ESCI-131L: LAB IN PHYSICAL GEOGRAPHY

Cuyahoga Community College

Viewing: ESCI-131L : Lab in Physical Geography

Board of Trustees:
January 2023

Academic Term:
Fall 2023

Subject Code
ESCI - Earth Science

Course Number:
131L

Title:
Lab in Physical Geography

Catalog Description:
The course provides laboratory exercises which use the scientific method to explore topics covered in Physical Geography. This includes the Earth's atmosphere, hydrosphere, biosphere and lithosphere. The laboratory experience includes the observation and interpretation of weather data, statistical analysis of climate data, hydrology, map analysis, remote sensing and spatial data interpretation, analysis of earth materials, along with landform processes, plate tectonics, and biogeography.

Concurrent enrollment in Lecture in Physical Geology is strongly suggested.

Credit Hour(s):
1

Lecture Hour(s):
0

Lab Hour(s):
3

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
ESCI-1310 Physical Geography or concurrent enrollment.

Outcomes

Course Outcome(s):
Apply hands-on laboratory techniques and safety measures to daily life.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Use the metric system to measure temperatures, lengths, and volumes.
2. Describe the five main themes of geography and how they are related to daily life.
3. Acquire spatial literacy by reading, interpreting and analyzing topographic maps.
4. Interpret weather maps and locate fronts and pressure systems.
5. Explain the characteristics of the global climate system.
6. Discuss causes of climate change, both natural and anthropogenic.

Course Outcome(s):

Demonstrate how the basic interactions between the sun and the earth's subsystems of the lithosphere, biosphere, hydrosphere and atmosphere affect such things as climate, seasonal changes, and hydrology, large scale tectonic processes, and distribution of landforms.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

1. Measure and differentiate between specific heat and latent heat.
2. Explain the relationships that exist between atmospheric pressure and altitude.
3. Explain the relationships that exist between temperature, albedo, radiation and conduction.
4. Explain the different temperature patterns, both lateral and vertical, that occur on earth.
5. Explain the formation, direction and velocity of winds as they relate to atmospheric pressure patterns.
6. Classify climates on the bases of temperature and precipitation.
7. Explain the hydrologic cycle.
8. Describe the flow of water both above and below the ground.
9. Explain the characteristics of soil horizons.
10. Discuss the oxygen, carbon and nitrogen cycles.
11. Construct food chains.
12. Explain the global distribution of plants and animals.
13. Discuss the various plate tectonic boundaries and their relationships to earthquakes and volcanoes, as well as to topography.
14. Determine vapor pressures, relative humidities and dew points.
15. Explain the biases of the different types of map projections.
16. Interpret aerial photos and remote sensing images, both historic and contemporary.
17. Discuss the relationships between earth-sun positions and latitude and longitude.

Course Outcome(s):

Students will become geographical problem-solvers capable of using qualitative, quantitative and/or spatial methods of research within the context of physical geography.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Identify the geographic contexts relevant to an inquiry.
2. Acquire and manipulate data relevant to a geographic inquiry.
3. Assess the results of a data-driven geographical inquiry.

Course Outcome(s):

Develop the ability to see meaningful relationships between people, places, and the environment.

Essential Learning Outcome Mapping:

Civic Responsibility: Analyze the results of actions and inactions with the likely effects on the larger local and/or global communities.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Analyze human-environment interaction(s) for a specific case and for specified social and/or environmental conditions.
2. Identify, collect and process digital spatial and tabular data using various repositories.
3. Employ appropriate geospatial analysis methods and interpret the results.

Methods of Evaluation:

a. Weekly experiments, including pre and post lab questions
b. Lab exams (practicals)
c. Participation in class discussions and field trips
d. Laboratory reports
e. Article summaries (current research in physical geography)

Course Content Outline:

a. The metric system
    i. Units of mass
    ii. Units of length
    iii. Units of temperature
    iv. Units of volume
    v. Conversion of all units
b. Mapping
    i. Using a compass correctly
    ii. The geographic grid - latitude and longitude; map projections and their properties
    iii. Scales - graphic, verbal and representative fractions
    iv. Isolines - their construction and interpretation
    v. Other map components - legend, magnetic declination, symbology
    vi. Topographic maps
    vii. Remote sensing, aerial photos, and image analysis
c. Earth-sun relationships
    i. Date-latitude determinations
    ii. Time-longitude determinations
    iii. Milankovitch cycles
    iv. Obliquity, precession and elliptical movements
d. Energy transfers
    i. Specific heat
    ii. Latent heat
    iii. Land/Water differences

e. Atmospheric pressure
    i. Relationship to altitude
    ii. Partial pressures
    iii. Structure and composition of the atmosphere
f. Temperature
    i. Relationship to albedo
    ii. Radiation vs. conduction as means of heating
    iii. Wind chill
    iv. Effect of altitude of the sun's rays on rate of heating
    v. Solar heating
    vi. Diurnal patterns
    vii. Seasonal patterns
    viii. Latitudinal patterns
    ix. Continental and maritime climate patterns
    x. Effect of currents
    xi. Effects of altitude - Environmental Lapse Rate
g. Winds
    i. Coriolis effect, pressure gradient force and friction
    ii. Isobars as determinants of winds - directions and velocity
    iii. Origin of wind, and interpretation of weather maps

h. Precipitation
    i. Water vapor and vapor pressure
    ii. Determination of vapor pressure, relative humidity and dew points using the sling psychrometer

   iii. Identifying and analyzing precipitation patterns using near to real time data
   iv. Location as a control of precipitation
   v. Season as a control of precipitation
   vi. Precipitation processes
i. Interpretation of weather maps
   i. Station models
   ii. Relationship of front locations to weather conditions
j. Storms
   i. Hurricanes
   ii. Tornadoes
   iii. Large scale climate oscillations (El Nino, La Nina)
k. Climatology
   i. Climate change
   ii. Climate classification
l. Hydrology
   i. Hydrologic cycle
   ii. Permeability and porosity
   iii. Aquifers and water tables
   iv. Drainage basins and divides
   v. Great Lakes hydrology
   vi. Water budgets
m. Pedology
   i. Identify the origins of soils
   ii. Analysis of local soils
   iii. Comparison of different soil types
n. Ecology
   i. Ecosystem interactions
   ii. Biogeochemical cycles
   iii. Effects of pH
   iv. Food chains
o. Plant and animal geography
   i. Transpiration rates
   ii. Biota and climate relationships
   iii. Environmental lapse rates
p. Plate tectonics
   i. Plate boundaries
   ii. Mechanism of plate movement
   iii. Past continental locations and associated climates
   iv. Landforms distribution and correlation to plate boundaries
   v. Volcanic and earthquake activity as a result of earths properties
q. Landforms
   i. Relationship to climate
   ii. Stream erosion and deposition
   iii. Ground water erosion and deposition
   iv. Glacial erosion and deposition
   v. Aeolian erosion and deposition
r. The scientific method
   i. Development and short history of the scientific method
   ii. Differences between hypotheses and speculation
   iii. Integrating deductive and inductive methods
   iv. Systematic studies and empirical data

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Resources

Christopherson, R. W Charles Thomsen. *Applied Physical Geography, Geosystems in the Laboratory*. 10th ed. Prentice-Hall, 2018.

Hess, Darrell. *Laboratory Manual for Physical Geography: A Landscape Appreciation*. 13th ed. Prentice Hall, 2021.

Strahler, Alan and Mark Potosnak. *Laboratory Manual for Physical Geography*. 3rd ed. Wiley, 2010.

Resources Other

a. **Articles and Research Used as Additional reading in the course**: Christopherson, R. W. Elemental Geosystems - A Foundation in Physical Geography. 7th ed. Prentice-Hall, 2008.
b. De Blij, H. J., Williams, R.S, and P. O Muller. Physical Geography of the Global Environment. 3rd ed. Oxford: Oxford Press, 2004.
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j. Soil Science Society of America. "Why is Soil Important?" Accessed: 6/12/18; https://soils.org/files/science-policy/sssa-marketing-2013.pdf
k. Steele, Erin M. Correlation of Terraces in the Chagrin River Valley with Ancestral Levels of Lake Erie, Northeastern Ohio Akron, OH : University of Akron, 2007; https://olc1.ohiolink.edu/record=b42127699~S0 (https://olc1.ohiolink.edu/record%3Db42127699~S0/)
l. Book Title: *Water on Earth: Physicochemical and Biological Properties.* Title: Chapter 2: Theories about the Origin of Water on Earth Author: Lécuyer, Christopher. Book Editors: Mariotti, André (https://onlinelibrary.wiley.com/action/doSearch/?ContribAuthorStored=Mariotti%2C%2BAndr%C3%A9) and Jean#Charles Pomerol (https://onlinelibrary.wiley.com/action/doSearch/?ContribAuthorStored=Pomerol%2C%2BJean-Charles) Web Address: https://doi.org/10.1002/9781118574928.ch2 Publisher: Wiley Online Library. Published: 02/10/2014.
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o. Title: *Ocean fertilization: a potential means of geoengineering? Journal: Philosophical Transactions of the Royal Society. Authors:* R.S Lampitt, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* E.P Achterberg, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* T.R Anderson, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* J.A Hughes, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* M.D *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* Iglesias-Rodriguez, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* B.A Kelly-Gerreyn *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*),* M Lucas *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*),* E.E Popova *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*),* R Sanders *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*),* J.G *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* Shepherd, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* D Smythe-Wright, *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*)* A Yool *(*https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139*). Web address/Origin:* https://royalsocietypublishing.org/doi/full/10.1098/rsta.2008.0139 *Date: 09/29/2008.*
p. Title: Climate change: Climate engineering through stratospheric aerosol injection Journal: *Progress in Physical Geography: Earth and Environment*, *36*(5), 694–705. Author: Hulme, Mike. Web Link/Address: https://doi.org/10.1177/0309133312456414 (https://doi.org/10.1177/0309133312456414/) Date: 2012.
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s. Title: Tides, Ocean Explorer, Multimedia Mission. Author: National Oceanic and Atmospheric Administration Date: 02/12/2013. Web Address/Origin: https://oceanexplorer.noaa.gov/edu/learning/player/lesson10.html
t. Title: Tides and Currents, Education. Author: National Ocean Service, National Oceanic and Atmospheric Administration. Web Address/Origin: https://tidesandcurrents.noaa.gov/education.html Date: 08/08/2018.
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w. Title: Our oceans are haunted by ghost nets: Why that's scary and what we can do. Author: Hancock, Lorin. Web Link/Address: https://www.worldwildlife.org/stories/our-oceans- (https://www.worldwildlife.org/stories/our-oceans-are-haunted-by-ghost-nets-why-that-s-scary-and-what-we-can-do--22/) are-haunted-by-ghost-nets-why-that-s-scary-and-what-we-can-do--22 (https://www.worldwildlife.org/stories/our-oceans-are-haunted-by-ghost-nets-why-that-s-scary-and-what-we-can-do--22/) Date: 06/25/2019.

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Instructional Services

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