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units are produced or lost in the face of competition, predation and disturbances. Demographers wishing to census the reiteration flux of plants are faced with a choice of variables because the process occurs at several levels of organisation, from leaves and flowers, to modules (life-time product of the activity single meristems), to entire ramets. I monitored the growth of *Potentilla anserina* L. (Rosaceae) under a wide range of experiment conditions to determine which reiteration variable best accounted for plant performance, estimated by total biomass and reproductive output. Total leaf births best explained total biomass and total module births best explained reproduction. Therefore the aims of each researcher should guide the choice of reiteration variable, with serious consideration given to modules. Indeed, modules play a more central role than leaves in morphogenesis because modules produce daughter modules whereas leaves provide photosynthates, and module meristems produce the reproductive organs.

MALANSON, GEORGE P., YEOU-LIH YAN, and WALTER E. WESTMAN. University of Iowa, Iowa City, IA, 52242, USA and Lawrence Berkeley Laboratory, Berkeley, CA 94720, USA. The realized niche of plant species and modeling their response to climatic change.

The abundance of Californian chaparral and coastal sage scrub species have been plotted over classes of three climatic variables: mean January temperature, mean July temperature, and annual precipitation. The distributions reveal responses unlike the parabolic and linear functions used in the JABOWA-FORET models for response to growing-degree-days and drought-days, respectively. Some responses are not unimodal, and thus appear to reveal complex interactions with other variables. The inclusion of these functions in a model to project vegetation response to climatic change results in differences relative to the use of simpler functions. Both approaches, however, incorporate the realized niche of the species, whereas the fundamental niche may be more appropriate for this purpose. When the functions are modified to represent assumptions about the unknown fundamental niche, the projections differ again. These results reflect the inertia of plant communities in respect to the direct effects of climatic change, and stress the importance of secondary effects, in this case altered fire regimes.

MALARET, LUIS, Tufts University, Medford, MA 02155, U.S.A. Ethnoecology in Third World Education, Extension and Research: Case studies from Kenya.

Ethnoecology is an integrative, site-specific form of knowledge which reflects a community's relationship to the ecological, economic and social aspects of its environment. It is argued that ethnoecology should be incorporated into educational, research and extension institutional programs at the local, regional and national levels. Potential benefits to basic and applied research, extension efforts, and local and national conservation and development efforts are presented. Two case studies illustrate the integration of local knowledge and practice with formal research efforts. The paper presents process and results from ethnobotanical research in university courses, and a pest control research project utilizing farmer ethnozoological knowledge of termites.

MALCOM, SHIRLEY M. American Association for the Advancement of Science, Washington, DC, 20005, USA. Women and minorities in ecology: natural resources for change.

Minorities are underrepresented in ecology and related fields of science. Their underparticipation denies these perspectives to the research community, limits inputs from minority communities and reduces the number of persons who are committed to serve as translators between the two. Women have been important throughout the history of ecology, but they are underrepresented among the "positions of power and influence" within the field. The presentation will discuss the problems which flow from underparticipation and suggest strategies for amplifying voices of women and minorities within ecology.

MARCOT, BRUCE G. USDA Forest Service, Pacific Northwest Research Station, Portland, OR, 97208, USA. Use of models of spotted owl populations for building a conservation strategy.

Providing for viability of northern owl populations has entailed use of an array of habitat and population models. Habitat models have included stand growth projections of amount and distribution of old forests suitable for reproductive spotted owl pairs, and Bayesian pattern-recognition models for predicting occupancy of varying amounts of old forests. Population models

have included static and stochastic models of demographic dynamics. A general procedure for analyzing population viability has been developed that expresses viability as a likelihood of continued existence of well-distributed spotted owl populations. Other models have been used to help gauge potential responses to management options. Models used as decision aids have been the targets of appeals and legal critiques of agency management direction. Estimating population viability via risk analysis has not succeeded in the decision-making arena, in part due to differing risk attitudes among various publics, decision-makers, and specialists.

MARINO, PAUL C. and HOWARD V. CORNELL. University of Delaware, Newark, DE 19716. Host choice by the native holly leafminer: the influences of clonal variation, light intensity and fertilization.

In a field experiment we examined the influences of 1) clonal variation, 2) the light environment in which clones are grown, and 3) fertilization on levels of infestation of American holly (*Ilex opaca*) by the native holly leafminer (*Phytomyza ilicicola*). In a randomized block design, 120 holly clones without miners from 3 parent trees were placed in an open field 8 weeks prior to miner emergence and randomly assigned to sun/shade and fertilization/no fertilization treatments. To infest clones, leaves with pupae were collected from local trees and scattered around the clones. Results showed that: 1) fertilization significantly influenced host choice since there were 50% more feeding scars and 33% more first instar larvae on fertilized plants, and 2) no other main effect or interaction significantly influenced feeding or oviposition.

MARKS, SUSAN and KEITH CLAY. Winthrop College, Rock Hill, SC 29733, USA and Indiana University, Bloomington, IN 47405, USA. Physiological responses of two grasses to fungal-endophyte infection.

Photosynthetic rates and stomatal conductance of *Acremonium* infected and uninfected genotypes of tall fescue (*Festuca arundinacea*) and perennial ryegrass (*Lolium perenne*) were measured over a range of times at ambient conditions. In tall fescue, there was a significant interaction of leaf temperature and infection. The photosynthetic rates of infected plants were less affected by high temperatures than the rates of uninfected plants. At temperatures above 35 C, infected tall fescue plants photosynthesized at a significantly greater rate than uninfected plants, although rates were not significantly different at leaf temperatures between 25-30 C. Measurements made on perennial ryegrass showed similar trends. In tall fescue, there was also a significant infection and genotype interaction, indicating that the response to infection was specific to a given genotype. Interactions with the environment appear to be important in host grass response to fungal-endophyte infection.

MARQUIS, ROBERT J., and CHRISTOPHER J. WHELAN. University of Missouri-St. Louis, St. Louis, MO, 63121, USA and The Morton Arboretum, Lisle, IL, 60532, USA. Don't fence me in: birds as predators of herbivorous insects on white oak (*Quercus alba*).

An experiment was conducted over a two-year period to determine the consequences of declining populations of North American insectivorous birds for forest growth. Three treatments were applied to 2-4 m tall saplings of *Quercus alba* in the Missouri Ozark Mountains: 1) a control, 2) cages which prevented access to plants by birds but allowed insects to enter, and 3) insecticide (synthetic pyrethrin) sprayed once a week to determine the effect of folivorous insects on plant growth in the presence of birds. Summed over the 1989 growing season, insecticide-treated plants had 0.3 leaf-chewing insects per 50 leaves, control plants 7.2 insects/50 leaves, and caged plants 10.4 insects/50 leaves. In turn, damage at the end of the season was 6.6%, 13.5%, and 25.7% percent leaf area missing, respectively. Finally, in 1990 caged plants produced one-third less biomass (leaves and twigs combined) than control and insecticide-treated plants. These results suggest that declining populations of insectivorous birds may result in increased herbivory levels and decreased growth of forest trees.

MARSCHALL, ELIZABETH A. and LARRY B. CROWDER. North Carolina State University, Raleigh, NC, 27695. Early life history of a stream fish: projected population responses to sublethal acidity levels.

Longitudinal patterns in species occurrences in streams have often been correlated with longitudinal patterns in environmental conditions. Less emphasis has been given to studies of patterns within a species over the

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