

Thank-Yous From Page Hollow

Laura Waterman, Secretary

Laurie Demrow – for designing our ad for the Writing Contest, and for the wonderful work she does for our newsletter.

Doug Mayer – for creating our contact list and the media list.

Dirk Ussler – for his valuable and much appreciated work on our website.

The Outdoor Gear Exchange in Burlington, VT, – for selecting the Fund as their “Nickel Bag” non-profit charity

for August. When a customer chooses not to take a plastic bag the Gear Exchange donates a nickel to the charity. In August they saved 2994 bags from going to the landfill with the Fund being the lucky recipient of each five cents for a grand total of \$149.71.

Matthew Cox – for updating our donor list.

Mary Margaret Sloan – for organizing the many details of the Writing Contest.

Rebecca Oreskes, Chuck Wooster, ad Doug Mayer – all past board members, for their willing support with the Writing Contest, and to...

Christine Woodside, editor of Appalachia – for publishing the winner’s essay in the December 2008 issue.

Waterman Fund Donors 2007-2008

Thanks to all who have supported The Fund in the past year.

Dan Allen & Natalie Davis	& Christopher Ellms	Jack & Susi Learmonth	Bill & Sue Parmenter	Derek Teare
Mark Alvarez	Ben & Judy English	Wink Lees	Linda Peavy	& Katharine Reichert
& Holly Fitzsimmons	Lynn Farnham	Lisa & Allen Locke	& Ursula Smith	Doug & Martha Teschner
Jim Anderson	Andy Fay	Steve Long & Mary Hays	Kevin Peterson	John & Patricia Thackray
Katrina Ashe	Pete Fish	Jeff Lougee	Ben & Barb Phinney	Chris & Wendy Thayer
Bill & Iris Baird	Brian Fitzgerald	Judith Sherman Macomber	Carol Phillips	Ned & Jean Therrien
Ginny Barlow	Dick Fortin	Bruce	Claire Porter	Elizabeth
Bill Barrett	Sue & John Foster	& Susan MacPherson	Kendall Query	& Stephen Thomas
Anne Barry & David	Brian Fowler	Stephen	Larry & Marla Randall	Sally & Tek Tomlinson
Greenwood	Friends of Guy	& Margot Maddock	John Reilly	Edith & Dan Tucker
Adam Bartkoski	Waterman Fund	Martin Manchester	Nancy Rent	Alice Tufel
& Erica Sherwood	Leslie & Nancy Frost	Judy Marden	Nancy Rich	Ed & Eudora Walsh
George, Paula,	Jane & Charles Gardiner	Steven Martin	& Lee Manchester	Laura Waterman
Annie Bellerose	Darius Ginwala	Jon Martinson	Bea Robinson	Susan & Seward Weber
The Bellerose Family Fund	Sara Goodman	Don Mayer	Mats Roing	Mary Weeden Winants
Peter & Emily Benson	& David Hyerle	Ellen Mayer	Louis & Eva Rubin	Blair & Patsy Weille
Richard Benton	Jim Goodwin	& Malcolm Pittman	Tom & Diane Sawyer	John Wesley
Charles Bickel	Cathy Goodwin	Dale Mayer	Rick & Jan Sayles	Tom & Nancy Witwicki
Katherine Birnie	Julia Goren	Doug Mayer	Jennifer & Mark Schiffman	The Wonderful Foundation
Putnam Blodgett	James Goyea	Bruce &	Jim Schley	Joel & Theresa Wood
Mary & John Brown	& Joan Gagnon	Mary Elizabeth McClellan	Patey & David Schorr	Chris Woodside
Michael Caldwell	Patti Gray	Carol & Charles McCrave	JoAnn & David Scott	Jim & Betsy Wooster
Libby & John Chapin	Ann Hall	Bruce & Susan McPherson	Nevin & Mary Scrimshaw	Chuck Wooster
Doug & Margaret Christie	Betsey & Sam Harding	Will & Pauline Merritt	Nat Scrimshaw	& Susan Kirincich
Ted Church	Tami Hartley	Hawk Metheny	& Jenny Rowe	Nancy Worthington
Herb & Jan Conn	& Regina Ferreira	& Zaz Brelsford	Dave Senio	David & Muriel Zandstra
Anne Cooley	Ryan Harvey	Scott Monroe	& Vivian Buckley	White Mountain Café
Louis & Sara Cornell	Wendy & John Heidenreich	Hugh &	Peggy Senter	John Hancock
Eve Coulson	Nancy Hirshberg	Stephanie Montgomery	Dennis Shaffer	Financial Services
& Nelson Obus	Linda Hlavacek	Peter & Alicia Moore	& Amy Emler-Shaffer	WVAIA
Matthew Cox	Carl Hoagland	Anna Sevier Morgan	Cindy & Paul Shumpert	AMC 4,000 Footer
Daniel & Jeanine Cox	Charles Houston	James Mullen	Tom Simon	Committee
Robert Dangel	Scott Hoyt	William	& Carolyn Hanson	IBM International
Alicia Daniel	Judith & Al Hudson	& Brenda Newman	Mary Margaret Sloan	Foundation
Natalie Davis	Marty	Hi M. Nicastro	Wells & Kathleen Smith	Outdoor Gear Exchange
Julie & Jay Davis	& Charles Humpstone	Donald & Gaety Niver	Steve & Carol Smith	
Tom & Dorcas Deans	Hope & Clark Hungerford	Andrew Norkin	Bradley Snyder	
Carl & Laurie Demrow	Doug & Terry Huntley	Andrew & Reidun Nuquist	Jim Snyder-Grant	
Peggy Dillon	Earl Jette	Rebecca Oreskes	Dana Sprague	
Edward Dimmock	Joanne & Kevin Jones	& Brad Ray	Kimberly Steward	
Audrey Duane	William Kaplin	Susan & Irwin Oreskes	Stonyfield Farm	
A. L. ‘H. Dunham	& Catherine Buni	Stanley	Profits for the Planet	
John Dunn	Lester Kenway	& Evelyn Orzechowski	Val Stori & Ken Linge	
& Linda Collins	William Kneeder	Priscilla Page	Tim Sullivan	
Marge Dwyer	Eleanor & Ernst Kohlsaot	Page Hill Foundation	Howard Sussman	
Scottie Eliassen	Allen Koop	Rick & Susan Paradis	& Margaret Gilmore	
Midge & Tom Eliassen	Robert & Harriett Kruszyna	Bill Parlett	Mike & Betsy Sylvester	
Rosemary	Agnes & Bixler Kurtz	& Sarah Clemmitt	Carl & Ching-Wen Taylor	

Compiled by Matthew Cox

The Alpine Steward

NEWSLETTER OF THE WATERMAN FUND

SUPPORTING EDUCATION & STEWARDSHIP TO PRESERVE THE ALPINE AREAS OF THE NORTHEAST

President's Letter

Carl Demrow, President



The Waterman Fund Board 2008

Front Row, L to R: Laura Waterman, Carl Demrow,.....

Back Row, L to R: Val Stori, Mary Margaret Sloan, Rick Sayles,, Matt Cox, Annie Bellerose

November 2008

Issue VIII

The Waterman Fund

Board of Directors

Carl Demrow
President

Mary Margaret Sloan
Vice President

Rick Sayles
Treasurer

Laura Waterman
Secretary

Louis Cornell
Clerk

Matt Cox
Annie Bellerose
Doug Mayer
Val Stori

WWW.WATERMANFUND.ORG

2008 Guy Waterman Alpine Steward Award Given to Dr. Hubert “Hub” Vogelmann

Annie Bellerose

The Waterman Fund presented its 2008 Guy Waterman Alpine Steward Award at the Fund’s annual dinner on Saturday, April 5, in Montpelier, Vermont. The award is given each year to a person or organization that has demonstrated a long-term commitment to protecting the physical and spiritual qualities of the northeast’s mountain wilderness.

Dr. Hubert “Hub” Vogelmann, of Jericho, Vermont, is the 2008 recipient of the Alpine Steward Award. Vogelmann, professor emeritus of botany at the University of Vermont, is best known for his pioneering research on acid rain, establishing UVM’s Field Naturalist Program, and his work on land conservation in Vermont. Vogelmann also has close ties to alpine issues. Beginning in 1964, Vogelmann took graduate students to collect data from the alpine areas on Mt. Mansfield and Camel’s Hump. What began as a basic ecological study in an all but unknown field has become an important measuring tool as we confront global warming and climate change. Vogelmann was instrumental in establishing Camel’s Hump’s first alpine naturalist and in creating the Green Mountain Club’s summit steward program. He worked to pass and later amend the 1963 Vermont Natural Areas Act, as well as the 1965 legislative act declaring Camel’s Hump an important state natural area, and later, a National Park Service Natural Landmark. In beginning the Green Mountain Profile Committee, he worked to protect high elevations and pushed for Act 250, Vermont’s groundbreaking development and land use law, to require special permits for building above 2500 feet. Vogelmann has shared the importance of alpine vegetation through slideshows to community rotary and garden clubs statewide, and has also worked to protect such areas in Maine and the Adirondacks. For over forty years, Hub Vogelmann has demonstrated a forward-thinking and consistent involvement in researching and protecting alpine areas, and in educating both scientific and recreational communities.



Caption

Hub Vogelmann was nominated for the award by Doug Teschner, a former student of Vogelmann’s at UVM. In his nominating letter, Teschner wrote “Hub Vogelmann’s lifetime achievement as a researcher, teacher, advocate, and leader for protection of mountain ecosystems and other wild places makes him most worthy of the Guy Waterman Alpine Steward Award. While Hub did not focus exclusively on alpine areas, he did extensive work in these environments and played a leadership role in encouraging many others to follow in his footsteps.”

In presenting the award, Carl Demrow and Laura Waterman echoed Teschner’s sentiments, stating that the Fund dinner gathering and the Fund itself would not exist without Vogelmann’s groundbreaking work in drawing attention to alpine concerns.

Vogelmann received a framed photograph of Camel’s Hump, taken by Vermont-based photographer Blake Gardner.

Friends of the Waterman Fund attended the annual dinner, held at The Chef’s Table in Montpelier. In addition to celebrating Vogelmann’s work, Fund President Carl Demrow revisited the three long-term initiatives the fund has set out at last year’s dinner: helping to fund research related to climate change, recreational impacts, and other alpine issues, creating permanent endowments for the popular Biannual New England Alpine Stewardship Gathering, and encouraging and cultivating new writers to continue the legacy of writing in the spirit of Laura and Guy’s work.

The First Annual Waterman Fund Alpine Essay Contest

Mary Margaret Sloan

The Waterman Fund concluded its inaugural Alpine Essay Contest in May and was thrilled with the quality and number of submissions. From 35 entries from across the country, the judges, who included board and former board members, chose Kimberley S. K. Beal's piece "Climate Change at the Top" as the winner. A graduate student in the University of Vermont's biology department, Beal's essay centers around her summer of field research on the effect of climate change at treeline in New England and is the basis of her master's thesis which she defends this fall. The essay resonated strongly with the judges because it took a complicated issue and made it personal and relevant. It will be published in the December issue of *Appalachia*, the Appalachian Mountain Club's biannual journal of mountaineering and conservation, and is reprinted in full here. In addition, Beal was awarded a \$2,000 prize to help her continue to pursue her writing.

Will Kemeza's essay "Dark Night on Whitewall" received honorable mention. While Beal's piece looks at the northeast's alpine areas through a scientific lens, Kemeza takes a philosophical approach to seasons spent working in the White Mountains. Both essays, plus seven others, are available in full at www.watermanfund.org.

The Alpine Essay Contest fulfills a long-term goal of the Waterman Fund — encouraging new voices speaking about northeastern environmental issues, much as Guy and Laura Waterman did in the 1970s, 80s and 90s. The deadline for next year's contest is May 1, 2009 and all are encouraged to submit. Full details and guidelines are available on the website.

Details and official rules can be viewed at:
www.watermanfund.org

To submit an entry, email a Word document (or compatible format) to Mary Margaret Sloan:
mmsloan@peoplepc.com

or mail to:
Mary Margaret Sloan
890 Hunt Road
Windsor, VT 05089.

Treasurer's Report

Rick Sayles, Treasurer

As you might have expected, our Fund balance has declined along with the broader market. You don't need this newsletter to remind you of the turmoil that has hit the world's markets. Nevertheless, the diversified low-cost approach that we have taken has proven its mettle by protecting the fund from any one or two stock disasters. As of the last Board meeting, our Fund had, in fact, outperformed the composite benchmark that we use for comparison purposes.

As I noted last year, the other real advantage we have is the cost-effectiveness of the Waterman Fund's operations. Not only is the working board entirely voluntary, but essentially all of the organization's functions are being carried out through voluntary help. All you volunteers - THANK YOU!

So, despite the market turmoil, with our diversified low-cost investment approach, and the wonderful volunteer efforts of all of the friends of the Fund, the commitments to Alpine stewardship in the Northeast are unlikely to be diminished in the foreseeable future.

Thank you for all of your generous donations.

Nominations Sought

To nominate someone for the Alpine Stewardship Award, please send a letter to the Waterman Fund, cite specific examples of the nominee's stewardship of the Northeast wilderness, along with other relevant personal or professional experience. The deadline for nominations each year is December 15th. The award is presented in April at the Fund's annual dinner. For more information, visit: www.watermanfund.org or mail your nominations to:
the Waterman Fund
PO Box 1064
East Corinth, VT 05040

Past Award Winners:

2008	Dr. Hub Vogelmann	2005	Lester Kenway
2007	Dick Fortin	2004	Ed Ketchledge
2006	Rick Paradis	2003	Roger Collins

2008 Alpine Stewardship Grant Recipients

Annie Bellerose

The Waterman Fund was pleased to announce its 2008 grant recipients in February. These recipients represent a broad geographic range, a diversity of projects, and a total of \$15,000 in funding, the greatest amount the Fund has been able to award since its inception in 2000.

The Adirondack Mountain Club (ADK), based in Lake Placid, New York, received funding for the creation of a year-round summit stewardship coordinator. Since 1990, the summit steward program has focused on raising awareness among hikers about how they can help preserve alpine areas. The goals of a year-round coordinator position will include increasing botany training for stewards and volunteers over the course of the field season, increasing the number of program presentations and sharing them with a wider community throughout the year, and recruiting more volunteer summit stewards. This fulltime position will provide the continuity necessary to expand the program and to take on new initiatives, while remaining true to the core program value of educating hikers on summits.

The Maine Appalachian Trail Conference (MATC) received funding for its Caretaker and Ridgerunner Education Program. The MATC's program, based out of Augusta, Maine, will focus on reaching the 10,000 hikers in alpine areas through their interactions with caretakers and ridgerunners. Specifics include creating teaching materials for use in the field, creating a manual to document and encompass the scope of the program, and continuing to build and share knowledge of site-specific alpine plants and ecology.

The Vermont Center for Ecostudies (VCE), in Norwich, Vermont, received funding for a project monitoring alpine butterflies endemic to the

Presidential Range. Working in conjunction with the White Mountain National Forest, the Appalachian Mountain Club, and citizen scientist volunteers, VCE is looking at two species, the White Mountain Arctic and the White Mountain Fritillary. The project's focus is on systematic monitoring and research for these two imperiled butterflies, noting changes in population. Monitoring will provide empirical data to help address the conservation of the butterflies themselves as well as the broader implications of climate change on wildlife and alpine zones. Read Jeff Lougee's article for more details about the summer's work.

Tales of Brave and Wet Field Biologists (aka Soggy Butterfly Biologists)

Jeff Lougee

This past year, the Waterman Fund made the largest grant in the Fund's history to support a unique alpine butterfly-monitoring project in the Presidential Range of the White Mountains. The project's goal is to establish a long-term monitoring program of two species, the White Mountain Arctic and the White Mountain Fritillary, that are found in the Presidential Range and nowhere else in the world. The project is a partnership of the Vermont Center for Ecostudies (VCE) and Appalachian Conservation Biology, and will help to sharpen a lens on the many ways climate change is likely to affect the alpine areas of our northeastern mountains.



Field biologists from the two organizations took to the mountains this summer to establish locations for monitoring these butterfly populations, and also to test out the methods for tracking them. With record-setting rainfall over the summer, and other challenges related to tracking these species, this was no easy task. Kent McFarland from VCE sums it up well: “We have a lot of experience with wildlife monitoring at VCE, but these two species are really difficult. With the worst weather in the world, rough terrain, unique life-history traits, and sensitive plant species that don't like boots on them, we knew we had our work cut out for us.”

Despite the many rigors, brave field biologists from the two organizations put on their raingear and still managed to fulfill the goals of the project for this year. “We were able to try different techniques, get a feel how long each takes, and what generally works up there and what doesn't with these butterflies,” said VCE seasonal biologist Brendan Collins. The results from this year's “pilot” phase study are currently being compiled into a report that will be available in November.

The Alpine
Steward



The Waterman Fund

SUPPORTING EDUCATION & STEWARDSHIP TO PRESERVE THE ALPINE AREAS OF THE NORTHEAST

Climate Change at the top: Investigating New England's treeline.

I am standing alone on a car-sized granite boulder, trying to see through the fog that walls off my view a dozen yards away. I feel isolated in a circumscribed world of white cloud and muted grey rock. Condensed water hangs in beads on a low bilberry bush. The wind is buffeting me so hard that I worry about twisting an ankle as I maneuver through this boulder-field, high above the valley. How long would it take someone to find me if I couldn't walk? Plenty of people will climb Katahdin today, but I am off-trail and not near a popular route. Despite its being August, I lose heat quickly and my hands are already creaky with cold. I hold a computer printout of a photograph, which flaps furiously and tries to get a free ride on a gust. I smooth the vital paper against my green pants and look again at the features of Witherle Ravine. There it all was in 1959: the ravine, the fir waves, and the cliffs. When I look up again the clouds have begun to dissipate and I can see farther down-slope. Suddenly I'm blessing the wind as it blows clear my line of sight. Shafts of sun hit the trees and rocks as the whole world reveals itself in sky blue and forest green. For a moment I take in the miraculous sight, and then it's back to work. With a little rock scrambling I am standing in the same spot where the original photographer took this picture nearly fifty years ago. While cloud-shadows flow across the topography like leaves in a stream, I hold my breath, raise my own camera, and take the same picture.

This is just one of the innumerable memories I have from my first summer of field research on the effect of climate change at New England's treelines. I was trying to find out; would a warmer climate mean a shrinking alpine zone?



Given the harsh environment high on New England's mountains, it is rather a wonder that any trees grow at all. Indeed, above a certain height, trees become very sparse as the plant community switches to alpine tundra species only a few inches high. Tree species like Balsam Fir and Black Spruce do persist in scattered clumps, but they are trimmed back by the winter storms and take on a stunted bush-like form. They are called *krummholz*, a German word meaning "twisted wood". Debate exists as to what causes tree-line—the elevation where trees give way to the alpine zone—but we know that different limiting factors are important at different treelines around the world. Climate is the main cause of treelines, specifically short growing seasons. In addition to temperature, other climactic factors fine-tune the location of treelines. In the Northeast, the effects of high winds, rime ice build-up and snow abrasion are thought to be especially important (Marchand 1987; Kimball 2000). It is easy to observe that some locations in the tundra are "safer" than others for trees. A big boulder, for instance, may provide enough shelter in its lee for a fir to establish itself, but the tree will be unable to grow taller than the protection of the rock. There are also non-climate factors that can exert a degree of influence on tree-lines. These include cliffs (not even the mildest climate will allow a forest to grow on sheer rock), human impact (the effects of recreational impact around huts or hotels) and natural disturbance such as an insect outbreak.

It is an amazing experience to spend time in this environment, especially alone—when the other-worldliness is most

sensible. Krummholz “forests” are like no other woods. Lilliputian in scale, they smell strongly of soil, moss and balsam. Moving through 4-7 ft high krummholz is not easy. Branches that have fought hurricane force winds to get where they are do not easily move aside. The boughs form a tight, almost impenetrable, canopy on the top and sides of a patch of trees, but the inside is dark and relatively clear. When navigating to a research site my strategy is to swim, not fight my way forward. The trees will damage me as much as I damage them if I push too hard. Instead I lean forward and feel for the path of least resistance. I am often reminded of a moment from the children’s book “The Lion the Witch and the Wardrobe” (Lewis 1950). The children in the story push past some fir trees and find themselves in a new world. I never know what the inside of a given krummholz forest will be like but I always feel like I am separate from the rest of humanity when I am there. Popping my head above the canopy after an hour or two, I am actually surprised to see that the world is so extensive as to stretch over range after range of mountains! My research has exposed me to new aspects of the mountains and I feel I can appreciate them more deeply than I did before.

I often crawl on my belly, winding past the 3-inch trunks of 70-year-old trees. Having read historical accounts of brave pre-trail hikers (Waterman 1989), I know not to bring extra gear. The trees would grab any loose backpack strap or jacket, and I would not make it through tight spots. Adventure was greater in Victorian times, but I thank my lucky stars to be wearing Labonville pants instead of layers of wet wool skirts as I navigate the “thickets”. Krummholz is usually wet. The needles efficiently collect water from the clouds and the sphagnum moss holds moisture exquisitely, making up the bulk of the “soil” these trees live on. In fact, the ground is often a pile of boulders or felsenmeer (sea of rocks) with the thinnest skin of humus above it. I have to move slowly and test each step to avoid putting my foot in a hidden 5 foot hole. Even when I find this frustrating, I know my presence has a purpose.

Between 1906 and 2005, the global temperature rose 1.33°F (IPCC 2007). sts in many parts of the world are able to grow at higher altitudes than they did a century ago. Scientists believe that the milder climate of today allows trees to grow where only low-growing alpine species could survive previously (Kullman 2002; Roush 2007). Should we expect a rise in treeline in New England also? We do know that there has been a rise in temperature and change in many climatic variables in the last century. Surface temperatures in the northeast have climbed 1.75°F, even more than the global average. Warming has accelerated in recent decades and winters



have been warming faster than summers (Union of



Concerned Scientists 2006).as already risen in elevation. Today the place where maples and beech give way to spruce and fir is higher up on mountains than it was in the 1960’s (Beckage 2008).

For trees that are limited by cold, warmer temperatures, especially longer growing seasons, should make growing easier. It is my goal to find out if trees in New England are growing higher on the mountains than they did 100 years ago.

I first became interested in this topic when I worked as a Naturalist in Appalachian Mountain Club huts in the Presidential Range. I had the precious opportunity then to live above treeline and observe at leisure that most striking of ecological boundaries. When I climbed the Valley Way or Ammonoosuc Ravine Trail I witnessed the changing life forms as I neared the summit. Tall Balsam Firs gave way to stunted krummholz and then to lawn-like sedges and miniature cushion plants. What is it, I wondered, that allows a tree seedling to sprout and proceed to live eighty or a hundred years in one spot, while a few feet away it cannot? The huts were also the first place I heard worries that global warming might cause this treeline to move up. My fascination with the alpine landscape led me to pursue answers in graduate school. At the University of Vermont Botany Department I have the freedom to find a gap in our knowledge of the natural world and try to fill it. I relish this opportunity to contribute to understanding of the environment because it is comprehension that allows us to be good stewards.

I came full circle when I began my research. After some years in the mountains of the western U.S., I came back to New England to follow up on my questions about this landscape. It was wonderful to stay in Madison and Lakes of the Clouds huts again and think back to when I worked there myself. On the practical side, these solid stone buildings provided a safe base camp from which to set out picture-hunting on sunny days or cower in thunderstorms.

I knew that treelines in other regions had risen with temperature and that New England's temperature had climbed. I decided to find out whether our treelines also had risen and I needed a good way to measure change. Other researchers had used repeat historical photography (re-photography) with success (Sturm 2001; Munroe 2003). If you want to see change in a landscape and you have old photographs of it, all you need to do is re-occupy the spot where the first photographer stood and take another picture. Simple photo-pairs of "then and now" allow analysis of things like erosion or human development as well as of vegetation change (for examples see the Landscape Change Program at www.uvm.edu/landscape). Though my focus is treeline elevation, the pictures I have taken tell the story of how the high huts changed shape and size through the years and also how fir waves move up mountain slopes. I can trace the paths of landslides and see how they have filled in with alders over time.

I played historian to find photographs, spending hours in the archives at the University of Vermont and the Appalachian Mountain Club. In their wonderful collections I found photographs, some over 140 years old, taken

by amateurs and professionals. People were climbing these mountains and recording the views then as now. It was a joy to see happy outings of snowshoers in wool skirts or proud groups at the summit and know that folks still enjoy the hills that way. Enjoyment of the landscape may be much the same, but I was looking for a change in the forested background of those pictures. The long gone hikers inadvertently recorded information about the state of the mountain at that point in time.

I found pictures of treeline from Mt. Mansfield in Vermont, the White Mountains in New Hampshire, and Katahdin in Maine. Once the snow melted in spring of 2007, I headed for the hills to track down the spots where those hikers had stood decades earlier. For my work I needed to be as exact as possible when relocating images in the field. Field copies of my chosen historical images were my guide, and past summers of hiking helped me to find the right general area to begin looking for the original location. I used the principle of parallax by changing my position until foreground objects, like boulders, lined up correctly with background objects, like summit ridges. The puzzle of finding the exact spot is addictive, something like a scavenger hunt for which I have to scamper from mountain top to mountain top, trying to take advantage of rare clear days.

As a researcher I constantly find my experience in the woods useful. Months of backpacking have taught me how to stay comfortable and safe in severe weather, but I have also gained scientific insight. The more time I spend in forests or on top of mountains, the better a sense I have of how the ecosystems are put together, which plants are most common, and what a "normal" state looks like. My undergraduate mentor, Dr. Joan Edwards, always stressed to me the importance of old-fashioned observation. In this era of remote sensing and computer models (which are excellent tools), it is important still to know an ecosystem on the ground. I think this familiarity provides a base from which to make realistic new hypothesis and interpret data. Each season in the field adds to that foundation.

Field seasons do come to an end, and autumn saw me back in Burlington with piles of photo-pairs to analyze. For every day in the field it seems to take weeks in the lab to process data and try to find the important results. I spent winter days in my university lab studying the photo-pairs while snow drifted down onto brick buildings outside. I may have been sitting in front of a computer all winter, but the images of the mountains in summertime reminded me why I was doing it. I used mapping software to resize digital copies of my new pictures to match the originals. Painstakingly, I searched for fixed objects (like cracks in rock) that I could locate in both images. I linked them

together so that the two pictures overlapped exactly. I then matched the contrast and brightness to accurately compare the extent of tree coverage then and now. I ended up with about 70 photo pairs that were of high enough resolution to distinguish trees from rocks and tundra. Most of the historical images were taken in the early years of the 20th century. Within each image I studied a slope that had uniform conditions (slope and aspect) and was distant from areas of known human impact. I also excluded landslides and avalanche shoots, which are a constantly changing aspect of steep areas. Zooming in on the area of interest, I flipped back and forth between the old and new image, noting the size of krummholz patches and areas where trees formed continuous canopy. I scored each picture for increase or decrease in tree cover. Spring is coming again to New England and I am finally able to put some preliminary numbers on the trends I've been seeing in my three northern New England study sites. The more pictures I examine, the clearer the trend becomes. A majority of the 2007 photographs show more trees covering a larger area at treeline than their historical counterparts. Some images show no net change, but many of these are areas where treeline would not be expected to move as readily, such as areas with extremely steep slopes, which are forbidding to tree growth in any climate. Some slopes may also be more or less prone to vegetation change due to aspect. I hope to know soon with further analysis. Increased tree cover after a century of warming is consistent with the hypothesis that warmer temperatures would cause higher treelines in the northeast. However, the complexity of both the causes of treeline and the changes in multiple climatic variables must be considered. As is often the case in science, these results will raise further questions.

With growing season expected to lengthen by 29 to 43 days in the next century (NECIA 2006), we might expect high altitude trees to be able to mature and cold-harden their needles, allowing them to survive more ice abrasion

in the winter. Given that annual temperature is expected to increase 5.0 to 9.5°F in the next century, should we expect treeline trees to be able to out-compete tundra plants for space? Alpine areas are effectively small sky islands in New England. If trees are more and more successful and invade into tundra, then the area of alpine zone will shrink ever smaller. Will slowly rising forest be yet another threat for plant species like dwarf cinquefoil, which lives nowhere else on earth? What will summits look like in another 100 years? It all depends on how trees respond to the changing climate of the northeast and how long it takes them to react. After all, trees are long-lived and slow growing so we expect some lag time in their reaction to change. Predicting the future gets trickier the farther out one tries to calculate, especially when the amount of warming that will occur depends on the gasses humanity decides to emit. Unforeseen circumstances, like the introduction of a devastating exotic insect, may turn the tables and reduce tree cover. Luckily the past is full of clues if we are willing to take the time to look for them. The more we can understand about how treeline has responded to climate in the past, the more we can say about how it will react in the future. The more we know about the ecosystems we love, the better we can care for them. I've reached the summit of Katahdin on an August day that has become clear and bright, with distant lakes twinkling in the sun. There are through-hikers finishing the Appalachian Trail, day hikers visiting from Europe—a few dozen people enjoying the view of Maine spread out below them like one big picnic blanket. In my mind I see even more people here. For me, the summit is crowded with the presence of climbers from many eras who came before and left records through their photographs. Their clothing looks strange but the expressions on their faces are familiar. At this point in the summer I have begun to realize that the view on which these hikers of the past looked down was different from the one I see today. The forest has been creeping slowly upwards since their time and I am here to investigate that change.

Literature Cited

- Beckage, B., B. Osborne, D.G. Gavin, C. Pucko, T. Siccama, T. Perkins (2008). "A rapid upward shift of a forest ecotone during 40 years of warming in the Green Mountains of Vermont" *Proceedings of the National Academy of Sciences* 105(11):4197-4202
- IPCC (2007) *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K. and Reisinger, A., (eds.)]. IPCC, Geneva, Switzerland, 104 pp.
- Kimball, Kenneth D.; Weihrauch, Douglas M. (2000). Alpine vegetation communities and the alpine-treeline ecotone boundary in New England as biomonitors for climate change. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. *Wilderness science in a time of change conference—Volume 3: Wilderness as a place for scientific inquiry*; 1999 May 23–27; Missoula, MT. *Proceedings RMRS-P-15-VOL-3*. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 93-101.
- Kullman, L. (2002). "Rapid recent range-margin rise of tree and shrub species in the Swedish Scandes" *Journal of Ecology* 90: 68–77
- Marchand, P. (1987). *North Woods*. Appalachian Mountain Club, Boston, MA.
- Munroe, J. S. (2003). "Estimates of Little Ice Age climate inferred through historical rephotography, northern Uinta Mountains, USA." *Arctic Antarctic and Alpine Research* 35(4): 489-498.
- Roush, W., J.S. Munroe, D.B. Fagre (2007). "Development of a Spatial Analysis Method Using Ground-Based Repeat Photography to Detect Changes in the Alpine Treeline Ecotone, Glacier National Park, Montana, U.S.A." *Arctic, Antarctic and Alpine Research* 39(2).
- Scientists, U. o. C. (2006). "Climate Change in the U.S. Northeast, A report of the Northeast Climate Impacts Assessment." UCS Publications, Cambridge, MA.
- Sturm, M., Charles Racine, Kenneth Tape (2001). "Increasing shrub abundance in the Arctic." *Nature* 411: 546-547
- Waterman, Guy and Laura (1989).