

GIS 666  
Projections and Coordinate Systems  
Syllabus for Fall 2024  
2 units [90 hours]

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Professor:	Mark Kumler
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### Course Description and Objectives.

This course explores map projections and coordinate systems. We will study the principles and properties of several of the common map projection families, which projections are suitable for which types of applications, the use of Tissot's Indicatrix, and how to recognize the presence/absence of certain properties from the graticule on a map. We will examine multiple spherical/geographical coordinate systems, the Public Land Survey System, and the two most common planar cartesian systems used in the United States: State Plane Coordinate (SPC) and Universal Transverse Mercator (UTM). You will also learn to recognize these systems when they are unspecified. In addition to the theoretical and conceptual foundations, you will learn to work with projections and coordinate systems within the ArcGIS and GeoCart environments.

**Class Meetings:** We will meet on Mondays from 1:00 p.m until 2:15 p.m. in Lewis 104 [13 meetings @ 1.25 hours = 16.25 hours]

### Required Texts and Map:

*Basic GIS Coordinates*, 3<sup>rd</sup> edition, Jan Van Sickle, CRC Press, 2017. Available as an e-book. [25 hours]

*Map Projection Essentials* (website). Dan Strebe. An excellent on-line resource on map projections:  
<https://www.mapmathematics.com/Essentials.php> [2 hours]

*An Album of Map Projections: U.S. Geological Survey Professional Paper 1453*, John P. Snyder and Philip M. Voxland, U.S. Government Printing Office (Washington, DC), 1989, 249 pages. A decent pdf version of this seminal publication is available on the course Canvas site. However... you are **strongly encouraged** to purchase the bound version. The many fine lines on the maps are much more legible; it is very affordable; and it is an invaluable desk reference book for quickly identifying/discovering over 100 common projections. This is widely referred to as "Snyder's White Book". [2 hours]

*Redlands, CA, 7.5' USGS Topographic Map, 1:24,000, 1996 edition*. This is known to the staff in the bookstore as "the GIS map". You will also need a ruler and several different colored highlighters to highlight the *five* different coordinate systems found on this map. You may use a used version, as long as it does not have notes or calculations in the margins. The map can also be purchased directly from the USGS for \$8 (plus shipping) at <https://store.usgs.gov/product/45198>

*Which Map Is Best? Projections for World Maps*. Committee on Map Projections of the American Cartographic Association, American Congress on Surveying and Mapping (Falls Church, VA), 1986, 14 pages. [2 hours]

*Choosing a World Map: Attributes, Distortions, Classes, Aspects.* Committee on Map Projections of the American Cartographic Association, American Congress on Surveying and Mapping (Bethesda, MD), 1988, 15 pages. [2 hours]

*Matching the Map Projection to the Need.* Committee on Map Projections of the American Cartographic Association, American Congress on Surveying and Mapping (Bethesda, MD), 1991, 29 pages. [2 hours]

**Some other very good resources.**

*Working with Map Projections.* Fritz Kessler and Sarah Battersby, CRC Press, 2019, 299 pages.

*Lining Up Data in ArcGIS.* Margaret M. Maher, ESRI Press (Redlands, CA), 3<sup>rd</sup> edition.

*Map Projections (a poster).* U.S. Geological Survey National Mapping Program. 24" x 36". PDF version available at <https://www.usgs.gov/media/files/map-projections-poster>

*Map Projections—A Working Manual.* U.S. Geological Survey Professional Paper 1395. John P. Snyder, U.S. Government Printing Office (Washington, DC), 1987, 383 pages. This is often referred to as "Snyder's Red Book".

*Flattening the Earth: Two Thousand Years of Map Projections.* John P. Snyder, The University of Chicago Press, 1993, 365 pages.

**Assignments.** You will complete a series of assignments that illustrate your understanding of the course material and your command of the techniques for working with map projections and coordinate systems. [10 assignments @ 3 hours each = 30 hours]

**Reading Reflections.** You will write and submit a "reading reflection" before each class meeting. These reflections should summarize, in 100-200 words, the contents of the assigned chapter (or part thereof). They should also include two questions: one that you have about the reading, and one that would be suitable to include on an upcoming quiz. [6 reflections @ 0.5 hours each = 3 hours]

**Quizzes.** There will be several quizzes to assess your preparation for class and your understanding of the material. Some of these will be "pop" quizzes, typically administered at the very beginning of class. There are no make-up quizzes; however, your lowest quiz score will be automatically dropped from the course grade calculation. [studying for quizzes: 6 hours]

**Grades:** The grading scheme in many graduate level classes may be different than you expect. On some assignments or exams you may receive qualitative grades in the form of one or two words from the list below. You may find most of these defined in the University of Redlands Catalog, but they basically mean exactly what you would expect.

Excellent/Outstanding (4.0)

Very Good (3.7)

Good (3.3)

Acceptable (3.0)

Fair (2.7)

Poor (2.3)

Very Poor (2.0)

Individual assignments and quizzes will be based on the above 4.0 scale. A composite score will be calculated by multiplying the individual scores by the following weights.

Reading Reflections .....	10%
Assignments .....	50%
Quizzes .....	20%
Participation .....	20%

Graduate students will not receive credit for a course awarded a grade of 1.7 or below.

**Tentative Schedule** (subject to revision, addition, subtraction, and serendipity):

Date	Class Mtg	Topic	Reading to be completed <i>before</i> class	Activity / Assignment
9-Sep	1	Syllabus, Background		Esri Web course: Basics of Geographic Coordinate Systems (1:15)
16-Sep	2	Latitude and longitude -- the Geographic Coordinate System	Van Sickle Ch. 1 (pages 17-22 can be skimmed);	Displaying Coordinate Data on a Map (0:35)
23-Sep	3	Map Projection Basics	ACA 86, ACA 88, <a href="https://www.mapthematics.com/Essentials.php">https://www.mapthematics.com/Essentials.php</a>	Esri Web class: Basics of Map Projections (3:00);
30-Sep	4	Great Circles & Loxodromes	ACA 91 esp. chapters 9-11	Esri Learn ArcGIS Lesson: Choosing the Right Projection (1:00) <a href="https://learn.arcgis.com/en/projects/choose-the-right-projection/">https://learn.arcgis.com/en/projects/choose-the-right-projection/</a> ; Projection Website Review
7-Oct	NO CLASS	(CAS Study Day)		
14-Oct	5	Projection identification	Critical Knowledge Handout	Review their Projection Websites; Practice identifying properties
21-Oct	6	Projection identification	Critical Knowledge Handout	Practice identifying properties; quiz
28-Oct	7	Geocart software	Geocart Manual Chs 2-4	Geocart 3.3 Ch 5 examples
4-Nov	8	Building a Coordinate System	Van Sickle Ch. 2 (pp. 41-54 only)	Esri Web course: Introduction to Coordinate Systems (2:25)
11-Nov	9	State Plane	Van Sickle Ch. 4 (pp. 111-140)	Florida SPC Zones
18-Nov	10	UTM	Van Sickle Ch. 4 (pp. 140-145)	One UTM Zone
25-Nov	11	PLSS	Van Sickle Ch. 5	Esri Learn ArcGIS Lesson: Make a web map without Web Mercator (0:50) <a href="https://learn.arcgis.com/en/projects/make-a-web-map-without-web-mercator/">https://learn.arcgis.com/en/projects/make-a-web-map-without-web-mercator/</a>
2-Dec	12	Redlands Miniquad		Redlands Miniquad
9-Dec	13	FINAL EXAM		

## SYLLABUS STATEMENTS from the College Dean's Office

### Accommodations

If you are a student with a disability that qualifies for academic accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act, contact Academic Success and Accessibility (ASA). ASA is located on the ground floor of the Armacost Library, down the hall from the Jones Computer Center (past the restrooms). You can reach the office at 909-748-8069 or [asa@redlands.edu](mailto:asa@redlands.edu) and online [here](#).

### Office of Equity and Title IX

In order to provide a safe and equitable learning environment for all students, faculty, and staff, discrimination, harassment, retaliation, sexual misconduct, and sexual harassment (including sexual assault, dating or domestic violence, and stalking) are not tolerated at the University of Redlands. The University prohibits unlawful discrimination or harassment (as defined in the [Policy Prohibiting Discrimination, Harassment, Sexual Misconduct, and Retaliation](#)) on the basis of age, color, race, ethnicity, national origin, ancestry, sex, marital status, pregnancy, status as a complaining party of domestic violence, sexual orientation, gender, gender identity or expression, physical or mental disability, genetic information, religion/creed, citizenship status (except to comply with legal requirements for employment), military/veteran status, or any other characteristic protected by law. If you or someone you know has experienced or experiences any of these behaviors, know that you are not alone. You can contact the Office of Equity and Title IX for reporting options, supportive measures, and resources to support you.

All faculty and staff at the University of Redlands are considered "Responsible Employees," which means that if you tell me about a situation involving any of the above, I must report the matter to the Office of Equity and Title IX. Although I make that report, you are in control of how you would like to proceed, including whether or not you wish to pursue a formal complaint. Our goal is to make sure you are aware of the range of reporting options available to you and have access to the support and resources you need.

To report an incident directly, you can:

- Contact the Interim Director of Equity & Title IX, Christopher Jones, at 909-748-8289 or [titleix@redlands.edu](mailto:titleix@redlands.edu)
- [Report online](#) at: [www.redlands.edu/titleixandequity](http://www.redlands.edu/titleixandequity)

You can also report to local law enforcement at 909-798-7681, ext. 1. If you are ever in immediate danger, please call 911 or email/text [911@redlandspolice.org](mailto:911@redlandspolice.org) if you cannot call.

To reach Public Safety on campus, call 909-748-8888 or use the [Rave Guardian](#) app.

If you wish to speak to someone confidentially (meaning not connecting with the Office of Equity and Title IX Office), you can contact the following resources:

Campus: [Counseling Center](#): 909-748-8108 or 24-Hour Crisis Line: 909-748-8960  
[TimelyCare](#), 24/7 emotional support; 12 free telehealth counseling sessions

Community: [Partners Against Violence](#), 24-hour sexual assault crisis line: 909-885-8884  
[Option House](#), 24-hour dating/domestic violence crisis line: 909-381-3471

Online: <https://www.rainn.org/> (sexual assault); <https://www.loveisrespect.org/>

For more information, visit [www.redlands.edu/titleixandequity](http://www.redlands.edu/titleixandequity)

## ADDITIONAL RESOURCES

### **Counseling Center**

The Counseling Center provides free and confidential mental health services, including short-term individual therapy, group therapy, single session therapy, consultations, and urgent appointments to all students with in-person or virtual options. Our Counseling Center is committed to inclusivity and to providing a supportive space for everyone. Please call 909-748-8108 to schedule an appointment or email [counseling\\_center@redlands.edu](mailto:counseling_center@redlands.edu). If a student is in crisis, please call 909-748-8960 for the 24/7 mental health crisis line. For more information on our resources, go [here](#). Another option for individual therapy for all students is [TimelyCare](#), which provides virtual therapy immediately (Talk Now) or up to 12 scheduled virtual therapy sessions per year. Students can choose their therapist from a list of providers for the scheduled therapy option.

### **Conflict Resolution Center**

Experiencing a conflict? Whether it's with a friend, roommate, another member of a student organization, or faculty or staff member, conflicts happen. Learning to navigate conflicts is important to success in virtually any field, and a vital step in being a part of a community and having healthy, meaningful relationships with others. See <https://sites.redlands.edu/conflict-resolution-center/student-resources/> for more information.

### **CARE Team**

The University [CARE Team](#) exists to help provide support and resources to students that are overwhelmed, experiencing significant distress, or possibly present some risk to themselves or others. As a faculty member, I may reach out to students about whom I am concerned to talk individually, and/or refer them to the CARE Team. If you have concerns about a fellow student, consider sharing your concern with the CARE Team via their [online form](#). This is part of who we are as a caring, proactive community where we all look out for one another. Additionally, if you feel that you or someone else needs immediate mental health support, the University has a 24/7 mental health crisis line at [909-748-8960](tel:909-748-8960), and the [Timely Care](#) app, which offers on-demand emotional care. Both services connect to a live, licensed counselor.

### **Book Lending Program:**

The Book Lending Program is an initiative to ensure the academic success of First-Generation students (students who are the first to go to college in their families and who meet a particular estimated family contribution [EFC] level). Funded through alumni donations, this program provides books and other classroom materials, when needed, for First-Generation students who could not otherwise afford to purchase them. Books are returned at the end of the course, to be used by other First-Generation students the next semester. The program works alongside the Library and faculty members to ensure the availability of books and classroom materials. For more information, see <https://www.redlands.edu/student-affairs/campus-diversity-and-inclusion/programs/first-generation-student-programs/book-lending-program/>

**Contact:** [blp@redlands.edu](mailto:blp@redlands.edu)

### **Emergency Student Loans:**

Student Financial Services (SFS) administers a short-term, no-interest loan fund to assist students experiencing an emergency or cash-flow problem. Except in unusual circumstances, these loans do not exceed \$200 and are billed to the

student's account. Evidence of repayment ability is a prerequisite for all short-term loans made to students. Students are not eligible for more than one emergency student loan per term.

**Contact:** [SFS@redlands.edu](mailto:SFS@redlands.edu) or x8047

**Student Affairs Discretionary Fund:**

These endowed funds in Student Affairs can be used to support student success and remove impediments that otherwise may cause the student to stop or leave school. To utilize this fund, divisional leadership should be made aware of the student in dire need of financial support. This support can be anything from personal expenses, such as utility bills, gas money, emergency trips home due to family tragedy, off-campus counseling, and other medical costs, and occasionally mental health assessment expenses. Students receive grants based on their financial need.

**Contact:** [student\\_affairs@redlands.edu](mailto:student_affairs@redlands.edu)

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**Student Food Support Pantry:**

The Student Food Support Pantry is a resource available to all established full and part-time University of Redlands students facing food insecurities. The Pantry is located on the north side of North Hall. This space is an open, no-questions-asked space with dried and canned goods, and non-perishable items, as well as seasonal fresh produce from our sustainable farm and limited refrigerated goods. Food for this distribution is provided in partnership with Feeding America Riverside and San Bernardino. It is also funded through private donations, ASUR, and the Office of Community Service Learning. For more information, please contact [SURF@redlands.edu](mailto:SURF@redlands.edu)

A **Student Lounges Map** can be found [here](#) on the University website.