LRES 569 and 536: Ecology of Invasive Plants in the Greater Yellowstone Ecosystem
Syllabus, Schedule and Assignments 2017, July 10-14 (field portion).

Professor: Dr. Bruce Maxwell
bmax@montana.edu
(406) 994-5717

Class meets ABS Hall (Animal BioScience) Room 238 from 8 am to 10 am; meet for Field Trips on East side of ABS. Computer Lab ABS 234 from 2 to 5 pm.

This course was originally designed for the Master of Science for Science Educators program (MSSE) and now additionally includes graduate students in Land Resources and Environmental Sciences (LRES). The MSSE students only take the field portion of the course (LRES 536) and the LRES students (LRES 569) are additionally required to do expanded assignments the weeks before and after the field course.

Course Objectives:

1. Familiarize students with the most current theories on what characteristics make species invasive and what ecosystem conditions invite or resist non-indigenous plant species.
2. Create an awareness of the philosophical debate within the ecology discipline and society in general about non-native species and the policies directed at their management.
3. Place students in the field where invasion is occurring to gain an appreciation for the complexity of judging a species to be invasive and having ecosystem impact.
4. Learn field sampling techniques, data summarization, statistical analysis, interpretation and results presentation.
5. Additional objective for LRES Graduate Students receiving +1 credit.
   a. Learn advanced forms of data analysis that allow for predicting the distribution and dynamics of invasive plant species.
   b. Learn to draw conclusions from monitoring data that will allow informed land management decision.

Schedule: [Changes to the schedule may occur, therefore information on the D2L site takes precedence over this document]

Readings: All readings will be on the D2L website for the class.
Monday July 10, 2017. Distribution of Invasive Plants

Before Class Read:


The questions that we will address:

1. What factors must come together to have a successful species introduction to a continent, a new region on a continent or a new area within a single habitat?  
2. How can we make an unbiased prediction of where the species occurs and is likely to occur on the landscape without conducting a full census?

8:30 am  Introduction of Course and Discussion of definitions [238 ABS]  
9:00 am  Lecture: Distribution of Invasive Plants (notes and ppt in D2L)  
10:00 am  Load up in cars and go to ?  
11:30 am  Presence/Absence transects.
3:30 pm       Return to MSU campus (try to arrive by 5:30 pm)

Assignment 2. In a paragraph list some abiotic and then some biotic determinants of non-native plant species distribution. Explain how these two factors may interact to determine habitat quality for the non-native species? Place your word document in the “Plant Distribution” Assignments folder in D2L by beginning of class on Tuesday.

Tuesday, July 11, 2017. Monitoring To Determine Plant Invasion Rates

Before Class Read:


The objective of this class and field trip is to examine the question of how one might objectively determine if a species is invasive in a given environment.

The questions that we will examine are:

1. What should be the criteria for determining if a non-indigenous species is invasive?
2. Can we detect change in non-indigenous plant populations that will allow us to judge them as invasive?

8:30 am       Lecture: Detecting changes in density and spatial extent [238 ABB] Lecture 2: Measuring Invasion Potential
9:30 am       Field Trip to Mt Ellis State Land. [meet near ABS in parking lot]
11:30 am      Return to campus
2:00 pm       Computer Lab Analysis [Meet in 234 ABB]

Assignment 3 (Estimating Invasion Potential):

Conduct analysis on patch data from Mt Ellis State Land. With the data that you collected and the data from previous years would you conclude that the sulfur cinquefoil populations (patches) are growing, shrinking, or show no trend? Present a table showing the area of each patch in each year using the Tape Measure Triangles Methods and the GPS patch perimeter method? Calculate the growth rate for each patch? Present a table showing the change in density of the samples from each patch and each year from the Mt Ellis data. Do you conclude that these invasive species are invading according to our definition of populations that are consistently increasing in density and/or spatial extent? Explain your answer in a paragraph and turn in your assignment by Wednesday at 8:30 am. Put into the “Invasion_Potential” dropbox
**Wednesday**, July 12, 2017. **Impact of Invasive Plants**

Before Class Read:

Review materials and background reading Leafy Spurge Problem Field Trip and Lab

Macdougall and Tukington 2005


The questions that we will examine are:

1. What should be the criteria for determining if a non-indigenous plant species can have a significant impact on the ecosystem?
2. What are the proper controls required to determine if a population of an invasive plant species is having an impact on species diversity?

8:30 am Introductory Lecture on Attributes of invasive plants and their impact

9:30 am Field Trip to “M” [Meet in driveway East side of ABS]

1:30 pm Return to campus and meet in Computer Room to analyze field data in Excel.

3:30 pm Discuss results

**Assignment 4, Invasive Species Impacts:**

Submit an error-bar graph that you make in Excel that shows the mean and standard deviation of species richness in and outside of leafy spurge patches. Conduct a two-tailed t-test to statistically ask the question if the species richness is lower in the leafy spurge patch. Write a sentence or two about the conclusion that you draw from the data and analysis. Write a final paragraph about how you might design the experiment differently to more conclusively test the hypothesis. *Due at beginning of class Thursday*

**Thursday**, July 13, 2017. **Invasive Species In The Context of an Ecosystem**

All day field trip to Yellowstone National Park. *Meeting time and place to be announced.*

We will examine invasive species in the context of different land management objectives encountered in the Greater Yellowstone Ecosystem. Discuss issues of boundaries between management objectives, the concept of ecological footprint and invasive species policies.

Before Class Read:


The questions that we will address:

1. What parts of the landscape are most apt to have non-native species?
2. Would a nature reserve like YNP be a logical place to find non-native species? Why or why not?
3. What is the role of disturbance (most notably fire in GYE) in determining invasive species dynamics?
4. Where on the landscape are invasive species most likely to disrupt ecosystem processes?

Assignment 5. Be able to answer the questions above as they are likely to be on the final exam. Nothing to submit but should discuss while traveling in the vehicles.

**Friday, July 14, 2017. The Decision To Manage Invasive Plant Species**

8:30 am   No Lecture. Meet in Parking Lot to go to Burke Park

11:00 am  Return to Campus

12:00 am  Lunch

1:00 pm    Meet in room 234 ABS to discuss observations from Burke Park.

2:00-3:30  Final Exam

**For LRES Graduate Students signed up for +1 credit.**

July 15-21, 2017 **Analysis and Report on Burke Park Data**

Assignment 6, Invasive Plant Management (for LRES 536 students):

Using the SpatTempPopDyn.R model compare at least 3 different management approaches designed to decrease the simulated invasive species population growth. Describe what methods you applied and the results. Which method was the best and why? Answer each part with no more than a paragraph. Turn in your assignment no later than Friday July 21 at 4:00 pm by placing a word document into the Simulated_Management_Analysis Assignments folder.