NR 426 – Programming for GIS I
SYLLABUS – Fall 2020   COVID EDITION
Department of Ecosystem Science and Sustainability | Warner College of Natural Resources

COURSE DETAILS

Credits: 2

Class meetings: Tuesday / Thursday 11:00 – 12:50pm

Instructor: **Elizabeth Tulanowski**

Office hours: Online through Microsoft Teams: Mondays 3-4pm ; Tuesdays 7-8pm

Course Length: 8 weeks

Warner computer lab, Rm 232 (both sides)

Email: _E.Tulanowski@colostate.edu_

Important COVID information for Students:

All students should fill out a student-specific symptom checker each day before coming to class

https://covidrecovery.colostate.edu/daily-symptom-checker/

In addition, please utilize the symptom checker to report symptoms, if you have a positive test, or exposed to a known COVID contact. If you know or believe you have been exposed or are symptomatic, it is important for the health of yourself and others that you report it through this checker. You will not be in trouble or penalized in any way for reporting. If you report symptoms or a positive test, you will receive immediate instructions on what to do and CSU's Public Health Office will be notified. Once notified, that office will contact you and most likely conduct contact tracing, initiate any necessary public health requirements and/or recommendations and notify you if you need to take any steps.

For the latest information about the University's response, please visit the CSU COVID-19 site
(https://covidrecovery.colostate.edu/).

COURSE MODIFICATIONS for social distancing due to Covid-19:
1. We will have 20 students in a space that can fit 49 so students can spread out.
2. Cleaning protocols: You must wipe down your workstation before and/or after sitting there.
3. Instructor will provide in-person assistance from 6 feet away. Screen-sharing with Microsoft Teams will be used so students' screens can be shown on the projector and the instructor can point to things from up front.
4. The instructor and every student will wear a mask at all times to limit spread of germs.
5. Office hours will be held online using Microsoft Teams. Students can share their screen to get help troubleshooting.

Course Overview: Fall 2020

This is a programming course for non-programmers. Previous Python experience is helpful but not required. By the end of the 8 weeks you should feel comfortable writing basic scripts to solve GIS problems and manage or update data, as well as seeking out the answers you need from the help and other online resources.

This Fall 2020 semester we will offer **lectures via video** which you are to watch before the class session on that topic. Our **in-class lab sessions** will focus on clarifying complex topics, doing live demos, troubleshooting, and working on labs. It will be similar to a flipped classroom. *This only works well if you actually do the work ahead of the lab sessions.* 😊

Official Course Description

Introduces students to basic computer programming concepts that can be used in a GIS environment. Develops the programming skills needed to create scripts for automating GIS data management and analysis, accessing spatial data and properties, performing queries, retrieving data values from tables, and incorporating logic and looping. Emphasizes best practices for writing code, error handling, and demonstrates how to share and publish these scripts.

Course Objectives

1. Demonstrate an understanding of object-oriented programming
2. Define the capabilities of scripting in a GIS environment
3. Implement appropriate programming methods and functions for a task
4. Extend the functionality of GIS applications using scripting
5. Automate geoprocessing tasks and complex spatial workflows with scripts
6. Implement techniques for proper error handling and user feedback within a script
7. Prepare script tools that can be run from GIS software or shared with users
8. Design and develop a complete tool for performing work-related tasks using scripting

COURSE MATERIALS

Required Text: Python Scripting for ArcGIS Pro. (PSA book). Paul Zandbergen. Esri Press. Available online through VitalSource for purchase or rental, and Amazon, and through the campus bookstore.

Video lectures for all lessons will be available as a YouTube playlist. You are to watch them BEFORE the assigned class session so we can focus on demos and independent exercises during lab.

> This playlist will be updated frequently as new videos are made.

Additional readings/videos may be assigned, these will be announced in lecture and available online.

Software

This course will use Python 3.6 and the PyCharm Community Edition 20xx, for writing the code. Most scripts will also require that **ArcGIS Pro v. 2.6** be installed on the machine you use.

> Your options for accessing the software we need:

1. Natural Resources building – computer lab in Room 232 (our classroom) and in Room 107
2. Install ArcGIS Pro and PyCharm locally on your own **_Windows_** computer (Not a Mac. It doesn't work on Macs)
   o Download the installation instructions can be found on Canvas > Course Documents
   o Install PyCharm from here
   o After installation, PyCharm will need to be configured to work with arcpy, as directed in the PDF on Canvas > Course Documents). We will do this together in class as on Day 1.
3. Borrow a WCNR laptop, which have Pro and PyCharm installed.
4. Use Remote Desktop to log on to a WCNR machine
   o Follow these steps from WCNR Help page and this how-to video

GRADING | Final Grade out of 1000 points

Category	Description
Laboratory exercises 40% (400 points)	**11** short hands-on Python scripting exercises to reinforce the concepts and perform geoprocessing tasks. A single lesson will typically have 2 associated lab exercises. These are due by the start of the next lesson.
Quizzes 30% (300 points)	**Six** short online, open-book quizzes through Canvas to test your understanding of each lesson. Refer to the Schedule for dates.
Project 25% (250 points)	Self-directed, hands-on project to assess students' understanding of the methods covered in class. Completed in lab and on your own time during the last two weeks of the course.
Class participation/ Engagement 5% (50 points)	Attendance is not mandatory this semester, but students are still expected to participate and engage in class. Raise and answer questions in class or by email/Canvas, demonstrate effort and time management being put forth for this course.

COURSE STRUCTURE

Face-to-Face class sessions

- This class will have two ~2-hour class sessions per week, TuesThurs 11am – 12:50pm.
- Attendance is not mandatory, but strongly encouraged to get live instruction, help you successfully complete the labs, and fully understand the concepts.
    - Our class will have both sides of the WCNR 232 lab this fall, so we can spread out.
    - If you choose to "opt-out" of live class sessions, please email Elizabeth to let her know your plans.
- Each class session will be taught in the computer lab with a mix of teaching techniques:
    - Software demos, and *follow-along* demos, Q&A (will be recorded and posted to Canvas)
    - Simple independent activities, to practice and test new skills
    - Lab exercises, where students will complete lab exercises which will get submitted to Canvas for a grade.
- The bulk of the lecture instruction will be provided by video, using pre-recorded videos and accompanying slides posted to Canvas.

Project

- The last four class sessions (two weeks) will be dedicated to the completion of a final project.
- Students will be writing the code to perform a typical work-related task using Python.
- Project topics will be provided, or you may choose a topic of your own.

Quizzes

- Six short **online quizzes** will be given throughout the semester, as indicated in the Schedule. Quizzes are open-book, and administered through Canvas. Late quizzes are not accepted without a valid, written excuse.

IMPORTANT DATES

Classes begin	Monday, Aug. 24th
Last day to drop / withdraw	Monday, Aug. 31st (8 week courses) / Mon. Sept. 21st
Labor Day (no classes)	Monday, Sept. 7th
Last day of NR426	Thursday, Oct. 15th
Final Project due	Friday, October 16th, 11:59pm

NR 426 Fall 2020 Tentative Schedule – Aug. 24 – Oct. 16

Week	Dates	Lesson #	Lecture Topic (Readings from PSA book)	Lab Exercise	Quizzes
1	Aug. 25	Lesson 0	Introduction (Ch. 1, 2, 3)	Lab 0 - Data management, setting up PyCharm, Meet ArcGIS Pro and Python	
	Aug. 27	Lesson 1a	Language syntax (Ch. 4)	Lab 1 - Python Basics	
2	Sept. 1	Lesson 1b	Language syntax (Ch. 4)	Lab 1 - Python Basics	Quiz 1a due Sept. 3, 11am
	Sept. 3	Lesson 1c	Language syntax (Ch. 4)	Lab 1 - Python Basics DUE Sept. 8, 11am	Quiz 1b due Sept. 8, 11am
3	Sept. 8	Lesson 2a	Accessing geoprocessing (Ch. 5)	Lab 2 - Working with arcpy	
	Sept. 10	Lesson 2b	Accessing geoprocessing (Ch. 5, 10)	Lab 2 - Working with arcpy DUE Sept. 15, 11am	Quiz 2 due Sept. 15, 11am
4	Sept. 15	Lesson 3a	Iterating with spatial data (Ch. 6)	Lab 3 - Listing and looping through spatial data	
	Sept. 17	Lesson 3b	Iterating with spatial data (Ch. 6)	Lab 3 - Listing and looping through spatial data DUE Sept. 22, 11am	Quiz 3 due Sept. 22, 11am
5	Sept. 22	Lesson 4a	Working with tables: Cursors and SQL (Ch. 8: 8.1-8.3)	Lab 4 - Working with tables	
	Sept. 24	Lesson 4b	Working with tables: Selections and Field Calculator (Ch 8: 8.3- 8.8)	Lab 4 - Working with tables DUE Sept. 29, 11am	Quiz 4 due Sept. 29, 11am
6	Sept. 29	Lesson 5	Error handling + Project intro (Ch. 7)	Lab 5 - Creating a publishable script tool	
	Oct. 1	Lesson 6	Creating tools + Project intro (Creating Script Tools PDF)	Lab 5 - Creating a publishable script tool DUE Oct. 6, 11am	Quiz 5 due Oct. 6, 11am
7	Oct. 6		Review + Final Project		
	Oct. 8		Final Project		
8	Oct. 13		Final Project		
	Oct. 15		Final Project	Final Project DUE Friday, Oct. 16th, 11:59pm	

OUTLINE OF TOPICS, WEEK BY WEEK:
1. Introduction
    a. Purpose of scripting
    b. Capabilities of scripting in GIS
    c. Examples of tools based on scripts
    d. Object-oriented languages
2. Language syntax
    a. Basic language structure: methods, functions, modules
    b. Creating variables: strings, numbers, lists
    c. Help resources
        i. Accessing help within the IDE and online
    d. Using logic to make decisions in a script
        i. For and while loops
        ii. If statements
3. Accessing geoprocessing functionality through a script
    a. Importing modules
    b. Accessing spatial data properties through a script
    c. Describing data
    d. Using data properties in if statements to make decisions
4. Writing code to iterate through a list of objects
    a. Working with lists of vector, and raster data, workspaces
    b. Running geoprocessing operations within a loop
5. Retrieving and modifying values from an attribute table through a script
    a. Working with the field calculator
    b. String manipulation and formatting
    c. Using cursors
6. Error handling and creating publishable tools
    a. Common error handling techniques, messaging
    b. Debugging tools
    c. Modifications needed to share scripts as tools
        i. Adding user arguments to a script
        ii. Use of existing tools as a guide
7. Final project, last 2 weeks of course: Create a fully functional script to perform a typical job-related task
    a. Choose a job-related task that can be accomplished with a script
    b. Prepare the data needed for this task
    c. Create an original script to accomplish this task
    d. Ideas/Topics and some data will be provided to get you started.

EXPECTATIONS

Expectations of Me:

My goal is to teach you the fundamentals of Python and how to write code to perform GIS operations.
- I will teach using up to date materials and offer relevant examples from the geospatial industry.
- I will strive to help you understand the concepts and am happy to provide extra help when necessary, but sometimes the best learning is done through some struggle – so you'll have to "figure it out" sometimes too!
- Quizzes and assignments will be graded within a week or two of the due date. I will typically respond to emails by the next day.

Expectations from You:
- **Be engaged**. You will get out of this course what you put into it. Start each week having watched the videos, read the assigned text, ready to discuss the content, or ask questions to facilitate better understanding
- **Complete assignments,** and on time.
- Adhere to the **academic code of conduct.**
- **Communicate**. Contact the instructor if you are having trouble (ie, understanding the material, keeping up with assignments, issues with a classmate).
- Be **respectful** of others. We can all learn from one another's stories, backgrounds, and ideas.
- **Help each other** when appropriate. Within the limits of the code of conduct, help each other out, study together, explain a difficult concept to a classmate who doesn't get it. Learn from each other, teach each other.

Final grades will be assigned using the following CSU grading scheme:

Grade	Score	Course Credit
A+	99 - 100	4.3
A	93.3 - 99	4.0
A-	90-93.3	3.7
B+	87-89	3.3
B	83-86	3.0
B-	80-82	2.7
C+	77-79	2.3
C	70-76	2.0
D	60-69	1.0
F	0-59	0

POLICIES

Health and Safety Precautions for COVID: Do not come to campus if you are sick. Wear a mask at all times. Wash your hands frequently. Clean your workstation when you arrive and before you leave. All public health guidelines will be enforced or you will not be allowed to attend class. More info here. Your patience and cooperation are greatly appreciated as we navigate this confusing and changing time.

Attendance Policy and Participation: Students are expected to either attend class or keep up with all assignments on their own. If you plan to take this course remotely, please communicate that with the instructor. All materials will be made available on Canvas.

Professionalism: Per university policy and classroom etiquette; mobile phones and devices must be silenced during all classroom and lab lectures. Those not heeding this rule may be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.
When emailing the instructor, please include your full name, CSU ID, and the course number in your email.

Late assignments / Make-up work: Late assignments and quizzes will not be accepted without a valid written excuse. If you are unable to attend class or complete assignments, please make arrangements with the instructor. This is the responsibility of the student.

Special Needs: Any student who needs special accommodations or has special needs is encouraged to speak with me about those needs within the first two weeks of the semester. Please work with the instructor to set up alternative due dates ahead of time, not after the assignments are due.

Academic Responsibility: All work in this course must be completed in accordance with the CSU academic honesty policy (http://catalog.colostate.edu/front/policies.aspx). Plagiarism or failing to meet the academic honesty policy in other ways will result in dismissal from class and will be reported. **By participating in this course, you agree to abide by the following honor pledge, "I will not give, receive, or use any unauthorized assistance in this course."**

Need Other Help?
CSU is a community that cares for you. Counseling Services has trained professionals who can help. Contact 970-491-6053 or go to http://health.colostate.edu. "Tell Someone" by calling 970-491-1350 to discreetly discuss your concerns (http://safety.colostate.edu/tell-someone.aspx).