

## **GEOG 5180/6180: Geoprocessing with Python**

\*\*\*\* DRAFT: Subject to change prior to Aug. 21 \*\*\*\*

Fall 2023, Units: 3

Prerequisites: GEOG 1180/3110 for 5180 (i.e. intro Python programming and GIS).

**Instructor:** Tom Cova      cova@geog.utah.edu  
Office:                    GC 4730  
Phone:                    801-581-7930  
Office Hrs:              Tue. 1:30-3:00 pm, Wed. 11:00 am -12:30 pm.

**When/where:** Mon. 3:30 pm – 6:30 pm, GC 1825 (Computer Lab)

**Text:** S. Rey, D. Arribas-Bel, L. Wolf (2023) *Geographic Data Science with Python*.  
<https://geographicdata.science/book/intro.html#>  
*Optional:* Zandbergen, P. (2020) *Python Scripting for ArcGIS Pro*. ESRI Press.  
*Optional:* Any introductory general-purpose Python 3.x book.

### **Course scope and objectives**

This course is an introduction to programming in the Python language as it pertains to manipulating and analyzing geographic information. Broadly the course will cover: 1) principles and good practice in computer programming, 2) the Python language, 3) manipulating and analyzing geographic information with Python, 4) scripting with Python in ArcGIS Pro, and 5) Python toolkits for the web, databases, and Graphical User Interfaces (GUIs). The lab and lecture are one and the same, and each week will consist of a presentation of concepts and background followed by lab exercises involving hands-on programming or scripting. The last month of the course will consist of individual programming projects.

Upon completion of this course, students will be able to:

1. *Recall* the fundamental definitions and principles to program in Python.
2. *Understand* the inner workings of Python programs for geoprocessing.
3. *Develop* and *code* new algorithms for geoprocessing in the Python language.
4. *Develop* and *code* Python scripts for geoprocessing in ArcGIS.
5. *Utilize* Python to access a host of libraries for the web, databases, etc.

**Grading:** Ten assignments (50%), project proposal (5%), final project (20%) and presentation (10%), in-class exercises and participation (15%).

**Projects:** The last month will be dedicated to GIS & Python projects. Students will be responsible for defining a geographic problem or question in an area of their interest, gathering and integrating the data, writing a Python Script or general-purpose Python program, and presenting the results. A slide presentation of the project (PPT) is due prior to your scheduled presentation time, and the Python code and data are due to Canvas (ZIP is best for data). Project proposals should include

the follow sections: **Name, Project Title, Objectives or Questions, Data sources, Methods** (e.g. Python with a brief description of any algorithmic steps), **Expected results/products, Time frame, and References**. Examples of past proposals, PPTs, and final projects will be provided.

### Course outline

Week	Date	Title	Readings/Lab
1	8/21	Intro. to Geoprocessing with Python	Lecture only <i>Assign. 1: Code academy Syntax through Functions</i>
2	8/28	Introducing Python Geoprocessing in ArcGIS Control flow, Lists, Loops	Chapters 1-2 <i>Assign 2: Code academy Control flow through loops</i>
3	9/4	<i>Labor Day</i>	<i>No class</i>
4	9/11	Geoprocessing in ArcGIS Pro Learning Python Language Fundamentals Geoprocessing using Python	<i>Chapters 3 &amp; 4 Assign. 3: Exercise 5</i>
5	9/18	Exploring spatial data Debugging and Error Handling Manipulating spatial & tabular data	<i>Chapters 6 &amp; 7 Assign 4: Exercise 8</i>
6	9/25	Working with geometries Working with rasters Map scripting	<i>Chapter 9 &amp; 10 Assign. 5: Exercise 11</i>
7	10/2	TBD	<i>TBD</i>
	10/9	Fall Break	
8	10/16	Methods in Geographic data science	<i>Assign 7: Driving/Flying</i>
9	10/23	Digital elevation models <b>Project proposals due (PDF to Canvas)</b>	<i>Assign 8: DEMs</i>
10	10/30	Slope & aspect calculations	<i>Assign 9: Slope/Aspect</i>
11	11/6	Geographic data science & Python I	<i>Assign 10</i>
12	11/13	Geographic data science & Python II	<i>Project time</i>
13	11/20	Geographic data science & Python III	<i>Project time</i>
14	11/27	Project advising & support	<i>Project time</i>
15	12/4	<b>1. Project presentations</b> <b>2. Projects due 12/11: PY/data to Canvas</b>	1. PPT due to Canvas 2. Code/data due to Canvas

**Safety & Wellness:** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677) this number will get you to a dispatch officer at the University of Utah Department of Public Safety (DPS; dps.utah.edu). You will receive important emergency alerts and safety messages regarding campus

safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit [safeu.utah.edu](http://safeu.utah.edu).

The University of Utah seeks to provide a safe and healthy experience for students, employees, and others who make use of campus facilities. In support of this goal, the University has established confidential resources and support services to assist students who may have been affected by harassment, abusive relationships, or sexual misconduct. A detailed listing of University Resources for campus safety can be found at <https://registrar.utah.edu/handbook/campussafety.php>  
Your well-being is key to your personal safety. If you are in crisis, call 801-587-3000; help is close.

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**ADA Statement:** The Americans with Disabilities Act. The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, (801) 581---5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services. \*

**Sexual Misconduct:** Addressing Sexual Misconduct. Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran’s status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801--- 581---8365, or the Office of the Dean of Students, 270 Union Building, 801---581---7066. For support and confidential consultation, contact the Center for Student Wellness, SSB 328, 801-581--7776. To report to the police, contact the Department of Public Safety, 801-585--2677(COPS).

**Code of conduct:** Students must produce their own assignments, as well as their own proposal, presentation, and final paper. The Student Code for the University of Utah can be found at: <http://regulations.utah.edu/academics/6---400.php>

**Student names/pronouns:** Class rosters are provided to the instructor with the student’s legal name as well as “Preferred first name” (if previously entered by you

in the Student Profile section of your CIS account, which managed can be managed at any time). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center. [https://lgbt.utah.edu/campus/faculty\\_resources.php](https://lgbt.utah.edu/campus/faculty_resources.php)

**Diversity/inclusivity:** It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you. (Source: University of Iowa College of Education)

**Undocumented students:** Undocumented Student Support. Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit [dream.utah.edu](http://dream.utah.edu).

**Faculty and student responsibilities:** The students and instructor are expected to attend class each week and complete the in-class assignments. Collaborating is encouraged, and the goal is avoid anyone from becoming “stuck” with a technical error. Students can also ask questions of each other remotely or through Canvas, as well as to the instructor of course (best email is [cova@geog.utah](mailto:cova@geog.utah)).