Ecosystems of Alaska
Biol. 467

Course overview

Ecosystems of Alaska focuses on the application of ecological principles to field research. The course emphasizes the integration of ecology with climatology, geology, and hydrology to understand the functioning of ecosystems at local and regional scales. The major objective of this course is to introduce students to the concepts of ecosystem ecology and their application to the major ecosystems of Alaska through field research in these ecosystems. The field research is intended to provide students with the opportunity to design and conduct several interdisciplinary research projects and to analyze and interpret the results of this research. Following several days of lectures, library research, and research planning, we will spend ten days doing field research in the major ecosystems of Alaska. At the end of the course, we will hold a symposium in which each student presents an oral and written report on the ecosystem on which she/he has specialized. The course involves a full-time commitment for three weeks in late August. The course provides three undergraduate credits.

Format and logistics

The course requires full-time involvement of students from 8 am until 8 pm every day from Aug. 12-30, 2002. There are three major sections to the course.

I. Introduction: Three days of introductory lectures and field trips will familiarize students with principles of ecosystem ecology and provide general background about Alaska.

II. Field research: Ten days of field research in selected Alaskan ecosystems. Half the time will be spent conducting student-led research projects. The other half of the time will be spent learning about other ecosystems from selected ecosystem experts. The class will be divided into 5 research teams. Each team is responsible for designing a research project to address a specific question that can be answered with one day’s field work. The student team responsible for an ecosystem will decide on the measurements to be made, using a research “toolbox” of techniques for which we have the necessary equipment. The team will make brief presentations to the rest of the class about their ecosystem, providing background information about that ecosystem and about the research that will be done. The team will then direct the rest of the class in collecting the essential data and will be responsible for analyzing and interpreting these data. Each student will be a member of one research team.

III. Data analysis and final presentations. For the last four days of the course, we will prepare and analyze samples and analyze the data statistically in preparation for a final symposium. At this symposium, each team will present the results of their research project to the rest of the class. Each student will prepare an individually written report in the form of a 3-5-page scientific paper that is due October 1, 2002.
For further information
For additional information about the course see
http://www.faculty.uaf.edu/ffsce/Ecosystems.html or contact Terry Chapin
terry.chapin@uaf.edu
Phone 907-474-7922
Fax 907-474-6967
Registration forms and information about registration are available at
http://www.uaf.edu/reg/schedule/index.html
tel: 907-474-6300
Housing information is available from UAF Conference housing
conferenceservices@uaf.edu, http://www.uaf.edu/reslife/
907-474-6768
Additional information is available from the Biology Department (Carol Piser)
Fncap1@uaf.edu
907-474-6294

Registration and fees
Registration information is available at www.uaf.edu/reg/,. Current University of Alaska (UAF) students can register after April 8. Non-UAF students can register after May 29. No student will be allowed to participate in field trips until they have registered for the course. To enroll in the course you must do the following:
1. Obtain permission of instructor
2. Register for the course and pay university fees
3. Pay transportation fees to the Department of Biology (upon arrival in Fairbanks)
4. Arrange your own housing (we recommend dormitories) in Fairbanks for the nights of Aug. 11-15; Aug. 26-30, possibly Sept. 1, depending on departure date (total of 10-11 nights). Be sure to tell the housing office that you will be using a shared double room and that you are a registered student. To register for dormitory housing, contact conferenceservices@uaf.edu.

The costs for the course are as follows:
Paid to the University of Alaska
Tuition (3 credits) $270
Technology fee $15
Laboratory fee $40
Paid to the Biology Department after arrival in Fairbanks
Transportation fee $50

In addition, each student is responsible for the cost of their transportation to and from Fairbanks and for housing and meals during the time we are in Fairbanks. Dormitory fees are $15/person per night for a shared double room or $25 per night for a single room. Meals on the Fairbanks campus are about $15-25/day. We will share the cost of the food for the time we are camping (approximately $20 per person per day) equally among all students and instructors.
Tentative Schedule

Aug. 12
Introduction
Course objectives and logistics 8:00
Principles of ecosystem ecology 9:00
Geography and history of Alaska:
  Climate: Terry Chapin 10:30
  Geology: David Stone 11:00
  Biota: Terry Chapin 11:30
  Culture and human history: Mimi Chapin 1:00
Univ. of Alaska Arboretum: overview of Alaskan ecosystems
Organize research teams
Supper at Chapins

13
Lectures: Major ecosystem components
  Mammalian herbivory: Terry Chapin 8:30
  The invertebrate world: Steve MacLean 9:00
  A microbial perspective: Terry 9:30
  Vegetation distribution and succession: Jill Johnstone 10:30
  Soils processes: Terry Chapin 11:00
Research teams meet with Colin and Terry
Visit UAF museum; Library research on projects

14
Class discussion:
  Global change in climate and land use
  Vegetation-climate interactions
  Biogeochemical processes
  Landscape dynamics
  Ecosystem change
Ecosystem teams meet to plan projects

15*
Bonanza Creek: Floodplain succession (Biotic controls over succession)

16
Drive to Eagle Summit; Treeline dynamics

17*
Eagle Creek: Tussock tundra (recovery from disturbance)

18
Free day: hiking, Circle Hot Springs

19
Drive to Fairbanks; process samples; discuss ecosystem generalizations

20
Delta Jct: Impacts of fire on ecosystem processes; camp at Delta

21*
Mentasta Pass: Permafrost and thermokarst
  (impact of global warming on tundra)

22
Drive to Kenai Peninsula

23*
Exit Glacier: post glacial succession to coastal rainforest
  visit Marine museum

24
Drive to Kenai Peninsula

25
Alaska Range: Landscape analysis of treeline

26
Rock Creek watershed: Drive to Fairbanks

27-29
Analyze data and prepare presentations

30
Symposium: Ecosystems of Alaska (Final presentations)
  Potluck

*Days with student-led research
Grades
Letter grades will be given to all students, based on the following criteria:

Intellectual contribution to discussions 25%
Active involvement in all phases of research 25%
Quality of the research and final presentations of your teams 25%
Final paper 25%

What conditions to expect:
Anything can happen. The challenge is to bring the minimum essential stuff for a range of conditions. This is easiest if you bring layers of clothes rather than big bulky jackets. It could be sunny and 70°F (20°C) or rainy and windy and 35°F (2°C). We will probably get some of both types of conditions. We will be sleeping in tents part of the time and inside part of the time. We will be traveling in cars with a minimum of storage space, so don't bring things you won't need.

What to bring:
Everyone should bring the following things:
Comfortable field clothes (for example T-shirt, long-sleeve shirt, jeans, hat for sun, and boots)
Things to keep dry: rain coat, rain pants, waterproof boots (preferably 14 inch rubber or neoprene boots). You should be prepared to work outside all day in the rain.
Things to keep warm: Warm coat, sweater, windbreaker, warm hat, gloves, long underwear. You should be prepared to work outside in the cold all day.
A set of extra field clothes if your clothes get wet
Sleeping bag and sleeping mat
Bug repellent, sun screen, sunglasses
Camera and film
Unbreakable coffee mug for warm drinks and picking blueberries
Money: we will share the cost of food equally among all of us. I am guessing that this will be about $200 per person for the 3-week course. I would bring at least an additional $100, in case you see something else you want from the stores (film; replacement for lost clothes, meal in restaurant, etc.). I am assuming that each person will have paid their tuition and lab fee prior to arrival. The transportation fee will cover the costs of vehicles for the field trips and can be paid when you arrive. You cannot participate in any field trip until you have paid these fees, for insurance reasons.

Special needs:
Please tell me if you have special needs or concerns. For example, it would be useful for me to know if you have special dietary needs (vegetarian?), severe allergies, etc. or if there are things we should know in planning the field work. Please bring any medicines you use regularly. We will supply a first aid kit for emergencies. There will be times when we will not see a store for 2-3 days.
Ecosystems and possible focal questions

*Bonanza Creek: Floodplain succession

Succession is typically viewed as a process where competition, facilitation, and life-history processes govern the changes in species composition. What is the relative importance of these processes? In particular, how might succession be influenced by herbivory? Document herbivore effects inside and outside exclosures that were constructed in 1988; document changes in woody species through succession. Initial references: Van Cleve et al. 1991; Walker and Chapin 1986; Kielland and Bryant 1998.

*Eagle Creek Tussock tundra: Recovery from disturbance

Tundra vegetation grows slowly due to severe climate and is very sensitive to human disturbance. What are the changes in environment, diversity and productivity following disturbance? We can examine an area that was disturbed 30 years ago and examined again after 15 years. Are things returning to their original state or moving to some new ecosystem type? Initial references: Chapin and Shaver 1981; Walker et al. 1987; Shaver and Chapin 1980.

Eagle Creek Tundra: Productivity and C storage along environmental gradients

If community and ecosystem processes of tundra are strongly constrained by environment, we should expect strong gradients in production and diversity along elevational gradients within tundra. Do these gradients exist? Do communities change as coherent units or does each species have its own pattern of distribution? (Miller et al. 1981, Walker et al. 1994, Chapin et al. 1996).

*Delta Junction: Role of fire in the Alaskan boreal forest

In July 1999, a wildfire burned a large expanse of white spruce forest. Fire is an important factor governing the dynamics of the boreal forest. What are the initial patterns of recovery following this burn? What are the fluxes of carbon from this site, and how do they differ from unburned sites?

*Alaska Range: Permafrost and thermokarst (impact of global warming on tundra)

The climate of Alaska has warmed substantially in the last 30 years. We will visit an area of tundra where the ground ice has begun melting in the past 10 years, leading to thermokarst and major changes in drainage. What have been the consequences for species composition, carbon storage and trace gas fluxes? Lachenbruch et al. 1991, Osterkamp et al. 1999, McKane et al. 1998.

*Exit Glacier: post glacial succession to coastal rainforest

In a few locations in Alaska there have been catastrophic retreats of glaciers, leaving large areas available for colonization by vegetation during recent history. We will visit one such area, where the glacier is rapidly retreating. What controls the patterns of development of plants and soils? Crocker and Major 1955, Chapin et al. 1994, Fastie 1995, Helm.
Animal impacts: Bark beetle outbreak in the Kenai Peninsula
Insects can have huge effects on forest stands. What have been the community and ecosystem consequences of bark beetle outbreaks in the Kenai Peninsula? Will these former forest stands recover or are they likely to change to some new type? What might determine their future state. (Malmstrom and Raffa, in press). In addition, we will visit moose exclosures similar to those on the Tanana River Floodplain

Alaska Range: Landscape analysis of treeline
Treeline is a sensitive indicator of climate. How does treeline move and where do trees establish in a glaciated landscape formed during the Pleistocene? Postglacial topography is highly heterogeneous. How does this influence the development of soils, the storage of carbon, and the advance of trees? (Brubaker et al. 1995, Sveinbjørnsson 1992)

Ecosystem Experts

Scott Rupp: Room 305 O'Neill Building
Forest biomass (allometric equations, density)
Campus facilities (computer labs, library, etc.)

Mimi Chapin: Rm 195 Arctic Health Building
Alaskan history and culture

Terry Chapin: Rm 195 Arctic Health Building
Other stuff