University of South Carolina
Carolina Core

GEOGRAPHY 104
INTRODUCTION TO PHYSICAL GEOGRAPHY

BULLETIN INFORMATION
GEOG 104: Introduction to Physical Geography (3 credit hours)
Course Description:
Basic concepts of landform geography, climatology and meteorology, and biogeography

SAMPLE COURSE OVERVIEW
Physical geography synthesizes and connects elements of our physical environment as they relate to human beings. It includes many aspects of various earth and life sciences, but expresses them in a way that emphasizes patterns of interaction between elements and with humankind. This means that physical geography, like other branches of geography, examines spatial relationships – not only where things are, but also the processes that underlie the observed patterns. The objective of this course is to provide a systematic introduction to physical geography, including the major components of the earth system (atmosphere, hydrosphere, biosphere and lithosphere) as well as regulatory processes, distribution patterns of important aspects, and impacts of human activity.

ITEMIZED LEARNING OUTCOMES
Upon successful completion of Geography 104 students will be able to:

1. Explain important terms associated with the scientific method, including hypothesis formulation and testing, experimental design, the method of multiple working hypotheses, and opposite concepts such as inductive vs. deductive reasoning and empirical vs. theoretical methods;
2. Demonstrate an understanding of the laws of science that operate in the atmosphere, biosphere, hydrosphere, and lithosphere to produce geographic patterns of weather, climate, life and landforms;
3. Describe the physical principles and processes governing the circulation and characteristics of the atmosphere and climates on Earth;
4. Illustrate the movement of water through the Earth's various systems, and link these movements to patterns of major water quantity and quality issues;
5. Summarize the factors that control the distribution of organisms and map basic global patterns of vegetation types;
6. Evaluate theories about natural and anthropogenic climate change and use current understanding about climate change to address local to international-scale policies designed to address this issue;
7. Critically analyze geomorphological issues at multiple spatial and temporal scales and establish linkages to societal concerns; and

8. Collect and analyze time series data and aerial photographs to describe Earth's processes and landforms.

SAMPLE REQUIRED TEXTS/SUGGESTED READINGS/MATERIALS

1. Christopherson, R.W. 2012. Elemental Geosystems (7th ed.). Prentice-Hall, Upper Saddle River, NJ. Additional handouts and readings will be made available through the course's Blackboard site: https://blackboard.sc.edu.

SAMPLE ASSIGNMENTS AND/OR EXAMS

1. **Exams:** There are four exams over the course of the semester, including a non-comprehensive final. In the first exam, students will demonstrate their understanding of terminology associated with atmospheric composition and structure and apply theories of radiation and energy to the earth's energy budget. In the second exam, students must build on the concepts from the first section to explain patterns and processes associated with atmospheric moisture, severe weather, global climate, and the cycling of water in its various forms. For the third exam, students will need to demonstrate their understanding of the factors that control the distribution of organisms and human activities that alter these patterns, the causes and consequences of climate change at a range of temporal scales, and natural- and human-related factors that shape the characteristics of soils. The last exam tests a student's understanding of past environmental conditions, how they have changed, and the processes involved, including human actions and natural agents, and Earth's landforms and the associated processes. Exam formats consist primarily of objective questions (multiple-choice, true/false, selection of numbers or letters from diagrams), along with short answer questions that explore a student's ability to convey their knowledge of relevant concepts.

2. **Activities:** In addition to standard class meetings, which consist of a mix of lecture and discussion material, several class sessions are devoted to hands-on activities that require students to apply the information presented in the lectures. The emphasis of these activities is on empirical observations, measurements, computations, and analytical reasoning. Students are responsible for turning in a completed assignment that will be based on each day's activity (*see descriptions following the tentative schedule*).
    a. **Activity 1: Energy Budgets:** The purpose of this activity is to help students understand the global radiation budget as a driver for atmospheric and earth processes. Using NASA datasets and global maps, students will explore how albedo differs over the globe and calculate total incoming radiation for different times of the year. Additionally, students will explore the concepts of solar radiation as a function of latitude and relevant energy flux calculations using a globe and light demonstration model.

    b. **Activity/Demo 2: Winds and Pressure:** The goal of this activity is for students to understand the forces that drive the wind and the resultant patterns of global

circulation. A demonstration using colored water of different temperatures will be performed to show how differential heating drives air movement. Student will then need to develop their own models of global circulation patterns.

c. **Activity 3: Severe Weather:** Today's class will be a hurricane case study. Students will use storm data to map approximate storm tracks, and graph how temperature, wind speed and barometric pressure vary over the lifetime of the storm. A class discussion will help students interpret the graphs and place hurricanes in context with the concepts presented in Activity 2.

d. **Activity 4: Weather Prediction - Guest speaker from National Weather Service:** Today's activity will involve a guest lecture from one of the meteorologists based at the National Weather Service's (NWS) Columbia office. In addition to providing a summary of this lecture, students will be asked to keep a weather journal for the week based on information from commonly accessible websites (e.g., www.weather.com) and evaluate the accuracy of NWS predictions over the week.

e. **Activity 5: Water Resources:** Using data on the world's water distribution, students will calculate the percentage of water that is available to humans and examine graphics that illustrate the distribution. The goal is to have students develop a sense of where the world's water is located and how it moves through the Earth system. They will also be calculating a 'water footprint', which (like an ecological footprint) is a measure of their water usage.

f. **Activity 6: Campus Plant Walk:** Today's class will introduce you to common tree leaf forms (e.g., deciduous vs. evergreen; broadleaf vs. needleleaf) and adaptations through a short on-campus demonstration. Students will then be given a dataset indicating the abundance of different species across the United States, which they will need to: 1) summarize using common ecological measures, and 2) explain on the basis of the species observed in those locations.

g. **Activity 7: Paleoenvironmental Reconstruction:** The purpose of today's activity is to introduce students to the use of dendrochronology, the science associated with the use of tree ring patterns, for reconstructing past climate patterns. After a brief overview, students will: 1) be given a dataset for which you will determine the statistical relationship between tree ring widths and precipitation, and 2) use that relationship to predict past rainfall patterns going back more than 1500 years and identify periods of drought conditions.

h. **Activity 8: Sea Level Change:** The purpose of the activity today is for students to assess the natural- and anthropogenic-based changes in sea level for various locations in the United States. Students will use recent sea level curves from the National Oceanic and Atmospheric Administration (NOAA) and future sea level

predictions from the Intergovernmental Panel on Climate Change (IPCC) to reconstruct the past and predict the future. You will also analyze topographic data, available online, with the sea level rise to determine the net effect of sea level change (shoreline position).

i. **Activity 9: Dune Migration and Climate Change:** Today students will analyze sand dune migration and the relationship to historical and future climate scenarios, with a focus on wind and precipitation regimes. Students will also obtain wind and sedimentological data from active dune fields to estimate sediment transport rates using models. The results will be compared to migration rates estimated by the students using historical imagery on Google Earth.

SAMPLE COURSE OUTLINE WITH TIMELINE OF TOPICS, READINGS/ASSIGNMENTS, EXAMS/PROJECTS

Part 1: Earth-Sun Relationships and Energy Concepts

Week 1:	Class 1:	Overview of Physical Geography
Week 2:	Class 2:	Lecture: Solar Radiation and Seasons
	Class 3:	Lecture: Energy Transfer Mechanisms
	Class 4:	Activity 1: Energy Budgets
Week 3:	Class 5:	Lecture: Atmospheric Temperature
	Class 6:	Lecture: Atmospheric Composition
Week 4:	Class 7:	Lecture: Pressure and Winds
	Class 8:	Lecture: Global Circulation
	Class 9:	Activity/Demo 2: Winds and Pressure
Week 5:	Class 10:	Exam 1

Part 2: Global Energy Distribution, Circulation and Climate

	Class 11:	Cyclone Systems Including Hurricanes and Tornadoes
	Class 12:	Activity 3: Severe Weather
Week 6:	Class 13:	Moisture and Humidity
	Class 14:	Lifting and Stability
	Class 15:	Activity 4: Weather Prediction: Guest Speaker from National Weather Service
Week 7:	Class 16:	Lecture: The Hydrologic Cycle
	Class 17:	Lecture: Water Resource Issues and Management
	Class 18:	Activity 5: Water Resources

Week 8: Class 19: Exam 2

Part 3: Water, Biogeography and Soils

Class 20: Lecture: Controls and Patterns of Species Distribution
Class 21: Activity 6: Campus Plant Walk

Week 9: Class 22: Lecture: Ecological Concepts
Class 23: Lecture: Threats to Global Biodiversity

Week 10: Class 24: Lecture: Long-term Perspectives on Climate Change
Class 25: Lecture: 'Recent' Climate Variability: The Holocene
Class 26: Activity 7: Paleo-environmental Reconstruction

Week 11: Class 27: Soil Characteristics and Processes
Class 28: Challenges to Soils in the 21st Century
Class 29: Exam 3

Part 4: Earth Surface Processes and Patterns: Landforms

Week 12: Class 30: Lecture: Weathering and Mass Wasting
Class 31: Lecture: Fluvial (river) Processes
Class 32: Lecture: Fluvial (river) Landforms

Week 13: Class 33: Lecture: Coastal Processes
Class 34: Lecture: Coastal Landforms
Class 35: Activity 8: Sea Level Change

Week 14: Class 36: Lecture: Aeolian (windblown) Processes

Week 15: Class 37: Activity 9: Dune Migration and Climate Change
Class 38: Lecture: Glaciers
Class 39: The Physical Geography of South Carolina

Final exam according to university exam schedule