of green-up was used as an indicator of ecosystem stability. The coefficient of variation for the onset of green-up of the steppes/forest ecosystems was used as an Ecosystem Stability Index (ESI). The ESI showed meadow steppe/forest ecosystems to be most ecologically stable and the desert steppe to be the least stable. Large areas of typical steppe, near the desert steppe ecotone, exhibited similar ESI values to those of the desert steppe suggesting greater ecosystem instability in these typical steppe areas. This suggests that large expanses of typical steppe in this region are undergoing ecosystem degradation resulting in lower productivity and changes in land use practices.

PRICE, J. University of California, Davis, CA 95616, USA. **Dispersal, speciation, and the fate of founders: The Hawaiian biota as a model for linking phylogenetic processes with large-scale diversity patterns.**

Due to its isolation and limited age, the biota of the Hawaiian Islands can be subdivided into groups of species derived from distinct founder events from the outside. These assumed lineages are treated as clades which evolved under similar spatial and temporal constraints. Detailed species range data for the entire flora and select groups within the fauna reveal an inverse relationship between the number of species in a lineage and the average range size of the species in that lineage. The resulting distribution acts as a conceptual model which may elucidate mechanisms that drive beta diversity at large scales. Since most Hawaiian species have narrow ranges while a few widespread species make up the bulk of the individuals in this system, Hawaii appears to follow the cannonical distribution of abundance. Rare species are generally members of large lineages, while most common species belong to small lineages; this suggests that differing speciation tendencies of clades may underlie cannonical abundances in Hawaii. The Hawaiian biota is shaped by in situ speciation rather than an equilibrium of immigration and extinction; as this is also the case for continental biotas, this model may be applicable at larger spatial scales.

PRINGLE, A.,[1] J. D. BEVER[2] and J. ANTONOVICS.[3] [1]Duke University, Durham NC 27708, USA; [2]University of California, Irvine CA, USA; [3]University of Virginia, Charlottesville VA, USA. **Winners never cheat; cheaters never win: Species' flexibility and the symmetry of benefit within a mutualism of arbuscular mycorrhizal fungi and plants.**

Mutualisms are constantly exposed to non-mutualistic "cheaters", or parasites. In tightly coevolved mutualisms, for example the mutualism between figs and fig wasps, species of fig wasp are either parasites or mutualists. In diffuse mutualisms, in which multiple partners interact, species may be more flexible and act as mutualists of one associate but parasites of another. Arbuscular mycorrhizal fungi (AMF) inhabit the roots of plants and provide phosphorus to plants in exchange for photosynthetically derived carbon. The relationship is a classic, and diffuse, mutualism. We have used a variety of species isolated from an old field community to explore interactions between pairs of plants and AMF. We ask 1) are species of plant and fungus strict mutualists or parasites? and 2) are there constraints to parasitism? We have found that species are not strictly mutualists or parasites, rather, predicting the net costs and benefits of a particular association requires a knowledge of the specific combination of plant and fungus. For example, plant shoots of *Anthoxanthum odoratum* are significantly heavier in association with the fungus *Gigaspora gigantea* versus the fungus *Glomus* "white", however, shoots of *Rumex acetosella* are significantly heavier with *G.* "white" versus *G. gigantea*. *G. gigantea* is a relative mutualist in combination with *A. odoratum*, but a relative parasite in combination with *R. acetosella*. Interactions may be weakly asymmetric. For example, the fungus *Acaulospora trappei* derives its greatest benefit from association with the plants *Veronica arvensis* and *Plantago lanceolata*, however, the fungus gives its greatest benefit to the plant *Allium vineale*. Despite this example, investments by plants and AMF are typically reciprocal: if a plant grows larger with a specific fungus, the fungus is likely to sporulate disproportionately in association with the same plant. This kind of reciprocity may constrain the evolution of parasitism within the mutualism.

PRINTZ, L.,[1] G. HOELZER[1] and G. TAYLOR.[2] [1]University of Nevada, Reno, NV 89557 USA ; [2]George Mason University, Fairfax, VA 22030 USA. **Genetic variation of *Lepidium latifolium*, an invasive plant species, across two spatial scales.**

Lepidium latifolium, an invasive plant species, across two spatial scales. Introduced from Russia in the early 1900's, *Lepidium latifolium* L., commonly referred to as perennial pepperweed or tall white top, is an aggressive, perennial species that forms dense, monospecific stands along. The degree of genetic variation within and among *L. latifolium* stands that grow along the Susan and Truckee Rivers in California and Nevada, respectively was quantified via the RAPD. Twenty stolons were randomly collected from each site and grown in a greenhouse. Fresh leaf tissue was then collected and cleaned. DNA was extracted with the DNeasy Mini Plant Kit (Qiagen) then genotyped with four pre-screened RAPD primers. Estimates of within and between population variation and population subdivision are based on the equations as described by Lynch and Milligan (1994). Within population genetic variation, ($Hj(I)$ = 0.4 and 0.7) for the Truckee and Susan Rivers, respectively. Between population genetic variation for the Susan and Truckee Rivers Hjk = 0.3 and is low but not as compared to other clonal plant species such as geranium, Hjk = 0.4. These results suggest that despite low genetic diversity *L. latifolium* is able to out compete native species, lowering species diversity and richness thus, altering riparian systems it is found in.

PRUYN, M. L., B. L. GARTNER and M. E. HARMON. Oregon State University, Corvallis, OR 97331. **Respiratory potential in sapwood of old versus young coniferous trees.**

We use research at the scale of stem tissue to reconsider the hypothesis that low net primary production in older forests results from higher respiration costs associated with increased biomass. Gradients of metabolic activity in sapwood (SW) have been examined extensively, but absolute patterns have not been identified. Further, physiological mechanisms controlling these gradients are poorly understood. SW in older trees has higher percentages of older cells than younger trees, suggesting the possibility of reduced metabolism in older trees because of increased senescence in living cells. Older trees also have a higher percentage of SW distant from meristimatic tissue than younger trees, suggesting that SW in older trees may play a more prominent role in maintenance than growth. We examined effects of age and position on respiration potential (defined as rate of CO_2 release under laboratory conditions) in parenchyma cells of SW in older and younger trees. We took core samples at various positions along stem heights from 100+ and 10+ year-old *Pseudotsuga menziesii* (Mirb.), PSME and 200+ year-old *Pinus ponderosa* (Laws.), PIPO trees. Cores were divided into three radial depths, outer, middle, and inner SW. Rate of CO_2 release from tissues was measured using a gas chromatograph. Both PIPO and older PSME outer SW released over twice the amount of CO_2 at node 15 (years from top) than at the 200+ and 100+ year-old bases, respectively. Older PSME outer SW at node 35 was also twice as active as at its base, whereas node 50 of PIPO outer SW was equal in activity to its base. Younger PSME outer SW at nodes 2 and 5 were equal in activity, and were 50% less active than older PSME outer SW at node 15. Outer SW was the most active of the SW radial depths, with middle and inner SW activity nearly equal, at all heights in all trees. Most notably, both the base of older PSME with only 35 years SW, and the base of PIPO with 100 years SW, showed similar gradients in activity from outer to inner SW (outer SW twice as active as inner). Our results suggest that age of SW tissue is less of a determinant of respiration potential in parenchyma cells than its position relative to apical or cambial meristems. The homogenous nature in metabolism of older SW in PIPO and PSME reflects its potential role in tissue maintenance.

PRYSBY, M. D. and K. S. OBERHAUSER. University of Minnesota, St. Paul, MN 55108 USA. **Monarch larval monitoring: A North American citizen science project.**

In an effort to describe and understand the variation in monarch (*Danaus plexippus*) distribution and abundance, we have developed a large-scale citizen science project to monitor monarch and milkweed (*Asclepias* spp.) populations across North America. The Monarch Larval Monitoring Project, now in its fourth year, involves volunteers from the public in data collection efforts. Each volunteer monitors a site weekly throughout the monarch breeding season, following a defined protocol. Since the project's inception, over 80 volunteers have participated, monitoring more than 40 sites in the United States and Canada. The resulting data are compiled to form the foundation of a long-term monarch population database. With these data, we have described consistent trends in interannual variation in