



## University of Alaska Geography Program University of Alaska Fairbanks

### B.S. in Geography Overview of Program and Degree Options

Geography provides an holistic view of the earth as a whole, its distinct and varied regions, as well as the types of, and interaction between human activities and the physical world. Geography is the two-way bridge between the physical and social sciences as it explores the interrelationships between the earth's physical and biological systems, and how these environmental systems provide a natural resource base for human societies. Geography also provides the framework for the integration of new and emerging technologies such as GIS and Remote Sensing with studies in a broad range of academic disciplines.

Geographers are interested in patterns and process of physical and social change including climate change, geographic information science and technologies, human settlement patterns, natural resources distribution and management, environmental studies, and in the inherent "sense of place" among peoples throughout the world. Geographic methodologies include observation, measurement, description and analysis of places including likenesses, differences, interdependence, and importance.

The UA Geography Program has recently revised the Bachelor of Science Program to offer students more options while pursuing a B.S. in Geography. These new programs were designed to prepare students to understand, live in, and work in a dynamic and changing world.

Below are general descriptions of the intent, rationale, and objectives of each of three options in the B.S. Program. Specific course requirements follow. See the rest of your advising packet for degree checklists, recommended course sequences and semester planners.

#### **Geography B.S., Option I: Environmental Studies:**

This option was the original B.S. in Geography with a strong emphasis on environmental issues, wilderness concepts, and management. This option provides the foundation necessary for understanding the natural and social environment, the analysis of environmental issues from an interdisciplinary geographic perspective, a diverse technical and scientific approach to environmental issues, and the ability to find balanced solutions to environmental problems. Students will be prepared to enter jobs or graduate study in management, wilderness management, and to work on diverse environmental projects and problems.

#### **Geography B.S., Option II- Landscape Analysis and Climate Change Studies:**

##### **Program Overview**

This program of study in Physical Geography integrates and synthesizes courses in geography, climate change, physical and biological sciences, and geographic information sciences and technology. The theme of climate and environmental change and the underlying 'pattern and process paradigm' will serve as the threads that unify this diverse course load. Senior Field Practicum will enable students to apply what they have learned in "real world" settings. Students will gain a sound and interdisciplinary understanding of how environmental change influences landscape and humans on both spatial (latitude, altitude) and temporal (past, future) scales.

**Courses in Option II are presented in 4 main categories:**

**1) Geography Foundation**

**2) Processes** (geomorphology, ecology, climate and weather)

**3) Patterns** (field methods, mapping, remote sensing, statistics, GIS, computer modeling)

**4) Practicum** (semester long field study of particular problem –with ‘real world’ application)

The “Processes” and “Patterns” components include specific courses offered in various departments, but both components will include a least one “synthesizing” geography course enabling students to integrate and apply (in the interdisciplinary context of Geography) what they learned in disciplinary subjects. The entire curriculum will be integrated through a field practicum required in the senior year.

**Background / Rationale**

Alaska is at the forefront of the geography of global change, as current climate models predict warming trends to strike at high latitudes soonest and hardest. Many noticeable changes are already being observed in high latitude environments. Among the natural processes already being affected are the wildland fire regime, permafrost dynamics, the turnover of soil carbon, sea-ice processes, resource distribution and subsistence hunting by humans, and thermal erosion of arctic lakes and coastlines. Managing these distinctly Alaskan processes in the milieu of global change is the single greatest challenge facing the scientists, politicians, land managers, and business people of our state over the next 50 years. This new B.S. Geography Option in Landscape Analysis and Climate Change Studies emphasizes the processes of environmental change and management strategies unique to the northern landscape.

Alaska is the perfect location for a course of study directed specifically at the causes, consequences, and management challenges of climate change. Not only is Alaska one of the first geographic settings to experience these changes, but Alaskan ecosystems also are highly sensitive to changes in both temperature and moisture availability and thus will respond in striking ways to future warming. Moreover, UAF has a premier outdoor classroom in the United States in the form of millions of acres of pristine ecosystems covering a wide array of geography in terms of climate, landforms, biota, and geological history. Given this ideal classroom, how do we prepare undergraduates for jobs in an environment that is changing? How do we provide sound conceptual understanding of processes and patterns, a proper “tool kit,” and practical experience for understanding and managing environmental change? Since many global change issues are inherently multidisciplinary, the UAGP faculty have created a multidisciplinary program integrated via the study of geography.

The Option in Landscape Analysis and Climate Change Studies will train students in two key areas: ***critical thinking and analysis through hypothesis testing***. Whether in science, business, or everyday life, these are key skills. The primary way to teach students critical thinking and analysis through hypothesis testing is what we call the “pattern and process paradigm.” Simply put, this paradigm explores how a system works by analyzing the patterns it creates in the world around us. Because the patterns we observe on landscapes are the signature of underlying causal processes, the pattern and process approach to the study of diverse natural landscapes necessarily integrates the study of spatial relationships with the analysis of physical, biological, and social processes.

**Program Objectives**

- Employ a “pattern and process” approach to the study of environmental change.
- Introduce students to the major, critical processes underlying physical and ecological systems in Alaska.
- Utilize the geographic diversity of Alaska as an outdoor classroom.
- Train students in an investigative, problem-solving methodology that involves first analyzing the spatial and temporal patterns involved in phenomena and then dissects the processes that drive them using hypothesis testing.

- Produce graduates with broad-based knowledge and necessary skills needed for managing and adapting to environmental change. These include, for example, the ability to ask good questions, to quantify and evaluate information, and to focus on multidisciplinary scientific, sociological, and land-management problems.

### **Student Outcomes**

- Produce students who are well prepared to excel in a multidisciplinary and interdisciplinary approach to problems such as those posed by climate and environmental change.
- Students will gain: 1) interdisciplinary and integrated understanding of the physical, climatic, and ecological processes that create landscape patterns, 2) the skills and tools necessary to observe, measure, analyze, and model landscape patterns and changes in these patterns, 3) an ability to see and understand *relationships between* physical, biologic, and climate processes, and how humans interact with and respond to changing landscape.
- We expect students who graduate from this program with a B.S. will be employable as geographic/mapping technicians, GIS techs, or field technicians in geography or other field sciences. Students will be prepared to succeed in work or academic settings that require training in multidisciplinary or cross-disciplinary areas. Many state and national agencies, organizations, and companies need professionals who can understand, integrate, and synthesize diverse and interdisciplinary environmental problems. This program, with its practical emphasis on spatial context, critical thinking, problem solving, *and* geographic information science and technology, will also provide a sound preparation for advanced study in more focused components of geography, geographic information sciences, resource/land management, or other fields of study.

### **Geography Option III – Geographic Information Science and Technology (GIS&T):**

#### **Program Overview:**

This program of study emphasizes skills and practice in geographic information science, systems, technology, and analytical aspects of geography. Courses in statistics, computer programming, GIS and GPS, Remote Sensing are integrated with the geography core curriculum and courses in natural sciences.

#### **Courses are presented in 5 main categories:**

- 1) **Geography Foundation**
- 2) **Geographic Information Science and Technology (GIS&T) Breadth**
- 3) **Remote Sensing**
- 4) **Geographic Information Systems**
- 5) **Landscape Analysis**

#### **Background / Rationale:**

UAF is well positioned to provide students an outstanding degree in the growing and high-demand field of GIS&T.

1) Geographic Information Science and Technology is known as the “new geography” or “geotechnology.” Former Director of the National Science Foundation Dr. Rita Colwell recently noted that geography and its implementation of new technologies are “well poised at this watershed juncture to help shape the new landscape of science” (Colwell, quoted in DiBiase, 2006). Indeed, demand for those with training and expertise in the “new geography” has experienced unprecedented growth in the recent decade and the U.S. Department of Labor notes that geotechnology, nanotechnology, and biotechnology are the three “most important emerging and evolving fields” (Gewin, 2004). Demand national-wide, and throughout Alaska will only increase.

The University Consortium for Geographic Information Science and the Association of American Geographers has recognized the growing interest in, and demand for, people trained in Geographic Information Science and Technology. At the same time, they realized the need for a well-defined,

disciplined-based framework for GIS&T, and as a result, published Geographic Information Science and Technology: Body of Knowledge (DiBiase, et al, 2006). This publication outlines the discipline's core tenets, body of knowledge (analytical methods, conceptual foundations, cartography and visualization, design aspects, data modeling, data manipulation, geocomputation, geospatial data, GIS&T and society, and organizational and institutional aspects) and curriculum components. The GIS&T Geography Option is the first of its kind in the state of Alaska. GIS&T takes advantage of a growing demand in Alaska and throughout the United States for skilled professionals in this area – and utilizes the growing body of knowledge and discipline-based standards for both workforce training and advanced studies in geography and related fields.

2) UAF has considerable institutional assets in remote sensing and GIS (Alaska Satellite Facility, Geophysical Institute – remote sensing group, Geographic Information Network of Alaska, etc). These assets are located in several academic departments and institutes. This B.S. option in GIS&T takes advantage of the significant UAF faculty expertise in GIS and Remote Sensing and the University of Alaska's investment in the infrastructure to support this expertise in both the academic and research areas. The GIS&T Option will utilize the significant expertise available throughout UAF, integrate this expertise into the geography program, train students in this critical and high-demand job area, as well as improving the quality of our geography graduates focusing on remote sensing, GPS, geographic information systems, and spatial analysis techniques.

At the present time, courses in geographic information science, technology, and analysis at UAF are found among several colleges, schools, and departments including geography, natural resource management, mineral engineering, biology, and geology.

#### **Program Objectives:**

- Train students in the high-demand area of Geographic Information Science and Technology
- Integrate courses in analytical methods, programming, GIS, Remote Sensing, and landscapes to provide students with sound background and practice in the geographic information sciences and technologies
- Utilize existing UAF strengths, such as expertise and resources in the Geographic Information Network of Alaska, Alaska Satellite Facility, and existing, applicable academic departments
- Provide courses that utilize the tools and technology of geographic information sciences and technology within a geographic context that includes disciplines such as natural resource management, geology, biology, computer science, and geologic engineering

#### **Student Outcomes:**

- Students will be trained in the use of geographic information science and technology, GIS, and Remote Sensing in landscape analysis areas such as natural resources management, environmental change, and other fields.
- Students will gain: 1) sound and integrated background in multiple fields of geographic information science, technology, and analysis, and 2) the skills and tools necessary to observe, measure, analyze, and model landscape patterns and changes in these patterns
- UAF graduates in the GIS&T option will find career opportunities in land management agencies such as the AK Department of Natural Resources, AK Department of Fish and Game, U.S. Fish and Wildlife Service, National Park Service, Bureau of Land Management, Tanana Chiefs, Fort Wainwright, Eielson AFB.
- Demand continues to grow in this area and the GIS&T Option will meet this growing need within the academic and business communities

# Geography B.S. Degree Course Requirements

(see advising packet, catalog, and degree checklist for details)

## For all B.S Geography Degrees

1. Complete the general university requirements
2. Complete the B.S. degree requirements.
3. Complete the following required foundation courses:
  - GEOG 101-- Local Places, Global Regions: An Introduction to Geography 3
  - GEOG 211X-- Earth Systems: Elements of Physical Geography 4
  - GEOG 312 – People, Places, and Environment: Principles of Human Geography 3
  - GEOG 338 – An Introduction to GIS 3
  - GEOG 490W,O--Geography Seminar 3
4. Complete one of the following options:

### Geography Option I - Environmental Studies:

- a. Complete the following:
  - GEOG 339--Maps and Landscape Analysis 3
  - GEOG 401--Weather and Climate 3
  - GEOG 402--Resources and Environment 3
  - GEOG 408--Quantitative Research Techniques 3
- b. Complete 6 credits from the following environmental studies electives:
  - GEOG/NRM 463--Wilderness Concepts 3
  - NRM 303X--Environmental Ethics and Actions\*\* 3
  - NRM 407--Environmental Law 3
- c. Complete 9 credits from the following environmental system electives:
  - ANTH 428W--Ecological Anthropology and Regional Sustainability\*\*\* 3
  - BIOL 271--Principles of Ecology\*\*\* 4
  - BIOL/NRM 277--Introduction to Conservation Biology\*\*\* 3
  - GEOS 304—Geomorphology 3
  - NRM 375--Forest Ecology\*\*\* 3
  - NRM 380W--Soils and the Environment\*\*\* 3
  - NRM/FISH 400W--Fisheries Science\*\*\* 3
- d. Complete 3 credits from the following environmental management electives:
  - FISH 401W,O/2--Fisheries Management\*\*\* 3
  - NRM 365W--Principles of Outdoor Recreation Management 3
  - NRM 430--Resource Management Planning 3
  - NRM/WLF 431--Wildlife Law and Policy\*\*\* 3
  - NRM 450--Forest Management\*\*\* 3
  - NRM 480--Soil Management for Quality and Conservation\*\*\* 3
- e. Complete one of the following techniques courses:
  - GEOG 301-- Geographic Field Studies 3
  - GEOG 309 -- Cartography 4
  - GEOG/NRM 338--Introduction to Geographic Information Systems 3

(for all options)

\* Student must earn a C grade or better in each course.

\*\* If used to fulfill core requirements, NRM 303X may not also count towards geography major.

\*\*\* Prerequisites required.

◇ Graduate level credit used to complete this undergraduate degree program may NOT be applied towards future graduate degree programs.

**Geography Option II - Landscape Analysis and Climate Change Studies:**

- a. Complete the following Processes requirements (geomorphology, climate, ecology, systems):
- GEOG 401 Weather and Climate 3
  - GEOG 411 Pattern and Process in Subarctic and Arctic 3
  - GEOG 412 Geography of Climate Change 3
  - BIOL 271 Principles of Ecology\*\*\* 4
  - GEOS 304 Geomorphology\*\*\* 3
- Complete one of the following courses:
- BIOL 467 Ecosystems of Alaska\*\*\* OR
  - BIOL 469 Landscape Ecology / Wildlife Habitat\*\*\* OR
  - NRM 370 Watershed Management\*\*\* OR
  - NRM 380 Soils and the Environment\*\*\* 3
- b. Complete the following Patterns requirements (Field Methods, GIS / Remote Sensing Tools):
- GEOG 309 Cartography 4
  - GEOG 339 Maps and Landscape Analysis 3
  - GEOG 341 GIS Analysis 4
  - GEOS 378 Introduction to GeoInformatics\*\*\* 3
- Complete at least 1 course of remote sensing electives selected from the following:
- GE 471 Remote Sensing For Engineering\*\*\* 3
  - GEOS 422 Geoscience Applications of Remote Sensing\*\*\* 3
  - GEOS 434 Remote Sensing of Cryosphere\*\*\* 3
  - NRM641 Remote Sensing Applications in Nat. Resources\*\*\* 4
- c.. Complete the following Senior Practicum requirements (program synthesis)
- GEOG 488 Geographic Assessment and Prediction of Natural Hazards 3
  - GEOG 489 Senior Practicum: Field Studies in Landscape Analysis & Climate Change 4

**Geography Option III - Geographic Information Science and Technology (GIS&T):**

- a. Complete the following GIS&T breadth:
- CS103 Introduction to Computer Programming\*\*\* 3
  - STAT200X Elementary Probability and Statistics\*\*\* 3
  - GEOG 339 Maps and Landscape Analysis 3
  - GEOG 341 GIS Analysis 3
  - NRM/GEOS 300 Internship in Natural Resources Management and Geography 3
- b. Complete at least two courses of remote sensing electives:
- GEOS 422 Geoscience Applications of Remote Sensing\*\*\* 3
  - GEOS 434 Remote Sensing of Cryosphere\*\*\* 3
  - GE 471 Remote Sensing For Engineering\*\*\* 3
  - NRM460 Remote Sensing of Natural Resources 3
  - NRM641 Remote Sensing Applications in Natural Resources◇ 3
- c. Complete at least two courses of GIS electives:
- GEOG 309 Cartography 4
  - GE 376 GIS in Geological and Environmental Engineering\*\*\* 3
  - GEOS 378 Introduction to GeoInformatics\*\*\* 3
  - NRM638 GIS Programming◇ 3
- d. Complete at least two courses in Landscape electives:
- BIOL 469 Landscape Ecology and Wildlife Habitat\*\*\* 3
  - GEOS 304 Geomorphology\*\*\* 3
  - GEOS 408 Photogeology\*\*\* 3
  - GEOS 430 Statistics and Data Analysis in Geology\*\*\* 3
5. Minimum credits required 120