

Rocky Mountain  
Biological Laboratory

*Science at the Top*

Fall Newsletter 2015



Gothic Mountain from Snodgrass Mountain.

Photo by Shayn Estes

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The Rocky Mountain Biological Laboratory's mission is to advance the deep scientific understanding of nature that promotes informed stewardship of the Earth.

Cover Photo by Shayn Estes:  
Aspens, *Populus tremuloides*,  
in RMBL Warming  
Research Meadow.

### Dear RMBL Members, Friends, and Community,

Thanks to RMBL's staff, past and present, as well as permanent and seasonal! Working for RMBL has always involved challenges. Being under snow for half the year not only beats up the facilities, but limits when work can be done. The scientific community is only active for about 10 weeks; so not only do we have to work quickly, but we have a short window in which to improve operations.

Working for an organization going through rapid change, as RMBL has the last five years, brings its own set of rewards and challenges. It is easy to focus on the rewarding part, such as pride in the improved facilities. In addition to renovating our historic structures and adding some wonderful new buildings, dependable water and internet are still novel enough that we continue to appreciate them. There is a glow around our education program, including filling enrollment for undergraduate research, adding a high school course in 2014, and initiating a new program for 9-12 year-olds in 2015. And, providing scientists access to new research equipment and research sites is a joy.

Beyond the normal challenges however, shepherding RMBL through its recent transformation has involved an enormous amount of work, patience, and adaptability. It has involved shifting expectations, revised job descriptions, and new buildings. From staffing the Visitor Center, to operating complicated building systems (who would have ever thought that Gothic would have buildings with online control systems?), to providing more support for scientists (e.g. weather stations, GIS/GPS, and other equipment), to extending the programs we offer for students of all ages, RMBL's staff have gracefully taken on many new functions that did not previously exist.

Indeed, this year we have pushed our season of operation from mid-August to late September by hosting workshops, conferences, meetings, and field trips for local schools. It is great to see our facilities more fully utilized. It will make RMBL more sustainable, but it has squeezed an already tight summer/fall.

The world needs RMBL more than ever. What we do matters, from producing scientifically literate citizens, to training the next generation of scientific leaders, to facilitating research that informs food security and human health along with the management of our water, air, biodiversity, and ecosystem services.

RMBL's staff is critical to meeting society's scientific and educational needs. Recruiting and retaining excellent staff increases our ability to use resources wisely and to balance short-term and long-term needs. It helps us build and sustain a culture that prioritizes serving students and scientists. Continuing to invest in staff is an important part of our journey in building a leading research institution. So, thank you to the staff and the entire RMBL community for what we have accomplished, as well as embracing future challenges!

Sincerely,

Ian Billick, Ph.D.  
RMBL Executive Director

# Supporting Science & Stewardship

## A Donor Profile of Marcella and Brian Wildes

Avid adventurers with inquisitive minds, Marcella and Brian Wildes were quick to ask questions about the Rocky Mountain Biological Laboratory even before they moved into their part-time home in Crested Butte in 2013. They noticed the solar panels and the scientists while passing through Gothic, and they wanted to know what was happening in this old ghost town now turned into a field station. The Wildes' involvement with RMBL officially began through a conversation between Brian and RMBL board member, John Haley, while the two were swimming laps in Dallas during one of their swim team's workouts. (As a side note, Brian swam the Maui Channel on a relay team for the 5th time in September 2015; Marcella has been on his relay team twice in past years). Through the Haleys, Brian and Marcella learned about the purpose and people of RMBL, and they quickly became involved in the RMBL community. "We love the mountains, we love the environment, and we love nature," said Marcella, "RMBL is all about protecting and understanding those precious gifts."

"RMBL aligns with how we think, and what we think is important," said Brian. Brian's love for the outdoors, and specifically the Rocky Mountains, began when he attended summer camp as a young boy at Ute Trail near Lake City. He decided to study philosophy at Southern Methodist University in Dallas as an undergraduate and then at the University of Colorado at Boulder, where he spent spare time rock climbing, skiing and riding his Harley while also earning a Masters. Later, Brian earned an MBA from Wharton and gave up his Harley after he and Marcella had their daughter, Rachael (now 26) and son, Chase (now 25). Marcella studied art at Drake University, Iowa and in Florence, Italy before finishing her BFA degree at The San Francisco Art Institute. Today, she is a life-long learner in both the arts and sciences. Brian currently works primarily in the oil and gas industry, and he is an entrepreneur with a strong interest in biology.

For the last decade, Brian has partnered with Dr. Glenn Bedell, previously a professor of Chemistry and Biology at New Mexico State University, on developing processes and commercial applications utilizing a certain plant material (information about the identity of this plant is confidential) that has the ability to purify water of toxins such as mercury and arsenic, as well as separate out and purify Rare Earth Elements (REEs) which are used in many green technologies, medical equipment, electronics, automobiles and defense



*Marcella and Brian Wildes on a hike from Crested Butte to Aspen.*

weaponry and guidance systems. Their Plant Induced Metal Ion Reductants (PIMIRS) process eliminates over 100 steps from the traditional solvent extraction method for purifying REEs currently used in China, steps that have very negative impacts on the environment. The plant material is utilized in a pH adjusted solution which drops out the REEs from their ionic state into pure individual crystals in one step. Not only can the PIMIRS extract pure REEs, but they can also be applied to remediating nuclear waste. Brian and Dr. Bedell have had many discussions with Sandia National Labs regarding potential applications. This past year, Brian and Dr. Bedell received funding from the US Department of Defense Army Research Lab to support their continued research in their private laboratory in Las Cruces, New Mexico.

Brian and Marcella support RMBL because of their belief in the importance of scientific research and education as well as the need to be stewards of the environment. "I admire RMBL's dedication to understanding and protecting our environment, particularly as that relates to the impacts of climate change," said Brian. He applauds and values the long term data sets collected by the scientists working at RMBL over the years, and he appreciates how RMBL makes science accessible to the public. Brian and Marcella have really enjoyed getting to know individual scientists and learning about the variety of research at RMBL. Marcella has especially enjoyed participating in the Summer Science Tours and Geek Week programs, and she has worked to connect others to the RMBL cause. "There really is something for everybody," said Marcella, "Whether it is bees, birds, pollination or plant acclimation, you can always discover one little thing that would be interesting enough to cause you to want to know more."

# Indicator of a Changing World

## The Warming Meadow

Contributed by Tony Stroh

Located at an elevation of 9,560 feet in the Gothic townsite, the “warming meadow”, with its overlay of wires and heaters, provides a stark contrast to the natural, unencumbered hillside above it. For over a quarter century, it has stood as a silent chronicler of how a rise in temperature and earlier snowmelt could alter the subalpine meadows of the Upper East River Valley by mid-century.

The warming meadow is the creation of John Harte, Professor of Ecosystem Sciences at the University of California at Berkeley. A veteran of RMBL field work since the late 1970's, Harte got the idea for the “warming meadow” in the 80's while doing research at the Mexican Cut site above Schofield Pass, where he and other researchers were studying the effects of acid deposition on pond chemistry and on salamander populations.

“The work we did at the Mexican Cut convinced me, around 1985, that even if acid deposition ceased, the paedomorphic salamanders would still be doomed by continuing climate change, which would eventually dry up their ponds by summer's end. That got me interested in the question of what else would climate change do, and that led to the idea of an experimental manipulation because the models of that time, and even today, were not adequate to the task of gaining predictive insight,” Harte explained. “To a great extent I made no hypotheses. I really wanted to observe, with an open mind, how a subalpine meadow would respond to climate change.”

It took Harte several years to find a suitable site, and to construct the apparatus necessary for the experiment. “We needed several things: A location relatively free of dust; one where we could lay out plots that extended downhill from a ridgeline so that the plots would be isolated from runoff from later snowmelt, a diverse mix of forbs and shrubs, and a source of electricity.” The system was designed to raise the temperature inside the heated plots by two degrees Celsius, which Harte explains was, in 1988, what climate scientists expected the temperature increase to be by 2050.

Spring snowmelt occurred 2-3 weeks earlier in the heated plots, as compared to the control plots, and this has triggered many other responses. Harte and his students have discovered, for example, that the forbs (non-woody flowering plants) were greatly impacted, while sagebrush grew profusely in the heated plots as compared to the controls. Moreover, the heated plots were losing carbon; in particular, soil carbon was being released into the air as carbon dioxide, a process he describes as ‘positive feedback.’ To the non-scientist, hearing the word ‘positive’ suggests something good. But in this case it isn't. Harte explains: “Positive feedback is a process wherein one action, (climate warming) causes a response (changes in the ecosystem) and



*Anne Marie Panetta and John Harte in the Warming Meadow.*

these changes cause the original action to become more intense.”

Since its beginning in 1990, Harte's warming meadow has provided a veritable treasure trove of research opportunities, which have resulted in the publication of nearly three dozen scholarly articles and nine Ph.D. theses. The most recent of these papers shows that 25-year trends in the vegetation and the carbon in the control plots are tracking the more dramatic changes in the heated plots, thereby documenting substantial ecological effects of actual climate change.

Two ongoing warming meadow studies include the work of Dr. Jennifer Rudgers, professor of Biology at the University of New Mexico, and Anne Marie Panetta, a Ph.D. candidate at the University of California at Davis. Rudgers is investigating aspects of the fungal symbionts of plants and how they are impacted by a changing climate. Panetta is investigating how one particular plant, the rock jasmine, is affected by climate change. Both are longtime veterans at RMBL, and their research will augment the impressive scientific contributions that have flowed from Dr. John Harte's warming meadow.

On a warm day last July, as Harte cautioned the photographer not to step over the line and accidentally enter a heated plot, he pointed to some sagebrush in a control plot. Bending down, he carefully ran some sagebrush through his fingers. “In another 50 years,” he said, “instead of celebrating a wildflower festival, they'll be having a sagebrush festival.”

Photo courtesy of Tony Stroh

# Tomorrow's Scientists

## Undergraduate Student Profile

Chiara Forrester, Hampshire College

### Why did you decide to spend a summer at RMBL?

In high school, I worked as a student leader at a residential environmental education program for 6th grade students in Portland, Oregon. Teaching students about plants sparked the passion I have for ecology today. I decided to attend Hampshire College in Massachusetts to study environmental education and plant ecology because coursework there is experiential, discussion-based, and includes hands-on field work. I really enjoyed my first independent research project as part of a course called Life and Water in the American Southwest, and I wanted to do more research. I wanted to go somewhere beautiful and do field ecology, so I applied to RMBL! I attended RMBL as a student in the summer of 2014 and returned as an REU student under Dr. Jennifer Rudgers in 2015. The summer of 2014 was a big turning point for me. I was interested in science before, but I had not had any serious experience. At RMBL, I realized how great my passion for plant ecology is and that science is something I can actually pursue.

### What sort of work and research did you do?

As part of Dr. Rudgers' lab, I study symbioses between grasses and fungi. This summer I was running two experiments, which will culminate in my senior thesis at Hampshire.

My first project was a potted experiment that we overwintered from last summer. Our question was whether a fungal endophyte affects the ability of its host, *Poa leptocoma*, to compete with its congener *Poa reflexa* (which has no endophyte) under differing water regimes, which might explain both species' distribution. We grew *Poa leptocoma* with and without its endophyte, and in competition against itself and *Poa reflexa*, under both flooded and ambient treatments. This competition experiment will help us to understand the results from a four-year experiment we concluded last summer investigating how these endophytes affect growth, survival and reproduction of their host in different microsites.

For my second experiment, I'm investigating how fungal endophytes in *Festuca thurberi* might affect soil enzyme activity below the host plant. I have eight sites total, which include a combination of high and low elevation sites and are located on the East River, Ruby, Treasury and Cinnamon. At each site, I have plants with and without endophytes, for which I took a variety of abiotic and biotic measurements and collected soil, litter, and leaf tissue samples. I then shipped my frozen samples to Hampshire where I will conduct soil assays.

### What was your biggest take away from this work? What inspired you?

These experiences have taught me that I am capable of



Chiara collecting a soil sample for her enzyme experiment at her low elevation site for her Ruby gradient.

carrying out ecological research. I have strengthened my ability to ask questions by being in the field, doing work independently, and by being immersed in ecology research throughout the summers. The most important part of being at RMBL for me has been working with Jenn Rudgers. She is indescribably inspiring, and her work ethic is immense. I have now worked with her both at the University of New Mexico and RMBL. She taught me how much you can do in a small amount of time and has been a very strong female role model for me. Sometimes I get burned out, and then I have a meeting with Jenn, and I get excited all over again. That is really unique! I feel like she believes in me. That is a really powerful thing to have, a mentor who inspires you and believes in you.

### Tell us a little about yourself.

I was raised in Portland, Oregon and I've been fortunate to have educational opportunities that allowed me to pursue my passions and interests. I was home-schooled for grades 5-8, and I was outside all the time; the first day of 5th grade I was at Yellowstone National Park. In high school, I had a fantastic science teacher who provided us with a strong understanding of the scientific process and of evolutionary biology. At Hampshire College, we are taught to be critical thinkers and read mostly primary literature, which has aided me in my ability to carry out research and with my writing. Our education is also ingrained with topics of social justice, and we are taught to be consciences citizens of the world. I'm a captain of the Hampshire soccer team, and I love to hike, sing and play guitar. After I graduate, I plan to attend graduate school at the University of New Mexico.

# A Look Toward the Future

## Research at Risk

Contributed by Ian Billick

Long a remote valley utilized for ranching and research, and the occasional hiker and horseback rider, the East River Valley now hosts tens of thousands of recreationalists a year. While this past summer was overwhelming and threatened to crowd out historic uses, we can learn from other beautiful places that are able to manage many more people with less resource damage while honoring research and ranching. By collaborating with Gunnison County, the US Forest Service, enforcement agencies, and the local municipalities, there are opportunities for the East River Valley to be special. Indeed, given that education is at the heart of RMBL's mission, and it has never been more important to introduce people to the outdoors and the science critical to managing the outdoors, it's an important opportunity.

What would such a future look like? It would not look like this summer with the congested traffic snarls, people driving through meadows, passing through Gothic at freeway speeds, and road rage. Rather, it would be a chance for visitors to take a deep breath, relax, and learn about science and history. And it would not involve converting the valley into a parking lot and cheap lodging, with human waste and toilet paper behind trees and under stones. Rather, the valley would be managed intentionally, with clearly marked places for parking and camping and appropriate facilities.

Change is needed. Our summer-end online survey and exit interviews indicate that managing recreation is a top priority for the scientists. The numbers reached levels that impacted not just the public lands, but we had people driving through meadows that RMBL owns, across research sites and water lines. The problems this summer were severe enough that the Crested Butte and Gunnison papers ran eight articles on these issues in the course of a single month.

Any changes will require careful analysis and evaluation. The Gunnison Times has suggested that vehicular traffic be restricted during peak periods to certain times of the day, perhaps along the lines of Maroon Bells. Unlike the Maroon Bells, the geography of the valleys above Crested Butte are different—they are interconnected and changes to use patterns in one valley can have unintended consequences for the other valleys. Management actions will have to take into account the unique features of our landscape. Ultimately, managing the valleys is an issue of managing



Photo by Aaron Huelstep

*An impatient driver uses the meadow instead of the road in a July traffic jam in the Upper East River Valley.*

people. And, managing vehicles is an important part of that.

If the larger Gunnison and Crested Butte community is willing to act, RMBL will have to participate. If traffic is managed, trips involving personal cars in the middle of the day during July to buy some groceries or grab a coffee might become a part of the past. Travel by scientists within and beyond the valley to conduct research might have to be actively managed. We can't put pressure on the meadows around Gothic by using them for our own parking and housing. RMBL will need to be part of the solution, not the problem.

The founding of RMBL involved a vision for education that has led to unique research. RMBL is recognized around the world for the quality of our science, much of which informs matters that impact the nation, from food security to human health, to managing the air we breathe and the water we drink. From its earliest years, Director John C. Johnson wrote to the Gunnison County Commissioners asking that they manage the road and general access to Gothic to "preserve for generations, if possible, the beautiful and almost virgin territory around Gothic for professional and amateur biologists of the nation". Fully realizing this vision will take work.

In August, the County Commissioners convened a public work session in Gothic. Approximately 100 people attended, including representatives from the towns, county, sheriff's office, US Forest Service, transportation officials, and emergency responders. The County has formed a task force, and recommendations should start to emerge in the next six months. RMBL will be an important member of this team that works to preserve the Upper East River Valley for generations to come.

# 2015 Snapshots



Photo by Benjamin Blouder, Ph.D.

*Richard Forbes and Rozalia Kapas measure aspen leaves near Gothic.*



Photo by Benjamin Blouder, Ph.D.

*The inaugural community art show and open-mic night attracted a large number of visitors.*



Photo Courtesy of Bobbi Peckarsky, Ph.D.

*The 2015 Benthettes.*



Photo by Ann Colbert

*Jaclyn Aliperti teaches Kids Nature Camp about trapping golden mantled ground squirrels.*



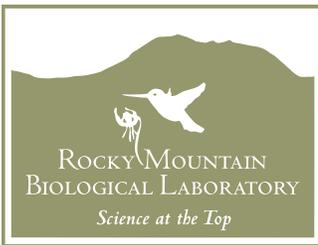
Photo by Shawn Teske

*Moose in the aspens below Gothic Mountain*



Photo by Jimmy Lee, Ph.D.

*Bombus and Corydalis.*



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## RMBL Publications and Media Coverage in 2015

The \*new\* RMBL publications database is accessible from the RMBL website:  
<http://www.rmbll.org/publications/>

Scientists at RMBL published 40 peer-reviewed articles between January, 1 and October 1, 2015. Pollination research made the news repeatedly. Graduate student Matthew Koski's paper describing floral pigmentation patterns across the globe was published in Nature Plants, and was highlighted in Nature's News and Views. An article in Wired, about bee communities changing in Colorado's alpine, referenced bee distribution data from RMBL. The Smithsonian highlighted work by Rebecca Irwin looking at climate change impacts on plant and bee phenology. RMBL scientists and students, Mascha Bischoff, Diane Campbell, John Powers, and Nick Waser had pollination articles in the journals, Evolution, Proceedings of the Royal Society B, and American Naturalist. Ecology published an article on climate change and plant phenology by Paul CaraDonna and David Inouye and an article on seed predation by Gretel Clarke and Alison Brody. Joshua Grinath's graduate work about trophic cascades was published in Ecology Letters. Articles in Global Change Biology addressed climate change impacts on plant plasticity, by Jill Anderson and Zak Gezon, and plant and carbon responses to climate manipulation by John Harte and Scott Saleska. Research on animal behavior continues to grab the public's attention. Dan Blumstein was interviewed about animal escape strategies, with a reference to Gothic marmots. An editorial by David Inouye in Science, outlined the next century of ecology.

Nine RMBL graduate students defended theses in 2015. Adriana Alexandra Maldonado Chaparro (UCLA), Zak Gezon (Dartmouth College), Parris Humphrey (U. of Arizona), Matthew Koski (U. of Pittsburgh), Nicole Munoz (UCLA) and Lindsey Sloat (U. of Arizona) received PhDs. Amy Kenwell (Colorado School of Mines), Christine Pribulick (Colorado School of Mines), and Stephanie Zorio (Idaho State U.) received a MS. Congratulations!

Look for Ellen Dobbin's book, RuMBLings: A History and Highlights of the Rocky Mountain Biological Laboratory. It is available online at Amazon or at Gothic's Visitor Center.

