

## **Magic Combination of Long-term Research, Research Training, and Great Science Leads to Insights into Changing World**

Using a combination of long-term data, data mining, and physiological plant measurements, RMBL scientists Dr. Will Petry and Dr. Kailen Mooney and colleagues recently published an article in *Science*, one of the top research journals read by scientists around the world, documenting that males are headed up the mountains towards concentrations of females. Sounds like Crested Butte, right?

In any single year, there are more female valerian plants (*Valeriana edulis*) as you move up in elevation. Female plants need more water and do better at higher elevations because higher elevations have more snowpack for longer and cooler temperatures, which translates into higher soil moisture over the growing season. However, over the last 40 years for any particular elevation, snow is melting out about 12 days earlier. Consequently, the soil is getting drier. Over the last 40 years, the change in soil moisture is equivalent to a roughly 2,500 foot change in elevation! Because warmer and drier conditions are moving upslope, more male plants, the plants that can deal with less soil moisture, are now found flowering at higher elevations. These sex-based responses to a changing world will likely lead to more valerian plants at higher elevations, but fewer at lower elevations. How do RMBL scientists know about changes in soil moisture and the locations of male and female valerian plants over the last 40 years? Petry resurveyed plants in plots originally studied by RMBL scientist Dr. Judith Soule in the 1970's.

Research around the world has previously demonstrated that areas where species are found are changing. But this study is unique in that it documents the complex ways in which species are changing and provides tools for making predictions about how plants will respond to warmer temperatures. It is also the first study that connects the ecological differences between males and females to their responses to climate change with consequences for plant populations.

According to Dr. James Thomson, a long-time RMBL scientist who was not affiliated with the study, "Most scientific investigations are brief, but documenting climate-driven changes requires studies that extend across decades at particular locations. For a cluster of reasons, RMBL has emerged as a leading institution for such studies. First, individual researchers become attached to the area and loyal to the institution, returning year after year. Second, they recruit succeeding generations of students who can extend investigations. Third, they publish studies and archive datasets that open unique opportunities for subsequent investigators. Petry and Mooney could not have achieved their *Science* paper without work begun by Dr. Judith Soule in 1977."

Image 1 (petry\_et\_al\_1.jpg): A female valerian plant (*Valeriana edulis*) in a high elevation population (3790 m) in which males are rare (23% of plants). Photo credit Will Petry.

Image 2 (petry\_et\_al\_7.jpg): Lead author Will Petry surveying valerian (*Valeriana edulis*) sex ratios in 2011 at a high elevation site (3450 m). Photo credit Will Petry.

### **About the Rocky Mountain Biological Laboratory**

In a rapidly changing world, RMBL promotes informed stewardship of the building blocks of life, by accelerating and sharing discoveries in the field sciences. Because biological processes are fundamentally the same everywhere, the work of RMBL is relevant globally.

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