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GPHY 284.00: Introduction to GIS and Cartography

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The University of Montana

FORS 250 \ GPHY 284

Introduction to GIS and Cartography

Spring Semester 2018 Syllabus*

FORS 250 \ GPHY 284, Lecture Section 00, Rm SH 304

Tuesday and Thursday, 11:00 – 12:20 PM

FORS 250, Laboratory Section 01, Room SH 106

Friday, 11:00-12:50 PM

GPHY 284, Laboratory Section 02, Room SH 107

Friday, 12:00-1:50 PM

FORS 250, Laboratory Section 03, Rm SH 106

Friday, 1:00-2:50 PM

GPHY 284, Laboratory Section 04, Rm SH 107

Friday, 2:00-3:50 PM

FORS 250, Laboratory Section 05, Rm SH 106

Friday, 3:00-4:50 PM

Instructor: Dr. John DiBari

Office: Room 207, Stone Hall

Office Telephone: (406) 243-4302

Office Hours: Tues 12:30-1:30 or by appointment

Email: john.dibari@mso.umt.edu

TA: Joe Offer

Office: Room 206 Stone Hall, Hrs. Tues. & Thur. 12:30 – 1:30

Email: joseph.offer@umontana.edu

TA: Conor Phelan

Office: Room 488 Clapp Bldg., Hrs. Wed. 11 – 1, Tues. & Thur. 1:30 – 2:30

Email: conor.phelan@umontana.edu

COURSE DESCRIPTION:

This course is designed as a practical introduction to the use of Geographic Information Systems (GIS) for storing, retrieving, analyzing and displaying spatial data. It will also cover the history of cartography as an art form and the cartographic conventions of the modern map making process.

The course will discuss all the major concepts and theories behind the use of GIS and put these skills into practice with laboratory exercises using GIS software. We will closely examine the proper use of data, both from its appropriate choice given a desired outcome, and to inform a deeper understanding of data manipulation within the “Black Box.” Secondly, the course will address the concepts of proper map design so that our maps more effectively convey the information we intend to impart.

Objectives:

- To learn the foundations of GIS in order to properly and truthfully display spatial data in a cartographic context.
- To understand the structure of spatial data including file associations, attribute tables, metadata, coordinate systems, and projections.
- To become proficient in the construction of geodatabases (GDB) as the fundamental data storage format within all GIS Science.
- To learn basic GIS analysis for answering rudimentary spatial questions using the scientific method.
- To develop software skills in programs used for map production in the modern cartographic workflow.

Learning outcomes - By the end of this course you will:

1. Understand the core concepts and functions of geographic information systems.
2. Be able to discriminate among different characterizations of the Earth's surface and choose projections that are suitable for specific forestry, geography, and natural resources applications.
3. Recognize and acquire different forms of spatial data, normalize its spatial reference systems, and organize it into a GDB in preparation for GIS analysis.
4. Be familiar with techniques of spatial analysis applied in forestry, geography, and natural resource management.
5. Be able to produce maps that appropriately display the outcomes of spatial analysis and communicate the results using proper cartographic conventions.

Course Format:

The general program for each week will be Tuesday and Thursday lectures, followed by Friday lab sections. However, this schedule is subject to change, and will vary with the needs of the class, workload, or in special circumstances. This is especially true towards the end of the semester.

Lecture days will start with announcements and then be followed by a presentation on the principles of GIS and cartography. Some lectures will be supplemented by hands-on demonstrations or group exercises. New labs will be introduced on Thursdays and may be followed by short on-screen demonstrations of valuable software techniques needed to complete that week's assignment. Don't miss lectures if you want to succeed in the labs.

Required Texts:

Campbell, J. et. al (2017). *Essentials of Geographic Information Systems*

Online text available @: <https://students.flatworldknowledge.com/course/2576924>

If the link will not work, search under John DiBari or GPHY 284/FORS 250; Make sure the book is version 2.1. Purchase the pass **the first week!**

Sobel, D. (1995). *Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time*. New York: Penguin Books.

Jennings, Ken. (2011). *Maphead: Charting the Wide, Weird World of Geography Wonks*. New York: Scribner.

*Note: The two narrative books can be purchased inexpensively online. Used copies are fine.

Required Storage: A thumb-drive or external hard drive with at least 4 GB of space.

Server Address: R:\Classes\Spring2018\Intro_GIS

POLICIES AND PROCEDURES:

The following policies are the minimum standards for which all students are responsible. They set the ground rules so that class can move forward in an efficient and productive manner. Please review and put into practice:

- Please consult the Class Schedule for relevant dates.
- All assignments will require submission on the due date specified in the Class Schedule unless otherwise noted.
- Required Class Attendance: Class will include theory, discussion, map critiques, and exercises – all of which are important to the overall understanding of GIS and cartography. Much of this information will only be available in class. If you must miss a class, **YOU ARE RESPONSIBLE** for the material covered. Ask another student for their notes, as I don't take any while lecturing. There will be in-class assignments that reward students with credit for regular attendance. If you are not in class, you **CANNOT** receive credit.
- Participation: This class is interactive and requires student participation in hands-on exercises and group discussions. You will also partner-up for some labs. Students that do not participate will not do well in the class. It is important to work with your fellow students and share ideas. They will be your best resource for missed material, design advice, technique tips, and moral support.
- Please don't disrupt class with personal conversations.
- **Please be on time.** I expect everyone to be on time for class in order to not disturb the lecture. Chronic tardiness will result in reduced performance. If for some reason you are late, I ask that you be quiet and not disturb anyone as you enter and sit down. Do not leave the class early. If you have a special reason for leaving early please contact me before class begins and sit close to the door in order to exit quietly.
- No **CELL PHONES ON** in class! Please make sure your cell phone is off before lecture begins.
- **LAPTOPS ARE NOT NECESSARY** in class! Please pay attention to each lecture. Numerous studies suggest that digital note taking is ineffective as multi-tasking with other computer distractions impairs cognitive work retention ([See this article](#)). Take written notes, and if you must transcribe them to a computer, it will be a valuable second exposure to the material.
- For assistance with writing, please consult the on-line resources of the UM Writing Center, Liberal Arts 144 at: www.umt.edu/writingcenter.
- Student Conduct Code – Consult the Students Affairs website at: <http://www.umt.edu/vpesa/Dean%20of%20Students/default.php>. Carefully review the sections on plagiarism. Cheating and plagiarism are not tolerated and will be dealt with as outlined in the Code. This includes copying text verbatim from the internet or books (Please paraphrase and cite), texting during an exam, or taking a picture of an exam, etc. Integrity matters, your academic career depends on it!
- This course is accessible to and usable by otherwise qualified students with disabilities. To request reasonable program modifications, please consult with the instructor. [Disability Services for Students](#) will assist the instructor and student in the modification process.

Please note, this course is time consuming. Be prepared to synthesize information and apply what you learn to things I have not covered in class. Be prepared to spend several hours per week outside of class in the computer lab working on assignments. Be prepared to study course material frequently.

EXPECTED TECHNICAL SKILLS:

Everyone should be able to manage files, make use of operating system utilities, map network drives, and have experience using other software including word processing, spreadsheet, and perhaps statistical software. Additionally, everyone should be comfortable accessing course information and assignments on the network. Assignments, reading materials, and various items may be posted online. Some of these documents will be in Adobe Acrobat (.PDF) format. Additionally, I may ask you to access information posted to other websites.

MOODLE:

Class materials will be available on **Moodle** the week they are covered in class. This syllabus will be posted in the header for the entire semester. Refer to it often for due dates and reading assignments. Each lab will be submitted to its own digital drop box on **Moodle**. That drop-box closes at **11:00 AM** on the **Friday** that the lab is due. This is so you come to Friday labs prepared to work on the new material. **All** labs should be submitted as **Microsoft Word documents**. File naming convention is: **Lastname_LabX.doc(x)**. They will be graded with comments and returned digitally within the Moodle grade book. The mid-term and final exam will also be administered on Moodle. See details below.

LAB SERVER:

The address for the class server is R:\Classes\Spring2018\Intro_GIS. Data needed for the labs will be stored in the MASTER_LABS parent folder that can only be accessed in the labs on campus. Under the STUDENTS parent folder, each student will find their private folder where all materials for the class should be stored. To start a new lab, navigate to the MASTER_LABS folder, copy the newest lab folder, then navigate to your student workspace and paste it into your student Labs folder. Work on your labs from this folder. All data will be backed-up; however, you will want to copy your student folder to an external memory device if you work at home and as a course back-up at the end of the semester.

CLASS ASSIGNMENTS:

- **Lab Exercises**

Labs will consist of exercises that provide a means to put theory as presented through the lectures and reading material into practice. The labs are software intensive utilizing ESRI ArcGIS and Microsoft Excel. There will be instructions for each lab that outline the learning objectives and the steps that should be taken to complete the project. The first labs will simply require questions to be answered about the software and data, and perhaps include a final map. As the labs become more intensive, the “button-by-button” instructions will taper off. For example, I will not write out steps for procedures that have been covered in previous labs; you must memorize these techniques or refer back to your completed work and journal. Some techniques required to finish the labs will only be demonstrated on screen during lecture. You will be expected to take notes of the steps and use them to complete the lab. If you miss a lecture, **YOU ARE RESPONSIBLE FOR THE MISSED MATERIAL**. Ask another student for a copy of their notes. A Report Template will be provided and must be used to write-up the lab work or points will be deducted. All labs will be submitted into separate Moodle drop-boxes in **Microsoft Word** format only. The drop-boxes for standard labs will have a due-by-time of 11:00 AM on the **Friday** that the lab is due. However, the drop-box remains open during a grace period until the final cut-off exactly one week later (11:00 AM, the next Friday). Moodle timestamps submissions

automatically, so we are alerted to all late Labs. There will be a **10%** deduction for labs submitted in the grace period. **NO LABS WILL BE ACCEPTED AFTER THE FINAL DROP-BOX CUT OFF!**

- ***Resource Journal***

Each student is required to keep a digital journal filled with the content featured in the class. The purpose of this journal is to give the student a “take-away” resource of GIS and cartography techniques for future mapping projects. Do not wait until the last minute to put together the journal. Start adding content the first week and continue to keep it organized throughout the semester. It will be your one-stop reference for the theory and techniques covered in class. **In your student folder on the server, create three folders labeled “Resource Journal,” “Labs” and “Lectures”.** You will create a separate folder for each lab. Work on your labs directly in your **Labs** folder. You need to download the .pdf documents of lectures from Moodle and store them in your **Lectures** folder. Feel free to make additional course material folders if you wish. This extra material can include chapters from the online text if you purchase that option, or study sheets and notes from class. In the labs folder create and keep a detailed journal for each lab – e.g., what you did, why you did it, question you are trying to answer, analysis methods, what you learned from the lab. Journal entries for each lab will “scale up” to be your completed Resource Journal. Append your initial journal file, which will live in the Resource Journal folder, with entries from each lab. The digital journal should be backed up onto your thumbdrive or external hard-drive occasionally and a complete copy should be taken with you at the end of the semester. The journal will be checked by the instructor or a TA during the final lab. There are only three possible grades: 0 for no journal at all, 25 points for a partial journal, and 50 points for a complete journal. They are the easiest 50 points in the class; don’t throw them away!

- ***Quizzes, Midterm and Final Exams***

- You are responsible for **knowing everything read or said** in this class. Occasionally there will be quizzes, administered in class, on the material presented in class and associated with labs. There are no make-ups for quizzes – you have to be present to get credit. The midterm and final exams will be administered on Moodle. Test questions will be generated from the online text, the two required narrative books, in-class exercises, and labs. You will have to complete one of three essay questions, which will be based on readings in the books. The exams will be available online for multiple days and are randomized by the computer to prevent side-by-side sharing. No two students will have the questions in the same order. Once you start the exam, you will have a specified amount of time to finish. Make sure that you allow enough time and have a good internet connection before you start. Campus computers would be the most reliable in this respect. Avoid complications like dead laptop batteries or streaming data limits. The final exam **IS Comprehensive**, with questions not used on the midterm being “fair-game.” However, the final will mostly consist of material covered in the second half of the semester. The Final Exam is longer and will be worth more than the Midterm. See the Points Table below for details.

The assignments and exams administered throughout the semester cover the topics that we discuss in class and are related your readings. The purpose of these assignments is to ensure that each student understands the concepts being discussed, practices and improves their software skills, completes the required readings, and attends each lecture. These assignments will be all that determines your final grade. Make sure to turn them in complete and on time.

If you are having trouble with a project, come and see me or a TA well **before** it is due. If you have an emergency, illness, or crisis; send an email, call, or stop by my office before the assignment is due.
NO LAB SUBMISSIONS WILL BE ALLOWED AFTER THE GRACE PERIOD!

GRADING:

This 3 unit class will be graded in the traditional letter grade (T) format. Various in-class assignments will be for credit and reward students for regular attendance. The tables below break down the point values for all assignments. Grades are evaluated on the completeness and organization of the project, as well as the use of the theory and techniques taught in class. Maps will not be graded purely on a subjective assessment of aesthetic appeal; however, a poorly executed map is certainly worth less than a professional one. Not everyone is an artist, but the student should demonstrate progress toward GIS and cartographic competency. All assignments, and the final grade, are evaluated on the following scale:

- A 95 – 100%
- A- 90 – 94.99%
- B+ 87 – 89.99%
- B 83 – 86.99%
- B- 80 – 82.99%
- C+ 77 – 79.99%
- C 73 – 76.99%
- C- 70 – 72.99%
- D 60 – 69.99%
- F 59.99% and below

* Since there are no “A+” marks, an “A” grade requires 95% or higher and is reserved for students with the highest work ethic.

Points Table:

Assignments	Points
Lab 1	50 pts.
Lab 2	50 pts.
Lab 3	100 pts.
Lab 4	100 pts.
Lab 5	100 pts.
Lab 6	100 pts.
Lab 7	150 pts.
Lab 8	150 pts.
Lab 9	150 pts.
Lab 10	150 pts.
Resource Journal	50 pts.
Quizzes	10-20 pts. each
Midterm Exam	200 pts.
Final Exam	250 pts.
Total	1600 points or so

Class Schedule		
Week/Day	Topic	Assigned Reading
Week 1: Introduction to GIS & Cartography		
Tuesday 1/23	Welcome, Syllabus, Moodle, Lab, Resources. Demo Video & What is GIS?	*Campbell Preface and Ch. 1-2
Thursday 8/31	Continued...	
Lab: Intro to the computer labs, signing in, server space, data storage, opening programs		
Week 2: The Structure of Geospatial Data		
Tuesday 1/30	GIS File Types and The Geodatabase, Georelational Model	*Campbell Ch. 3-4 *Sobel Ch. 1-3
Thursday 2/2	History of Cartography and GIS	
Start Lab 1: Working with GIS data and Metadata in Arc Catalog		
Week 3: Measuring the Surface of the Earth		
Tuesday 2/6	Research Presentations	*Campbell Ch. 5 *Sobel, Ch. 4-6
Thursday 2/8	Geodesy	
Lab 1 Due , Start Lab 2: Building Geodatabases, Importing and Normalizing Data		
Week 4: Shape and Scale: The Map Compromise		
Tuesday 2/13	Coordinate Systems	*Review PDF - Moodle *Sobel, Ch. 7-9
Thursday 2/15	Projections, Scale	
Lab 2 Due , Start Lab 3: Choosing Appropriate Projections within the Data Frame		
Week 5: Cartographic Principles in GIS Map Design		
Tuesday 2/20	OPEN	*Campbell Ch. 6 *Sobel, Ch. 10-12
Thursday 2/22	Map Layout & Labels	
Lab 3 Due , Start Lab 4: Creating a Base Map: The Common Street Grid		
Week 6: Raster Data – The Earth from Space		
Tuesday 2/27	Satellite Imagery	*Campbell Ch. 7 *Sobel, Ch. 13-15
Thursday 2/29	Digital Elevation Models (DEM) & Hillshading	
Lab 4 Due , Start Lab 5: Creating a Shaded Relief Topographic Map		

<i>Week/Day</i>	<i>Topic</i>	<i>Assigned Reading</i>
Week 7: Midterm Week		
Tuesday 3/6	Exam Review	*Campbell Ch. 8
Thursday 3/8	Midterm Exam On Moodle (*NO CLASS*)	*Exam Review
Lab 5 Due, Start Lab 6: GPS Data Collection in the Field – Mapping Campus Trees		
Week 8: Vector Data – Points, Lines and Polygons, GPS Data		
Tuesday 3/13	GPS and Differential Corrections	*PDF Reading
Thursday 3/15	Vector Analysis and Symbols	*Jennings Ch. 1-2
Continue Lab 6		
Week 9: Thematic Maps		
Tuesday 3/20	Aspects of Color, Choropleth and Graduated Symbols Maps	*Jennings Ch. 3-4
Thursday 3/22	Isarithmic and Dot Density Maps	
Lab 6 Due Start Lab 7: Choropleth Maps of Population		
Week 10: Spring Break		
Tuesday 3/27	Spring Break	
Thursday 3/29	Spring Break	
No Lab		
Week 11: GIS for Decision Making		
Tuesday 4/3	TBD -- Democracy Maps	*Campbell Ch. 9
Thursday 4/5	TBD -- Recreation GIS	*Jennings Ch. 5-6
Lab 7 Due, Start Lab 8: Dissolves, Intersects, and Summaries – Recreation Management		
Week 12: GIS for Natural Resource Management		
Tuesday 4/10	TBD -- Pine Bark Beetle Infestation of Northern Forests	*PDF Reading
Thursday 4/12	TBD -- GIS for Forestry	*Jennings Ch. 7-8
Lab 8 Due, Start Lab 9: Decision Making with Map Overlays – Forest Management		

Week/Day	Topic	Assigned Reading
Week 13: Applied GIS		
Tuesday 4/17	TBD -- Climate Change and Temperature Modeling	*Campbell Ch. 10
Thursday 4/19	TBD -- Wildlife Conservation	*Jennings Ch. 9-10
Lab 9 Due, Start Lab 10: Mapping Census Data		
Week 14: Geographic Literacy		
Tuesday 4/24	TBD -- Global Awareness in the Geo-Spatial Age	*PDF Reading
Thursday 4/26	TBD -- Global Health and Wealth	*Campbell Ch. 11 *Jennings Ch. 11
Lab 10 Due		
Week 15: International and National Demographic GIS		
Tuesday 5/1	TBD -- Demographic Data of the US Census	*Jennings Ch. 12
Thursday 5/3	*Exam Review	
Resource Notebook: Due In Friday Lab. Lab Final due by end of lab.		
Week 16: Final Exam Week		
5/7 through 5/10 @ 10:00 am	Final Exam on Moodle	

**Syllabus is subject to change.*