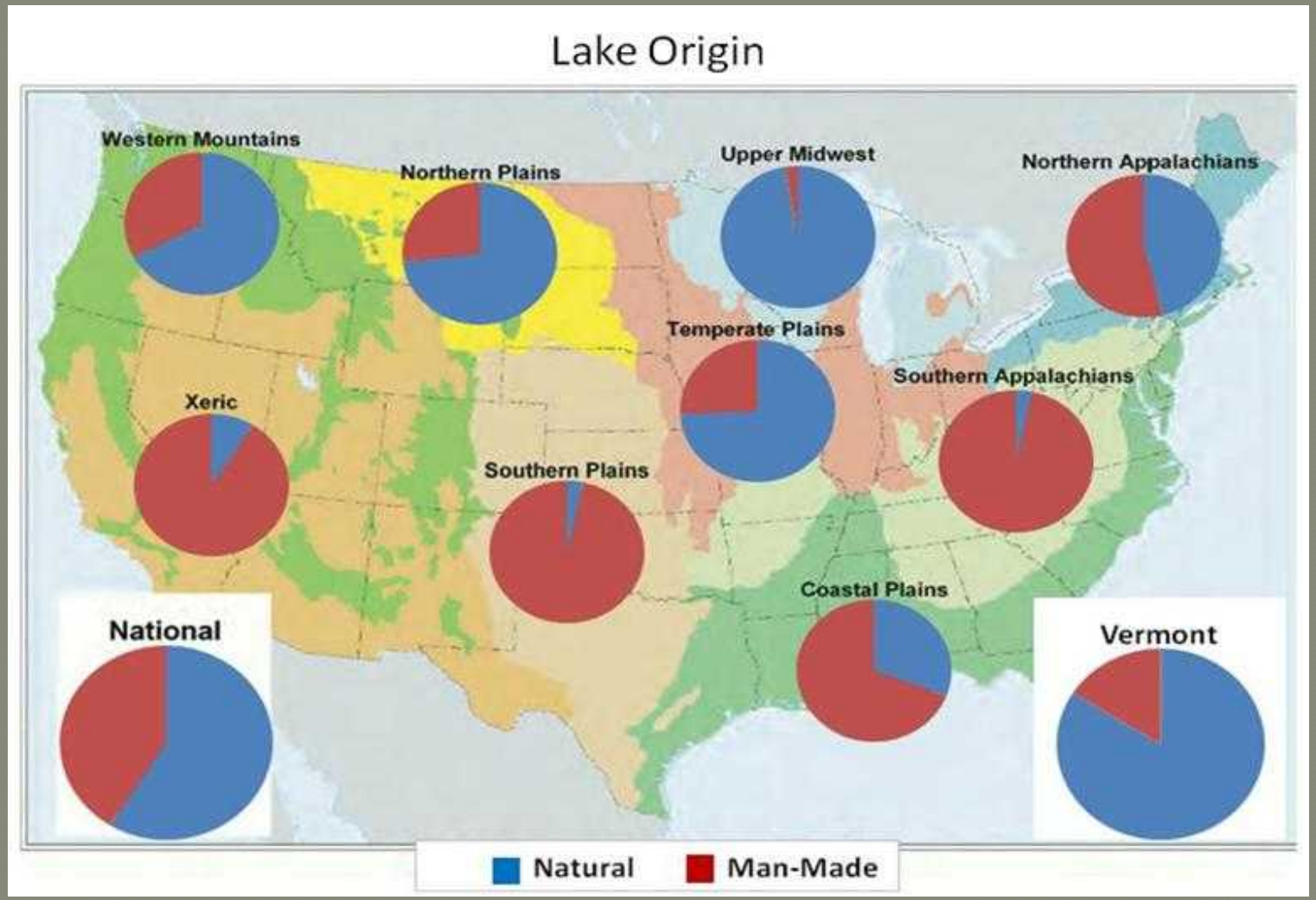
Throughout this presentation Vermont's results will be compared to the results from:

Northern Appalachian Ecoregion

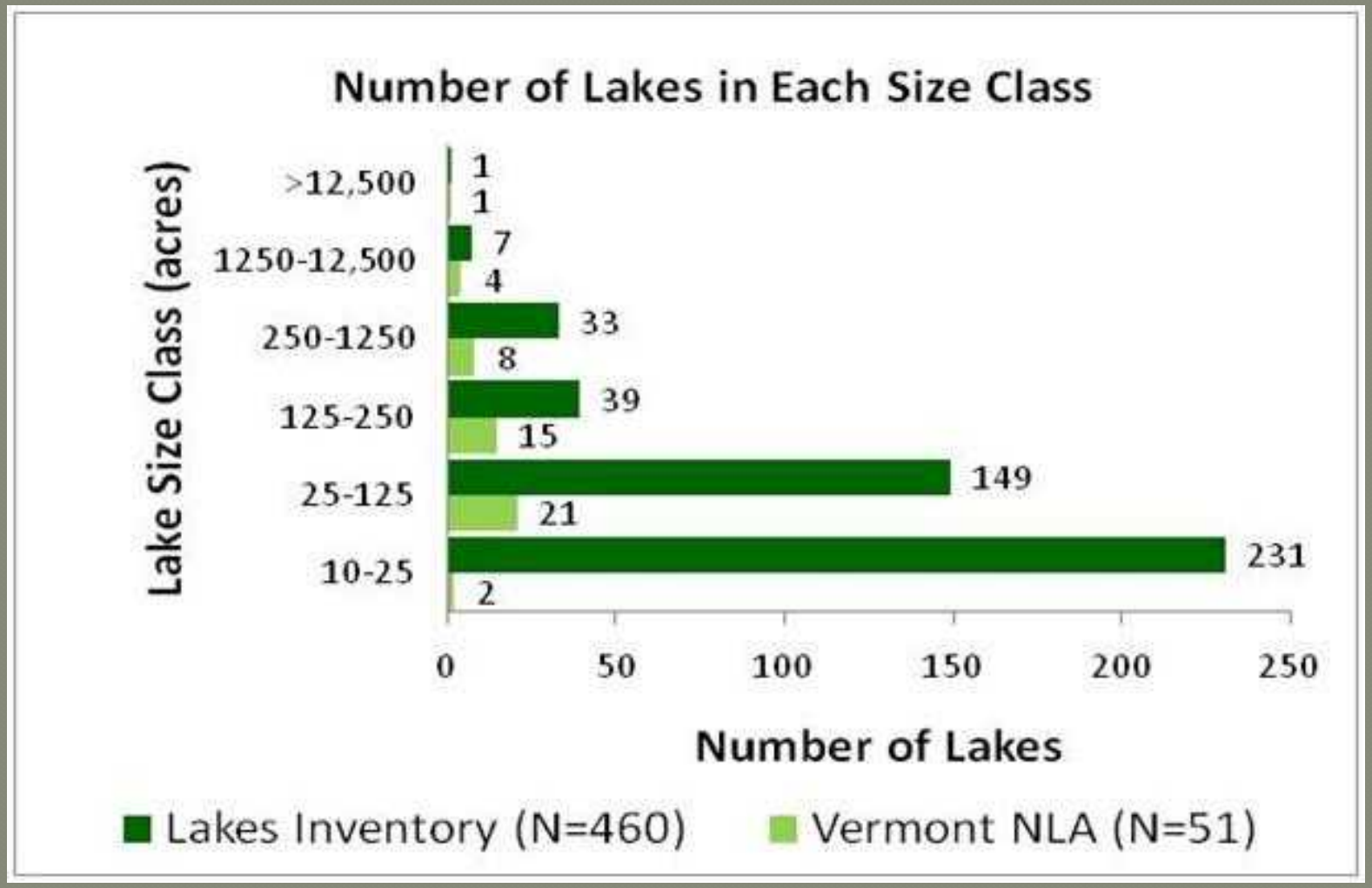


Nation

84% of Vermont's Lakes are of Natural Origin

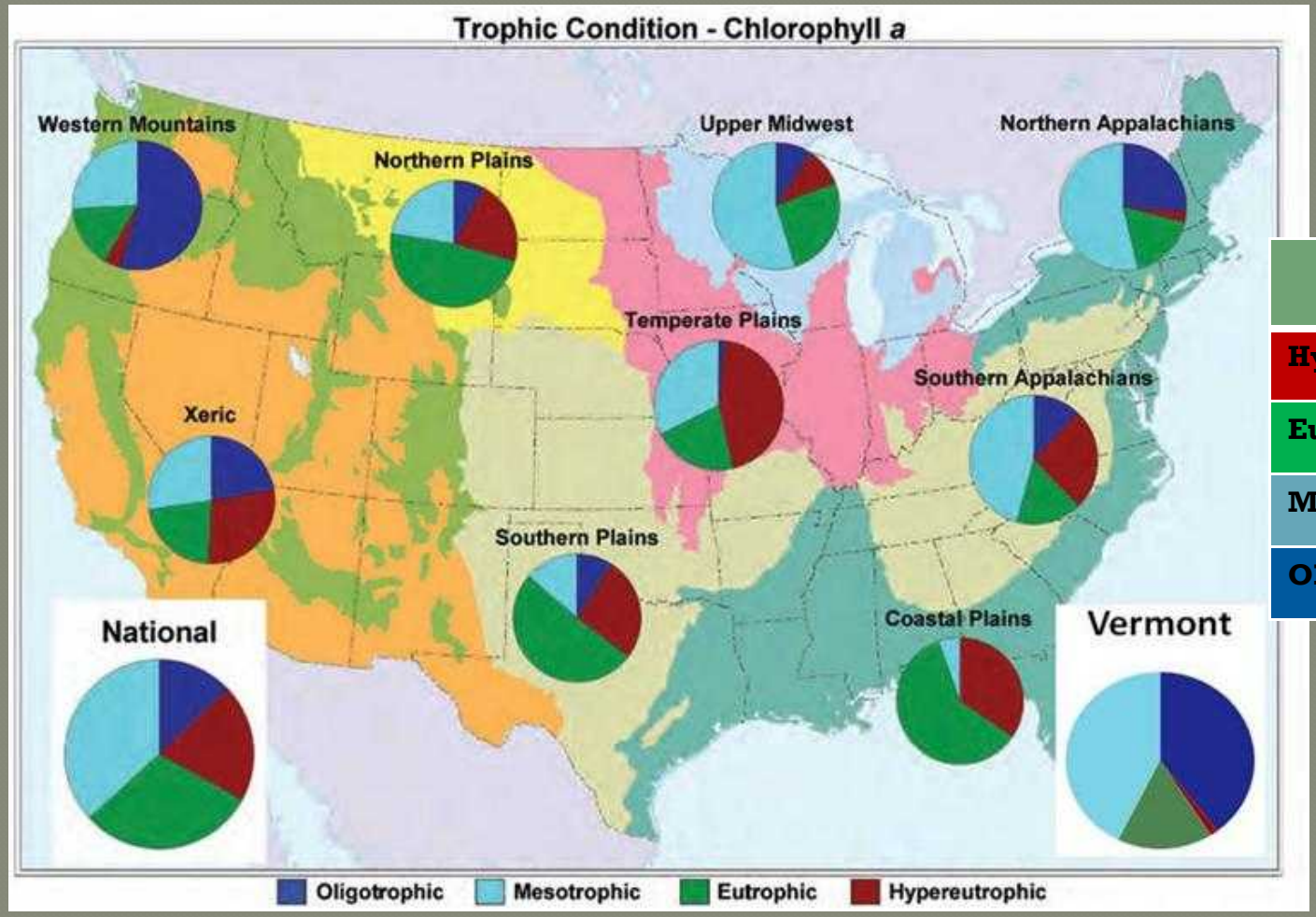


Weights were assigned to each lake based on size class and representation in Vermont



Water Quality Indicators

Vermont has a larger proportion of oligotrophic lakes than both the Northern Appalachian Ecoregion and Nation

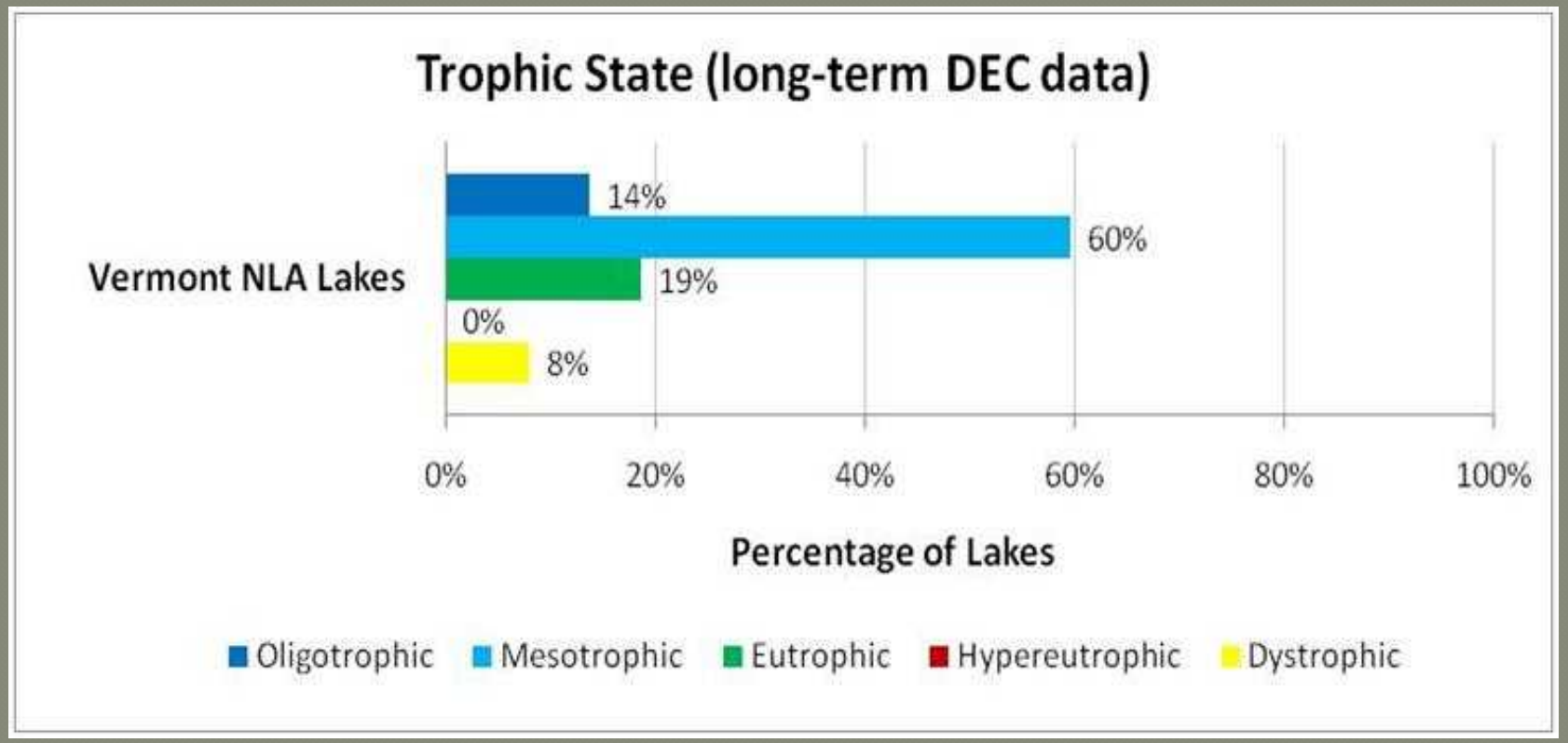


NLA Threshold Chlorophyll-*a* (ug/L)	
Hypereutrophic	>30
Eutrophic	>7 – 30
Mesotrophic	>2 -7
Oligotrophic	>2

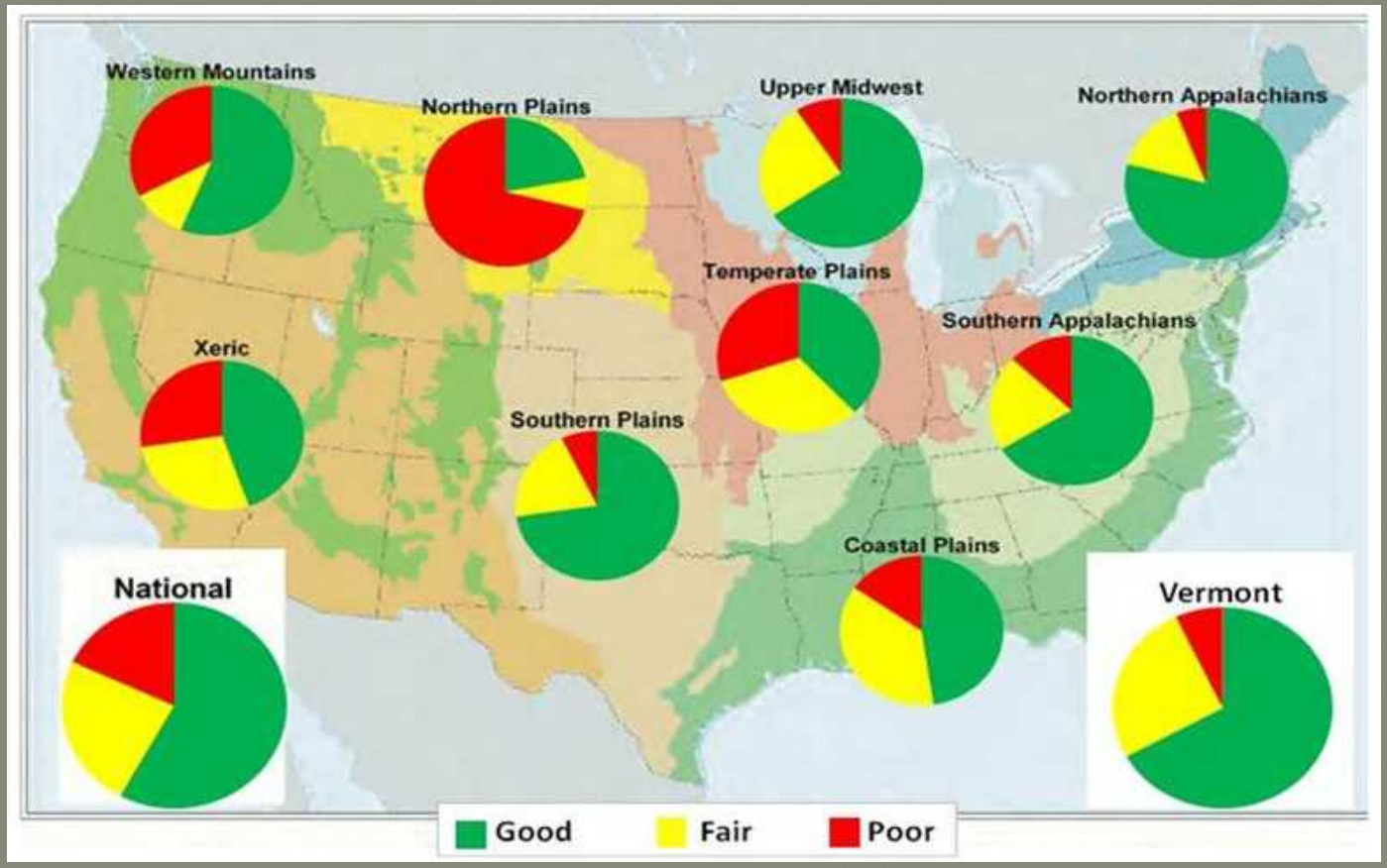
Vermont has its own trophic thresholds

Trophic StateT	NLA Chl - a	Secchi	Chl - a	TP	TP *(Nurnberg , 1996)*	TN *(Nurnberg , 1996)*	Color
		Summer mean (m)	Summer mean (ug/L)	Spring mean (ug/L)	Summer photic zone (ug/L)	Summer photic zone (mg/L)	(PtCo)
Hypereutrophic	**>30**			>100		>1.2	
Eutrophic	**>7 – 30**	0 - 3.0	≥ 7.0	> 15	>24	0.65-1.2	
Mesotrophic	**>2 -7**	3.0 - 5.5	> 3.5 - 7.0	>7 - 15	10-24	0.35 - <6.5	
Oligotrophic	**>2**	≥ 5.5	0 - 3.5	≤7	<10	<0.35	
Dystrophpic				<20	<24		>50*

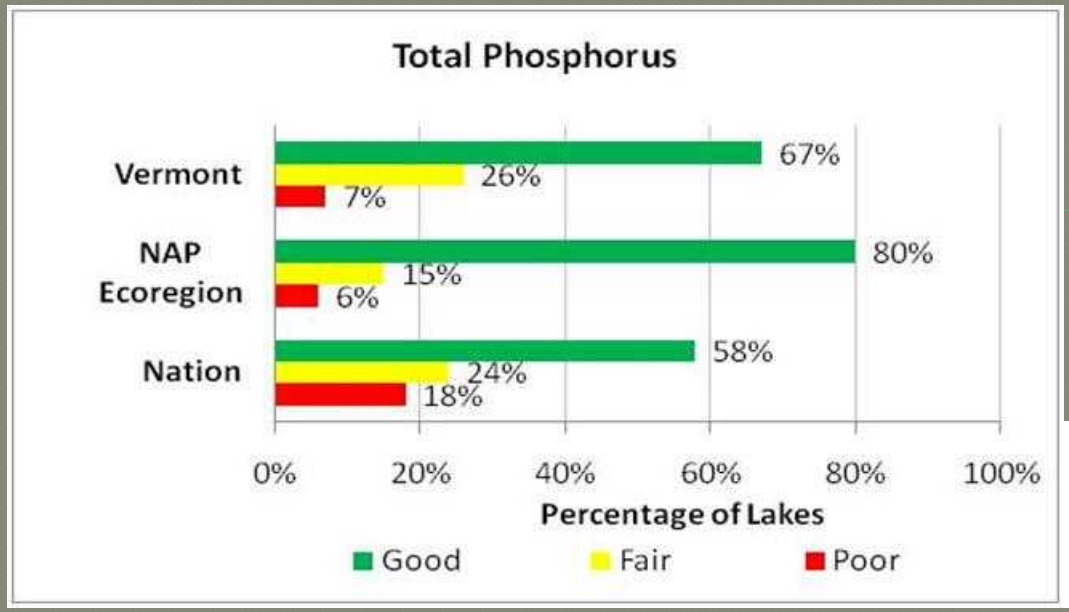
Vermont happened to have long term water quality data on all of the NLA lakes sampled.



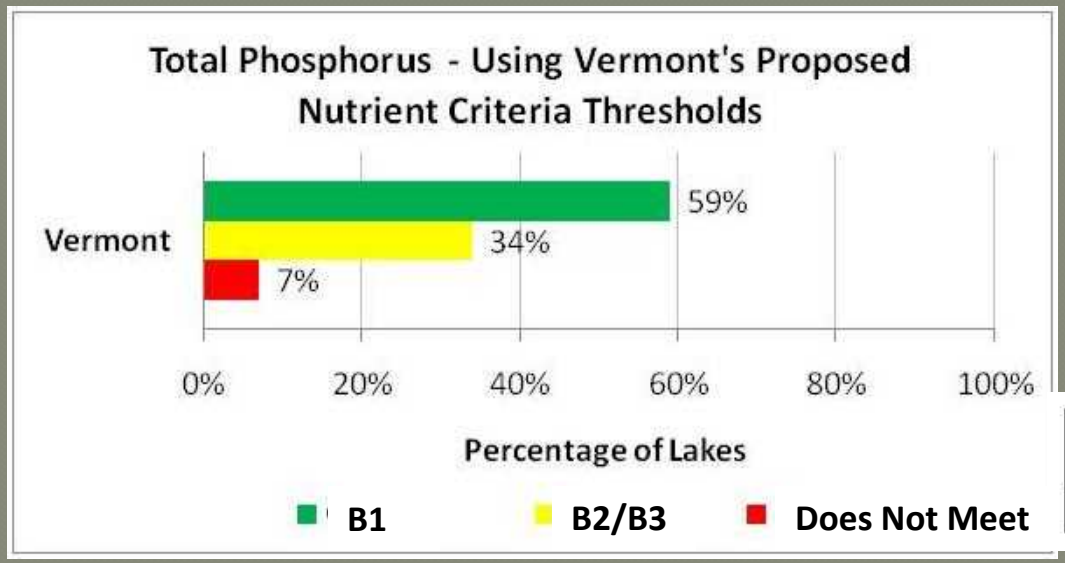
Total Phosphorus



NAP Ecoregion Thresholds	Good	Fair	Poor
Total Phosphorus µg/L	<16.5	16.5 - <36	≥36

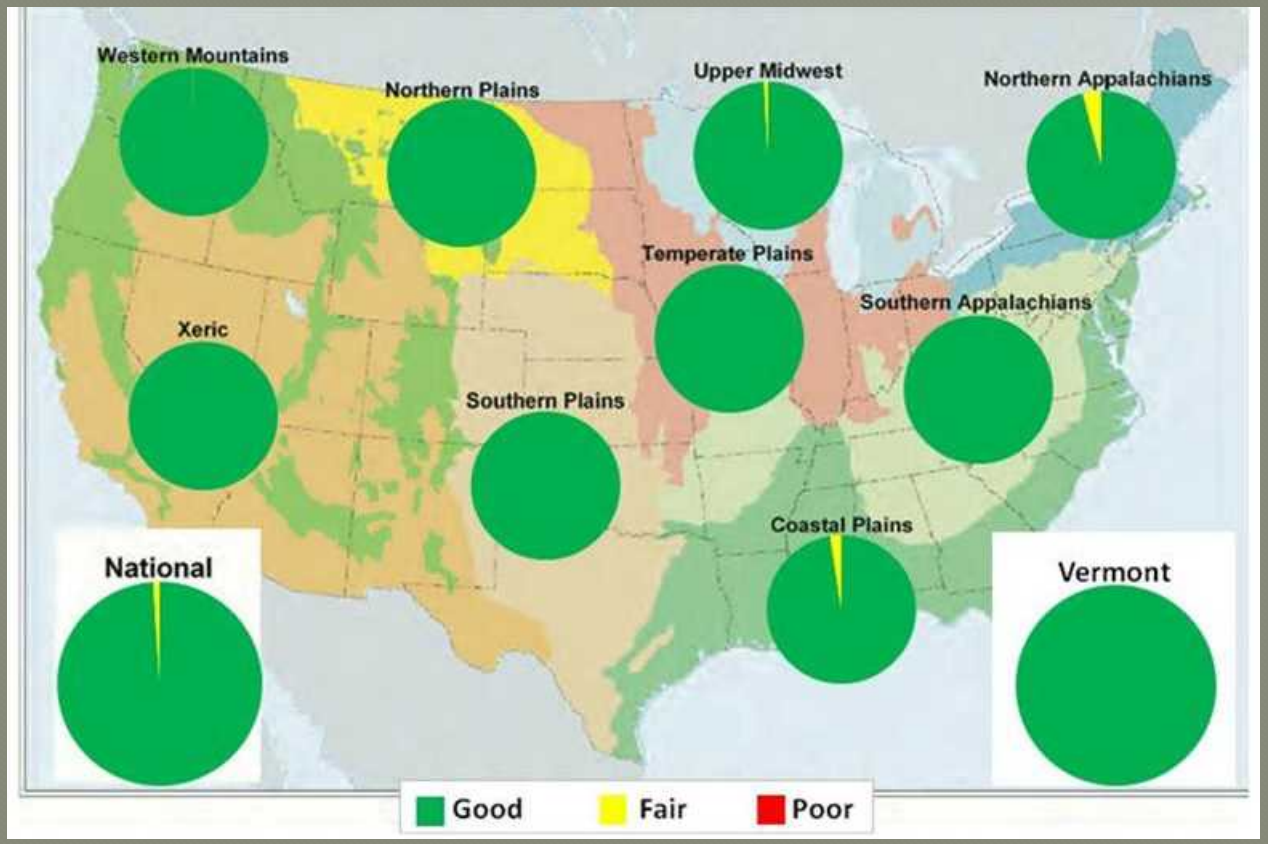


NAP Ecoregion Thresholds	Good	Fair	Poor
Total Phosphorus µg/L	<16.5	16.5 - <36	≥36



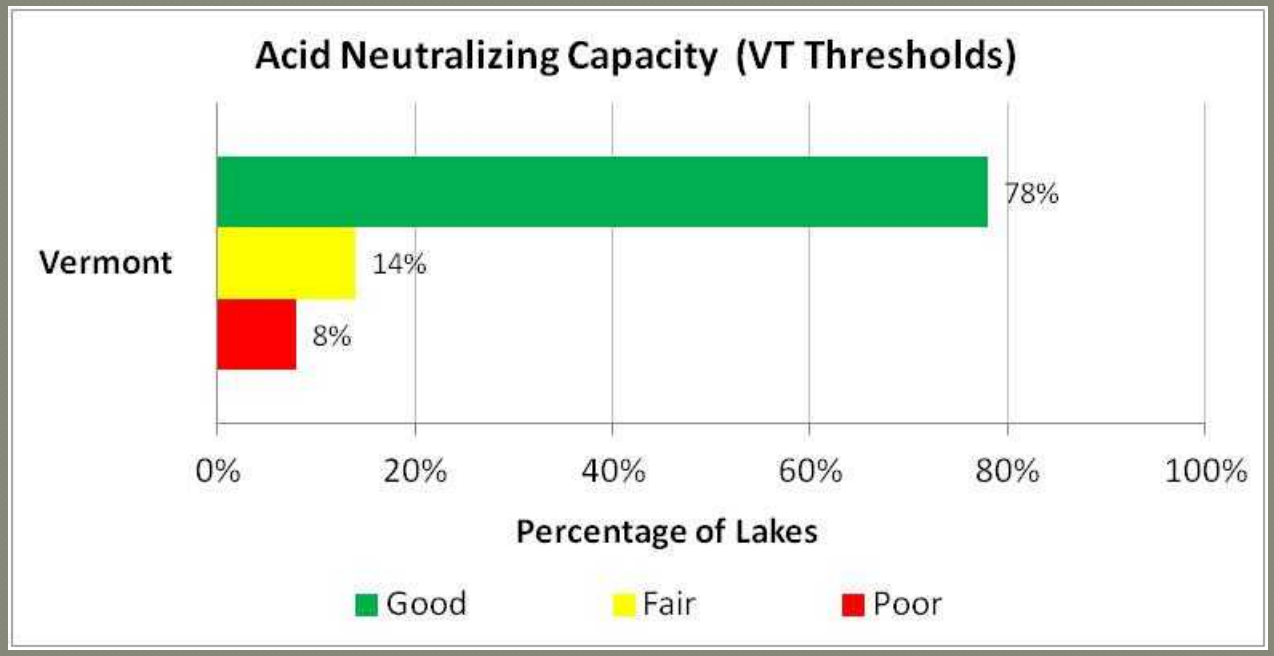
VT Nutrient Criteria Thresholds	B1	B2/B3	Does Not Meet
Total Phosphorus µg/L	<14	14-24	>24

Acid Neutralizing Capacity



NLA Thresholds	Good	Fair	Poor
Acid Neutralizing Capacity:			
1) Alkalinity mg $CaCO_3$/L	>2.5	2.5 - >0	≤0
2) DOC mg/L	NA	≤5	>5

Vermont thresholds for acid neutralizing capacity.

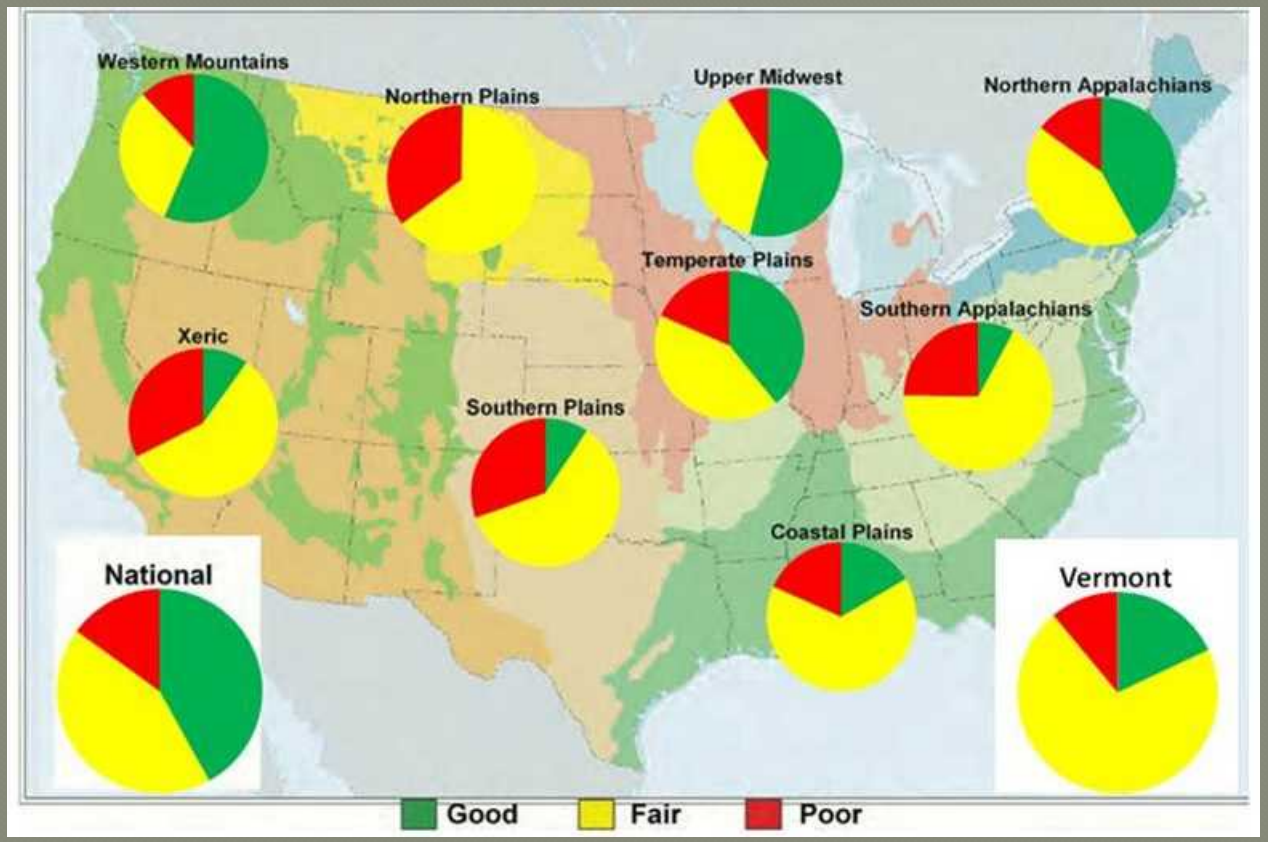


Vermont Standard	Good	Fair	Poor
Lowest RegAlk or GranAlk (mg CaCO3/L)	>12.5	2.5-12.5	<2.5

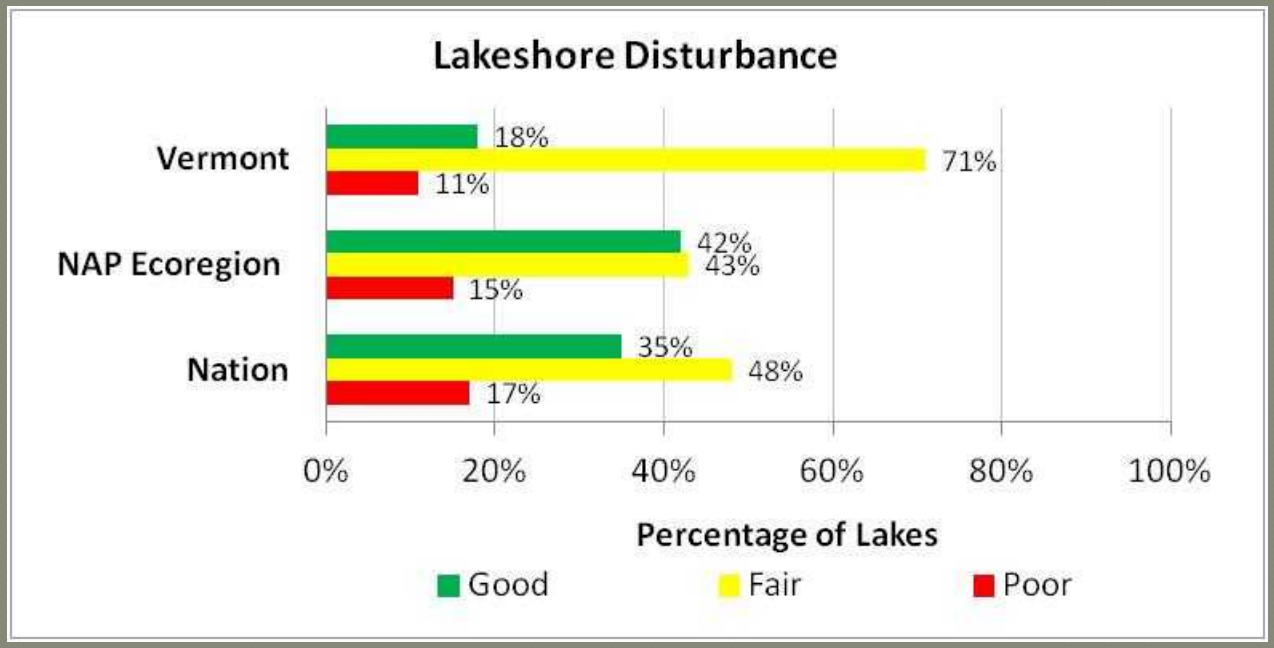
NLA Thresholds	Good	Fair	Poor
Acid Neutralizing Capacity:			
1) Alkalinity mg $CaCO_3$/L	>2.5	2.5 - >0	≤0
2) DOC mg/L	NA	≤5	>5

Physical Stressors

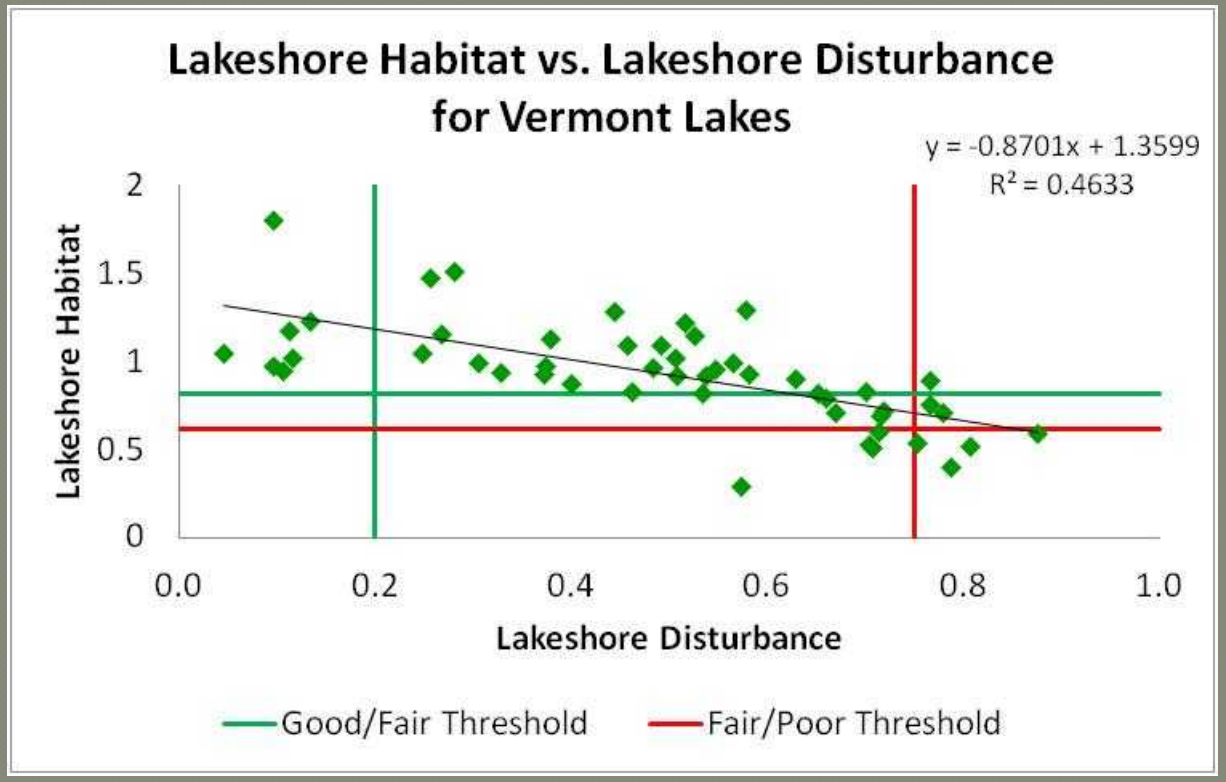
Lakeshore Disturbance



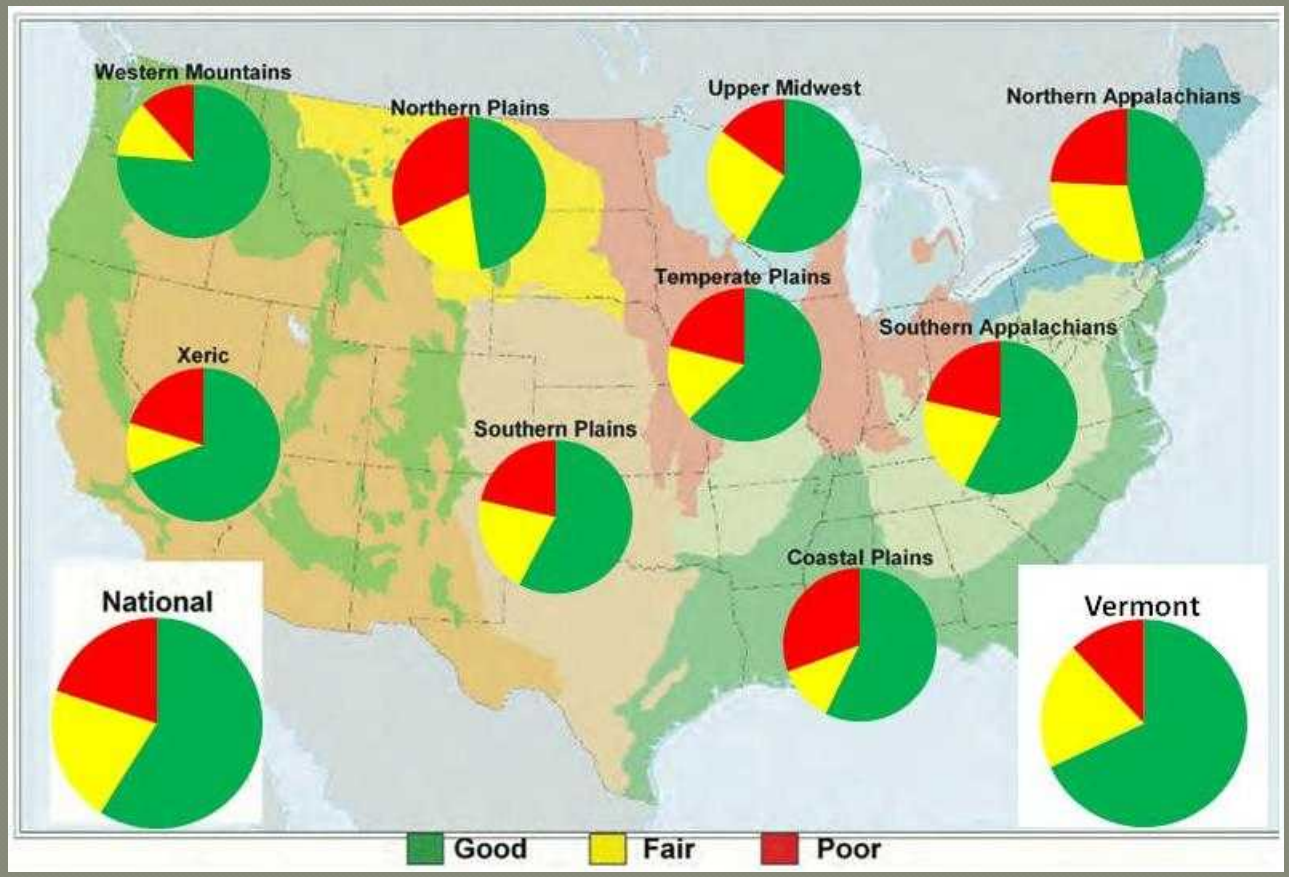
Lakeshore Disturubance



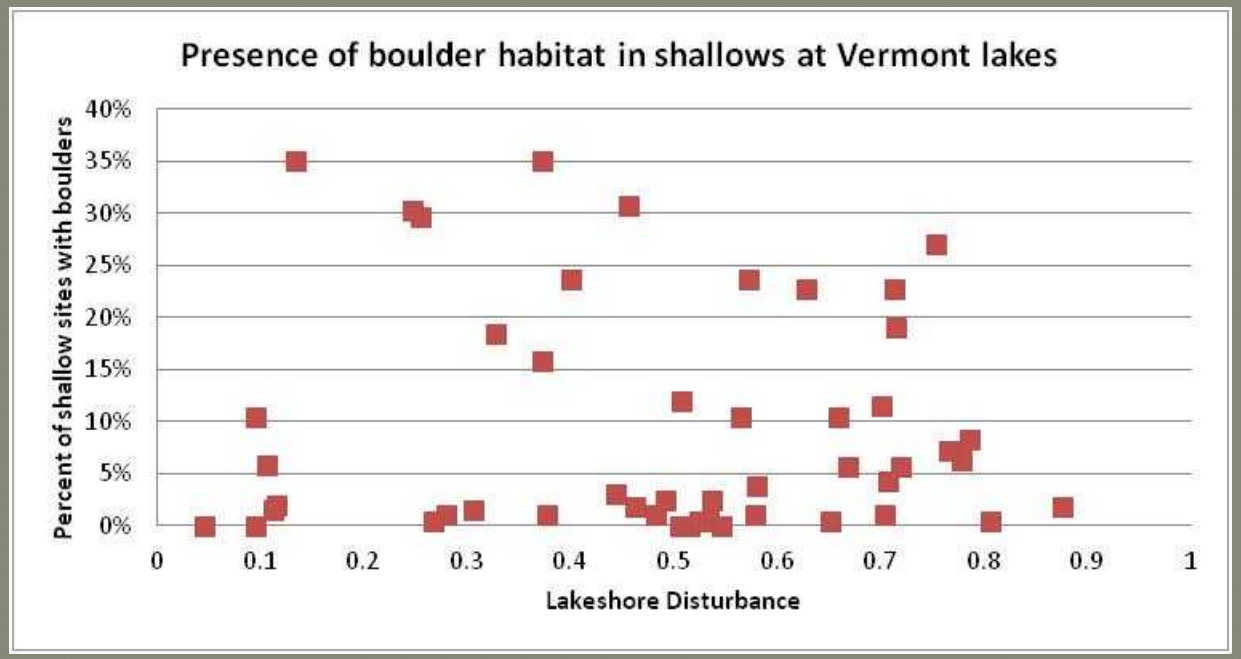
More Disturbance, More Degraded Lakeshore Habitat



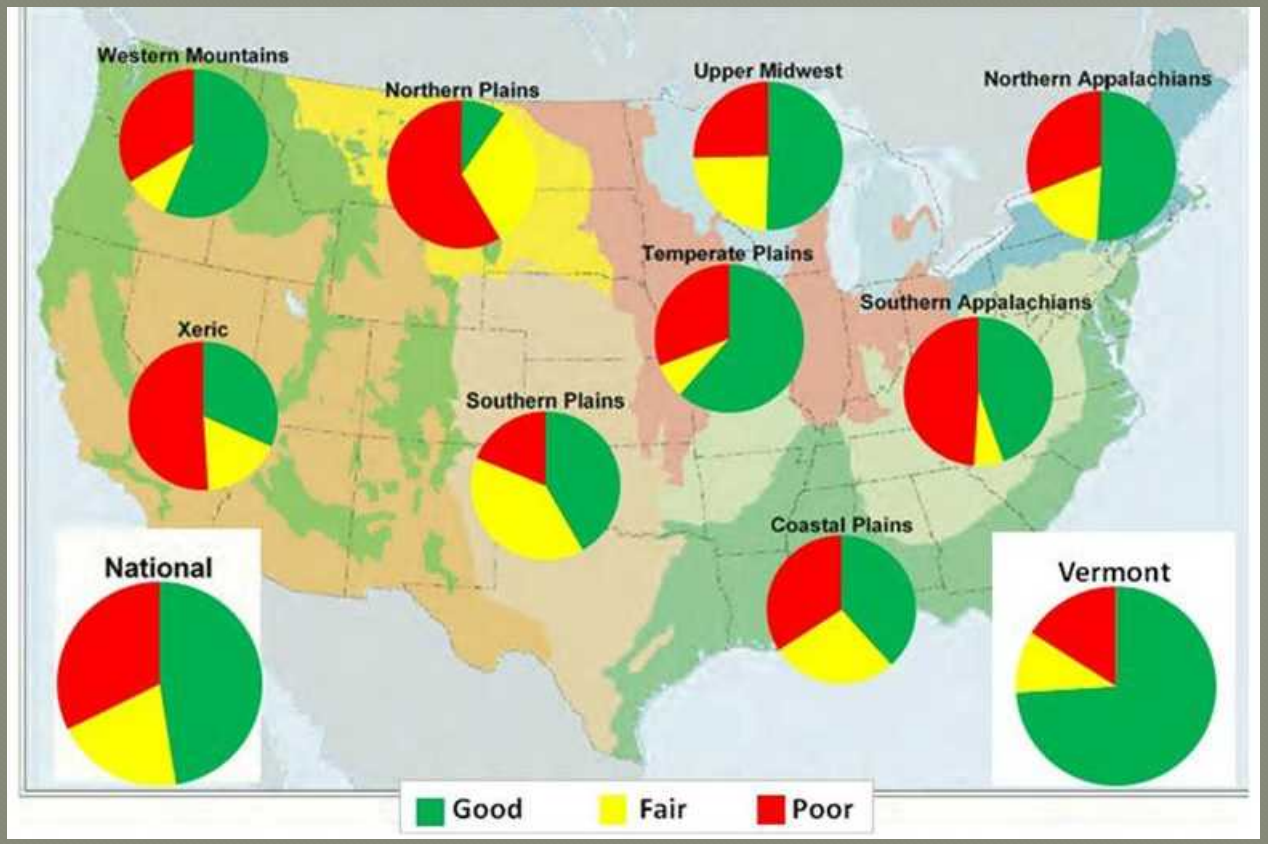
Shallow Water Habitat



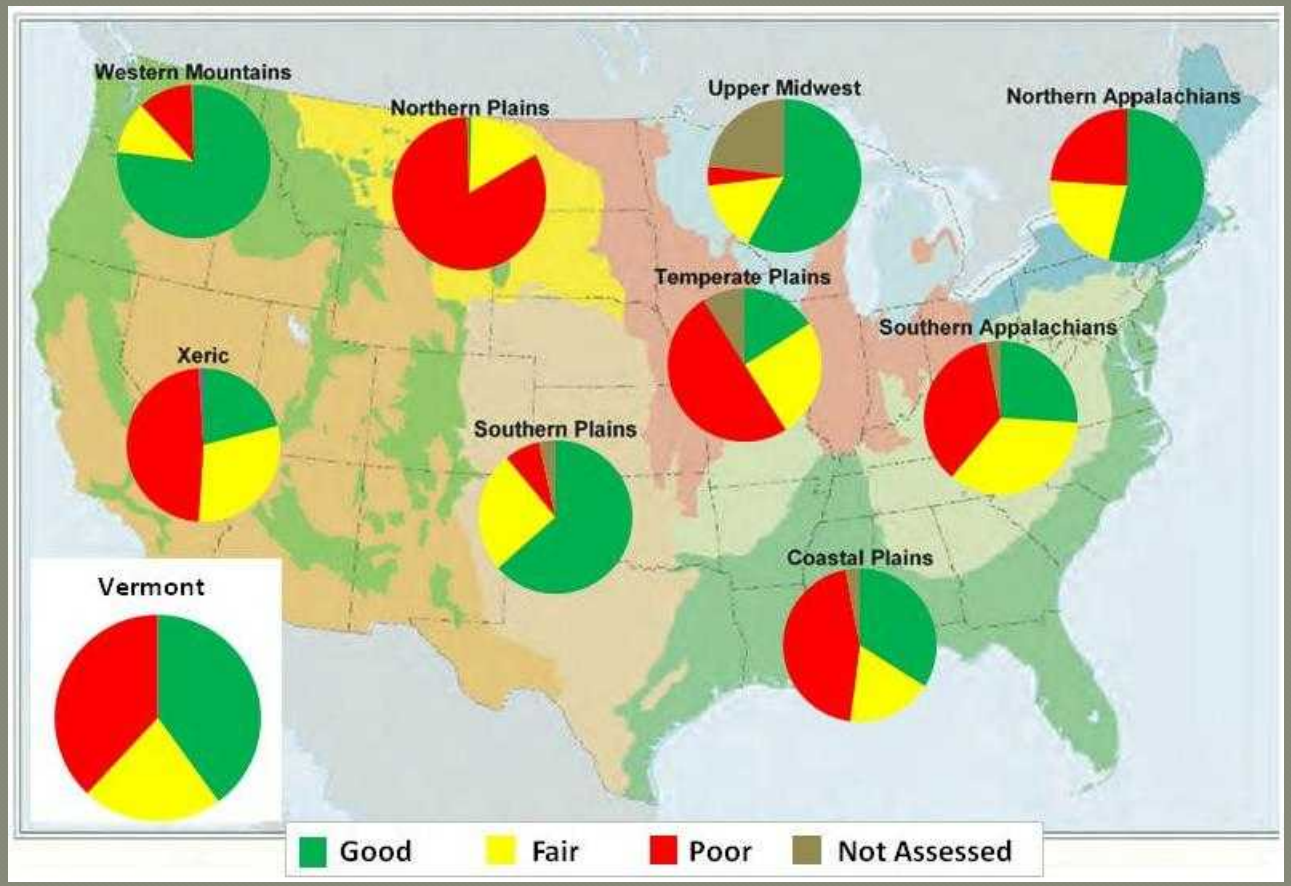
Lakeshore Residents Remove Snags, Coarse Woody Structure, Emergent & Floating Leave Vegetation but not boulders



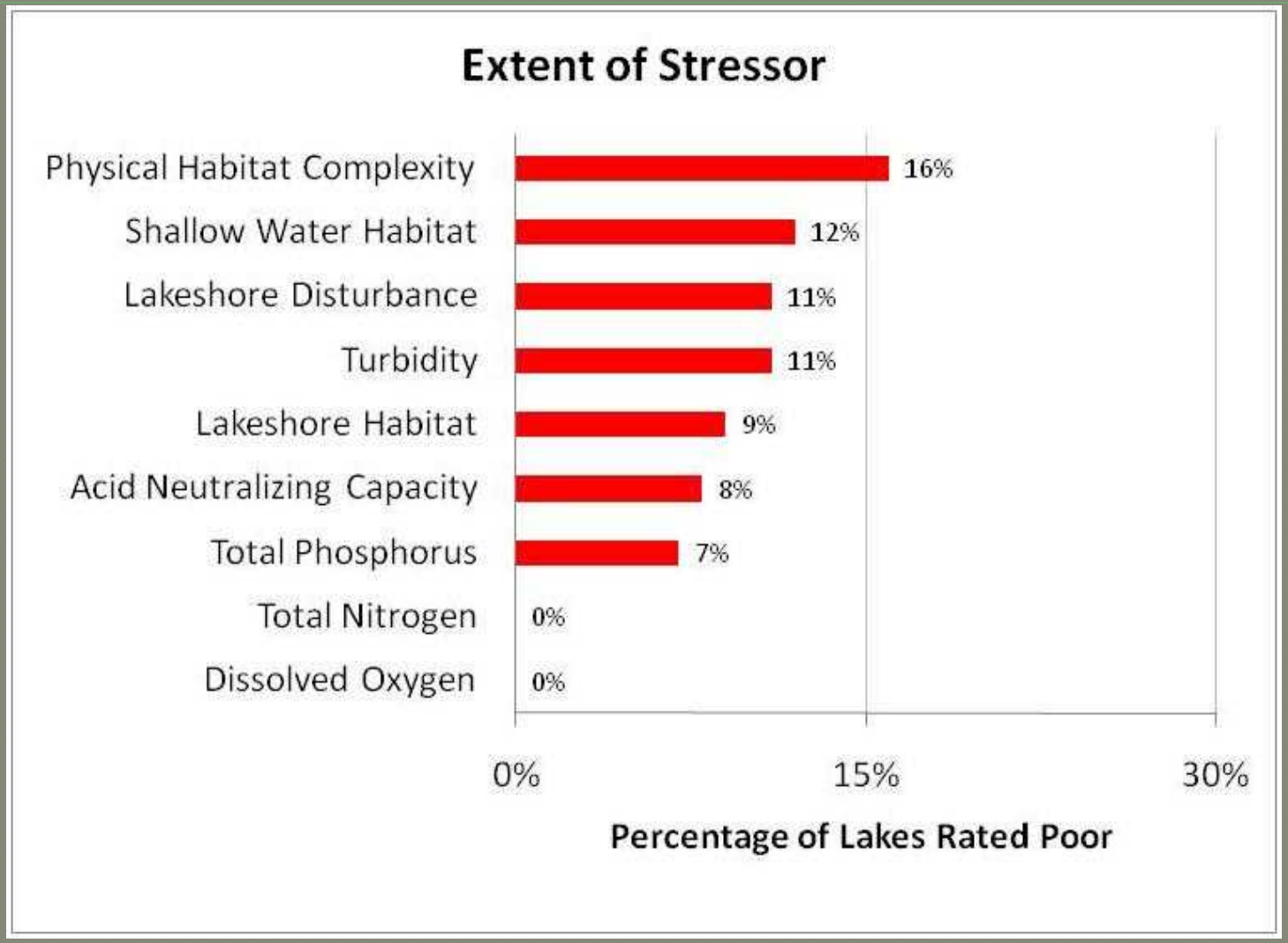
Physcial Habitat Complexity



Macroinvertebrate Index of Biological Integrity



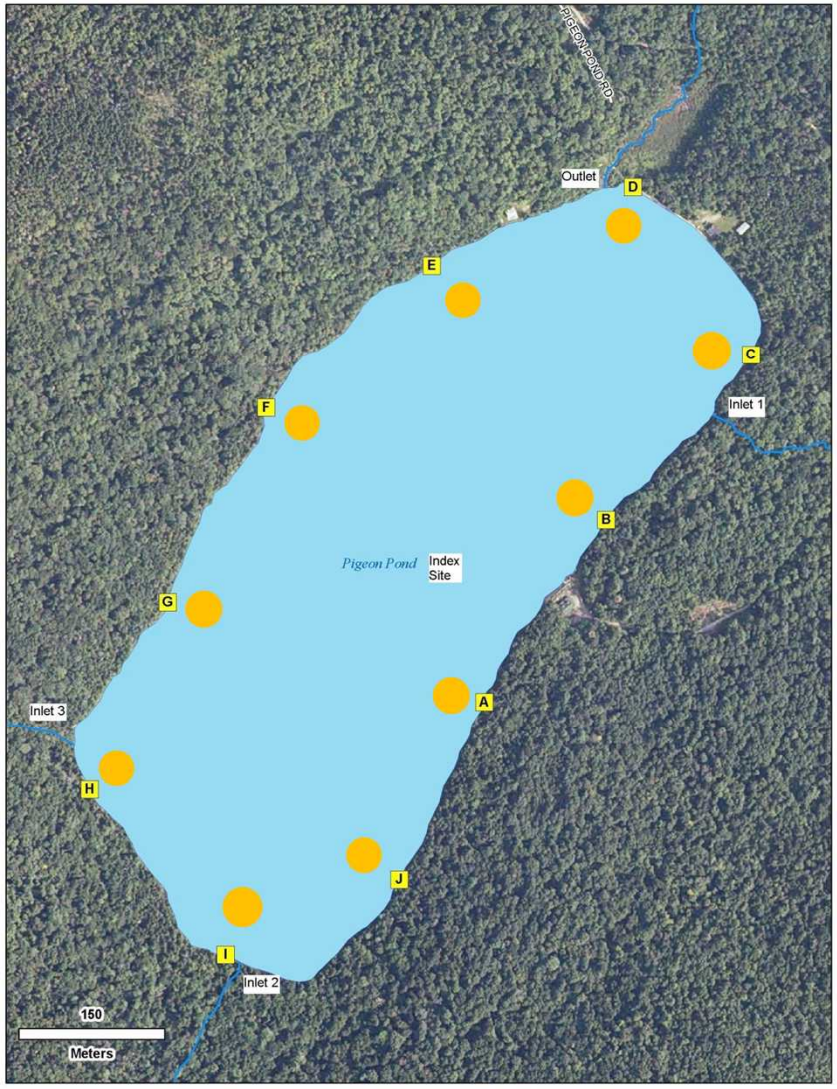
Extent of Stressor



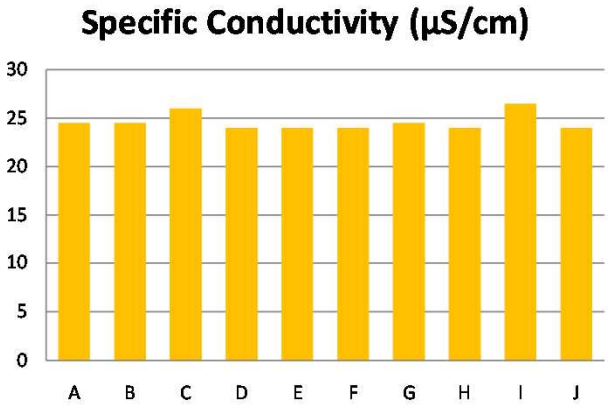
Ways Vermont is Using the 2007 NLA Results

Monitoring
Permitting
Outreach & Education
Policy

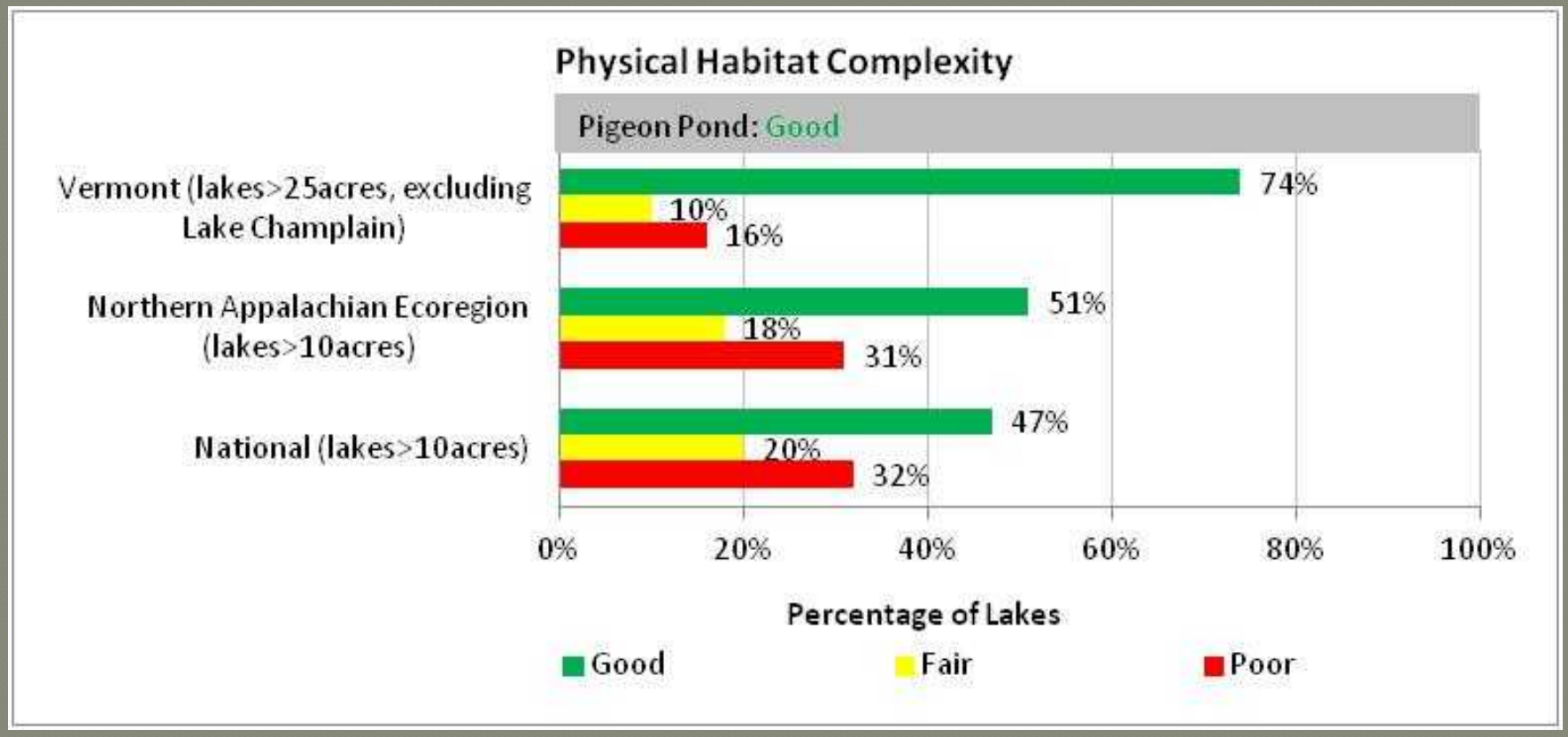
Monitoring



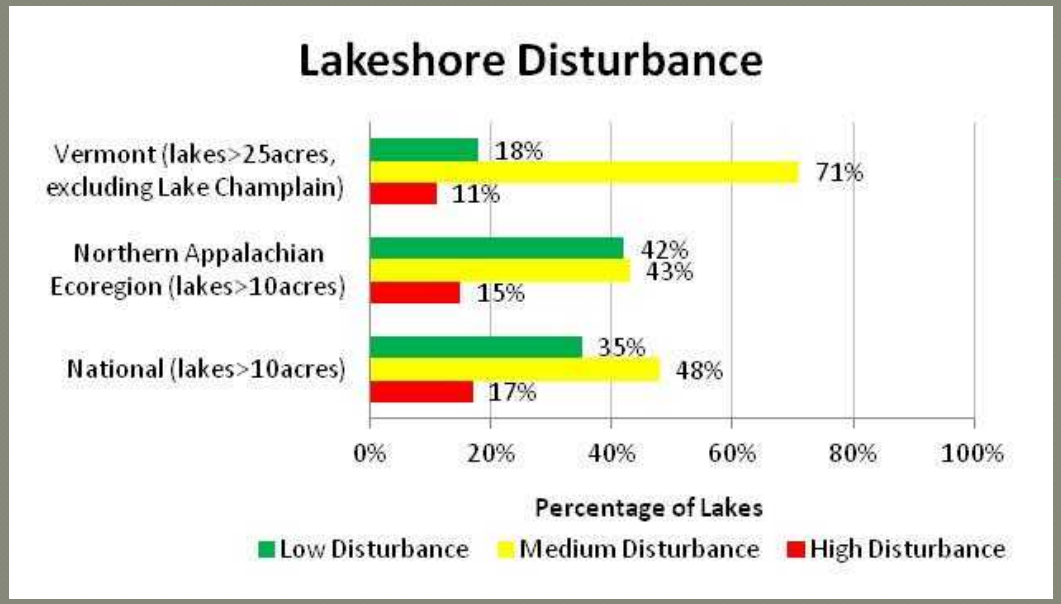
Pigeon Pond Physical Habitat Sites



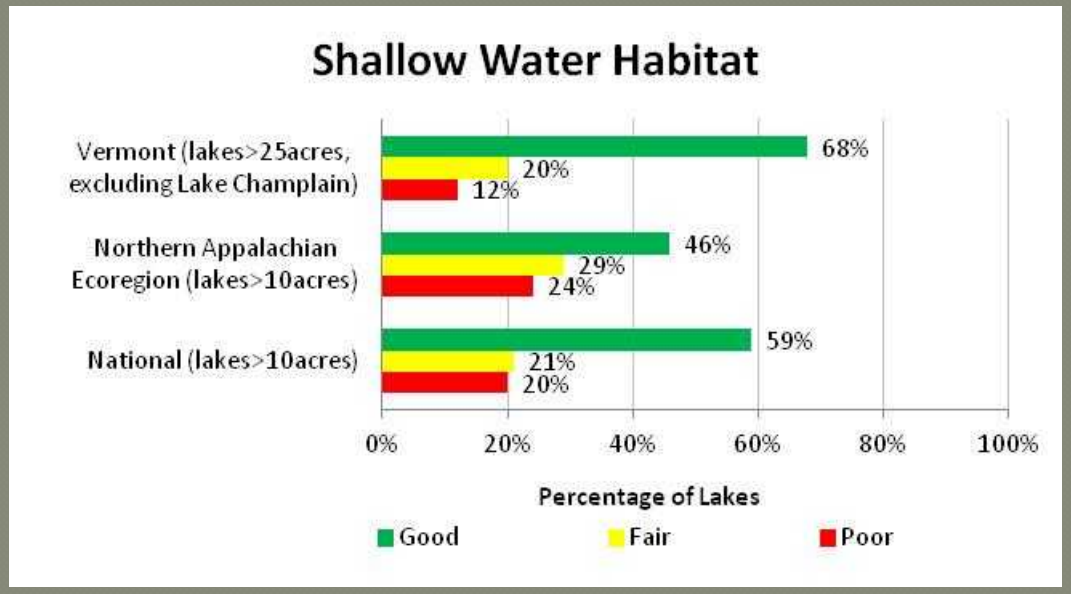
Monitoring


Physical Habitat Complexity
Pigeon Pond: Good
Vermont (lakes>25acres, excluding Lake Champlain)
74%
10%
16%
Northern Appalachian Ecoregion (lakes>10acres)
51%
18%
31%
National (lakes>10acres)
47%
20%
32%
0%
20%
40%
60%
80%
100%
Percentage of Lakes
Good
Fair
Poor

Permitting

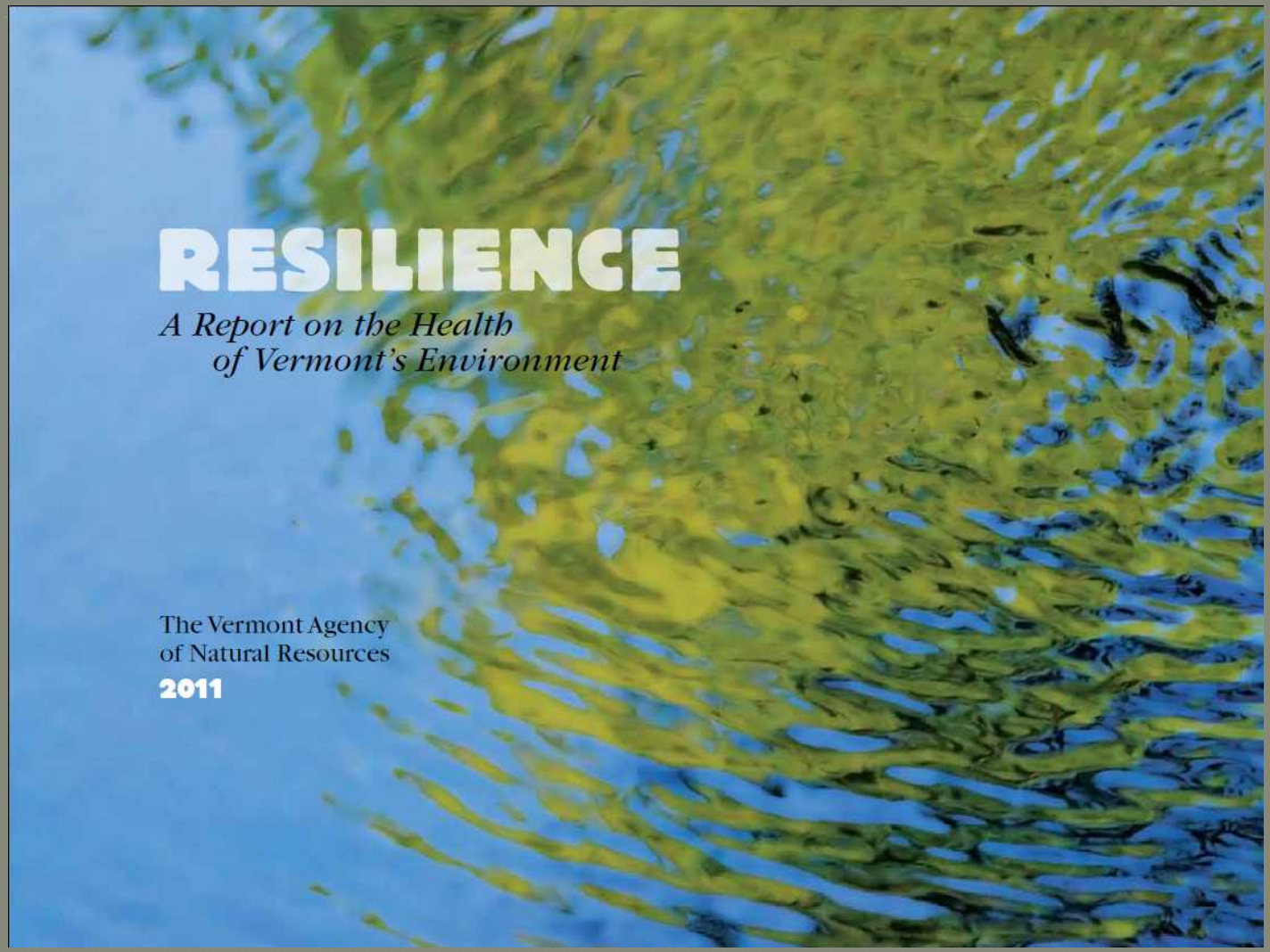


LakeID	RDis_IX
GREEN RIVER	0
ELMORE	0.79



LakeID	LitCvr_OE
GREEN RIVER	0.457880255
ELMORE	0.38186771

Outreach & Education



Protecting Lakeshores

What can we do to conserve the remaining natural vegetation along our lake shorelines?

Vermont lakes are natural jewels left by glaciers that melted away over 10,000 years ago. Some have a rich history that includes battles, settlement by native Americans, and the transport of traded goods. Now our lakes provide fishing, boating, and other recreational opportunities, as well as shores for homes, camps, and beaches. Ecologically healthy lakes are essential to Vermont's prosperity.

A new assessment of Vermont lakes builds on the results of more than 30 years of lake monitoring by Agency of Natural Resources (ANR) staff and volunteers across our state.

This assessment delivers some surprises about the condition of our lakes. Water quality problems — such as phosphorus pollution — are a major concern for a few lakes, including Lake Champlain. The biggest threat to the long-term resilience of most lakes, though, is the increasing degradation of shoreland habitat.

Trends in the Condition of Vermont Lakes

Beginning in 2007, Vermont and many other states joined with the U.S. Environmental Protection Agency (EPA) to complete a rigorous scientific assessment of the nation's lakes. Fifty Vermont lakes were randomly selected for the assessment. Choosing a random sample ensured that the results could be used to draw sound conclusions about the health of all Vermont lakes, large and small.

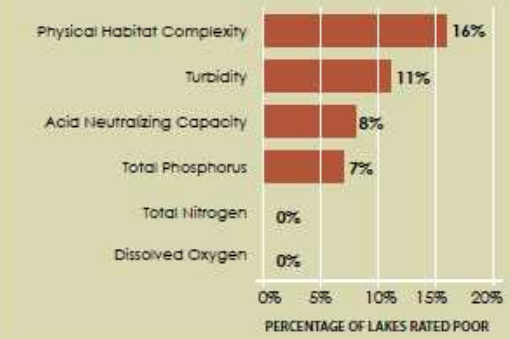
The greatest threat to lake health, according to the assessment, is the lack of physical habitat complexity along lakeshores — both on land and in shallow water. Sixteen percent of Vermont lakes greater than 25 acres in size have "poor" habitat complexity (Figure 1).

Vermont lakes with good physical habitat at the shore have layers of vegetation, such as groundcovers, understory plants, shrubs, and trees. In the nearshore waters, they have a variety of sediments, woody snags, emergent and submerged plants, and boulders. These complex environments provide habitat for a wide diversity of terrestrial and aquatic organisms — from fish, to aquatic insects, to birds and mammals.

Complex lakeshore habitats are degraded when vegetation is removed from properties and lawns are planted right to the water's edge, or impervious surfaces such as driveways are built close to the shore. Shallow-water habitats also deteriorate when people armor shorelines with rock walls or boulders, "clean up" fallen trees, remove aquatic plants, and import sand into the lake. The reduced habitat complexity along lakeshores explains why many of the lakes sampled during the assessment showed some evidence of stress in the communities of macroinvertebrates that live in lakeshore sediments.

It's no surprise, then, that lakeshore disturbance is the most serious stressor for Vermont lakes (Figure 2). The majority — 82 percent — are rated fair or poor for lakeshore disturbance, because of the buildings, docks, lawns, roads, and seawalls built at or near the water's edge. On average, Vermont lakeshores show more disturbance than those across the United States, and the higher the degree of disturbance present, the less natural vegetation they have.

Figure 1: Vermont Lakes Rated Poor for Different Stressors



A Lay Monitoring Program volunteer uses a Secchi disk to test for water clarity.

Although this scientific assessment raises a large red flag about our current patterns of lakeshore development, it also provides some good news. The majority of Vermont lakes are still in "good" condition in terms of acidification caused by acid rain. Most also have relatively low levels of phosphorus pollution, although this could change if shoreline habitat continues to deteriorate. ANR data also show that 65 percent of Vermont lakes do not have aquatic invasive species such as Eurasian watermillfoil or zebra mussels.

Why Protect Lakeshores?

During the 2011 flood events, lake stewards across the state reported the impacts on their lakes. Naturally vegetated lakeshores along Lake Champlain and other lakes helped buffer the damage by reducing the erosion of shorelands. Aerial photographs taken after the storms show what happened in areas with little vegetation. Huge plumes of sediment muddied lake waters, bringing pollution from land into sensitive lake environments.

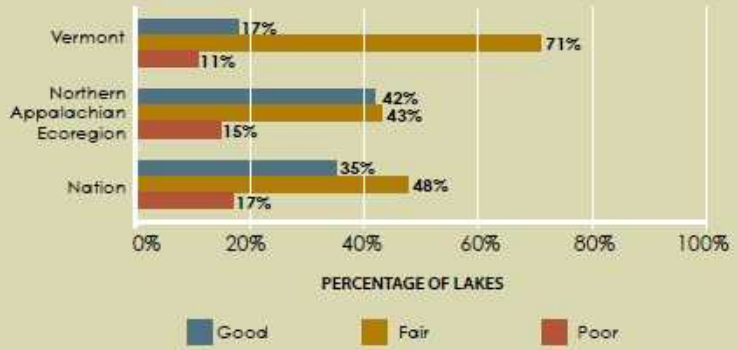
This phenomenon provides a warning call for our lakeshores. If the losses of lakeshore vegetation continue, our lakes will become less resilient to water quality threats from land. There will be few plants and trees along the lakeshore to help stem erosion when water levels rise, or to absorb runoff and filter the pollutants it carries from roads, driveways, and fertilized gardens. Stresses on plant and animal communities will likely increase.

Although 16 percent of our lakes have poor habitat complexity as a result of losses in shoreline vegetation, 84 percent are still in fair or good condition. We have an opportunity to protect them before expansive lawns, impervious surfaces, and shoreline armoring cause more degradation.

Currently, the tools available for protecting lakeshores are limited. Lakeshore associations are collaborating with ANR to bring information about the importance of naturally vegetated shorelines to lakeshore property owners. A small number of Vermont communities have incorporated the protection of lakeshores into local land use regulations, but most communities with lakes have not yet taken this step.

Lakeshore properties can provide owners with views, docks, and recreational spaces, while still preserving shoreland vegetation.

Figure 2: Extent of Lakeshore Disturbance



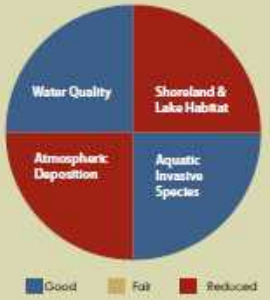
A NEW SCORECARD FOR VERMONT LAKES

For decades, Vermonters who care passionately about their lakes have helped gather information to assess their health. Trained Lay Monitors have collected data on nutrient enrichment. Trained Invasive Patrollers have scouted lake waters and shores diligently, looking for new evidence of invasive species.

In 2010, ANR developed a lake scorecard to synthesize all of this data into an easily understandable format. The new scorecard can answer the question: ***How is my lake doing?***

The scorecard for Lake Salem in Derby (Figure 3) shows the benefits of persistent efforts by Derby residents to detect and control aquatic invasive species. The lake is rated "reduced" for atmospheric deposition because it has a fish consumption advisory for walleye. Most lakes in Vermont are subject to fish consumption advisories issued by the Department of Public Health as a result of mercury contamination. Lake Salem has good water quality, but the poor condition of its shoreland and lake habitat could threaten its water quality in the future.

Figure 3: Lake Salem Scorecard



NLA 2012

- Sampled 13 reference lakes in Vermont in 2011 in preparation
- Sampling 50 lake in 2012