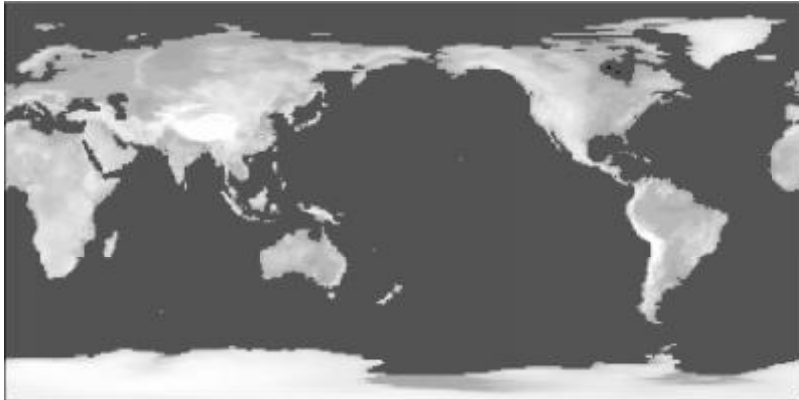


# Remote Sensing and Geographic Information Systems (EESC03)

Winter 2021



## Mike Doughty

Email: [mike.doughty@utoronto.ca](mailto:mike.doughty@utoronto.ca)  
Office Hours: Thursday 1.00-2.00p

## Teresa Morante Arona (TA)

Email: TBA  
Office Hours: TBA  
Submission: Quercus only

This course focuses on the use of Geographic Information Systems (GIS) and Remote Sensing (RS) for solving a range of scientific problems in the environmental sciences and describing their relationship with and applicability to other fields of study (e.g. geography, computer science, engineering, geology, ecology and biology). Topics include (but are not limited to): spatial data types, formats and organization; geo-referencing and coordinate systems; remotely sensed image manipulation and analysis; map production.

## Lecture Topics

### L01 Introduction to GIS and Data Models

*What is a GIS; Contributing disciplines and technologies; Areas of application; Analysis functions; Raster and vector data models*

### L02 Maps, Coordinates and Attributes

*Maps and cartographic abstraction; Projections; Coordinates and attributes; Surveying and GPS; Sampling methodology*

### L03 Topology and Vector Operations; Spatial Analysis

*Topological overlay and vector operations; Spurious polygons; Spatial analysis - operators and methodologies*

### L04 Data Sources - Input and Incorporation

*Primary and secondary data sources; Data errors; Input of spatial data (digitize, scan, convert); Rasterization and vectorization*

### L05 Spatial Interpolation; Surface and Volume Representation

*Characteristics and methodologies of interpolators; Surface representation (2D); Volume representation (3D)*

### L06 Spatial Analysis and Modeling

*Numerical models; Artificial intelligence (ANN; GA; ES); Fuzzy logic; Pattern analysis; Spatial autocorrelation*

### L07 Introduction to Remote Sensing

*Remote sensing - characteristics, systems, applications and components; Aerial photography*

### L08 Interaction of EM with the Earth's Surface - Overview; Satellites

*Interaction of EM with vegetation, water and soil; Atmospheric interactions of EM; Earth resource and meteorological satellites*

### L09 Tutorial - Remote Sensing, Surveying & GPS

*Aerial photograph interpretation; Satellite imagery interpretation; Surveying; GPS*

### L10 Image Processing and Classification

*Restoration and correction; Enhancement (CS and filters); Image classification (BR, PCA, Unsupervised/Supervised Classification)*

## Assignments

### A01 Introduction to GIS and Data Models

*Introduction to GIS - maps; Surfaces; Projections; Suitability analysis; Vector operations; Geomorphological analysis*

### A02 Georectification, Digitization, Interpolation and Fuzzy Logic

*Georectification and digitization; Interpolation and uncertainty; Structured query language; Fuzzy logic*

### A03 Introduction to Remote Sensing

*Histograms; Saturation; Filters; Composite imagery; Band ratios; Image servers; Supervised and unsupervised classification*

## Reference Material (optional):

Lo, C.P. and Yeung, A.K.W. (2002) *Concepts and Techniques of Geographic Information Systems (2nd Edition)*. Prentice Hall, Upper Saddle River, New Jersey

This text may be used for review of concepts discussed in lecture and lab; multiple copies will be made available in the library under short-term loan. Note that almost any GIS text can be used for this purpose (consult with the Course Instructor as necessary).

Required readings will be included/listed within the lecture and lab material.

## Grading

Assignments (3 Total - Late assignments are penalized 10% per day):

January (A01) - 15% (presented January 11th, due February 5th)

February (A02) - 10% (presented February 1st, due March 5th)

March (A03) - 15% (presented March 1st, due April 5th)

Midterm Test: 15% (February 22)

Final Exam: 45%

## Lecture Time

Monday 12-2pm

## Tutorial Time

Monday 2-4pm