Moose Habitat and Nutrition Research Projects
Biol. 445 – Herbivore Ecology
Fall 2006

The focus of the laboratory part of this course will be to develop methodologies for the assessment of moose carrying capacity and habitat quality for the Placer Valley in the Chugach National Forest. The project will entail some creative and innovative work from the class, from determining the diets of moose in the Valley and investigating new methods for analyzing the digestible energy and protein of the major dietary items, to mapping and quantifying the availability of food to moose in the Valley. The project is supported logistically and financially by the US Forest Service and the Alaska Department of Fish and Game, and the product of our work will be of great interest to these agencies (and very likely other land management agencies) for measuring habitat quality for herbivores elsewhere.

As explained in the lab syllabus, the project will consist of 6 sub-projects or components, each of which will be the focus of a 2-person team. I will initially be the team-leader for each team, to help focus and direct the efforts and progress of the teams. As you become immersed in the projects, I will relinquish control of the projects to you. The final product of the class will be a comprehensive report of the entire project, which the teams will present as both a written report and a presentation to invited personnel of the agencies, as well as invited faculty and administrators of UAA.

The 6 sub-projects will focus on the following aspects of moose habitat and nutritional analysis.

1. *Field mapping and estimation of forage availability for the major browse species of moose in the Placer River Valley*. This part of the project may require 2 teams of 2 people each, and will include field verification of vegetation maps, quantification of browse availability using computer-aided sampling procedures, and several trips to Placer Valley to conduct the survey work. You will be able to stay in the US Forest Service Field camp in Placer Valley, and will be required to do extensive forays around the valley in search of the illusive browses. Skills required and/or to be learned will include the use of GPS to locate random plots, the use of the computerized mapping and 3-D digitizing equipment for browse measurement, GIS techniques for mapping and map generation, and statistics appropriate to the field data collected. This team will also work closely with computer programmers of Dr. Kenrick Mock's Software Engineering Class (CS 401) to develop and refine the software to run the field sampling hardware.

2. *Measurement of moose diets in Placer Valley.* This sub-project will include assisting the ADF&G research biologist in the construction of temporary holding pens for moose in Placer Valley, the transport and handling of our tame moose into the field, determining the activity and feeding patterns of the moose, and estimating diet and intake rates of the various foods consumed by our tame moose. This project will also include the collection of fecal samples from both tame and wild moose in Placer Valley. The collection of wild moose fecal samples will be accomplished by radio-locating several of the GPS-collared wild moose in the Valley, and then hiking to these sites to find and collect the samples. You will also be required to collect samples of all the major foods consumed by tame and wild moose, and properly handle these to the point of passing the samples to the laboratory team responsible for their analysis.

3. *Fecal Alkane Analysis*. The samples returned by team 2 will be used to conduct an experiment by this team to determine the similarity between the tame and wild moose diets, and

to quantify the wild moose diets in Placer Valley. This team will be responsible for the refinement of a method for quantifying the alkanes in each of the major food species of Placer Valley moose, and then quantifying their presence in the feces of the tame and wild moose. You will also verify the assumptions of indigestibility of alkanes in moose using samples collected in previous digestion trials with moose. It will require the use of the Accelerated Solvent Extractor (ASE) in the ASET laboratory, the use of Gas Chromatography (GC) for quantification of alkanes, and the investigation of extraction efficiency of alkanes using the methods developed.

4. *Digestion Kinetics Analysis.* Team 4 will measure the digestible energy and digestion kinetics of the major food plants of moose in Placer Valley, using the samples of plants returned to the lab by Team 2. Digestion kinetics will be performed using nylon bag techniques in our fistulated moose (Diana) in Palmer. This team will be responsible for the preparation of the plant materials for analysis, the handling of the moose in Palmer, and the running of the nylon bag digestion trials. The team will also complete the detergent extraction of the samples, and analyze the data using non-linear regression techniques. The team will also be required to measure the gross energy of the food samples using bomb calorimetry.

5. *Quantitative Chemical Analysis of Cell Wall Digestibility*. This team will use FTIR spectroscopy, Detergent Extraction, and Automated Solvent Extraction to develop and test a new quantitative method for determining digestible energy of foods for moose. This team will be required to work closely with Team 4, using their results to verify the techniques developed. The team will isolate the chemical fractions of the cell walls of plants, determine their FTIR signatures, and attempt to develop predictive equations for digestibility based on these studies. The team will work with Dr. Marc Perry (Chemistry) to interpret the FTIR spectral data.

6. *Digestible Protein and Tannin Analysis*. Team 6 will be responsible for the analysis of digestible protein of the major food plants of moose in Placer Valley. Working with the samples returned by Team 2, this team will analyze the N concentration of the plants using the Elemental Analyzer (EA) in the Arctic Stable Isotope Laboratory, and determine the protein binding capacity of the plants (equivalent to the tannin concentrations of the plants) using Accelerated Solvent Extraction (ASE) and microplate UV-Vis assays. This team will also compare the predicted digestible protein of forages fed to moose to their measured protein digestibility, thus verifying the appropriateness of the assay method for moose.

The Software Engineering Teams

In addition to the teams we create in the Herbivore Ecology Course, we will be interacting with two teams from Dr. Kenrick Mock's CS 401 Software Engineering Class. They will be developing and refining two computer applications that you will be using, and you will be providing input to them regarding their development. The teams will be involved in developing the software for (1) field measurement of forage biomass density, and (2) the moose carrying capacity model, which we will use at the end of the semester to compute the nutritional carrying capacities of the habitats in Placer Valley.

Team Membership

I request that you volunteer for a team that fits your particular interests the most. I request that only one graduate student participate on any one team. Please email me your choice of team membership within the following 3 days. You may discuss your choice of partnerships

with class members, and decide to sign up as a team, or you can simply email me your top choice, your second choice, and your third choice for team membership. Depending upon how the class fills the various teams, I reserve the right to modify and assign members to teams to ensure that each team is populated appropriately. In any case, I will encourage cross-fertilization of the teams by having members of different teams periodically participate with or on other teams as time allows. Everyone should be thoroughly familiar with the function and subject matter of each of the teams by the end of the semester. This will be accomplished through volunteer participation on any of the other teams, through review of the progress reports by all members of the class, and via periodic discussions in class.

Final Report and Presentation

Near the end of the semester, we will begin to link the teams together and formulate the format and content of the final report. The teams will decide how to put this report together, who will write what sections, and who will present the information in the seminar to be conducted at the end of the semester. The report will consist of introduction, methods, results, and discussion sections, as well as a literature cited section at the end, all in Ecology format (i.e., just like a journal article in Ecology). The presentation may consist of individual presentations from each of the teams, but both the final written report and the presentation will also include a synthesis of the projects and an analysis of the moose carrying capacity of Placer Valley. The carrying capacity analysis will be derived from a Carrying Capacity Model currently being programmed by Dr. Kenrick Mock's Software Engineering Class, and we will explore its use and the implications and appropriateness of its predictions near the end of the semester.

The final report will be sent to the Alaska Department of Fish and Game (ADF&G) and to the US Forest Service (Chugach National Forest Staff) at the end of the semester. The final presentation(s) will be conducted as a special seminar, and I will be inviting biologists and managers of the US Forest Service and ADF&G, and appropriate faculty and administrators at the University to attend the seminar.