ANNOTATED BIBLIOGRAPHY

PUBLICATIONS

1. Kittelson, P. M. 2004. Sources of variation in insect density on *Lupinus arboreus* populations: effects of environment and plant genotype. American Midland Naturalist 152(2): *in press*.

American Midland Naturalist publishes research in field and experimental biology that extends beyond midwestern ecosystems. The diversity and significance of this journal are evident in that it is one of the most frequently cited sources in botany, ecology, and aquatic biology. This paper focused on variables that influenced insect density on lupine plants. The experiment was designed to tease apart the effect of local environmental conditions and genetically determined plant characteristics on the abundance of four insect species. I found that insect density primarily was affected by environmental factors unique to each study site; insects seem to prefer grassland sites relative to dunes locales. I also found that plants from the same neighborhood, which were closely related and expressed a set of unique characteristics, influenced insect density; plants from some neighborhoods were colonized by insects more than plants from other neighborhoods. However, insect density was not affected by family origin within a neighborhood. Thus, insects were influenced by both environmental factors and in a broad sense by genetic characteristics.

2. Adler, L. and P. M. Kittelson. 2004. Variation in *Lupinus arboreus* alkaloid profiles and relationships with multiple herbivores. Biochemical Systematics & Ecology 32: 371-390.

Biochemical Systematics and Ecology published our original research in one of the two areas it serves, i.e., the role of biochemistry in interactions between organisms and their environment. Our paper analyzed how one group of plant defensive chemicals, called alkaloids, varied in related families of seeds. We also examined variation in alkaloid quantity and composition in related families of adult plants growing in three different environments. For seed alkaloid profiles, we found that alkaloid composition was affected by maternal factors (the mother's DNA and the natal environment) and by maternal x paternal contributions. For plants in the three environments, one insect and a fungus were affected by alkaloid composition, whereas alkaloids did not affect two other insect species studied. Finally, there was no relationship between alkaloids in seeds and the adult plant profile. Our results show that these defensive traits are complex and do not affect all plant pathogens and herbivores in a simple or similar way.

3. Kittelson, P., C. Pastor, P. Graeve, A. Anderson, D. Boll, E. Dahlquist, J. Eckberg, L. Kempema, M. Maley, M. Panzer, M. Paulson, L. Smart, S. Tuel, E. Wenger and J. West. 2002. Minnesota students explore California natural history using NRS reserves. Transect 20(3): 12-15.

We were invited to submit an article to Transect after I met the U.C. Reserve publications coordinator during a January field course. Transect is a quarterly publication with diverse readership (teachers, students and researchers). The article discusses our experiences in California ecosystems, our impressions of the natural and cultural history, the role of reserves in learning and teaching, and explores the meaning of environmental stewardship. I constructed the article by writing the prologue, selecting and editing journal entries from everyone in the course.

4. Kittelson, P. M. and J. L. Maron. 2001. Fine-scale genetically-based differentiation of life-history traits in the perennial shrub *Lupinus arboreus*. Evolution 55: 2429-2438.

Evolution publishes manuscripts of significance that expand understanding of evolutionary processes. In this manuscript, we showed that plant life-history traits varied dramatically for populations less than 1 kilometer apart; surprisingly, across a very small geographic scale, plants exhibited large differences in size, flowering time, seed set. We demonstrated that this genotypic structure is not a function of limited reproduction (i.e. gene flow) or random events that fix certain genetic combinations (i.e. genetic drift), but that selection likely was responsible for creating the measured differentiation. This research contributed to an understanding of how evolutionary processes shape local adaptation. Additionally, we provided field-based evidence that selection can be strong enough to create differences among populations that are experiencing high levels of genetic exchange.

5. Kittelson, P. M. and J. L. Maron. 2000. Outcrossing rate and inbreeding depression in yellow bush lupine, *Lupinus arboreus* (Fabaceae). American Journal of Botany 87: 652-660.

The American Journal of Botany is an internationally recognized journal that publishes research on all aspects of plant biology. In this paper, we provided the first calculated estimate of outcrossing rate and inbreeding depression for perennial lupines; lupines are legumes, which are important functional group in most ecosystems. Our field and experimental work refuted theoretical assumptions that assumed that long-lived perennial species would be self-incompatible and highly outcrossing; we found that *L. arboreus* is both self-compatible and has a mixed mating strategy, where some seeds are produced by mating with another individual and some seeds are produced by mating with itself. Selfed progeny exhibit substantial inbreeding depression, which is expressed primarily at seed maturation; many selfed seeds fail to mature. However, once lupine become established, selfed and outcrossed progeny experience similar fitnesses, which may contribute to the long-term maintenance of the mixed mating system.

6. Karban, R. and P. M. Kittelson. 1999. Effects of *Lupinus arboreus* genetic structure and previous herbivory on *Platyprepia virginalis* caterpillars. Oecologia 120: 268-273.

Oecologia is an international journal that publishes articles about ecophysiology, ecology and plant animal interactions. In this paper, we showed that the genetic composition of individual plants influenced if a caterpillar fed on a plant; plants with certain mothers were damaged more than plants from other families. Additionally, previous herbivory by another species of caterpillar strongly affected if the second species would feed on the leaves; lupine that had been previously eaten also were preferred by the second caterpillar. Both species may prefer the same lupine because of similar plant traits or because the herbivory by the first species enhances susceptibility in the plant, regardless, susceptibility to caterpillar herbivores is likely inherited.

7. Kittelson, P. M. and M. J. Boyd. 1997. Mechanisms of expansion for an introduced species of cordgrass, *Spartina densiflora,* in Humboldt Bay, CA. Estuaries 20: 770-778.

Estuaries is a bimonthly journal with a mission to promote research in estuarine and coastal waters. Here, we examined the life-history components of a non-native, invasive species of cordgrass, *Spartina densiflora* in Humboldt Bay, California. We found that *S. densiflora* is an excellent competitor because it can expand both vegetatively and through seed recruitment. We found that it produced an enormous number of seeds that are tolerant of a range of salinity levels

and it can spread asexually throughout the year. However, seedling establishment is limited by pre-existing vegetation, so every effort should be made to maintain intact native assemblages or to plant native species in restoration sites. Our research helped land managers better assess the impact of this non-native in salt marsh mitigation and restoration projects along the west coast.

PUBLICATIONS IN PREPARATION

1. Paulson, M., P. Graeve and P. Kittelson. Ant diversity in restored prairies.

This publication is in its final revision. It will be submitted for publication to Prairie Naturalist and the Minnesota Department of Natural Resources. Ant abundance and richness was compared within and among three different southern Minnesota grassland communities that recently were restored. We collected a total of 7,950 individuals from 12 different species; prairies with higher forb diversity had higher ant richness relative to prairies with lower plant richness. Ant abundance and richness also was affected by habitat heterogeneity. Ant species richness may be used as an indicator of restoration success.

2. Handler, S. and P. Kittelson. Genetic diversity in isolated patches of *Lithospermum canescens*.

This paper is in its first revision. In this study, we evaluated genetic diversity of a native prairie forb called Hoary Puccoon (*Lithospermum canescens*) at Kasota Prairie, which is a small (~40 acres) and isolated tallgrass prairie. Leaf tissue samples were taken from three distinct populations. We determined that a high level of genetic diversity was present within populations and that diversity in any one population was similar to diversity in the other two populations. While it is encouraging that hoary puccoon has retained a considerable amount of genetic diversity among populations, we do not know if this population is connected to other prairie island population or if hoary puccoon populations at Kasota are locally adapted.

3. Bockman, E.*****, Eckberg, J*****. and P. Kittelson. Effects of nitrate on *Melilotus offincinalis* fitness.

Data has been completely analyzed and the first draft of this paper is being written. *Melilotus officinalis* is invasive to tallgrass prairie restorations in southern Minnesota. We investigated if a nitrate additions could hinder *M. officinalis* establishment and growth. Discrete early-season nitrate applications may retard the symbiotic relationship between *Rhizobium* symbionts and host-*Melilotus*. In our study, we analyzed the response of *M. officinalis* cover, biomass, abundance and inflorescence production to three concentrations of ammonium nitrate in a common garden. Abundance, total biomass per plot and inflorescence number were significantly reduced with nitrate additions. These results suggest that even low concentrations of nitrogen may dramatically reduce *M. officinalis* dominance. Results from our study could aid in developing effective eradication techniques for *M. officinalis* from tallgrass prairies.

CONFERENCE PRESENTATIONS

1. Handler, S.and P.M. Kittelson. 2004. Genetic diversity in a fragmented population. Ecological Society of America. Portland, OR.

In this poster we present our results from a study that evaluated genetic diversity for a native prairie forb, *Lithospermum canescens*, at Kasota Prairie, MN. We determined that a high level

of genetic diversity is maintained within patches and that diversity in any one patch is representative of diversity in the other two areas.

2. Bockman, E, J. Eckberg and P.M. Kittelson. 2004. *Melilotus* management using nitrate additions. Ecological Society of America. Portland, OR..

In this poster we present our results from a study that examines how invasive *Melilotus officinalis* is effected by nitrate. Results suggested that even low concentrations of nitrogen can dramatically reduce *M. officinalis* dominance by depressing abundance. As a result of reductions in overall population size, total biomass and seed banks of *M. officinalis* are reduced when nitrate is added.

3. Eckberg, J. , P. Graeve, M. Paulson and P. M. Kittelson. 2002. Ecological Society of America, Tucson, AZ. Controlling invasive legumes.

Our research poster focused on four invasive legumes common to tallgrass prairie restoration sites in south central Minnesota: *Melilotus alba, Melilotus officinalis, Trifolium repens* and *Medicago lupulina.* Mowing of *Melilotus* during flowering reduced reproductive potential by over 500 times. Short-term nitrogen additions reduced *Trifolium* and *Medicago* abundance and cover in common garden plots.

4. Kittelson, P. M.. Gene flow and life-history differentiation in the yellow bush lupine. Bodega Marine Laboratory, University of California, Riley seminar series (1999), Ecological Society of America, Snowbird, UT (2000),Colorado State University, Pueblo (2004), University of Nebraska, Lincoln seminar series (2004).

I discussed the results of experiments that quantified levels of gene flow and determined the degree of differentiation in life-history traits between populations of yellow bush lupine, *Lupinus arboreus*. Despite high levels of gene flow, I found strong evidence for local adaptation and genetically-based differentiation in adaptive traits such as plant size, flowering phenology, fecundity and mortality. Environmental factors within gardens also produced fitness related responses in growth, survival and seed production. My results indicate that there is a surprising amount of divergence in life-history traits between local *L. arboreus* populations. Given the homogenizing influence of gene flow, it is likely that strong but differing selection regimes operating within each subpopulation drive spatial differentiation in lupine life history traits.

5. Simms, E., P.M. Kittelson and J.L.Maron. 2000. Variation in seed dormancy: genetic & maternal effects. Ecological Society of America, Snowbird, UT.

In this poster, we compared seed dormancy in adjacent populations of yellow bush lupine with contrasting life history strategies. Variation in seed dormancy was caused by genetic and environmental factors. Our results suggest that that habitats strongly select components related to seed dormancy.