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Rapid assessment of rapidly-responding organisms as a complement to vegetation observations: monitoring of arthropod assemblages and resulting trends relative to winter precipitation

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Arthropods have remarkably high diversity and trophic complexity, function as pollinators and seed dispersers, integrate ecological processes, and influence vegetation assemblages via powerful feedback loops. Insects, spiders, and other arthropods respond more rapidly than vegetation to environmental drivers in some environments, although responses can have higher variance. Monitoring of arthropods may thus provide a broad window into changing ecological function and has the potential to be a strong addition to mountain observatory programs, which often focus on vegetation responses. We implemented two monitoring techniques as supplemental activities associated with a GLORIA master site in the White Mountains of California, USA: sweep netting and vacuum netting. The former includes 50 standard sweeps/sample; the latter uses a vacuum inserted into a 0.5x0.5 m net-covered quadrat. Sweep netting effectively samples flying and vegetation-associated fauna and integrates a large area. Vacuum netting captures similar fauna as sweep netting and is also effective at sampling organisms on the substrate, if vegetation is not dense. Sweep netting is more integrative, whereas vacuum netting is more quantitative. We are using both techniques in a) rock-dominated "barrens" with minimal canopy height, and b) spring-associated wetlands with a taller vegetation canopy. Our initial eight years of data suggest that arthropod assemblages may respond rapidly to changes in climate in this environment, particularly reduction of snowfall. Richness, diversity, and population metrics, especially abundances of beetles, butterflies, moths, and spiders, were positively related to winter precipitation and responded to annual differences in snow water equivalent. During dry years, 36% and 76% of faunal families were absent from wetlands and barrens, respectively, whereas most plant taxa at our sites persisted during dry years. Signal-to-noise ratio was greater for sweep sampling than vacuum netting. Our results indicate that arthropod monitoring can capture responses to fine-scale temporal changes in the mountain environment.