National CZO Program | Jemez River Basin and Santa Catalina Mountains CZO

Soil Respiration and Evaporation

Influence of Snow Cover Duration on Soil Respiration and Evaporation Efflux in Mixed-Conifer Ecosystems. Subalpine mixed conifer ecosystems are sensitive to a warming climate and are dependent on snow fall, which is expected to decrease in coming years. We are measuring soil respiration and evaporation within these ecosystems to evaluate how changing snow accumulation and duration of snow cover might affect CO_2 and H_2O fluxes out of the soil.

Approach. At the mixed conifer ecosystems within both the Santa Catalina Mountains and the Jemez River Basin, we have three understory cameras located within the footprint of an eddy covariance tower. Using the images, we placed 6 soil collars; 3 in short snow duration and 3 in long snow duration. Since July 2010, soil respiration and evaporation data have been collected regularly (~ biweekly) from collars in the Santa Catalina Mountains, and will be collected starting in Summer 2011 in the Jemez River Basin.

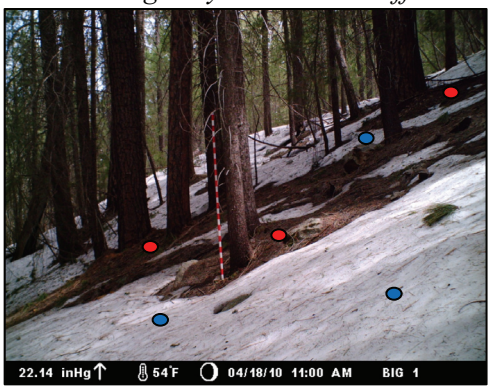
Instruments:
- ❑ Licor 840 CO2/H2O Gas Analyzer
- ❑ Delta-T WET Sensor, WET-2
- ❑ Oakton Temp 100 Dual-Input

Bi-Weekly Measurements:
- ❑ Soil Respiration
- ❑ Soil Evaporation
- ❑ Soil Temperature top 10 cm
- ❑ Soil Moisture top 10 cm
- ❑ Chamber Air Temperature
- ❑ Depth from top of collar to soil

Average Snow Duration at Collars:
- ❑ Long Snow Duration: 56 Days
- ❑ Short Snow Duration: 44 Days

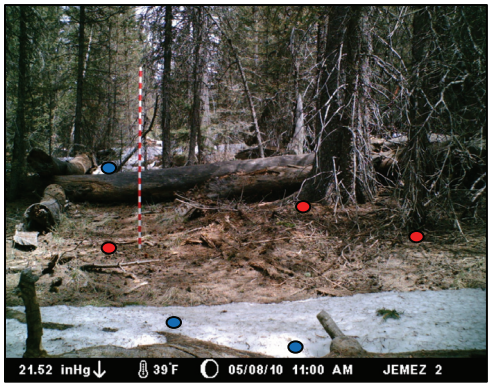
Santa Catalina Mountains:

Co-located with Mount Bigelow Tower
tower managed by G. Barron-Gafford



Jemez River Basin:

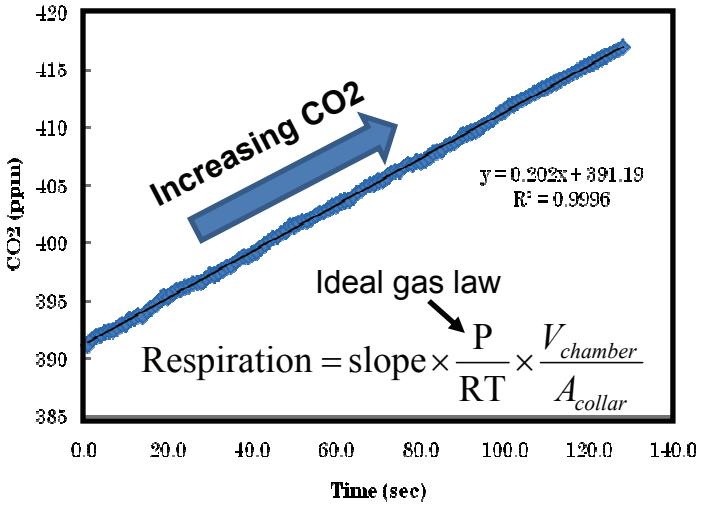
Co-located with Mixed Conifer Tower
tower managed by M. Litvak



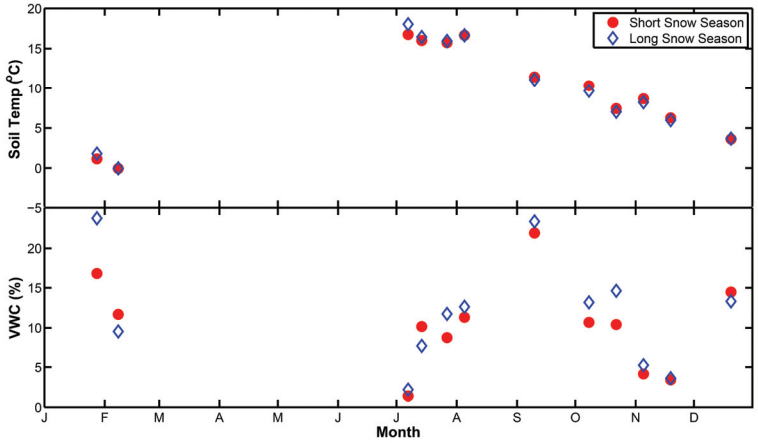
Using Digital Images to Determine Soil Collar Sites with Long Snow Duration and Short Snow Duration. We used Images from the understory cameras when snow patchiness could be identified to determine areas in the frame of the image which had long and short snow cover durations. Soil collars were then installed in these locations as "long snow duration" (blue dots in the images above) and "short snow duration" (red dots in the images above) sites. Image time series enable us to confirm that these collars are located appropriately, and that the duration of snow cover at the sites is as expected.

This project is part of JRB-SCM CZO student Krystine Nelson's Masters work.

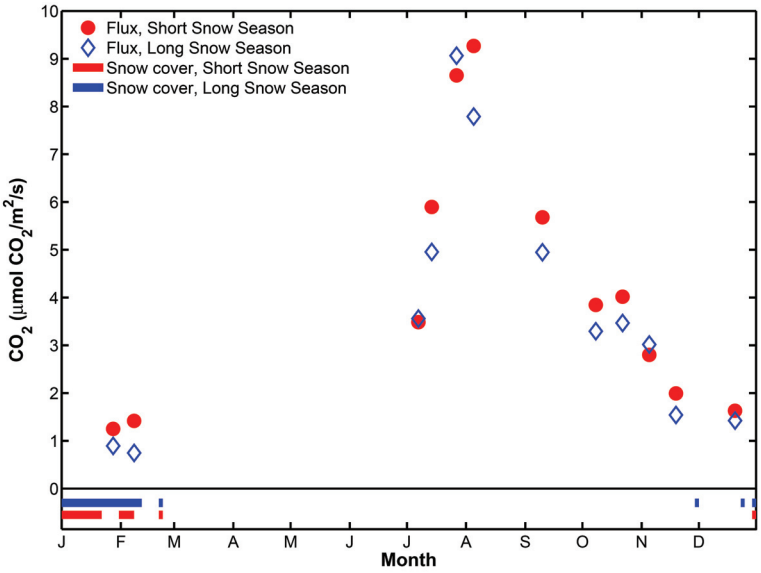
Calculating Soil Respiration and Evaporation. The Gas Analyzer measures the concentration of CO_2 and H_2O in the chamber over a 2-minute period. This change in concentration over time is used to calculate the fluxes.

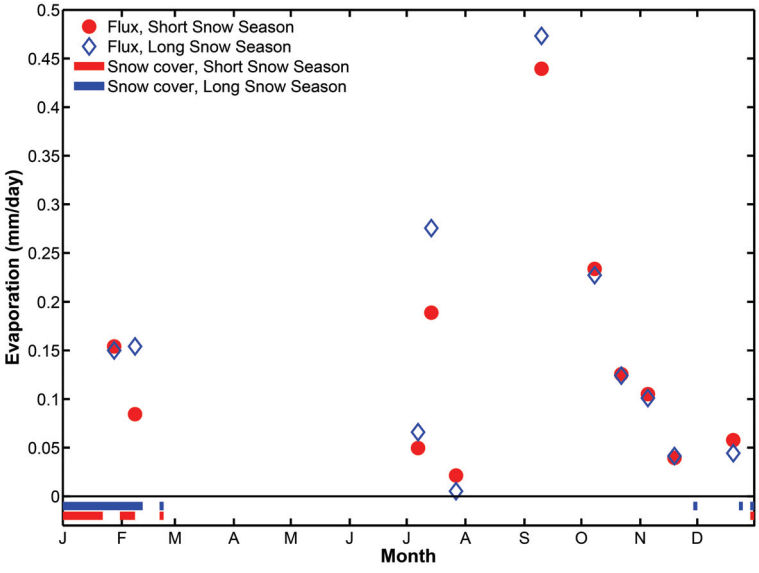


Soil Temperature and Soil Moisture. Soil temperatures are very similar between long and short snow duration sites; long snow duration is slightly warmer until late in the summer (September) when long snow duration sites become slightly cooler. Soil moisture is quite variable except in the summer and fall when long snow duration sites are consistently wetter than short snow duration sites.



Soil Respiration and Evaporation. Soil respiration peaks in mid-July to mid-August, whereas the peak in soil evaporation occurs later in the summer, in late September. Soil respiration is generally higher at the soil collar sites with short snow duration; additionally respiration fluxes drop more slowly after the peak in these short snow duration sites. Long snow duration sites have higher evaporation fluxes than short snow duration sites during the summer months, otherwise the sites experience similar fluxes.





Influence of Soil Moisture and Temperature on Soil Respiration and Evaporation. Surprisingly, soil moisture has no strong relationship with soil respiration when all measurements throughout the year are considered. However, soil temperature appears to be a strong control on soil respiration throughout the year. The opposite is true for evaporation. Soil moisture is strong control on evaporation, while temperature is a very weak control.

	Soil Moisture		Soil Temperature	
	Long R^2	Short R^2	Long R^2	Short R^2
Respiration	0.03	0.01	**0.34**	**0.37**
Evaporation	**0.26**	**0.38**	0.01	0.01

Contact. For collaboration or to learn more about soil respiration and evaporation measurements at these JRB and SCM sites, contact:

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