The world comes to UVM to date rocks

Carefully moving acid capable of dissolving solid rock, Eric Portenga, a geologist at Eastern Michigan University, dates sediment from central Australia. These grains of rock tell the tale of human impact on the outback 50,000 year ago – aboriginal-lit, landscape-scale fires preserved in the chemistry of reddened sand.

If you want to date a rock, UVM is the place to be. Thanks to a half million dollar grant from the US National Science Foundation, Vermont now hosts a diverse group of scientists from around the world to work in labs so clean you'd look for days to find a single piece of dust. Cleanliness is key when you are counting every atom.

What's new?

Students and professors from as far away as South Africa and Denmark now work daily in UVM's only clean lab, a bright, glass-enclosed space. They don bright yellow lab coats to dissolve minerals in fuming acid then purify brilliant yellow solutions. The rocks they dissolve hold great secrets. When did ancient glaciers come and go? How quickly do the towering Himalaya crumble? When will salty ocean waters flood the world's coasts?

Why VPR listeners should care!

Earth is a complicated place and it's changing quickly. As people turn up climate's thermostat, understanding how nature reacted in the past to changing climate is critical to anticipating what the future holds. Dating rocks provides geologists a view into the past and the more we know, the better we can adapt and plan for an uncertain road ahead.

Go deeper

Visit the lab's web site at http://uvm.edu/cosmolab

Paul Bierman, Professor, UVM

Paul Bierman has been a professor of Geology and Natural Resources at the University of Vermont since 1993. His research and teaching expertise focus on the interaction of people and Earth's dynamic surface. Bierman is a native of Baltimore, Maryland. For college, he moved north to Massachusetts, where he earned a bachelors degree in Geology at Williams College. After several years working as an environmental consultant in Boston, Bierman moved north again to the University of Washington in Seattle where he earned both a masters and doctoral degree in Geology. After a short post-doctoral interlude far to the south in Australia, Bierman has been a professor at the University of Vermont since 1993.

Bierman's research has taken him around the globe. He has studied erosion in Australia, South America, and several countries in Africa and the Middle East. In Greenland, Bierman and his graduate students are tracing the history of the Greenland Ice sheet over the last million years, an adventure that repeatedly takes them helicoptering over the ice.

Bierman works extensively communicating science to the pubic. He teaches summer science programs for highly motivated high school students, directs a public web site (www.uvm.edu/landscape) holding over 70,000 photographs of historic Vermont landscapes, has been co-author since 2005 of Pipkin et al., an introductory Environmental Geology textbook, and is the lead author of a new, NSF-funded textbook, *Key Concepts in Geomorphology*, that uses extensive visuals and photographs to teach about the workings of Earth's surface.

Bierman was awarded the Donath medal as the outstanding young scientist of the year by the Geological Society of America in 1995; he has since received a CAREER award from the National Science Foundation specifically for integrating scientific education and research. In 2005, Bierman was awarded the NSF Distinguished Teaching Scholar award in recognition of his on-going attempts to integrate these two strands of his academic life. Together, Bierman, his graduate and undergraduate students, and collaborators have more than 100 publications in refereed journals and books as well as hundreds of abstracts.

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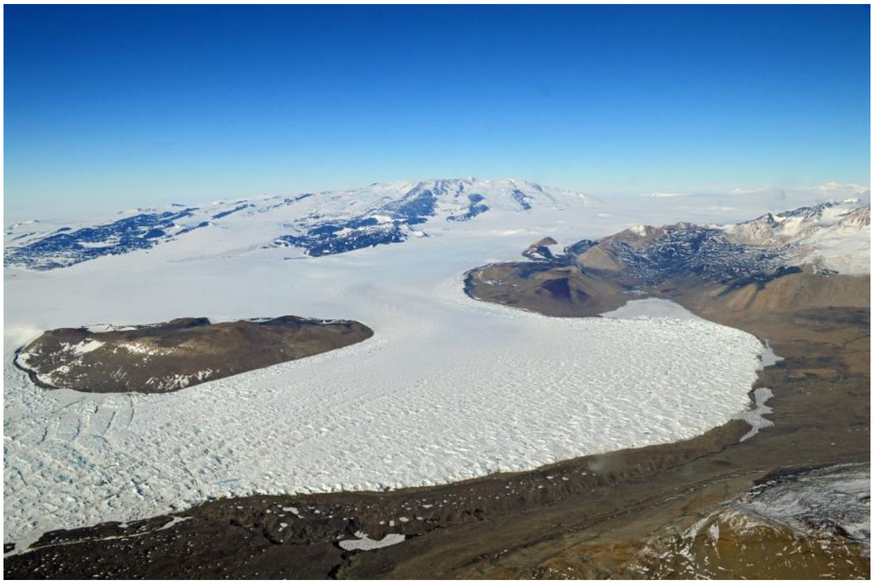
Sea level rise accelerates ice loss from East Antarctica



The desolate Antarctic landscape preserves secrets about its future response to climate change and sea level rise.

Why it matters: Massive glaciers in East Antarctica may be more sensitive to rising sea level from climate change than previously thought.

Near the end of the last ice age, ice from East Antarctica receded in response to rising global sea level and changing ocean heat from melting glaciers in the northern hemisphere.

- Thick Antarctic glacier ice can flow onto the sea floor as a marine ice sheet. If marine ice becomes too thin, it can become buoyant – making the ice flow more quickly into the ocean and raise sea level.

How they did it: A team of geologists mapped out where and when a marine ice sheet inundated the Antarctic landscape during previous ice ages.

- Expanded glaciers left behind a bathtub ring of debris marking where ice was in the past.
- Radiocarbon ages of fossil algae living at the edge of the former ice sheet tell us when the ice was – and was not – present.

What they found: Unlike ice in Canada and Europe that started melting around 20,000 years ago, ice in this part of East Antarctica remained at its greatest extent until 12,300 years ago. Rapidly rising global sea level and changing ocean heat circulation triggered this marine ice to retreat.

The big picture: As global climate warms, the ocean will absorb more heat and melting ice from West Antarctica and Greenland will raise global sea level. This threatens to destabilize East Antarctica and raise sea level even more dramatically within the next few centuries.

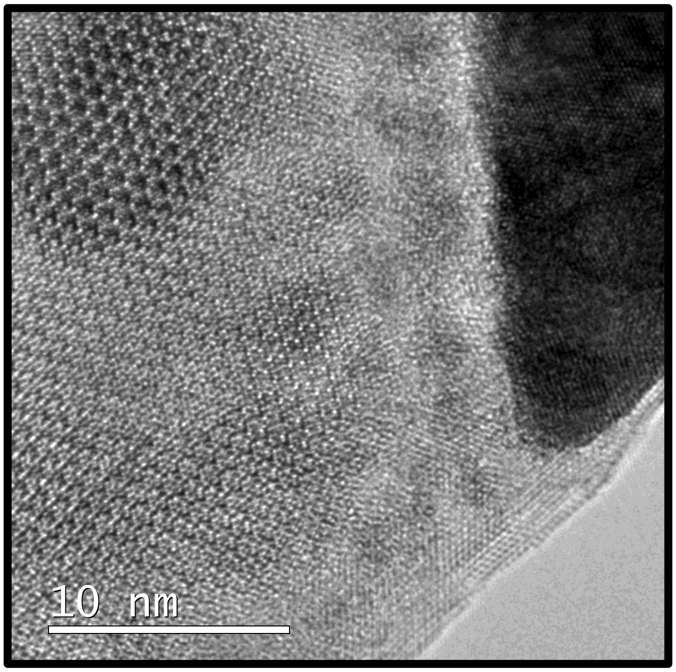
Drew Christ is a geomorphologist who studies how glaciers alter landscapes in response to changing climate. He's particularly drawn to polar landscapes – such as Antarctica and Greenland – as climate change in these regions affects the global climate system and sea level. Education lies at the core of Drew's passion for science – he enjoys teaching students of all ages and abilities about the earth, human's relationship with nature, and learning in the outdoors. Whether in a middle school classroom or on the side of a volcano in Antarctica, Drew believes in mentoring and empowering young scientists.

A Colorado native, Drew ventured east for his undergraduate degree in Geosciences at Hamilton College, where he became fascinated with recent climate change in the Antarctic Peninsula through his honors thesis. Following graduation, Drew worked as an environmental consultant at URS Corporation in Denver. He spent many months on the road at contaminated sites across the western US, ranging from a former uranium mine on the South Rim of the Grand Canyon, to contaminated oil and gas sites in the Texas Panhandle, to next to active F-16 runways at an Air Force. Drew returned to graduate school for his doctorate in Earth Science at Boston University to study the glacial history of Antarctica. Over the course of his research career, Drew embarked south four times to conduct geologic mapping and sampling in the remote wilderness of Antarctica. Now, Drew is learning new geochemical methods as a Visiting Graduate Fellow at the University of Vermont in the Community Cosmogenic Facility.

During his doctorate Drew was awarded a Graduate Research Fellowship from the National Science Foundation to support his education. Drew additionally served as a GK12 STEM Teaching Fellow at a Boston-area middle school, acting as the Resident Scientist for over 160 sixth through eight graders. As a passionate science communicator, Drew has given invited lectures about Antarctic climate science to people of all ages ranging from kindergartners to sustainability-focused start-up investors. He believes in sharing and explaining scientific concepts to improve access to cutting-edge, socially relevant research.

Why our apatite matters?

Author: Adele Conde



Microscope (TEM) image of the mineral apatite, that shows the individual atoms that make it up.

What We Study: For the first time ever, we are studying the breakdown of a mineral called apatite at the atomic scale! Apatite is a mineral that contains phosphorus, which makes up our bones and teeth as well as the rock we stand on.

Why Should You Care? To understand large-scale processes involving apatite and phosphorous, we need to study its breakdown at the most basic level.

- The breakdown of apatite is the primary source of phosphorous in the environment, which is a vital nutrient to all living things and a key element in DNA.
- The release of phosphorus from apatite in rock early in Earth’s history was likely crucial to the development of life, and the presence of apatite on Mars could provide evidence extraterrestrial life.
- If there is not enough phosphorus in the environment, our crops won’t grow, but if there is too much, it runs off into our lakes and bays feeding harmful algal blooms.
- Furthermore, dentists have built a multibillion-dollar industry on preventing the breakdown of apatite in the form of teeth.

The Experiment: We partially breakdown apatite minerals by running acid over their surfaces and then used a very powerful microscope called a transmission electron microscope (TEM) to directly observe the individual atoms that make up each apatite crystal and how they change as it breaks down.

Author Bio

Adele Conde is a graduate student at the University of Vermont studying geochemistry. Her research focuses on the nanoscale breakdown of a mineral called apatite and the elements it releases into the environment, a process vital to all living thing. In 2018 she was awarded the VTSCG Graduate Research Fellowship through the NASA Space Grant Program, for her work on the breakdown of apatite at the nanoscale and its implications for mineral-water interactions and life-supporting processes on Mars.

She grew up in West Virginia where coal mining was a family affair that introduced her to the wonders of geology and earth history. She then went on to attend college at Virginia Tech in 2013, where she studied geology. During her summers she interned with Civil and Environmental Consultants Inc. reconstructing and remediating streams damaged by strip mining and deforestation in North Central West Virginia. These experiences drove Adele to pursue a master's degree in geochemistry, where she could continue to study geological processes. Loving the outdoor and seeing first-hand the destruction humans can bring she hopes to spend her career remediating these geological hazards.

The agriculture-climate change connection

As our climate continues to change, farmers are struggling to produce abundant yields. Central to this threat is developing agricultural systems that maintain healthy soils and reduce agriculture's contribution to greenhouse gas emissions, all while keeping farmers in business to feed a growing population.

Why this matters: Most agricultural soils are currently a source of carbon dioxide and nitrous oxide (a powerful greenhouse gas). Traditional farming methods greatly promote the loss of soil carbon as carbon dioxide, which in turn, degrades soil fertility and reduces crop yields. An additional concern is the nitrous oxide emissions associated with the application of manure. These greenhouse gasses are major drivers of climate change and further threatens the agricultural sector. Fortunately, adopting no-tillage practices, planting cover crops, and changing how manure is applied to soils have the potential to increase soil carbon storage and decrease nitrogen losses.

What we did: This project focuses on the ability for different tillage practices and manure application methods to mitigate climate change by reducing greenhouse gas emissions from agricultural soils.

- We established a field trial in northeastern Vermont with management practices consisting of a combination of vertical tillage, no-tillage, broadcast manure, and manure injection.
- Greenhouse gas measurements and soil samples were collected twice a week, on average.

What we found: Tradeoffs exist between management practices. Over three years:

- No-tillage decreased total carbon dioxide emissions by 12-14% compared to vertical tillage.
- Manure injection increased total nitrous oxide emissions by 41-52% compared to broadcast application.

Kyle Dittmer

After **Kyle Dittmer** received his bachelor's degree from the University of Central Florida (UCF) in Environmental Science and Biology, he decided to delve deeper into research and immediately start a master's program in Natural Resources at the University of Vermont. From his undergraduate career, Kyle gained three years of experience measuring greenhouse gas emissions from aquatic ecosystems; his independent research project resulted in a publication within UCF's Undergraduate Research Journal. He is also a co-author for an article in press within Geoderma assessing the effects of saltwater intrusion into coastal wetlands on C and N mineralization rates.

Kyle's research interests broadly encompass ecosystem alterations due to anthropogenic activities and the consequences that may arise from these actions. To narrow his research scope, he's primarily interested in understanding the mechanisms responsible for greenhouse gas emissions from soils, and how certain land management practices may influence the rate of these fluxes to the atmosphere, further exasperating climate change scenarios. Specifically, his thesis research is focusing on the potential for best management practices (i.e., conservation tillage, alternative manure application methods/timing, and cover cropping) to mitigate nutrient losses via greenhouse gasses from agricultural soils without compromising soil fertility or crop yield. When Kyle isn't in the lab or amongst the corn, you can find him at Hot Yoga Burlington or exploring the vast landscapes Vermont has to offer.

Figure 1:Looking back to the *Flightless,* our home during the 2018 field season, here being dwarfed by the high peaks of New Zealand's Southern Alps. This photo is taken in Bligh Sound Fiordland, NZ, along the western coast in the Tasman Sea.

Concerning the way more interesting ground once walked on by hobbits…

In the south west corner of South Island New Zealand, scarred by glaciers and ripped apart by on-going plate tectonics, there stand the Southern Alps of Fiordland. These mountains are the roots of an ancient geologic setting similar to the modern-day Andes of South America.

How does the Earth make mountains?

When oceanic crust collides with continental crust:

1. There is the scrapping, bending and folding of rocks resulting in earthquakes. Eventually the oceanic crust will sink below the continental crust and into the earth's mantle.
2. Once the sinking crust interacts with the earths hot mantle, it begins to melt, producing magma. The magma rises through the deep crust explodes at the surface from volcanoes.

This one way the Earth is building mountains like those of the Andes and has done in the past with the Southern Alps of New Zealand.

You shall not pass… into the upper crust so unimpeded:

On its path through the deep crust, magma experiences all the violent affects of the colliding crust. Once the magma has cooled into rock, what is left is a history of how the mountains were formed.

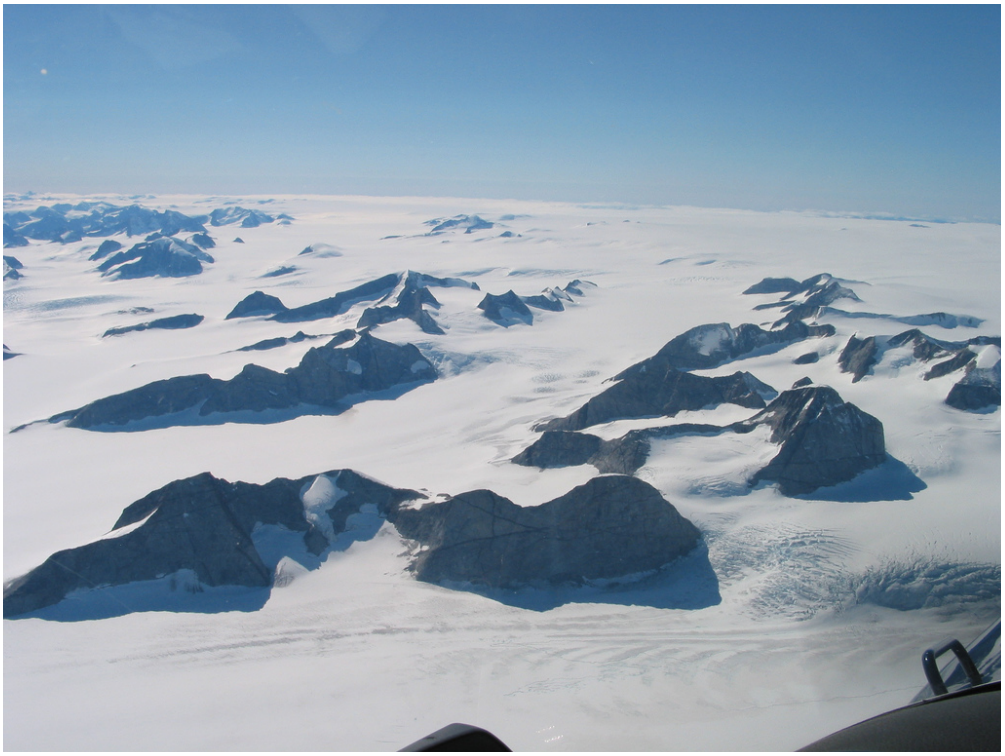
Rarely do geologists ever get to see this because the deep crust that the magma freezes into can be 50km deep; that's 125 empire state buildings stacked on top of each other. Fiordland is so unique because some of the deepest crust on Earth has been brought up to the surface where we are able to study the makings of mountains.

Chris Eddy

Christopher Eddy is Geologist earning his Master of Science degree from UVM. Following a six-year service commitment as an Airborne Arabic Linguist with the United States Air Force, he and his wife moved to Vermont where Christopher attended Norwich University earning a B.S. in Geology. There he focused mainly on mountain building related to the Green Mountains but is now interested in the mountains of New Zealand. With is advisor Dr. Keith Klepeis, and a team of geologists from California, Alabama and New Zealand, he studied the roots of an ancient mountain system built over 150 million years ago.

Christopher Halsted

Ancient catastrophic ice loss event demonstrates possibility for rapid melting of large ice sheets



Prominent mountain ridges poke out from beneath the thinning Greenland Ice Sheet. Could a similar phenomenon have happened in northeastern North America in the past? Photo: Flickr

With coastal communities worldwide becoming increasingly concerned about future sea level rise, the possibility of rapid ice loss from large ice sheets like Greenland and Antarctica is alarming. Observations of rising ocean temperatures in close proximity to these ice sheets has only added to these concerns.

The Project: To investigate a possible analogy to modern ice sheets, a team of researchers from the University of Vermont, Boston College, Bentley University, and Purdue University are reconstructing a large portion of an ancient ice sheet that may have lost most of its volume when the North Atlantic Ocean underwent an abrupt warming event around 14,500 years ago.

How: By measuring chemical changes in certain minerals, geologists can estimate when a rock surface was last covered by a thick ice sheet. The research team used this technique at different elevations in the mountains of New England and southern Quebec to track the lowering surface of the last great ice sheet to cover North America.

Results and Implications: Consistent results at several locations in northern New England indicate that a wide swath of ice thinned about 4,000 feet (or more than 3 Empire State Building's worth of height) at a rate seen only in the fastest flowing outlet streams of Greenland and Antarctica. This extreme ice thinning event occurred at approximately the same time as the abrupt North Atlantic warming. These results demonstrate that sustained, rapid ice loss from large ice sheets is not only possible; it may have happened in the past.

Christopher Halsted is a PhD student at the University of Vermont and a Graduate Research Fellow with the Gund Institute for Environment. Chris is interested in how climate change works and has spent most of his academic career researching how climate has changed in the past as well as how it may change in the future. Chris's research at UVM is specifically focused on the dynamics of large ice sheets, an understanding of which is needed for sea level rise predictions. To understand how ice sheets behave on long time-scales, he reconstructs ancient, long-gone ice sheets and observes how they behaved through time. Of particular interest to Chris and his collaborators is the response of ice sheets during periods of warming temperatures. He is working on this research at UVM with Professor Paul Bierman and Dr. Lee Corbett, and collaborating with Assistant Professor Jeremy Shakun from Boston College and Professor P. Thompson Davis from Bentley University.

Chris is originally from the Greater Boston Area of Massachusetts but spent much of his teenage years escaping the city to explore the natural areas of northern New England. He followed this passion when applying to colleges and landed at Bates College, in Lewiston, Maine. Following his love of the outdoors and inspired by an exceptional teacher, Chris decided to pursue a Bachelor of Science degree in Geology, with a focus on climate processes. After graduating, he took a couple of years away from academia to explore other career options before deciding to return to graduate school and pursue a Masters' degree in Geology. Chris applied to work with a researcher whose work he followed with interest and was fortunate to be given the opportunity to join Dr. Jeremy Shakun at Boston College. Here he began working on an ice sheet reconstruction project that would eventually grow and evolve into his current PhD project.

Chris's Masters' (and eventually PhD) project involved hiking many miles throughout the mountains of New England and southern Quebec, carefully searching for glacially-deposited boulders and exposed bedrock surfaces that were once covered by ice. These boulders and bedrock surfaces are goldmines of information, if the curious party knows how to properly investigate. By measuring certain chemical changes in these rocks, Chris is able to determine when a large ice mass was last at that location, either depositing the boulder or covering the bedrock surface. Using over a hundred of these analyses, Chris hopes to create a 3D reconstruction of ice retreat in New England and southern Quebec. Chris expects this reconstruction to provide valuable information on how ice sheets respond to warming temperatures.

Chris intends to continue researching climate change and ice sheets after finishing his PhD. He is interested in many other areas of the climate system including ocean circulation, atmospheric convection, sea level rise, and the role of human emissions in modern-day climate change. Chris is also passionate about teaching and hopes to design courses focused on the fundamentals of the climate system and how human actions have begun to change the climate.

Bogs: Pandora's box for climate change?
Kenna Rewcastle

A board walk winds through a spruce-tree covered bog in Big Bog State Recreation Area, Minnesota. Photo: Brian Peterson/Star Tribune

Scientists are keeping a close eye on bogs as climate change threatens to warm up and dry out these carbon sinks that store nearly 25% of the carbon found in soil.

Why it matters: Bogs act as a bucket in which carbon, in the form of dead plants and moss, is trapped.

- The cold temperatures and water-logged conditions in bogs prevent soil microbes from breaking down this dead plant matter and releasing this carbon into the atmosphere.
- If all the carbon trapped in bogs was released into the atmosphere, the size of this carbon dump would be over fifty times the amount of carbon that human emissions put into the atmosphere every year.

Kicking the can down the road: Lucky for us, the evergreen trees scattered through bogs seem to be slowing down the draining of the carbon sinks in bogs.

- During the day, the deep roots of spruce trees act as straws, sucking water out of the bogs and lowering the water table by as much as three feet to power photosynthesis. At night, the water table returns to the surface.
- Microbes, like the rest of us, perform best in a stable environment, and these daily changes in the water levels create stressful conditions that limit microbial decomposition.

The bottom line: Trees are moving into bogs and slowing down the microbial pump that pulls carbon out of bogs and dumps it into the atmosphere, but bogs will continue to dry out. Warmer, drier bogs will open the floodgates holding back the carbon trapped beneath the murky surface. The end of these carbon traps will accelerate climate change, painting a pretty grim picture for the future.

Kenna Rewcastle is a PhD student in the Rubenstein School of Environment and Natural Resources at the University of Vermont. Her research investigates the impact of climate change on ecosystem functions like decomposition and nutrient cycling. Rewcastle's research focuses on alpine ecosystems in ten mountain ranges around the world, meaning that her summers are spent hauling equipment and samples up mountains in idyllic locations like Greenland, the Rockies of Colorado, Swedish Lapland, and the Swiss Alps. While her research is based in ecological experiments, Rewcastle is especially excited to extend her scientific results to better understand how the benefits that humans derive from mountains will be impacted by climate change. To support her research, Rewcastle received a Graduate Research Fellowship from the National Science Foundation and collaborates with her advisors, Dr. Nate Sanders and Dr. Aimée Classen, on a global climate change experiment funded by the Carlsberg Foundation. She currently sits as a Board Fellow on the Green Mountain Club Board of Directors.

Prior to arriving at UVM for her graduate studies, Rewcastle spent a year studying the link between reindeer grazing and carbon cycling in Sweden on a Fulbright Fellowship. Rewcastle is originally from Chattanooga, Tennessee, where she grew up spending time in her first mountain loves, the Great Smoky Mountains. She graduated from the University of Tennessee with an inter-disciplinary degree in Ecosystem Ecology and Biogeochemistry.

Can saving snow over the summer save nordic skiing?

Skiers on an artificially-made nordic trail at the Craftsbury Outdoors Center, Craftsbury VT (Photo by Judy Greer)

Climate change is devastating the global ski industry. Saving snow is one economically-viable method that has allowed nordic ski centers to open on time. However, only high elevation (European alps) and/or high latitudes (Scandinavia) have done it successfully; a ski center in Vermont will be the first low-elevation, low-latitude, one to attempt it.

Why it matters:
With shorter and warmer winters, saving snow could be a cheap way to extend the lifetime of Vermont's nordic ski industry.

How it works:

1. Make a large pile of artificial snow outdoors during cold months (some are tall as a three-story building, as wide as a football field)
2. Insulate the pile by covering it in woodchips
3. Let it sit over the summer
4. Scrape off woodchips and spread snow out on a trail to open the ski season

Who's trying it in Vermont?
The Craftsbury Outdoors Center (COC) is an all-year recreation facility in the northeastern corner of Vermont. Among a variety of uses, it's an Olympic biathlon training facility and holds national ski races.

Why it's useful:
The COC doesn't need to rely on cold temperatures in November or environmentally-dangerous alternatives to make and keep snow.

The bottom line:
If saving snow is successful in Vermont, other similarly-located nordic ski centers could also save snow to open on-time in the winter, even in our quickly-warming climate.

Hannah Weiss

Hannah Weiss is a first year graduate student in the Natural Resources department (M.S) at the University of Vermont (2018 through 2020). She attended the University of Vermont as an undergraduate (2013 through 2018) and graduated with a B.S in Environmental Science, Geology Concentration, and a Mathematics minor. Both her undergraduate, and graduate studies, combine several of her interests: climate change adaptation, mathematics, geology, and communication of science. Her current research involves environmental data collection, Python-modeling, environmental economics, and public outreach through a project studying the feasibility of over-summer snow storage in Vermont.

Hannah grew up in the woods of rural western Massachusetts and developed a connection to geology through her mother (a geologist and physical science professor at Westfield State University). Her father, a mechanical engineer, helped cultivate her interest in mathematics. During undergraduate studies, she studied abroad in southern Chile, Patagonia and participated in field research projects through the Round River organization. This study abroad experience exposed her to community-based participatory-action research projects, as well as human-nature conflict resolution, and improved her Spanish fluency.

She has presented her research at the sectional Geologic Society of America conference (April, 2018) and will be presenting again at the national American Geophysical Union conference (December, 2018). This upcoming January 2019, she will be attending the Consortium of Universities Allied for Hydrologic Sciences Inc's Snow Field School in Bozeman, MT.

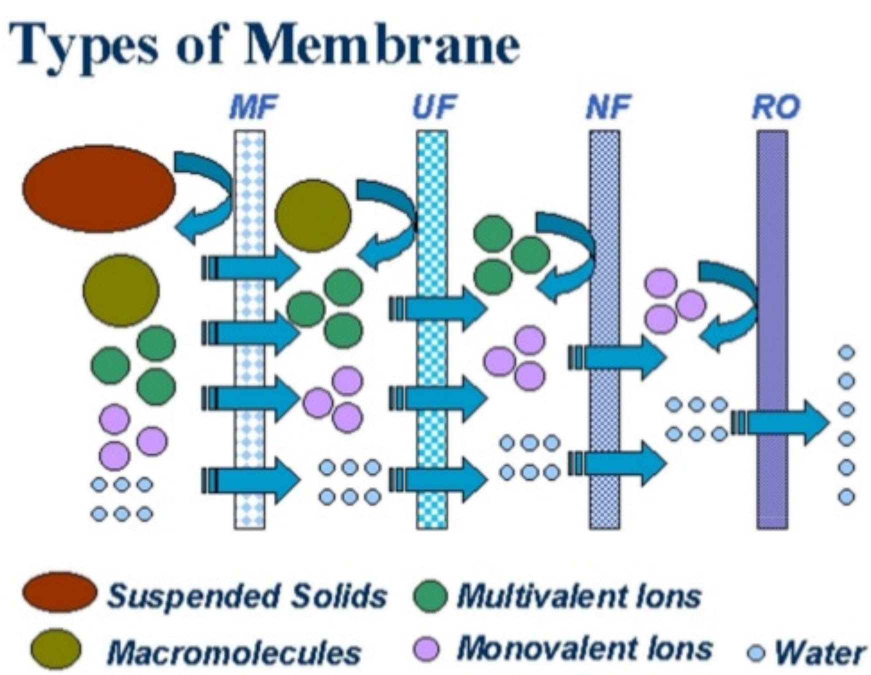
Logan Werner

Membrane Filtration and a Promising Future in Clean Water

The Big Idea: Production of clean water is currently the biggest challenge facing scientists in the 21st century. By using new and innovative materials to change the makeup of membranes, we are trying to create membranes that will do a better job of extracting clean water from contaminated solutions and improve methods of water purification worldwide.

Background Information: Membrane filtration is currently one of the premier areas of water filtration and clean water production due to its high efficiency and low cost compared to other conventional methods of water treatment. By filtering out contaminants using a selective barrier, membranes are able to separate pure water from solutions. For example, membrane filtration is used on some farms to extract pure water from animal waste. While membrane filtration can remove a large amount of pollutants, fouling, or the blocking and clogging of the extremely small tubes that make up membranes, reduce the workable lifetime of the process. Fouling has been noted as one of the major road blocks to larger implementation of membrane filtration.

The Project: Our lab is currently working to create carbon nanotube-blended thin film composite and asymmetrical membranes. Current research into these membranes has yielded higher water permeation, up to 4.7 times in magnitude compared to traditional methods, as well as a reduction in fouling. By improving the efficiency of the membrane filtration process, scientists around the world will be able to implement membrane filtration at a lower cost.



Logan Werner

Logan Werner is an environmental engineer currently pursuing a master's degree in civil and environmental engineering. Logan earned his Bachelor's of Science in Environmental Engineering from The University of Vermont in the spring of 2018, and immediately went into the graduate program. Logan is concentrating his studies on water filtration, water resources, and watershed management. He has always been an outdoors enthusiast, and spent winters enjoying the natural beauty of the Vermont mountains, and summers spent on the Atlantic Ocean or the Lakes Region of Ontario.

Logan was born and raised in Rowayton, Connecticut. After discovering an interest in physics in high school, he spent his first year of college hoping to become an astrophysicist. During his first semester of college, Logan learned about the water deficit in the southwestern United States, and some of the environmental impacts that have occurred due to over-extraction of naturally occurring fresh water. This prompted Logan to change his path and began his studies of the environment.

After completing his studies at The University of Vermont, Logan hopes to go South/Southwest and spend time working in environmental restoration and water treatment.

Nature helps refugees ease the stress of resettlement and improve mental health

Tatiana Gladkikh

Nicole, recently resettled to the USA, enjoys a winter camping trip, organized by the refugee resettlement agency.

Big picture: Since 1975, the U.S. welcomed over 3 million refugees, approximately 1% of the U.S population. Fleeing war-torn countries, refugees experience and witness a lot of violence. Similar to soldiers who returned from war zones, refugees need extra support to cope with past traumas, stress and depression. Yet lack of financial means and language barriers limit access to professional help and lead to poor mental health among refugees.

The research: The researchers at the University of Vermont examined studies of refugees' interactions with nature. They found that nature, through gardening, farming, or walk in a park, helped refugees cope with trauma, depression, and homesickness. Refugees shared that being outdoors helped them adjust to new home country and ease the stress of resettlement.

Implication: Refugee resettlement agencies should include access to nature as part of their strategies. This researched showed that nature-based activities were rarely included. However, when they were, they provided numerous benefits to refugees and improved their mental health.

How to get involved:

- Around 2% of Vermont population are resettled refugees. If you know some who just moved to Vermont, invite them for a walk. Show them parks that can be easily accessed. But be mindful, as preferences towards types of nature (e.g. a state park vs urban farm) vary across cultures
- In Burlington, a non-profit New Farms for New Americans provides resettled refugees with access to community farms. Reach out to them if you are interested in volunteering.

Tatiana Gladkikh (the second “k” is silent) is a second-year doctoral student at the Rubenstein School, University of Vermont. She is from Russia. Her passion for environmental research has taken her to Bulgaria where she completed her Bachelor’s, and to Puerto Rico where she did her masters. At UVM, Tatiana is using social sciences to figure out ways that encourage environmentally-friendly behavior. This spring, she will be going to New York City to interview Eastern European immigrants who gather mushrooms in the New York City’s parks and forests. She will explore whether these mushroom pickers also act as stewards and protectors of the forests. Her work will help New York City Parks and Recreation Department to improve their stewardship programs.

Getting Dirty in the Cuban Landscape

On a hot day at the end of August, a team of researchers from the University of Vermont and the Center for Environmental Studies of Cienfuegos, Cuba, collect water and sediment samples from a river in Central Cuba. Photo by Josh Brown.

When Americans get permission for a rare visit to Cuba, they usually go to experience a land "frozen in time"—the old cars, Soviet-era relics, and undeveloped natural areas.

Not for the dirt.

But that's what brought one team of American researchers to this long-isolated island. They are hoping that the Cuban landscape holds the key to determining how agriculture affects erosion. Understanding how growing food affects the health and sustainability of soil is essential to feeding increasing global population.

Why Cuba?

Cuba is an ideal place to study agriculture and erosion, because the landscape experienced a large-scale change in agricultural practices. Cuba went from using more tractors than the US Midwest when they were allied with the Soviet Union, to organic agriculture after the Soviet Union collapsed.

Understanding the Changing Landscape

The researchers are using the chemical composition of the dirt they are collecting to determine what erosion was like before humans began altering the landscape, and comparing those long-term erosion rates to more modern erosion records from rivers.

The team analyzed the chemical makeup of river water, and found high amounts of dissolved material in these samples, suggesting that the rocks underlying the Cuban landscape are breaking down at one of the fastest rates in the world.

In addition to helping understand a little-studied location, their research has opened a bridge for collaboration between Cuban and American scientists.

Biography:

Mae Kate Campbell is a master's student in geology at the University of Vermont who is working to understand erosion rates in Cuba. She has long been interested in how the earth works, which drew her to the field of geology. She completed her undergraduate degree at Oberlin College, also in geology, where she began thinking about how an understanding of earth processes can be used to reduce humanity's impact on the environment.