

HOW A MODEST REU SUPPLEMENT LED TO A PAPER IN GSA TODAY

BIERMAN, Paul and MASSEY, Christine, Geology Department, University of Vermont, Delehanty Hall, Burlington, VT 05405



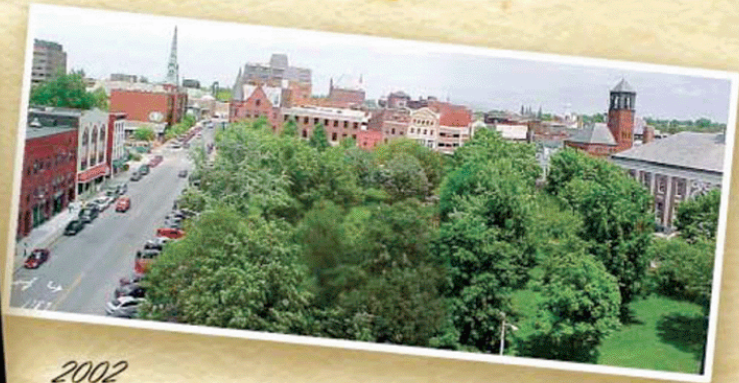
See your town as it was 100 YEARS AGO!

LANDSCAPE
CHANGE
PROGRAM

Burlington's City Hall Park



1859



2002

Marvel at the damage wrought by the 1927 flood. Find pictures of long-vanished farms. View the Green Mountain state clearcut for sheep farming. See landslides, ice jams, mines, and quarries. Visit our collection and search thousands of Vermont images by place, by date, by topic!

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landscape
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**24/7 access
Free to anyone
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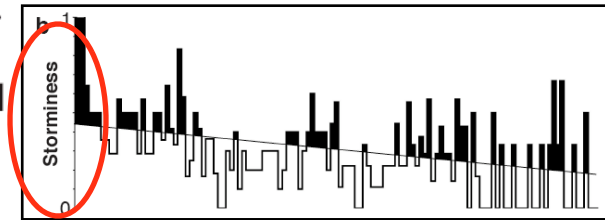
But, it wasn't always that way...

1996 Hydrologic Sciences Career grant *Erosion history of New England*



Millennial-scale storminess variability in the northeastern United States during the Holocene epoch

Anders J. Noren*, Paul R. Bierman*, Eric J. Steig†, Andrea Lini*
& John Southon‡§



Calendar age (kyr)

letters to nature

Vol. 7, No. 10

October 1997

GSA TODAY

A Publication of the Geological Society of America

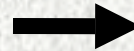
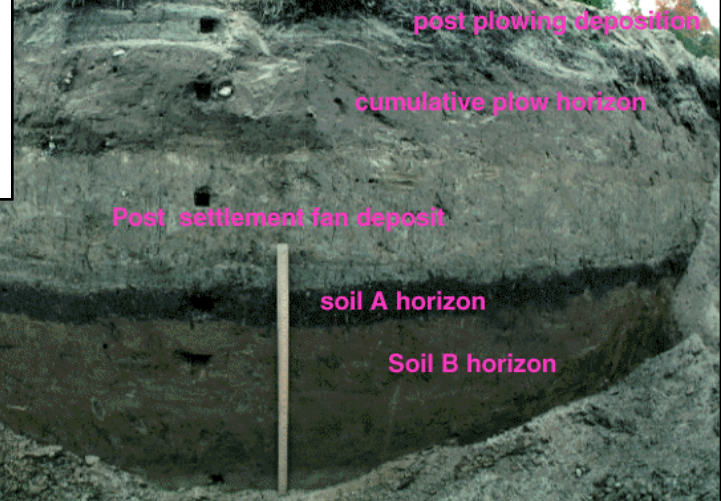
INSIDE

- New Honorary Fellows, p. 15
- Call for Award Nominations, p. 16, 22, 24, 26
- 1998 Section Meetings Southeastern, p. 27
- Cordilleran, p. 29

Postglacial Ponds and Alluvial Fans: Recorders of Holocene Landscape History

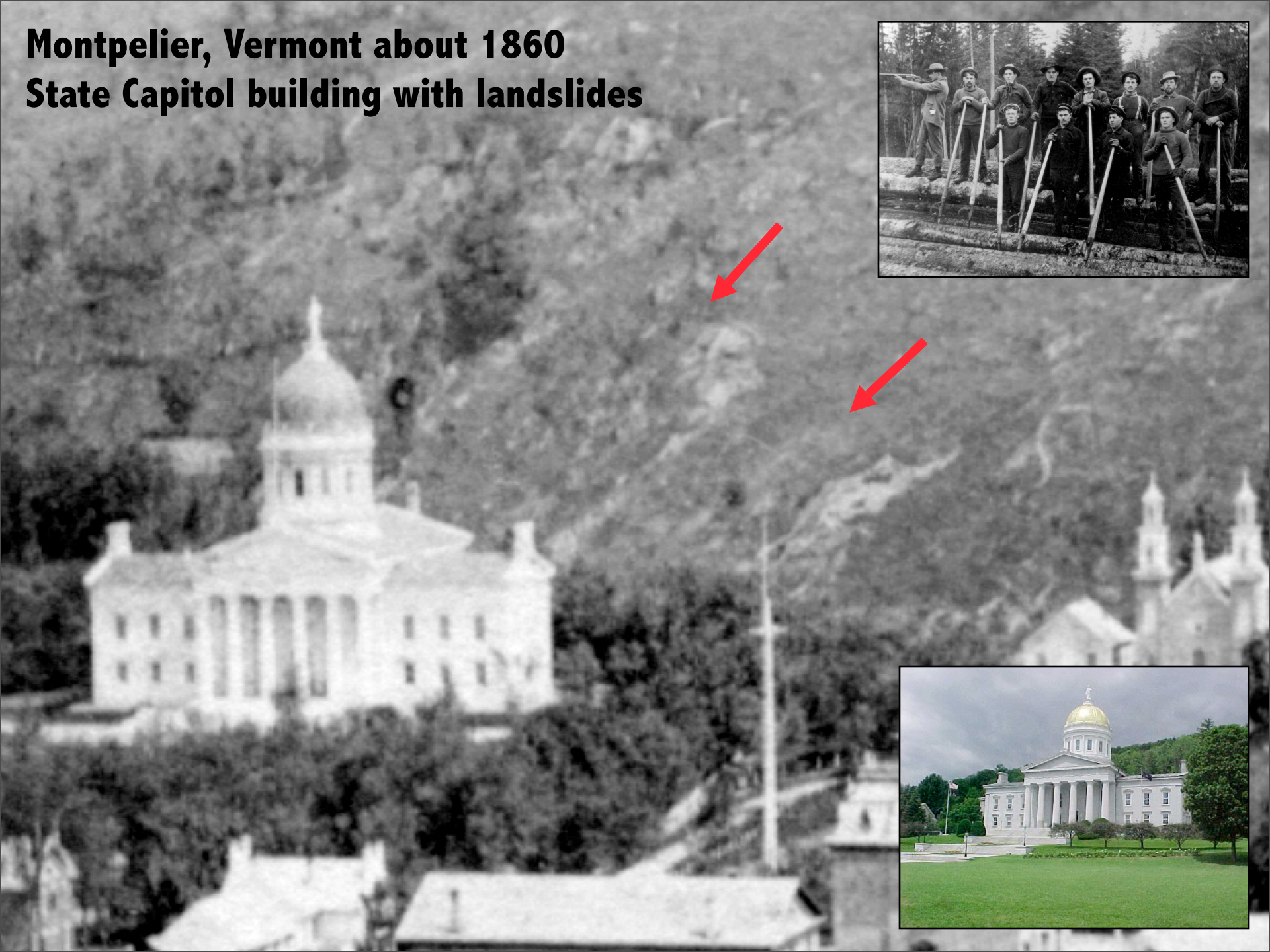
Paul Bierman*, Andrea Lini, Paul Zehfuss, Amy Church, Department of Geology, University of Vermont, Burlington, VT 05405
P. Thompson Davis, Department of Natural Sciences, Bentley College, Waltham, MA 02154
John Southon, Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, CA 94550
Lyn Baldwin, Field Naturalist Program, University of Vermont, Burlington, VT 05405

AN ET AL FIGURE 1 B
an original slide for paper!!!!



Montpelier, Vermont about 1860

State Capitol building with landslides



Images seemed to be the key... to science, education and outreach



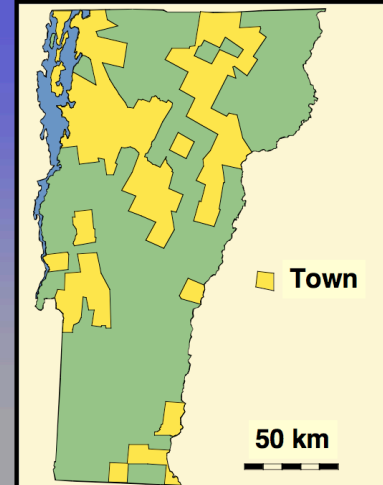
“In an integrated research and education program designed to involve high school science students and their teachers directly in active, on-going geologic research, we propose to build a digital library of photographs documenting two centuries of landscape change.”

EAR-9907724, Geoscience Education,
1999 proposal

30% Town Coverage in Vermont

- 300 Students
- 12 Schools
- 70 of 230 Towns
- 12 of 14 Counties
- 270 Image Pairs Archived

2000/2001 Vermont Towns



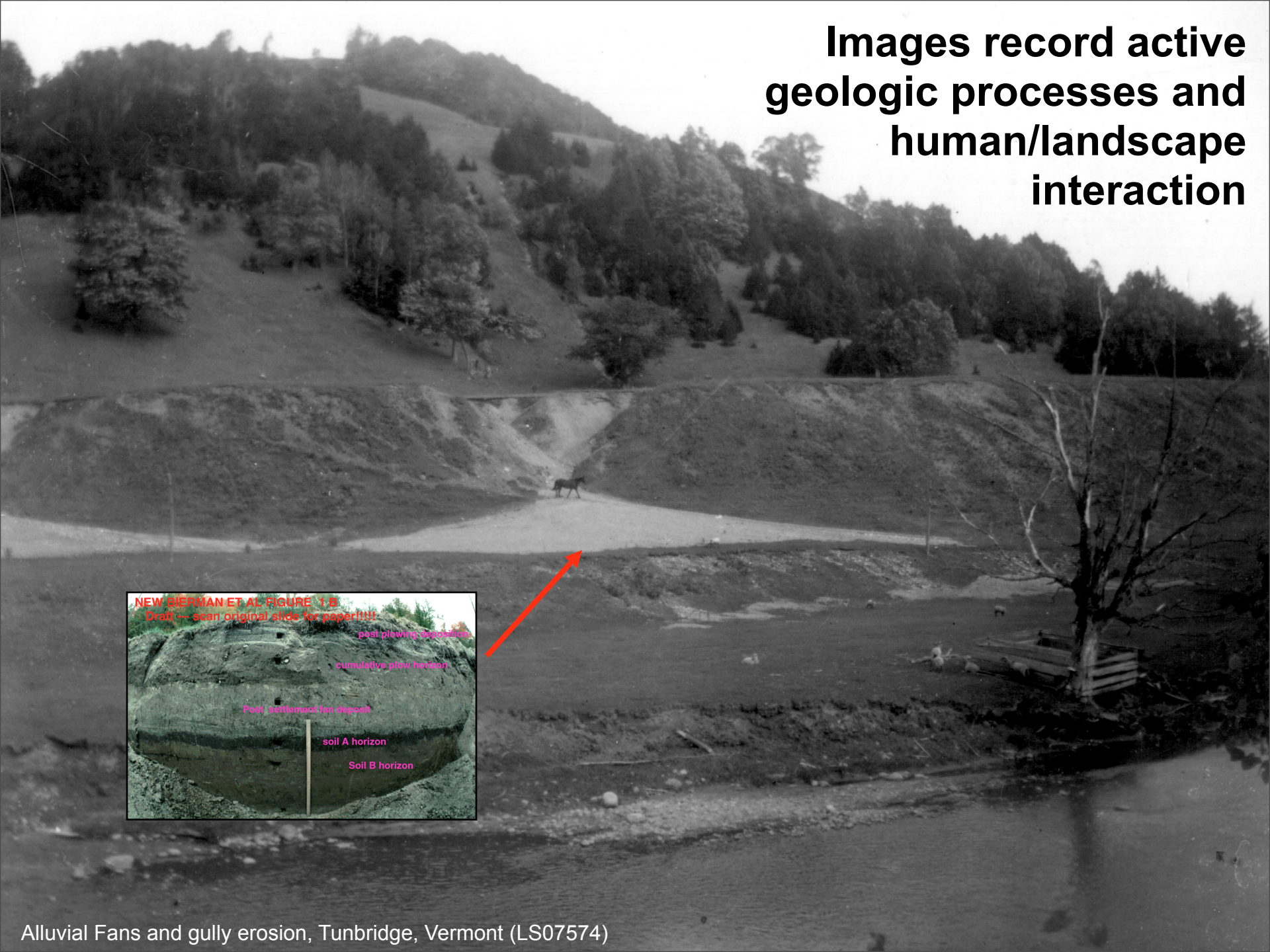
“...increase the efficiency of image collection and expand our efforts to a broader informal science constituency in preparation for regionalizing our effort.”

EAR-0122005, Geoscience Education proposal

VERMONT LANDSCAPE CHANGE ARCHIVE SEARCH RESULTS	
(For Floods, in ALL Co. between the years 1700 to 2003)	
Total Records: 18	
	Former Road that is Now a Brook Clarendon, Rutland Co., 1927 (about) Special Collections of Bailey/Howe Library at UVM
	1927 Flood of the Winooski River Winooski, Chittenden Co., 1927 The Champlain Mill
	Winooski Flood of 1927. Winooski, Chittenden Co., 1927 Special Collections at Bailey/Howe Library, UVM
	Flood Damage in Town Proctor, Rutland Co., 1927 Special Collections of Bailey/Howe Library at UVM
	The Railroad Cut After the 1927 flood Proctor, Rutland Co., 1927 (about) Special Collections of Bailey/Howe Library at UVM
	The White River Washing Away the Bank During the 1927 flood. Randolph, Orange Co., 1927

Clarendon, Rutland Co., Vermont (Latitude/Longitude: 43.520889/ 73.012000)	
Historic View, 1927 (about)	Current View, 8/7/2000
Former Road that is Now a Brook	TITLE: Former Road that is Now a Brook, 8/7/2000
Source:	PHOTOGRAPHER: L. Mallard
Key Words: Bridges, Floods, Rivers and Shorelines	KEY WORDS: Post flood, Rivers and Shorelines
Click Here for Full Display and Description.	Click Here for Full Display and Description.
Photo Pair Submitted by: UVM, 2001-01-20	

Images record active geologic processes and human/landscape interaction



To really do science and engage the informal science community, what we needed were more images from more places



“We seek NSF salary support for three undergraduate students.... These students will be part of the NSF-funded Landscape Change Project, a web-based initiative to gather, interpret and place on-line images that document changes in Vermont landscape...

EAR- 0122005, REU

Supplement, \$13,000

Intern Activities

learning goals

Field Training

skills and facts

Scanning at archive

technology, sense of time and place

Image description

seeing and writing skills

Image uploading



LANDSCAPE CHANGE PROGRAM

See Vermont as it was
200 YEARS AGO
A digital archive of historic and current photo pairs, educational resources, and more!

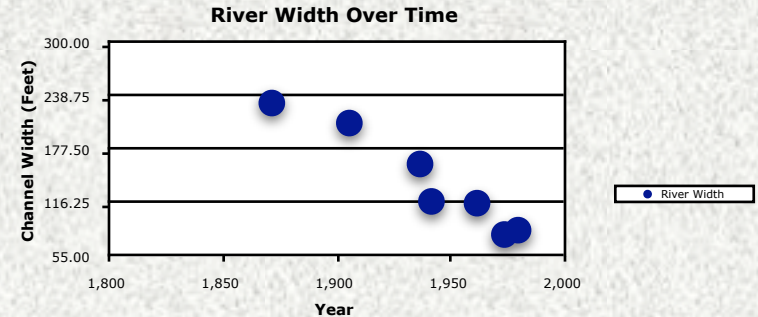
home searching submitting learn mission contact

SUBMIT Historic Image

Required Fields in red ? for Help or Explanations

1) About you
Your Name: ? Your School or Institution:
Your Email: OR Phone Number: ?

2) Image Location
TOWN, COUNTY: : ?



4 interns, 8 weeks, 7000 images
246/252 Vermont towns and
gores now represented in archive



Science

Students asked

....how have channels changed over time

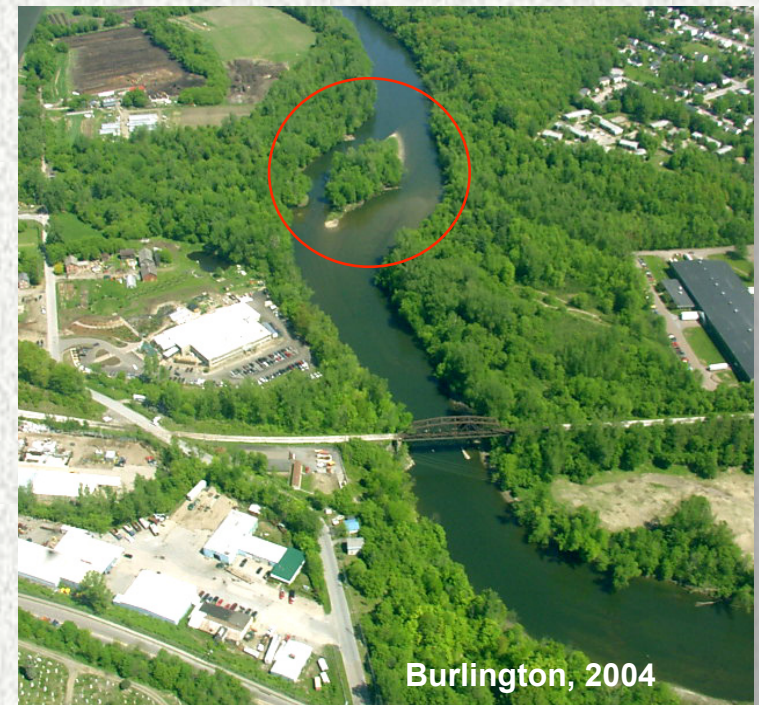
....does clearing the slopes facilitate erosion?

....how have riparian zones changed over time

*Image data base provides
quantitative spatial results*

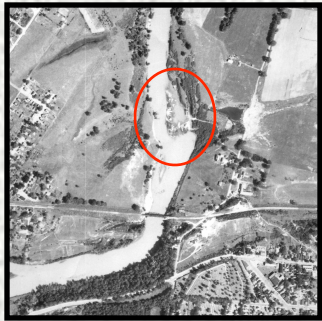
Channel Change: Migrating Rivers

After comparing the historic aerial photographs to their current counterparts, we noticed a marked change in channel width between a few image pairs.



Images as a catalyst for research.

Historical Aerial Photos



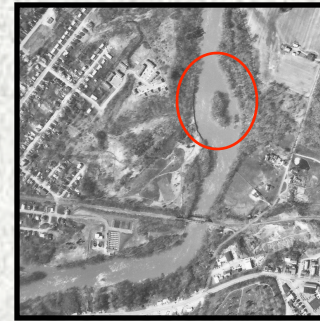
1937



1942



1962



1974



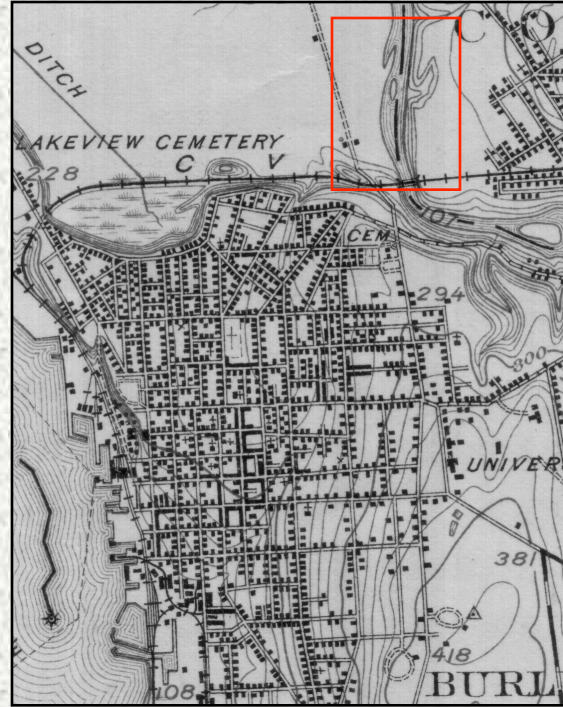
1980

Aerial photos of Winooski River showing change in channel width and development of mid-channel island. These photos were used to calculate channel change and island development over time.

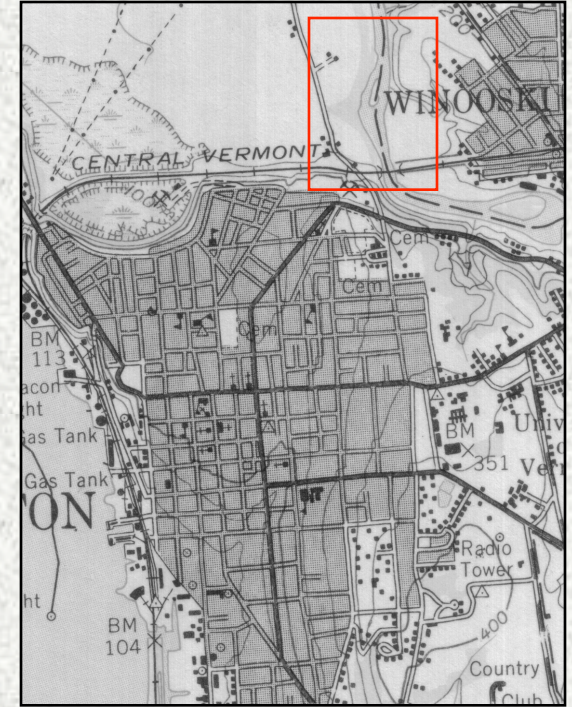
Historical Maps



1872



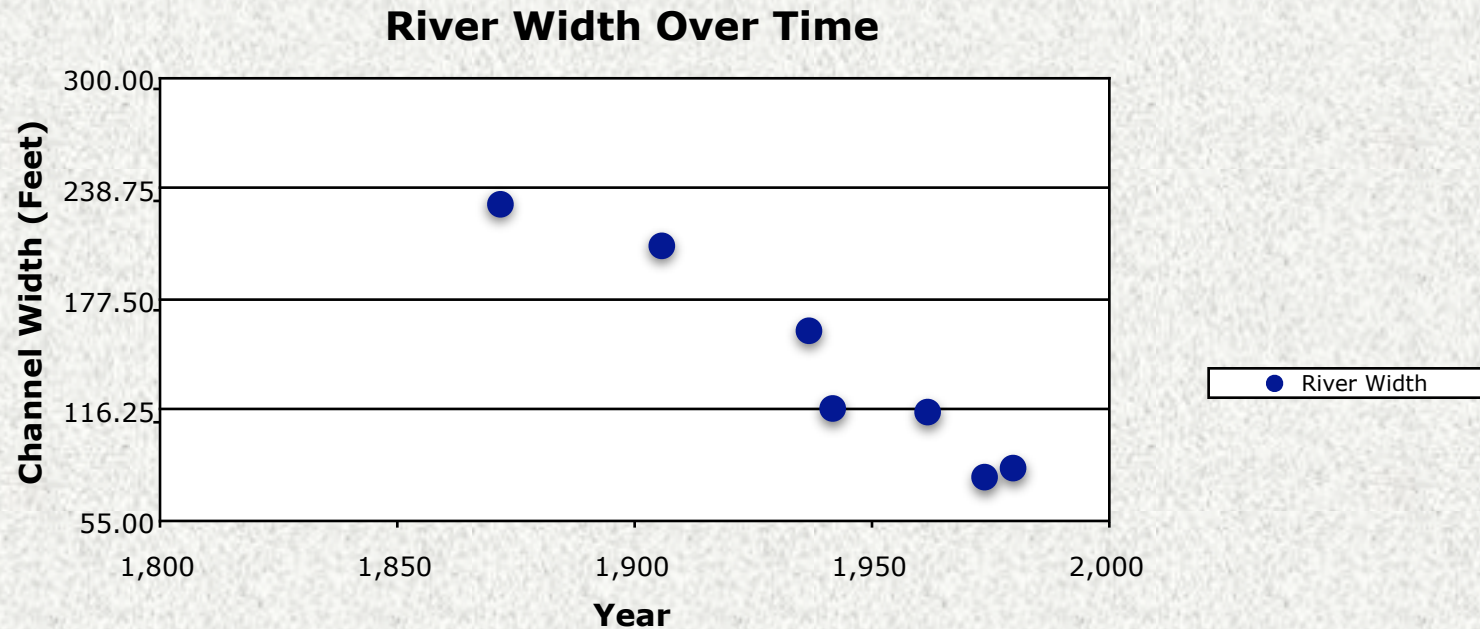
1906



1948

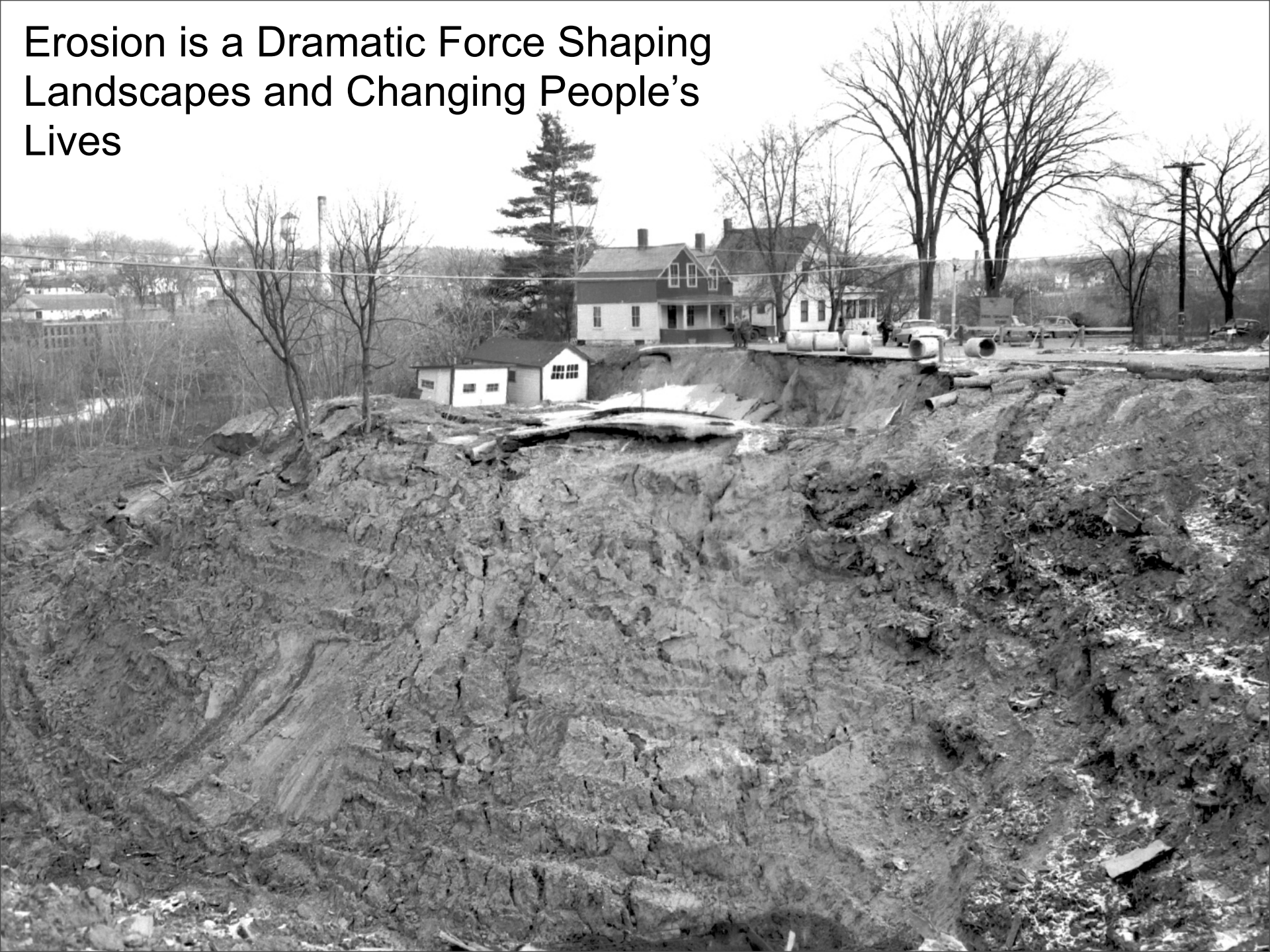
Three maps showing the field area described above. All three maps show a mid-channel island, indicating that the flood of 1927 completely removed the island. 1906 and 1948 maps 1:62,000.

Results: Channel Change



- Channel width steadily decreased over time.
- Change in channel width is possibly due to deforestation throughout the state in the 1800s that supplied large amounts of sediment to the rivers.
- The rise in sediment yield forced the rivers to aggrade, thus creating a wider river. The increase in forestation over the past 100 years has allowed the river to narrow and incise into the sediment.

Erosion is a Dramatic Force Shaping Landscapes and Changing People's Lives



**Mount Mansfield from Underhill, Vermont
Charles Heyde, c. 1855-65**

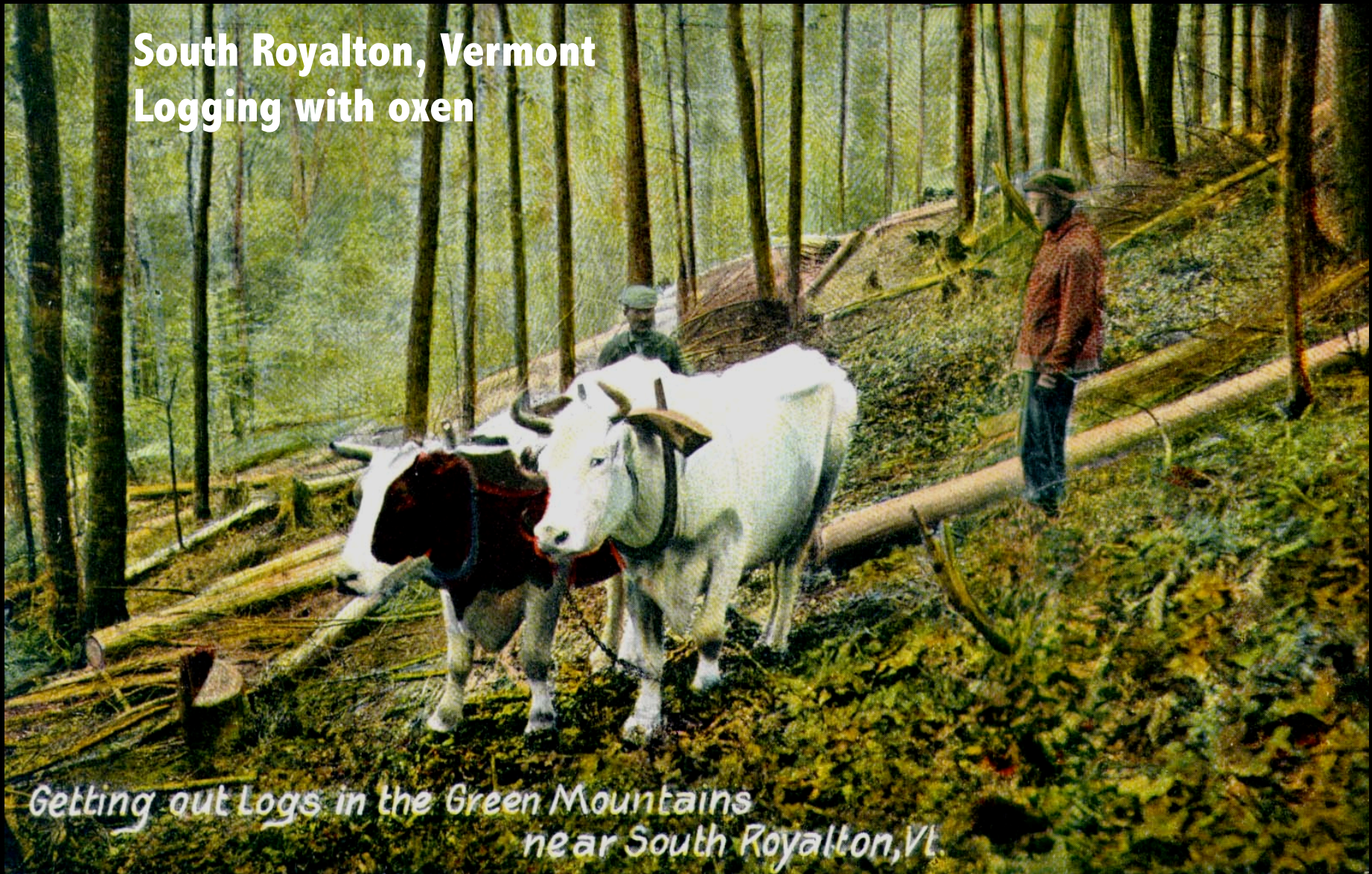
Gully

Stumps



Without the trees, erosion ravaged the landscape.

**South Royalton, Vermont
Logging with oxen**

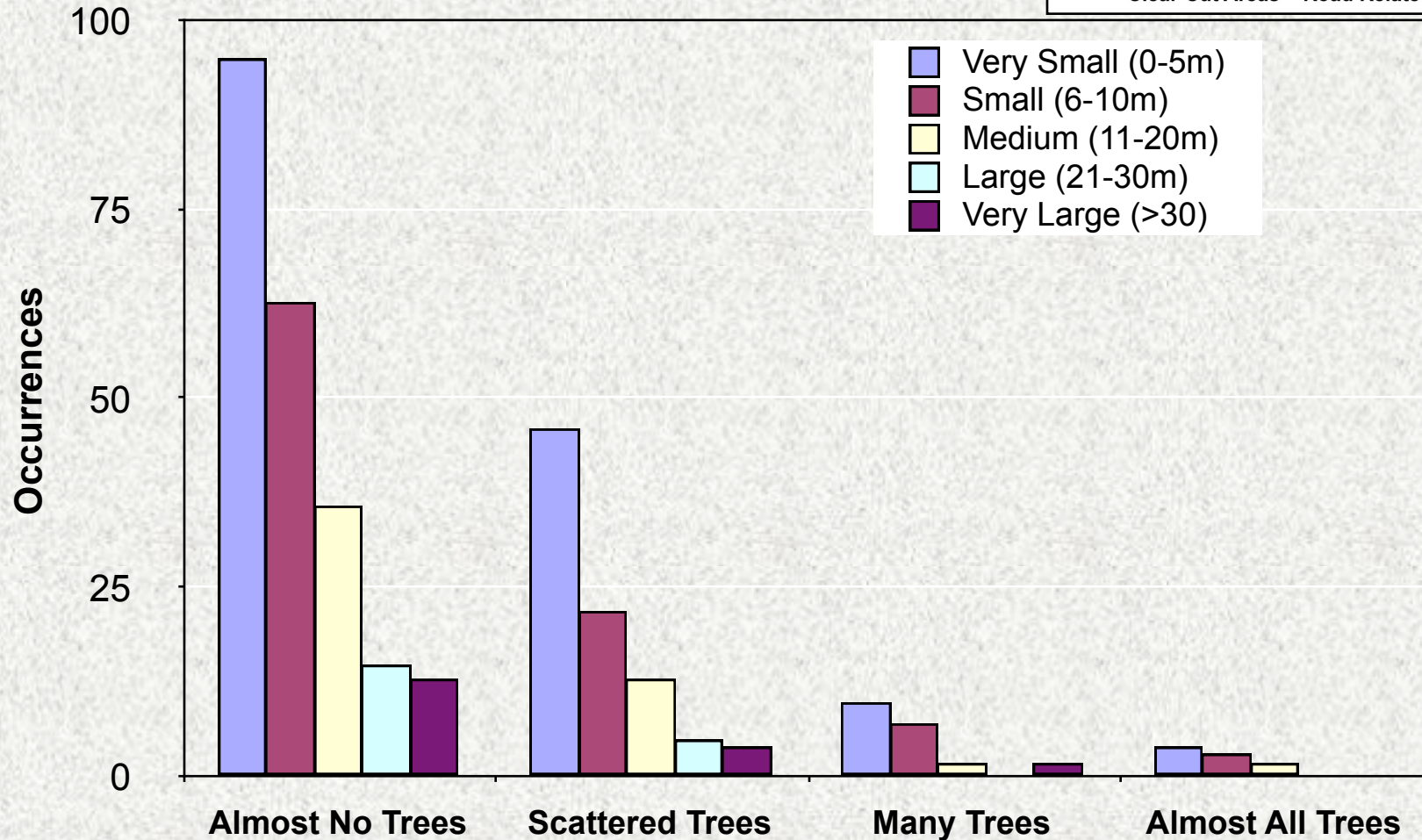
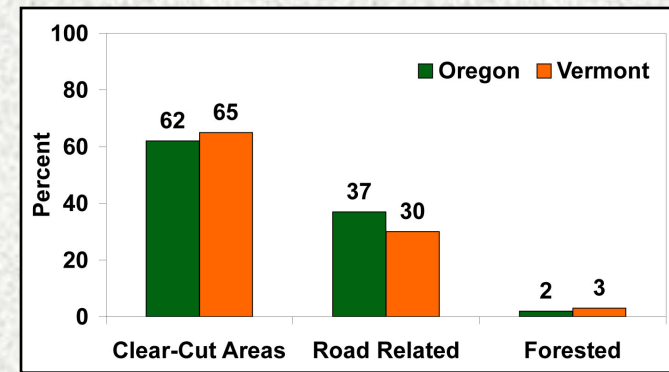


*Getting out Logs in the Green Mountains
near South Royalton, Vt.*

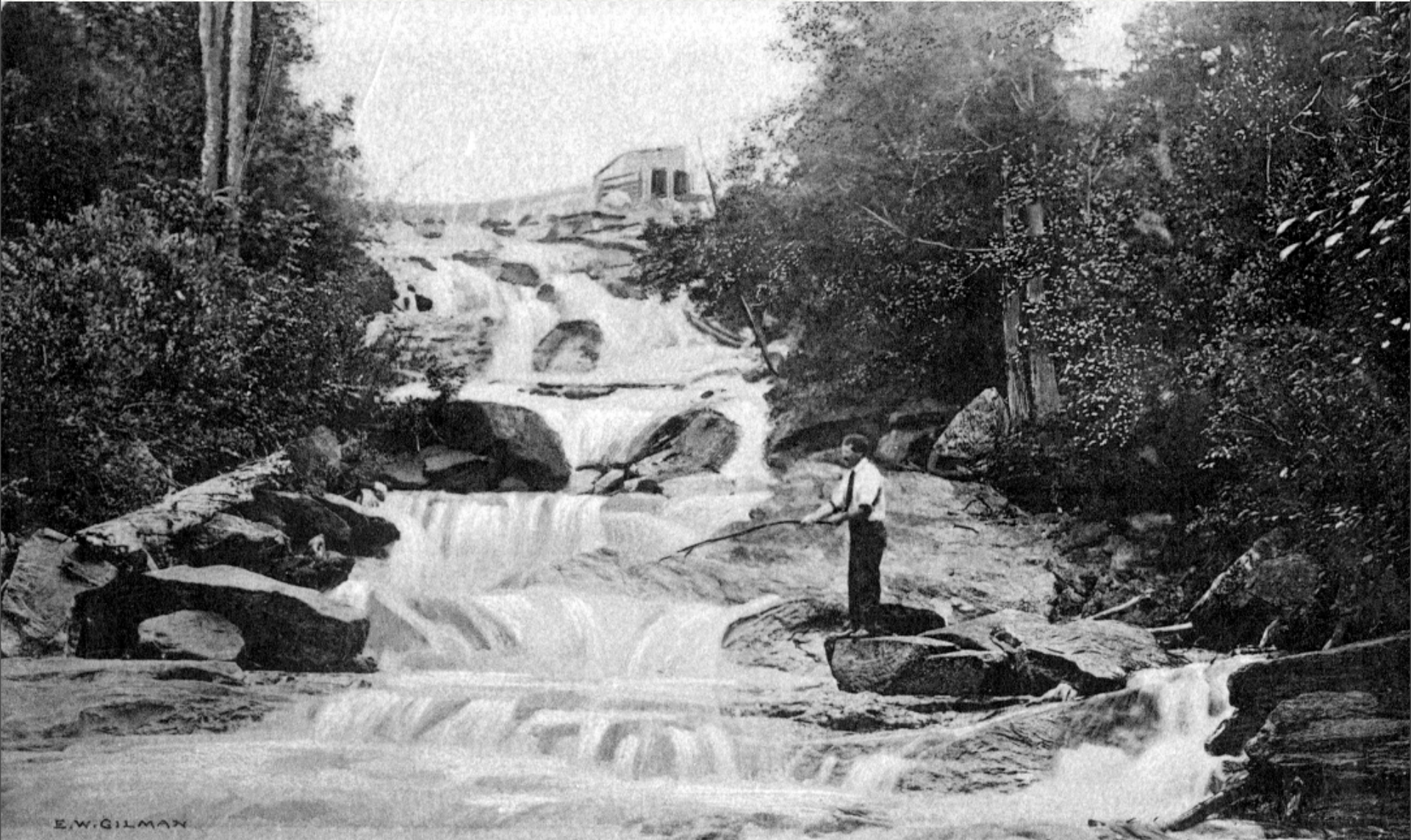
Vermont - stripped of trees for farms, fires and transportation.

Bare landscapes erode!

Analysis of 342 images



Riparian Zones are Ecologically Important



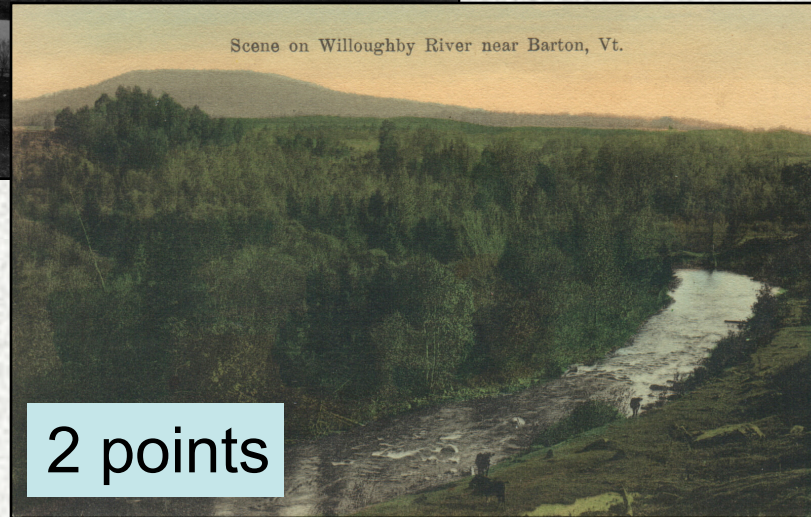
E.W. GILMAN

MOLLYS FALLS, MARSHFIELD, VT.

Poor riparian buffer
no vegetation



1 point



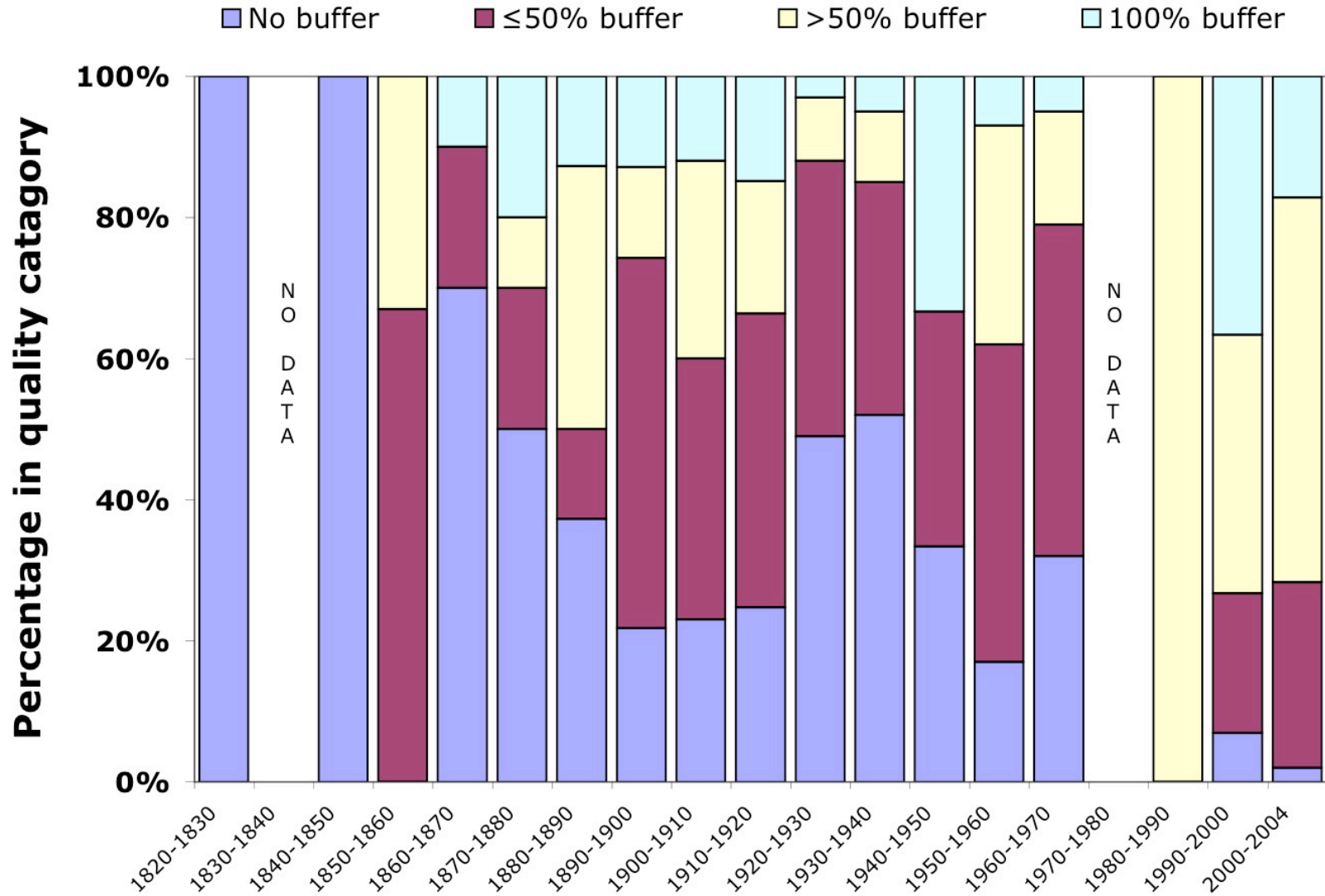
2 points

Full riparian buffer
all vegetation



4 points

Buffer Quality is Increasing over Time



As a team, REU students present their work at Denver GSA



2004 Denver Annual Meeting (November 7–10, 2004)

Paper No. 85-14

Presentation Time: 8:00 AM-12:00 PM

A WEB-BASED TIME MACHINE – PICTURING TWO CENTURIES OF LANDSCAPE CHANGE

BIERMAN, Paul, HOWE, Jehanna, [PEABODY, Michala](#), STANLEY-MANN, Elizabeth, HILKE, Jens, and MASSEY, Christine, Geology Department, Univ of Vermont, Perkins Hall, Burlington, VT 05405, mcpeabod@uvm.edu

Ever wondered what landscapes of 100 years ago looked like? The Landscape Change Program is a web-based, NSF-supported community archive of Vermont landscape imagery that answers this question.

The Program provides primary data (images of past landscapes) useful for understanding and managing present-day landscapes. The archive contains many thousands of images collected from or contributed by a variety of sources, all available free-of-charge, on-line at uvm.edu/perkins/landscape. Many of these images show both geologically- and landscape management-relevant subjects including floods, landslides, deforestation, reforestation, development, road building, and erosion.





Describe and Upload Images



Scan images

Enrich and Expand Database

Formulate Testable Hypotheses



Find Images

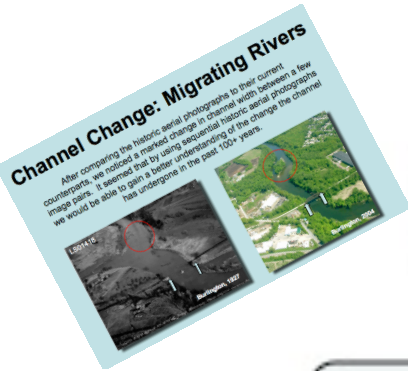


Test Hypothesis Quantitatively

Write up results

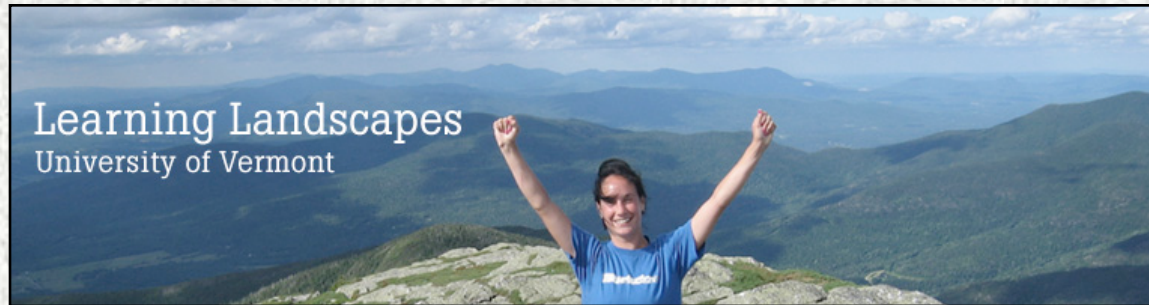
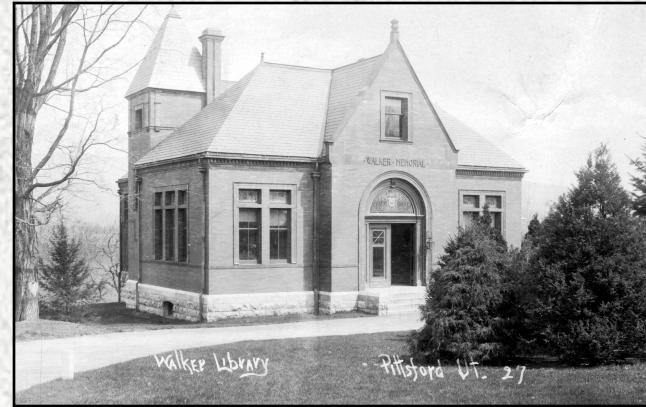
Create GSA Poster

Merge Findings into GSA Today Paper



The ripple effect..is significant!

Public Involvement
and Outreach

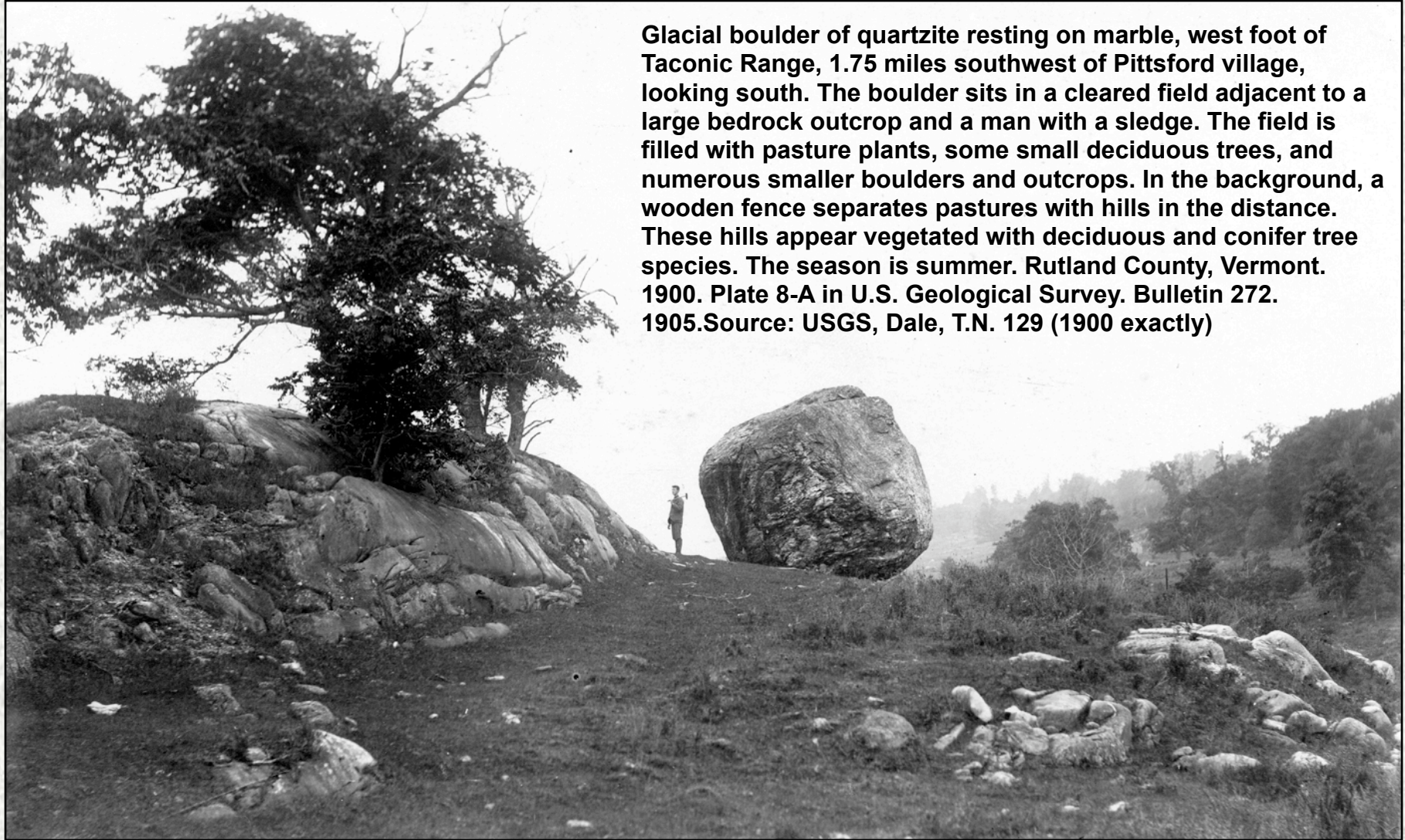


Educational
Materials
Development



Informing Policy Decisions
e.g., Highways

20 images from Pittsford 10.865 images of Vermont



Glacial boulder of quartzite resting on marble, west foot of Taconic Range, 1.75 miles southwest of Pittsford village, looking south. The boulder sits in a cleared field adjacent to a large bedrock outcrop and a man with a sledge. The field is filled with pasture plants, some small deciduous trees, and numerous smaller boulders and outcrops. In the background, a wooden fence separates pastures with hills in the distance. These hills appear vegetated with deciduous and conifer tree species. The season is summer. Rutland County, Vermont. 1900. Plate 8-A in U.S. Geological Survey. Bulletin 272. 1905. Source: USGS, Dale, T.N. 129 (1900 exactly)

Learning Landscapes

An NSF-supported educational website, Learning Landscapes uses 150 years of images to help students understand how Earth's surface works. Log in and join us on this virtual trip across Earth's amazing landscapes.

Developed at the University of Vermont



<http://www.uvm.edu/learninglandscapes>

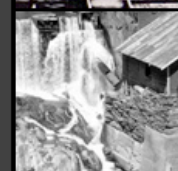
Learning Landscapes

[Home](#)
[Orientation](#)
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Rivers
[I. Why Rivers?](#)
[Recreation](#)
[Resources](#)
[Transport](#)
[Ecology](#)
[Change](#)
[II. Shapes](#)
[III. Conveyors](#)
[IV. Interactions](#)
[V. Changes](#)
[Rivers](#) / [Why Rivers?](#) / [Resources](#)

Resources

Finish *Why Rivers?*

Rivers and the water they carry have been used by civilizations for millennia. These men are working on a wooden dam. The water that will be stored behind this dam, once it is complete, will be used to power a mill for grinding grain, sawing logs, or weaving cloth. Look at some more images and take some time to understand rivers as resources.

[Try Looking Closer](#)


Learning Landscapes



Transport

[← Learn More](#)

Can you find the river?

[Close this Window](#)

[>> Read more at The Landscape Change Program](#)

Why? Form Convey Change Interact

Learning Landscapes



Channel Form

Channel form describes the shape of a river channel as seen from above. How do you get such a view short of hiring a plane?

Maps are a great way to study channel form. So too are aerial photographs. There are three common channel forms: [Braided](#), [straight](#), and [meandering channels](#) and we will look at all three.

[Close this Window](#)

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Conveyors Welcome

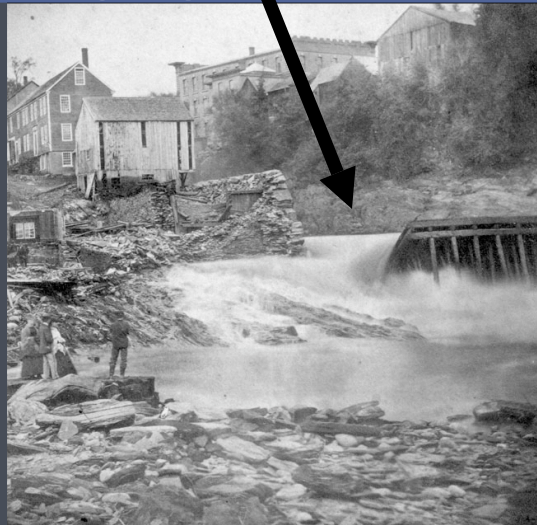
The goal of the CONVEYORS module is to help you understand better what rivers carry. We will use images to observe the transport of mass including fluids, solids, and biologic materials. By the end of this module, you should be able to identify a wide variety of river-transported materials and better understand the processes by which these materials are moved.

Rivers carry all sorts of things some, expected and some not. Use the chapters and images in this module to explore how rivers act as conveyors by examining examples of water, sediment, and waste transport as well as seeing how rivers transport ice, people, and all sorts of unusual objects.

[Close this Window](#)

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Learning Landscapes



Humans

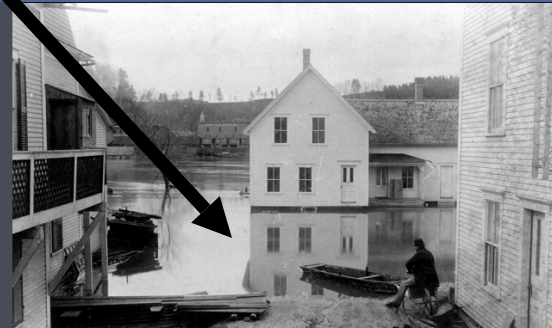
[← Learn More](#)

What evidence can you find in the image to determine who's in control of the river channel here?

[Close this Window](#)

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Learning Landscapes



Change

[← Back to Question](#)

Perhaps you would dwell on how your life is linked to the river or maybe you would wonder, when will the floodwaters recede?

Floods are certainly one of the most dramatic ways that rivers affect our lives. Every year, floods cause billions of dollars worth of damage in just the United States as river levels rise and fall over time.

But this image is about more than floods. Do you notice anything different about the water in the foreground versus that in the background?

The water in the foreground is slow-moving, still and glassy, the mark of over bank flooding. In the background, there are ripples created by the swift-moving current flowing through the channel.

[Close this Window](#)

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Resources

[← Learn More](#)

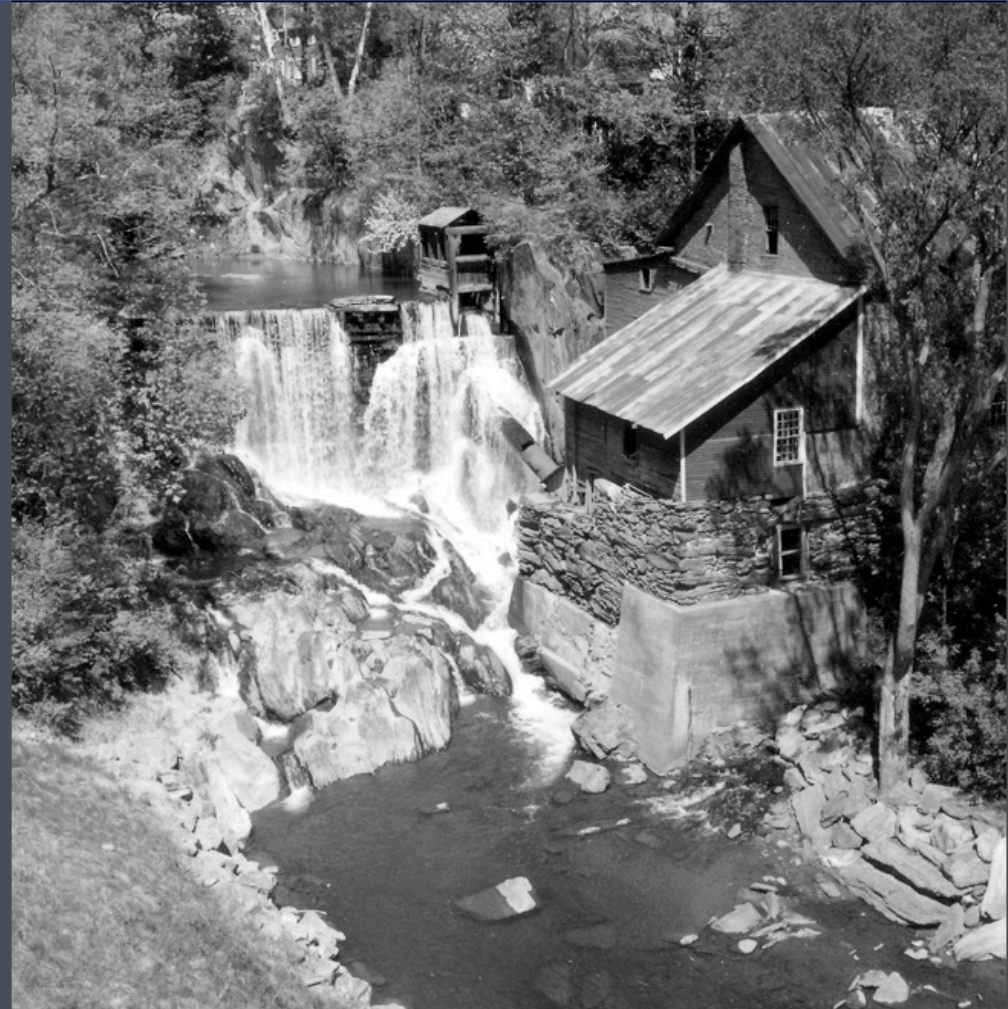
Why would anyone build a house deep in a gorge like this?

[Close this Window](#)

[>> Read more at The Landscape Change Program](#)

Fall '05 testing Geomorphology

1. usability
2. learning outcomes



Resources

[← Back to Question](#)

Ah, but this is not a regular house. It's a mill, taking advantage of the power of moving, and falling, water.

Do you know what makes this spot a particularly good place for a mill? Take a look at the stream channel. This mill has been built at the site of a natural waterfall. The dam helps guide water into the mill and ensures a steady stream of water power even during drought and periods of low flow.

Can you find the metal pipe that brings the water right into the mill building?

[Close this Window](#)

[>> Read more at The Landscape Change Program](#)

The Interstates come to Vermont - impact of the 50s, 60s, 70s



Vermont State Archives, Agency of Transportation: May '61-October '64



Vermont State Archives, Agency of Transportation: May '61-October '64



Vermont State Archives, Agency of Transportation: May '61-October '64



Vermont State Archives, Agency of Transportation: May '61-October '64

6095



Vermont State Archives, Agency of Transportation: May '61-October '64

REU Results:

Student engagement and experience

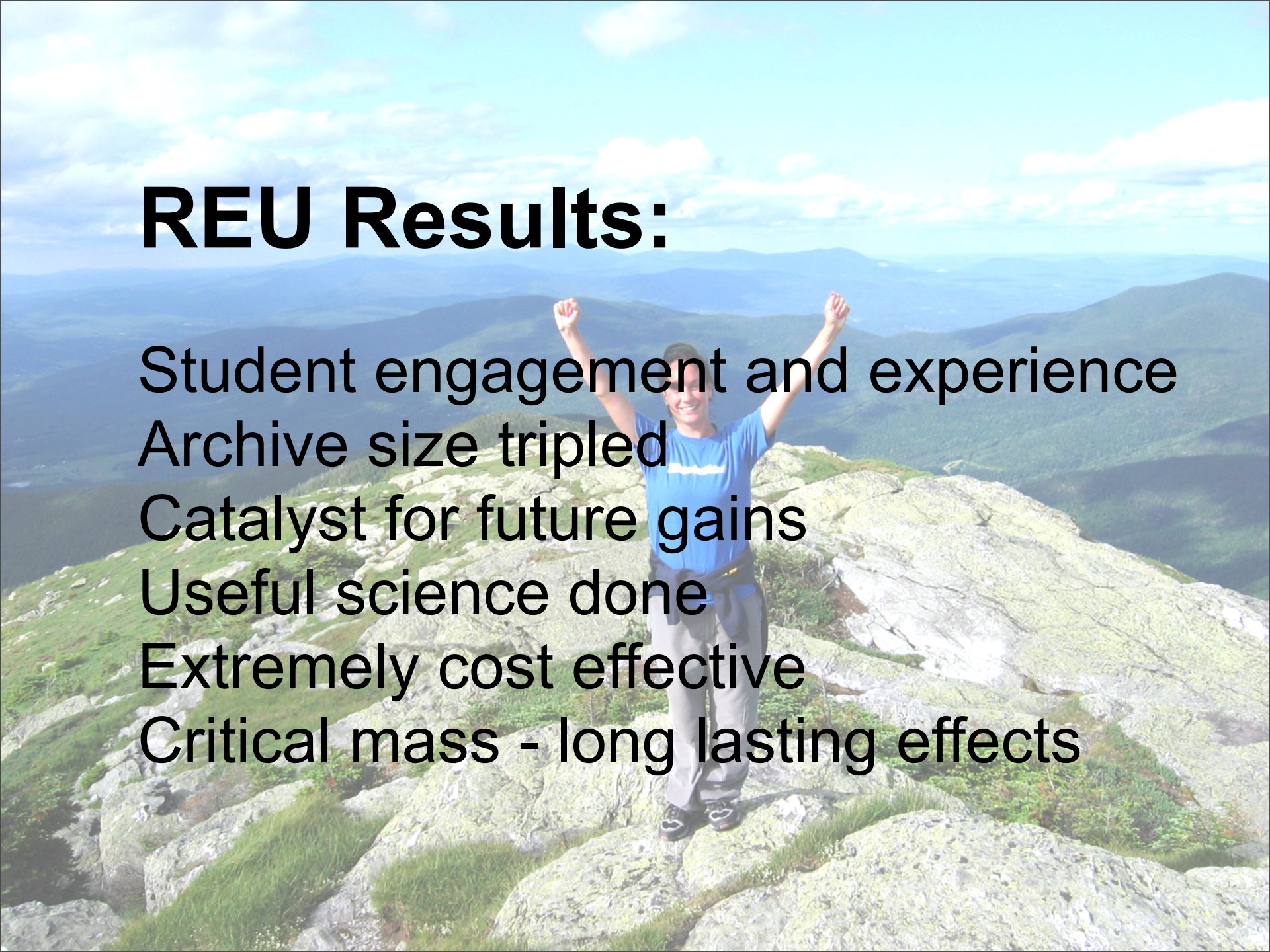
Archive size tripled

Catalyst for future gains

Useful science done

Extremely cost effective

Critical mass - long lasting effects

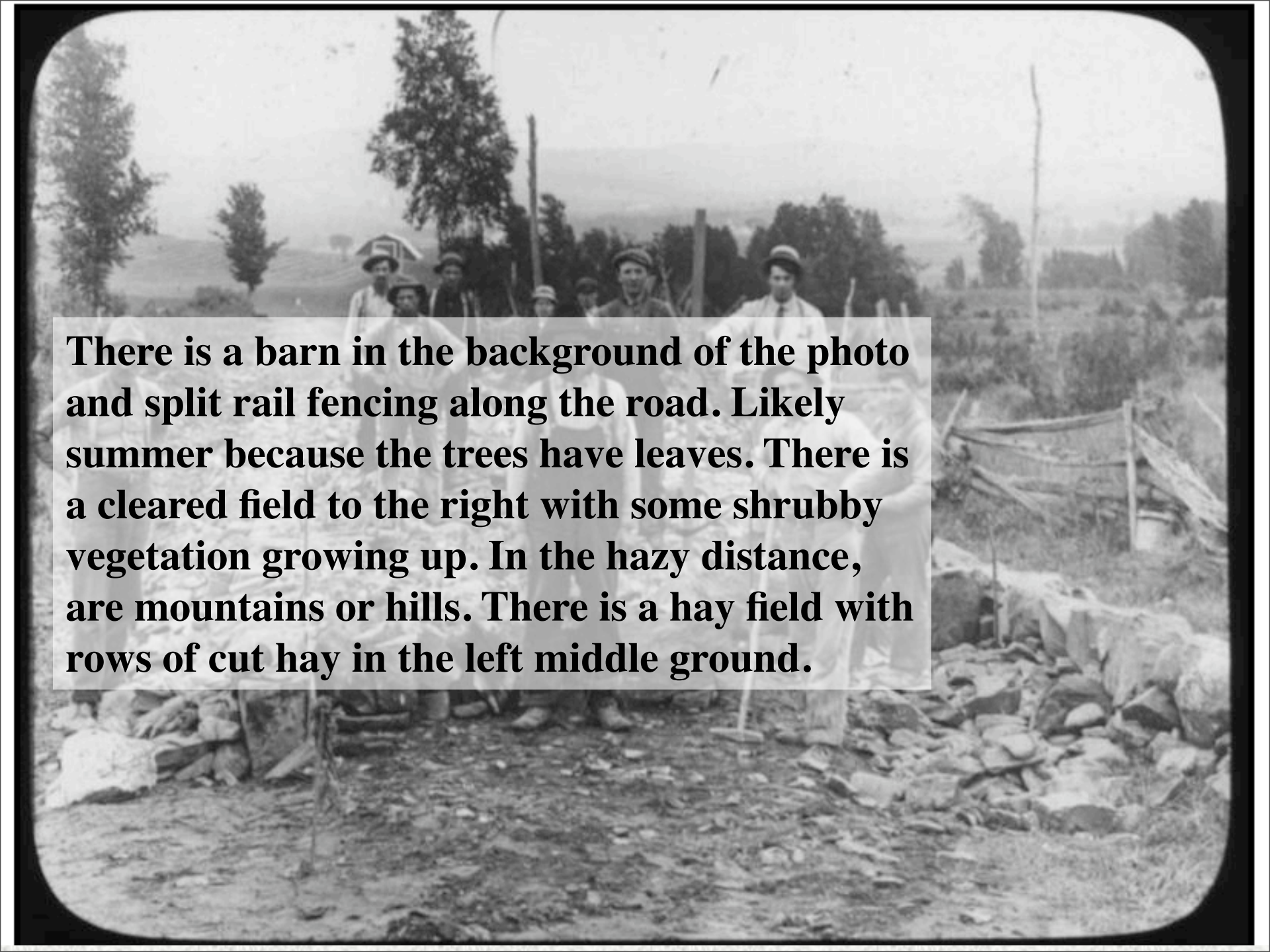




This image shows a group of men working on a road. They are laying down broken large rocks as a foundation for the road. Several of the men are wearing suspenders and overalls. One man holds a long handled tool that looks like a pick-axe.







There is a barn in the background of the photo and split rail fencing along the road. Likely summer because the trees have leaves. There is a cleared field to the right with some shrubby vegetation growing up. In the hazy distance, are mountains or hills. There is a hay field with rows of cut hay in the left middle ground.





**The title on the photograph was "Telford Foundation".
Lanternslide.**

