

ESM 263 - Geographic Information Systems
Winter 2019

ESM 263 is a one-quarter introduction to geographic information systems (GIS). The course is intended for MESM students who need to acquire a working knowledge of GIS theory and practice in a single quarter.

Instructor: James Frew (office hours by appointment)

- NB: I often leave the door closed when I'm in my office. It's OK to knock!

TA: Niklas Griessbaum (Office hours: Thursday 14:00-15:00 in Bren 3001, or by appointment)

Labs: all in Bren 3035 (the GIS Lab). Attend only the lab you are enrolled in:

1. Mon/Wed 15:30–17:20 (code: 22574)
2. Tue/Thu 12:00–13:50 (code: 22582)

Textbooks:

- Bolstad, P. (2016) GIS Fundamentals: A First Text on Geographic information Systems, Fifth Edition. White Bear Lake, MN: Elder Press. ISBN 978-1-50669-587-7 [publisher] [Amazon]
NOTE: be sure to get the fifth edition.
- Law, M. and Collins, A. (2015) Getting to Know ArcGIS Desktop, Fifth Edition. Redlands, CA: ESRI Press. ISBN 978-1-58948-510-5 [publisher] [Amazon]
NOTE: be sure to get the fifth edition.

I recommend getting the Kindle edition, so you can have it on your screen as you do the exercises.

More info:

- Grading criteria
- ArcGIS background
- Windows & ArcGIS setup procedures

NOTE: The syllabus is a work-in-progress. Sections shaded like this may contain broken links; check back often...

Assignments

All assignments should be submitted by 8:00 AM on the due date to the course's GauchoSpace. (This is the only thing we'll be using GauchoSpace for.)

#	due	assignment
1	Mon 21 Jan	Cartography
2	Mon 04 Feb	Sea level rise in Santa Barbara
3	Mon 18 Feb	Site suitability analysis for wind power subsidies
4	Mon 11 Mar	Conservation priorities using multicriteria decision analysis

Week 1: Introduction to GIS & cartography

- Lecture
 - o slides: Geographic Information Systems: Introduction
- Reading
 - o textbook: Bolstad: ch 1: An Introduction to GIS

- articles
 - Geographic information science and systems for environmental management
 - On the Theory of Scales of Measurement
- Lab
 - Notes
 - Windows file system
 - Windows setup
 - ArcGIS setup, part 1
 - ArcGIS setup, part 2
 - textbook: Law
 - ch 3a: Displaying map data & 3b: Navigating a map
 - ch 10: Making maps for presentation

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Week 2: Coordinate systems and map projections

- Lecture
 - slides: Coordinate Systems and Map Projections
 - data: projections
- Reading
 - textbook: Bolstad: ch 3: Geodesy, Datums, Map Projections, and Coordinate Systems
 - video: "Are you saying the map is wrong?" (from "The West Wing", season 2, episode 16)
 - ArcGIS help
 - What are map projections?
 - What is geocoding?
 - Reference
 - An Album of Map Projections
 - CDFW Projection and Datum Guidelines
- Lab
 - slides: Cartography Basics
 - article: Principles of Cartographic Design
 - notes
 - Using ColorBrewer with ArcMap 10
 - Classifying numeric data that includes a "No Data" code
 - textbook: Law: ch 10: Making maps for presentation

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Week 3: Vector data

- Lecture
 - slides: Vector Data
 - data: vector formats
- Reading
 - Textbooks
 - Bolstad
 - ch 2: Data Models
 - ch 9: Basic Spatial Analysis
 - Law
 - ch 15: Querying data
 - ch 16: Selecting features by location

- Lab
 - o notes: spatial analysis

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Week 4: Attribute data

- Lecture
 - o Slides
 - Attribute Tables and Tabular Data
 - o example:
 - data: U.S. Board on Geographic Names Gazetteer Download Files
 - (just download 1 state; the "National" file has >2M entries)
 - ArcGIS help
 - Adding a Microsoft Excel table to ArcMap
 - Adding an ASCII or text file table (note: try Excel first!)
 - o Schema.ini file format
 - Adding x,y coordinate data as a layer
- Reading
 - o Textbooks
 - Bolstad: ch 8: Attribute Data and Tables
 - Law
 - ch 17: Joining and relating data
 - ch 18c: Exporting data
 - o book chapter: P. Revesz, Introduction to Databases: From Biological to Spatio-Temporal. Springer-Verlag, London, 2010. DOI: 10.1007/978-1-84996-095-3
 - ch 3: Relational databases

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Week 5: Raster data

- Lecture
 - o slides: Raster Data
 - o data: raster formats
 - o data: raster operations demos
- Reading
 - o Textbooks
 - Bolstad: ch 10: Topics in Raster Analysis
 - Law
 - ch 7d: Symbolizing rasters
 - ch 18d: Running tools in a model
 - o ArcGIS Help: ModelBuilder
 - from What is ModelBuilder?
 - through Tutorial: Executing tools in ModelBuilder
 - data: ModelBuilder tutorial data
- Lab
 - o Notes
 - ArcGIS setup, part 3
 - (Re-)Enabling ArcMap datum checking
 - using Spatial Analyst and Model Builder with raster data
 - data: Lab 5
 - o self-study: ArcGIS Spatial Analyst tutorial

- data: Spatial Analyst tutorial data

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Week 6: GIS models

- Lecture
 - slides: GIS Models (with a side of ArcCatalog)
- Reading
 - textbook: Bolstad: ch 13: Spatial Models and Modeling
 - book chapters
 - J. Malczewski, GIS and Multicriteria Decision Analysis. Wiley, New York, 1999. ISBN: 978-0471329442
 - ch 3: Introduction to Multicriteria Decision Analysis
 - P.A. Longley et al (eds.), Geographical Information Systems. Wiley, New York, 1999. ISBN: 978-0471321828
 - ch 35: Multi-criteria evaluation and GIS
 - T.L. Saaty & L.G. Vargas, Models, Methods, Concepts & Applications of the Analytic Hierarchy Process. Springer, New York, 2012. DOI: 10.1007/978-1-4614-3597-6
 - ch 1: How to Make a Decision
 - articles
 - Ian McHarg (Wikipedia)
 - M. Wagner et al, Design with Nature: Key lessons from McHarg's intrinsic suitability in the wake of Hurricane Sandy. DOI: 10.1016/j.landurbplan.2016.06.013
 - (McHarg's 1969 map)
- Lab
 - Notes
 - ArcGIS environment settings: precedence and persistence
 - ModelBuilder notes
 - HW3 tools
 - Finding and ranking contiguous areas in a raster

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Week 7: Terrain and watershed analysis

- Lecture
 - slides: Terrain and Watershed Analysis
 - demos:
 - terrain data
 - watershed modeling
- Reading
 - textbook: Bolstad: ch 11: Terrain Analysis
 - book chapter: P.A. Longley et al (eds.) Geographical Information Systems. Wiley, New York, 1999. ISBN: 978-0471321828
 - ch 9: Representation of terrain
 - article: Rapid calculation of terrain parameters for radiation modeling from digital elevation data
- Lab
 - (work day for assignments 3 & 4)

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Week 8: GIS data sources and data capture

- Lecture
 - o Slides
 - UCSB Library GIS resources (Jon Jablonski guest lecture)
 - GIS Data: Sources and Capture
 - animation: How GPS Works
 - o download standalone Flash Player
- Reading
 - o textbook: Bolstad
 - ch 4: Maps, Data Entry, Editing, and Output
 - ch 5: Global Navigation Satellite Systems and Coordinate Surveying
 - ch 6: Aerial and Satellite Images
 - ch 7: Digital Data
 - o book chapter: Data Source Handbook
 - Locations
- Lab
 - o notes: Landsat and NDVI
 - data: Lab 8

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Week 9: Interpolation and uncertainty

- Lecture
 - o slides: Interpolation and Uncertainty
 - demo
 - o examples:
 - Snow's cholera map
 - Demo
 - o Source
 - UCLA Dept of Epidemiology's John Snow website
 - the Broad Street pump
 - Geostatistical Analyst
 - Tutorial
 - o Data
- Readings
 - o textbook: Bolstad
 - ch 12: Spatial Estimation: Interpolation, Prediction, and Core Area Delineation
 - ch 14: Data Standards and Quality
 - o book chapters: P.A. Longley et al (eds.) Geographical Information Systems. Wiley, New York, 1999. ISBN: 978-0471321828
 - ch 34: Spatial interpolation
 - ch 13: Models of uncertainty in spatial data
- Lab
 - o (work day for assignment 4)

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Week 10: Your choice

- Stay tuned...

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