# ENVIRONMENT AND NATURAL RESOURCES 3700

## Introduction to Spatial Information for Environment and Natural Resources SPRING 2019
## (3 Credit Hours)
## Semester Syllabus

**This syllabus provides a tentative schedule and the best summarizations of course policies to date. This schedule and policies may require further clarification or it may be necessary to change them. If there is to be a change, it will be announced in lecture and you will be notified by email.**

**Course Instructors:**


**Dr. H. Alexis Londo**
*Director for the Applied Geospatial Analysis and Remote Sensing Outreach Program*
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**ALWAYS available by appointment**.

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Office hours: 9 – 10 am Mon and Wed, KH 469A (in Columbus only on lecturing days) or by appointment.


**Office hours will be posted on Carmen**

Any of us are available during the posted office hours or by appointment. If you can not see us during our posted times, please just email us and we will find a time that works.

**Teaching Assistants:**

Lab Instructor: Philip Gould gould.199@buckeyemail.osu.edu Office Hours: Wednesday 9 – 11 Kottman Hall 382
Laura Mason mason.567@buckeyemail.osu.edu, Office Hours: Tuesday 12 - 2 in Parker Food Sci 061A.
Maritza Pierre pierre.77@buckeyemail.osu.edu Office Hours: Monday 3-5 Kottman Hall 247

**Times and Location: -**

Lecture Monday and Wednesday – 8:00 - 8:55 – Howlett Hall 164
Lab - 3700- Monday 10:00 – 1:00 Kottman Hall 114 – M. Pierre
Lab - 3700- Tuesday 3:00-6:00 Kottman Hall 114 – P. Gould
Lab - 3700- Wednesday 4:10-7:10 Kottman Hall 114 – L. Mason
Lab - 3700- Friday 12:45 – 3:45 Kottman Hall 114 – M. Pierre

**ATTENDANCE AT LABORATORY IS MANDATORY! Unexcused lab absences will result in a 25% reduction in the week's assignment.**

**Student Learning Goals:**

Students will gain an understanding of the principles, theories, and methods used in geospatial information (GIS), remote sensing (RS) and global positioning systems (GPS). Students will be introduced to the criteria for and practice of spatial data acquisition, organization and applications (including GIS, RS, and GPS), the implications of readily available spatial information and the potential of science and technology to address problems of the contemporary world.

**Expected Learning Outcomes:**

1. Students will develop a basic understanding of the nature and representation of geographic data; specifically, students understand the basic facts, principles, theories and methods of spatial information management as related to GIS, RS and GPS technologies.
2. Students explore examples of the interdependence of scientific and technological developments and management of the Earth's resources.
3. Students will learn interpretation and measurement techniques used to create extract, and manipulate information from various data types inherent to GIS, RS and GPS technologies.
4. Students discuss social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world, particularly environmental issues, food security, and human health.

**Specific Learning Outcomes:**

1. Students understand the nature of spatial information of the environment

2. Students explore various technologies for data acquisition and organization
3. Students learn about important spatial information forms and representations
4. Students examine the role of spatial information and systems in understanding and managing natural resources
5. Students learn about methods for assessing environmental change

Learning goals and objectives will be satisfied through a sequence of lectures, computer lab exercises and demonstrations, online presentations, in-class discussions, quizzes, individual feedback, and assigned readings.

**Course Description:**
This introductory course in spatial information for natural resources and environment presents the basic concepts and vocabulary of spatial information systems and geospatial technologies, particularly in the context of environmental management. During the course we will examine spatial information systems, remote sensing and aerial imagery, GPS systems for spatial location, spatial modeling and methods for assessment of temporal change in natural and managed ecosystems. Students will learn how to access use a variety of spatial data including map data, digital aerial photography and high-resolution satellite imagery in conjunction with geographic information systems (GIS), digital elevation models (DEMs), and Global Positioning Systems (GPS) to solve problems in the natural resources.

There will be a basic introduction to traditional paper-based maps and aerial photos. However, the emphasis is on computer-based interpretation, measurement, and analysis of digital vertical imagery, and integration with other spatial data. The central goal is to teach students how to use a wide range of data in GIS software, as would be expected for many jobs (private and public) in natural resources management. Basic geographic and cartographic principles such as resolution, distortion, and map scale will be introduced. Students will learn to make professional quality maps for presentations and reports using Geographic Information Systems. An introduction to basic non-digital interpretation techniques using paper aerial photographs will be provided. We will learn techniques to capture and analyze information from digital imagery for use in modern GIS software. An introduction to the wide range of problems in the natural and environmental resources where spatial data are useful will be discussed. Applications of spatial information in a variety of natural resource management scenarios including agriculture, forestry, wildlife, wetlands and aquatic systems, urban and other highly disturbed systems will be introduced, Students will learn how to identify a wide range of natural and anthropogenic features in aerial imagery and to make basic measurements for natural resources inventory and land use change.

The basic skills needed to use air photos, multi-band satellite imagery, and digital elevation models within geographic information systems (QGIS, Google Earth, ArcGIS) will be practiced. Students will be introduced to public sources for free digital vertical imagery to use in this class and future work.

**Course Materials:** You will need a **16 GB USB jump drive or larger** or some equivalent suitable method for storing lab output **(DO NOT COME TO LAB WITHOUT THIS).** The following textbooks are useful, but not required:

> ***GIS Fundamentals: A First Text on Geographic Information Systems***
> Author: Paul Bolstad
> Publisher: Eider Press; 4th Edition (2012)
> ISBN-13: 978-0971764736
>
> ***Remote Sensing and Image Interpretation***
> Authors: Thomas Lillesand, Ralph W. Kiefer, Jonathan Chapman
> Publisher: Wiley; 6th edition (2007)
> ISBN-13: 978-0470052457

Other readings and media required or recommended for the course will be posted on Carmen.

**Prerequisites:** Not open to students with credit for ENR 3750.

**Course Content:**
Reading assignments from textbooks and online sources are intended to complement lecture material presented in class, and will be referenced on the Carmen page for the course. Most lectures will be directly related to assigned readings. The objective of the lectures will be to present and clarify important concepts and provide some supplemental material. Students are responsible for subject matter covered in lecture, assigned readings, and any handouts. Handout pages of all lectures will be provided on the course web page on Carmen (soon to come).

**Assessment Format:**

The course will be assessed using performance on quizzes, homework, exams, a comprehensive final exam, and laboratory reports/assignments. The quizzes can encompass lab and lecture material. Most lab sessions will involve an assignment to complete and turn in at the end of lab or at a later lab session as indicated by the lab instructor; most will be submitted online. **Attendance at both the lecture and laboratory is mandatory. Unexcused lab absences will result in a 25% reduction in the week's assignment**. Excused absences must be taken care of before the absence (when possible) by email. Each student will be allowed to make up one EXCUSED absence (sickness, death in family etc.) without penalty. The final is comprehensive.

**Important Dates:** **Final Exam Thursday April 25, 2019, 8:00 am to 9:45 in Howlett Hall 164**
**Tentative Exam Dates: February 18 and March 27. These dates are subject to change. If moved forward, you will be given at least a weeks' notice. If pushed back you will be given at least 5 days' notice.**

**Task Points % of Grade:**

| | |
|---|---|
| Attendance/Participation/Quizzes | 10% |
| Weekly Laboratory | 30% |
| Final Lab Project | 15% |
| Two Exams | 25% |
| Final Exam (Cumulative) | 20% |
| TOTAL | 100% |

The grading scale is 93 - 100 (A) 90 - 92.9 (A-) 87 - 89.9 (B+) 83 - 86.9 (B) 80 - 82.9 (B-) 77 - 79.9 (C+) 73 - 76.9 (C) 70 - 72.9 (C-) 67 - 69.9 (D+) 60 - 66.9 (D) Below 60 (E)

****** You must have a passing average on Labs and final project (combined for 45% of your grade-average), in addition to a passing average on exams and attendance (the other 55 % of your course) in order to pass the course! If you have a failing average for either one of these categories you will fail the class.**

**Assignments are due at the beginning of class or lab period. Late assignments will result in a 10% reduction in possible points from which to start the grading for each day the assignment is late. You must have email consent from the instructor to turn in assignments late without penalty. This must be dated before the assignment is due. Late assignments will only be accepted up to 7 days after the date for which the assignment was originally due.**

**If you will be unable to take an exam, arrangements to make up an exam must be made by email at least 3 days prior to the exam and be documented by email confirmation. If you miss an exam and have not made arrangements before the exam period you will not be able to make up the missed exam except in extreme circumstances and with the approval of the professor.**

**You must have a passing average for your exams and for your labs to pass this class.**

**Academic Misconduct:** Academic misconduct (plagiarism, cheating, and other forms of misconduct as defined by the university) will not be tolerated. According to Faculty Rule 3335-31-02, academic misconduct is defined as any activity that tends to compromise the academic integrity of the institution or subvert the education process. Please see the Student Resource Guide or instructor if you have further questions.

**Special Needs:** If you have a disability that requires accommodations please make an appointment with me as soon as possible (preferably the first week of the semester) to make arrangements as necessary. Please also coordinate with the OSU Office of Disability Services (http://www.ods.ohio-state.edu, 614-292-3307).

**Take Care of Yourself:** A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other, and alcohol use among the top ten health impediments to academic performance. Students experiencing personal problems or situation crises during the semester are encouraged to contact the OSU Counseling and Consultation Service (http://www.ccs.osu.edu; 614-292-5766) for assistance, support, and advocacy. This service is free and confidential.

**Course Outline and Schedule:**

Please note that the lecture and laboratory topics are subject to change depending on our progress through the lecture material and the laboratory exercises. In particular, some laboratory exercises may take more than 1 session to complete.

**Tentative Lecture Topic Schedule**

| Week | Topic |
|---|---|
| | |
| 1 | Introduction, Syllabus and Course Outline.<br>Parts of a map! Types of Maps. Information obtained from maps. |
| 2 | What is Spatial Information? Coordinate systems, projections.<br>Why we need them, troubleshooting projection problems. Define Location. |
| 3 & 4 | Introduction to spatial information systems and GIS and datatypes.<br>What are the data types? What information is stored in each data type? What are the implications of converting from one type to the other type? Topology |
| 5 | GIS operations. How are these operations different from data type to data type? What results does each operation give you? What results do you want? |
| 6 | Scale and Orientation<br>Georectification. Summary of how coordinate systems and data types affect our spatial information. |
| 7 | **EXAM**<br>GPS data technology and data collection |
| 8 | GIS Applications. Interaction with vegetation and nonvisible portion of the EMR. How do we remote sensing with the vegetative principles. |
| 9 | Introduction to Remote Sensing – Electromagnetic Radiation (EMR).<br>Considerations for using EMR to obtain information for natural resources.<br>Resolutions of digital data and active vs. passive sensors. |
| 10 | SPRING BREAK |
| 11 | Image enhancements for data extraction and image viewing principles.<br>Hyperspectral, Multispectral, and Thermal applications for natural resource management. |
| 12 | **EXAM**<br>Resolution scattering and spectral curves |
| 13 | Remote Sensing Attributes<br>Aerial Photo history and principles. Photo interpretation techniques. |
| 14 | Image Interpretation and Classification<br>Hybrid and Object Oriented Classification<br>Lidar |
| 15 | Catch Up |
| | **FINAL PROJECT DUE April 22, 2019 by 5:00 pm**<br>Wrap up topics and Exam Review |