ESCI 433/533 POPULATION BIOLOGY

Guidelines for Independent Projects

1 Objectives

1.1 To address a question that:

1.1.1 Is relevant to population biology

1.1.2 Is possible to answer within your constraints of available time, equipment, and experience.

1.1.3 Will strengthen your experience in the conduct of population research.

1.2 Develop a method of answering your question.

1.3 Conduct the study you have proposed.

1.4 Analyze and interpret results of your work.

1.5 Present your work effectively in written form.

2 Selecting a Project

2.1 General guidelines: follow guidelines 1-3 before considering 4-7. First let your imagination run wild. Then invite the critic in you to distinguish between projects that will work and those that will not.

2.1.1 Be imaginative and creative. Almost anything that is ethical, relevant, and likely to succeed would be appropriate.

2.1.2 Think of several potential project ideas before selecting one to develop. There are many questions in need of answers; do not jump on the first one that comes to mind.

2.1.3 Choose a project that really interests you. You will spend much time on it …

2.1.4 Be realistic. Select a project that you can complete in the time available.

2.1.5 Consider several approaches, including study designs that are descriptive, comparative, and experimental. Select the approach(es) most appropriate for answering your question.

2.1.6 Consider the equipment available, and its reliability in field settings.

2.1.7 Avoid projects that would require capturing or restraining vertebrates, because such projects would require review and approval by WWU's ACUC, which would exceed time available.

2.1.8 Be specific! You should identify locations and species that you will use to address your question.

2.2 Specific Ideas

2.2.1 See following list of ideas for potential projects. Feel free to choose something completely different.

2.2.2 Develop your idea into hypotheses. Express them in the following format: "If …, then …, because … ." For example: "**If** most birds in Whatcom County specialize on a relatively small number of food types, **then** Bellingham's central business district will support fewer birds species than any comparable sized area in the county, **because** fewer kinds of avian foods are available in the central business district than anywhere else in the county."

2.2.3 Design your project so that it will produce results that are interesting and interpretable, even if your hypothesis proves incorrect.

3 Project Ideas

This is a list of project ideas and approaches that an ambitious student could complete. You are encouraged to develop your own project ideas, or to adapt any listed below to your own interests.

3.1 Consider several approaches to addressing your question.

3.1.1 Descriptive. Record systematic observations about a species or group of species and analyze patterns in your observational data.

3.1.2 Comparative. Observe a species in two or more habitats, observe two or more species in the same habitat, or compare species interactions in two or more habitats. Relate patterns in your data to differences in the habitats or species.

3.1.3 Experimental. Manipulate conditions in space and/or time, and observe organism responses to your treatments.

3.2 General Areas of Inquiry

3.2.1 Biogeography: the distribution of species in space.

3.2.2 Behavior: responses of individuals to stimuli and/or to resources.

3.2.3 Demography: rates of birth, death, immigration, and emigration, and how these rates affect population abundance.

3.2.4 Interspecific interactions: effects of one species on the distribution, abundance, and growth of another(s).

3.2.5 Community structure & composition: patterns in the occurrence of species in an area.

3.2.6 Conservation or management: status of a population or system and strategies to maintain it within desired bounds.

3.3 Projects that could be done with most species.

3.3.1 Compare species occupancy across habitats representing a range of disturbance intensities or frequencies. Disturbances could result from anthropogenic or non-anthropogenic agents. Collect data to test any of the following hypotheses.

i) "Edge" species are favored over "interior" species by habitat fragmentation that results from road construction, (sub)urban development, resource extraction, avalanches, or storms.

ii) Gradients in human activity correlate with an increasing relative abundance (population density or species richness) of generalist species, and a decreasing abundance of specialist species.

iii) Species diversity reaches a maximum in areas subject to intermediate levels of disturbance.

- What is "intermediate" in local ecosystems?
- Do anthropogenic disturbances affect species diversity in ways similar to non-anthropogenic disturbances?

3.3.2 Determine which characteristics of habitat structure exert the greatest influence on species diversity. Compare the importance of these characteristics with that of habitat area, diversity of adjacent habitat types, or landscape context.

3.3.3 Compare trophic structure in fragmented or developed areas vs. less fragmented or developed areas. Does human activity result in the loss of top carnivores? An increase in primary consumers? An increase in omnivores? Does anthropogenic disturbance select for species with smaller body size over larger species? Does human activity affect the relative abundance of arboreal vs. terrestrial vs. fossorial species? Nocturnal vs. diurnal species?

3.3.4 Do dispersal or travel corridors exist, and are they used? Corridors connecting resources or habitats may be important to the maintenance of populations in fragmented landscapes. This project might compare characteristics of putative corridors with their actual use.

3.3.5 Choose a species and determine the following.

i) Spatio-temporal patterns of habitat use.
ii) Interaction with other species and abiotic ecosystem components.
iii) Conservation status or recommended management strategies.
iv) How (iii) would affect associated populations.

3.3.6 Determine and describe the role(s) that a population plays in its native habitat. Compare matched sites to infer how a system would be affected by the introduction or removal of that population.

3.3.7 Select a species and, by studying interactions with other species and resources, determine as much as possible about that species' native ecosystem. Use your findings to address how well results from studies of single species can be applied toward understanding entire ecological systems.

3.3.8 Quantify road mortality. Measure rates of roadkill by species, as affected by any of the following variables: road surface, road width, road density, traffic density, adjacent vegetation, proximity to water.

3.3.9 Measure the effects of competition on growth of trees. If all else is equal, the growth rate of a tree will be suppressed more by a close neighbor than by a more distant one. Measure the size of trees growing various distances apart, and analyze the data to determine the relationship between growth rates and neighbor proximity. (See me for details.)

3.3.10 Compare the strength of intraspecific competition vs. interspecific competition in trees. Proceed as described for (I), but compare results for neighbors that are the same species vs. pairs of differing species. (See me for details.)

3.3.11 Determine the relationship between diversity and invasibility. Two competing hypotheses have been posed for this relationship. First, communities with many native species may be more "full," and consequently more resistant to invasive species. Alternatively, conditions that support many species may support native and invasive species alike, leading to higher rates of invasion in species rich communities. Evaluate the contrasting predictions from these two hypotheses by comparing invasion rates (e.g., of herbaceous plants) in areas with few vs. many native species.