



Sweet Clover in Montane Plant Communities

The Question: How do yellow and white sweet clover affect native plant communities?

Yellow and white sweet clover (*Melilotus officinalis* and *M. alba*), like other members of the pea family, have the ability to fix nitrogen in root nodules. Because of this capability pea family members have long been planted in agricultural fields and then plowed under as an inexpensive means of adding nitrogen to the soil. *Melilotus* was introduced more than a century ago to stabilize soil following road construction.



Though quite attractive, sweet clover displaces native species.

Although clover is not listed as an invasive species in Colorado, observations suggested it was spreading in the park. For instance large patches of clover can be seen in Horseshoe and Moraine Parks.

National parks are committed to maintaining vegetation communities in their natural condition. Exotic species, i.e., species not native to a park, may spread decreasing the diversity of native plant communities, and in many cases, eliminating cover and food for wildlife. Park staff wanted to know whether clover was having an impact on native communities. In particular it was hypothesized that the nitrogen-fixing capability of clover was giving it a competitive edge.

The Project: Measure sweet clover patches in the park.

Joy Wolf, then a graduate student at the University of Colorado at Boulder, began an intensive study of these two clover species in the park's montane grasslands in 1998. She mapped all vegetation in clover-invaded and nearby non-invaded (control) patches. She measured soil temperature, moisture, and texture. She also analyzed soil samples for available nitrogen, moisture, organic matter, and other characteristics. She examined the roots of clover for nitrogen-fixing nodules. Ms. Wolf further worked with the park's fire managers to examine the impact of fire on sweet clover.



Fast-growing roots appear to give sweet clover an edge at absorbing moisture relative to native plants. (photo by Joy Wolf)

The Results: Sweet clover depleted soil nitrogen and moisture.

Research results showed clear differences between the invaded and non-invaded patches for both species composition and nitrogen availability. Several exotic species were found only in invaded patches, while some native species were found only in control patches. Invaded patches had lower available nitrogen and less soil moisture than control patches. Close examination of clover plants in the park study plants revealed few functioning nitrogen-fixing nodules. Tests also indicated soil temperature, moisture, and texture conditions in these montane grasslands were generally unfavorable for nitrogen-fixing nodule formation.

Thus contrary to expectations clover plants were actually depleting soil nitrogen in the park's montane communities. Further *Melilotus*'s expansive lateral root system was quickly absorbing available moisture. Native plants in these environments were slower than clover to develop in the spring and were at a competitive disadvantage for moisture and nutrients. Fire treatments generally inhibited clover growth and increased native species. A spring fire appeared to take away the competitive edge clover had over native plants. However using fire to control clover is expensive and logistically difficult.

This study reveals again the complexity of natural systems. Sweet clover has been treated in Colorado as a relatively benign exotic plant and is still being used in road stabilization projects. However its long-term negative impact on native plant communities should not be underestimated.