

**GIS in Water Resources**  
**Fall 2019**  
**CUAHSI Virtual University**

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**Course Description**

Application of Geographic Information Systems (GIS) in Water Resources. Digital mapping of water resources information using content from publicly available sources such as the US national map, and other climate and hydrography datasets. Hydrologic terrain analysis using digital elevation models (DEMs) and DEM based delineation of channel networks and watersheds. Flood hydrology modeling and inundation mapping based on height above the nearest drainage derived from digital elevation models. There will be four detailed computer exercises that introduce (1) Building a watershed basemap using publicly available hydrography and watershed boundary data in the US; (2) Spatial analysis. Calculation of slope, land use and precipitation over subwatersheds; (3) Watershed delineation from digital elevation models; and (4) Basic GIS Programming using Python, using calculation of river hydraulic properties using height above the nearest drainage (HAND) as an example.

**Prerequisite:** This course will use ArcGIS Pro from ESRI. The prerequisite is basic knowledge of GIS through any prior GIS course or self-preparation through the 3 hour free Getting Started with ArcGIS Pro lesson from ESRI at <https://learn.arcgis.com/en/projects/get-started-with-arcgis-pro/>. Arrangements will be made for students to use ArcGIS Pro through their university site license or student licenses valid for 1 year.

**Course Objectives**

The course exercises are intended to enable you to be able to:

- Prepare a base map of a hydrologic region including watersheds, streams, topography, land use measurement sites and data measured at those locations;
- Interpolate measured data at points to form raster surfaces over a region, and spatially average those surfaces over polygons of interest;
- Do hydrologic calculations using map algebra on raster grids;
- Analyze a digital elevation model of land surface terrain to derive watersheds and stream networks.
- Calculate hydraulic properties of stream channels from a digital elevation model using the height above nearest drainage (HAND) approach.
- Use programming to automate and extend GIS work.

**Course Web Site**

<https://cuahsi.instructure.com/courses/73>

## Course Computer Environment

This course will use ArcGIS Pro version 2.4 from ESRI.

The ArcGIS Pro software is available for Windows computers. On a computer with a different operating system you may need to use a Windows virtual machine.

First you need an ESRI account. The universities participating in CUAHSI Virtual University all have ESRI site licenses and I have requested that your local instructor arrange for your local ESRI site license administrator to create an ESRI account for you linked to your university. Look out for an email from email from “ArcGIS Notifications notifications@arcgis.com” that has the subject “An invitation to join an ArcGIS Online organization” that invites you to set up an ESRI account. Follow the instructions in this email to create an account.

Once your ESRI account has been created and associated with your university ArcGIS Online organization, the administrator needs to authorize you for use of ArcGIS pro. This may take up to a day as it is a manual step that requires them to log in and link your account.

A number of Toolboxes within ArcGIS Pro, such as The Spatial Analyst and 3D Analyst toolboxes will be used in the course.

Refer to <https://cuahsi.instructure.com/courses/73/pages/instructions-for-accessing-and-using-arcgis-pro-software>

## Course Readings

Readings for this course will be given out as in-class handouts or links to resources on the web.

## Method of Evaluation

Course grades will be based on assigned exercises.

## Schedule

Class	Date	Subject
1	Tue Sep 3	Introduction to GIS in Water Resources. Data sources.
2	Thu Sep 5	Exercise 1: Building a base map.
3	Tue Sep 10	Spatial Analysis
4	Thu Sep 12	Exercise 2: Spatial analysis in Hydrology
5	Tue Sep 17	Digital Elevation Model Watershed and Stream Network Delineation
6	Thu Sep 19	Exercise 3. Watershed and Stream Network Delineation
7	Tue Sep 24	Basic GIS Programming using Python. Height above Nearest Drainage (HAND) Flood Inundation Mapping
8	Thu Sep 26	Exercise 4: Height above Nearest Drainage (HAND) Flood Inundation Mapping