Project Plan

1. Project Title: Evaluating the intermediate disturbance hypothesis in a managed forest
a. Group Members:

Alex, BIOL570L Students

2. Topic Background Statement:

Community structure within an ecosystem can be extremely different between environments. Notably, some ecosystems have extreme biodiversity, with a wide range of different taxa while others have very low biodiversity. Often differences in biodiversity can be explained by differences in environmental conditions. For example, low-latitude ecosystems often have high biodiversity due to the warm, resource rich conditions. Alternatively, high-latitude systems tend to be harsher and sport lower biodiversity (Hillebrand 2004). However, discrepancies in biodiversity can be readily observed in similar ecosystems, even within extreme proximity.

The intermediate disturbance hypothesis suggests that higher biodiversity can be maintained through an intermediate regime of disturbance frequency and severity. This hypothesis is based on successional theory which suggests that ecological communities will move from fast life-history strategists to slow ones following disturbances. However, if disturbances are in a 'goldilocks' zone it should sustain the highest level of biodiversity, balancing different ecological strategies. The intermediate disturbance hypothesis was first suggested by Connell (1978). However, it has been extensively researched, notably in Sousa (1979)'s classic intertidal boulder experiment. Yet, this hypothesis is still subject to criticism of its fundamental validity (Fox 2012).

Here, we suggest a simple observational test of the intermediate disturbance hypothesis in a state-managed forest. We will survey biodiversity in a low, mid, and high disturbance region.

3. Main Question(s):

Is there a difference in biodiversity of plants in different regions of the forest which have been subjected to different disturbance regimes?

4. Hypothesis(es):

Consistent with the intermediate disturbance hypothesis, the regions which have experienced moderate levels of disruption will host the highest levels of biodiversity while the

5. Proposed Methodology:

Three regions of the forest will be sampled. These regions are in close proximity and have similar soil characteristics. However, the low disturbance plot is consistently mowed to provide space as a wild-life feeding refuge. The second region was subjected to a prescribed burn last year and is regularly managed. The third region has not been burned or disturbed. Thus by comparing biodiversity between these regions, we provide an elegant test of the intermediate disturbance hypothesis.

To sample each region, randomly placed quadrats will be placed in a grid. The regions differ slightly in size. A random number generator will be used to select coordinates within each sampling grid to place quadrats. In each quadrat, the number of unique taxa will be recorded. This will facilitate calculation of

numerous diversity and evenness indices. $1m^2$ will be used, with the exception of high-grass plots. To make counting feasible, a ¼m quadrat will be used and the results will be multiplied by 4. Each forest region will be sampled with a minimum of 5 quadrats with a goal of 10.

a. List of Needed Equipment:
- Transect tapes
- Quadrats
- Note/collection grid
-

b. List of Collected Variables:
- Forest region (categorical, predictive)
- Count of each unique taxa (integer/count, response)
- Richness, Shannon's H, Pileou's D (continuous, response) (derived variable).

c. Proposed Analysis Method:

The richness, biodiversity (H) and evenness (D) will be calculated within each quadrat, then averaged with standard error recorded. These metrics will be compared between the three regions using a one-way ANOVA. If a statistically significant result is found, A post-hoc test will be used to determine which groups in particular are significantly different.

6. Group Member Responsibilities:

Alex – Provide supplies and instructions

Students – Count quadrats

7. References:

Connell 1978. Diversity in tropical rain forests and coral reefs: High diversity of trees and corals is maintained only in a nonequilibrium state. *Science* 199(4335): 1302-1310.

Fox 2012. The intermediate disturbance hypothesis should be abandoned. *Trends in Ecology & Evolution* 28(2): 86-92

Hillebrand 2004. On the generality of the latitudinal diversity gradient. *The American Naturalist* 164(2): 192 – 211.

Sousa 1979. Disturbance in marine intertidal boulder fields: the nonequilibrium maintenance of species diversity. *Ecology* 60(6): 1225-1239