

**Applying Geographic Information Systems for Terrain and Watershed  
Analysis in Hydrology  
Fall 2021  
CUAHSI Virtual University**

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### **Course Description**

Digital mapping of hydrology and 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.

**Prerequisites:** 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 Predict Deforestation in the Amazon rain forest online lesson from ESRI at

<https://learn.arcgis.com/en/projects/predict-deforestation-in-the-amazon-rain-forest/>.

Arrangements will be made for students to use ArcGIS Pro through their university site license.

### **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/199>

## **Course Computer Environment**

This course will use ArcGIS Pro version 2.8 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.

The universities participating in CUAHSI Virtual University all have ESRI site licenses and your local instructor needs to arrange for access. See “Instructions for Accessing and using ArcGIS Pro Software” document in course website.

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

## **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**

<b>Class</b>	<b>Date</b>	<b>Subject</b>
1	Thu Sep 9	Introduction to GIS in Water Resources. Data sources.
2	Tue Sep 14	Exercise 1: Building a base map.
3	Thu Sep 16	Spatial Analysis
4	Tue Sep 21	Exercise 2: Spatial Analysis in Hydrology
5	Thu Sep 23	Digital Elevation Model Watershed and Stream Network Delineation
6	Tue Sep 28	Exercise 3. Watershed and Stream Network Delineation
7	Thu Sep 30	Basic GIS Programming using Python. Height above Nearest Drainage (HAND) Flood Inundation Mapping
8	Tue Oct 5	Exercise 4: Height above Nearest Drainage (HAND) Flood Inundation Mapping