Corvallis, Oregon
Flood Inundation (2023)

Geospatial Information and GIS

CE 513, Winter 2023

Oregon State University

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-Objective-

Corvallis, OR

Corvallis, Oregon, is located in the Mid-Willamette Valley in Oregon. It is located at the confluence of the Marys and Willamette River. Corvallis is home to a thriving economy, featuring HP and Oregon State University as main employers. Weather in Corvallis is temperate, with cool winters, the occasional snowfall, and thick clouds during most of the rainy season. The city itself averages roughly 41 inches of rainfall per year. Originally founded in 1845, the city has experienced various flood events throughout its history. With a population of just over 60,000, it is more important than ever that community members and the city be aware of potential flooding hazards.

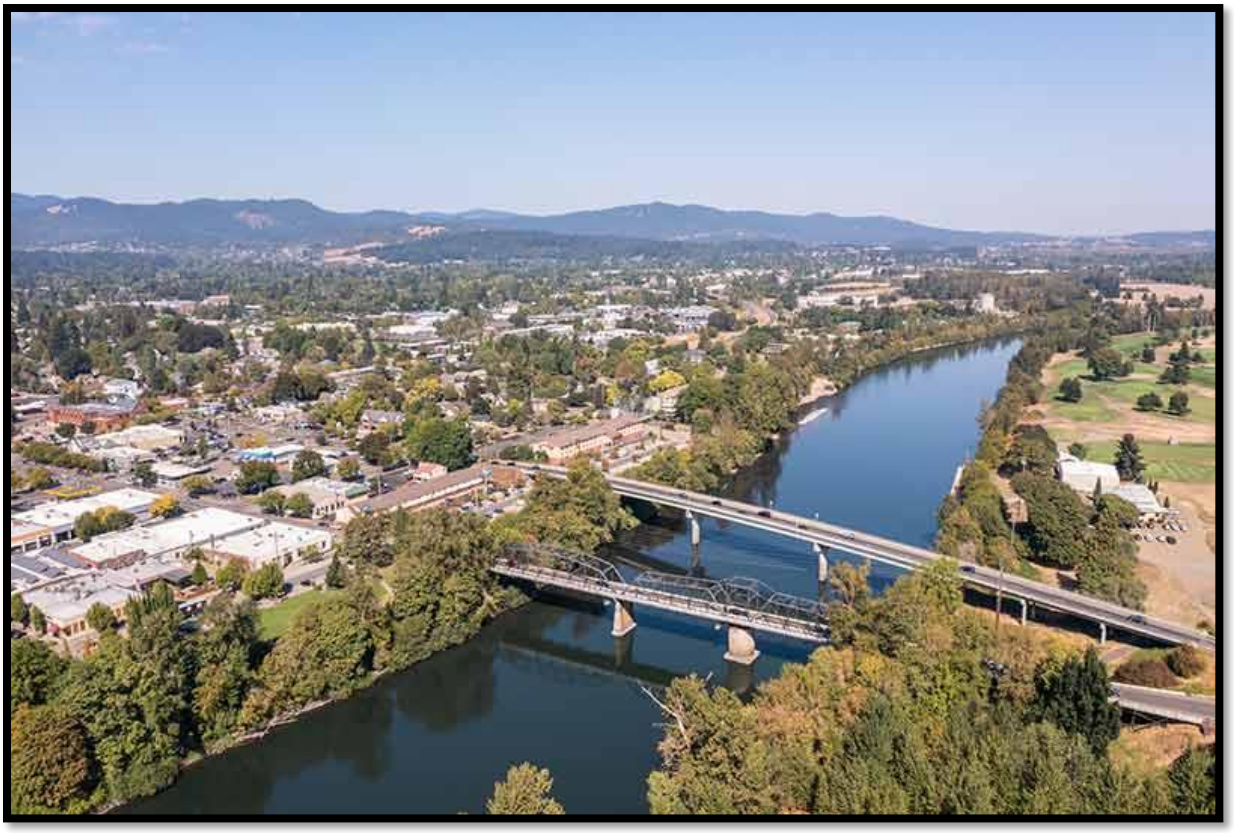


Figure 1. Corvallis, Oregon (Wikipedia)

-Objective-

Primary Objective

The primary goal of this project is to identify the areas that are most likely to flood when the Willamette River rises above its banks. Flood depth and inundation will be determined using a DEM of the Corvallis area, along with flowline and information on the headwaters of each waterway. The need for this project is due to overall community concern and the need for flood resistance, especially when flood frequency and severity are expected to increase with the onset of climate change (Shao, 2022).

Figure 3. Flooding in Downtown Corvallis

-GIS Methodology-

Datasets

Oregon Counties (2000)- This dataset displays the location and boundaries of Oregon Counties. Attribute information includes county name and area.

Name	Oregon Counties (2000)
Description	Counties in Oregon
Type	Vector- Polygon
Map Projection	Lambert Conformal Conic
Unit	Foot
Author	Oregon State University Rural Studies Program
Web Address	https://oregonexplorer.info/
Attributes Used	INSTNAME

Table 1. Oregon Counties (2000)

Figure 4. Oregon Counties (2000)

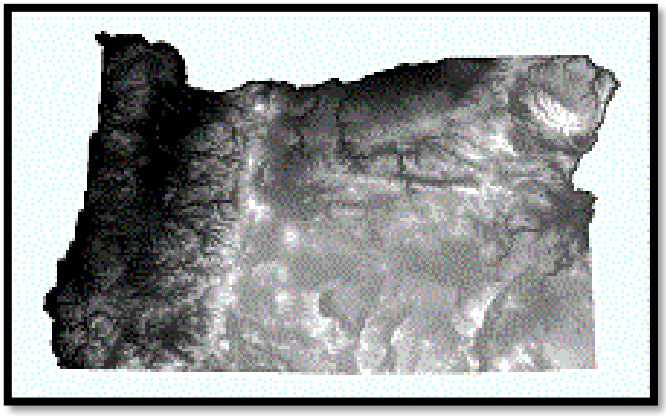


Figure 5. Oregon 10m Digital Elevation Model (DEM)

Oregon 10m Digital Elevation Model (DEM)- A dataset displaying the height of 10x10m points in the State of Oregon.

Name	Oregon 10m Digital Elevation Model (DEM)
Description	Elevation Data for Oregon
Type	Raster
Map Projection	Lambert Conformal Conic
Unit	Meter, Elevation values in feet
Author	Oregon Geospatial Enterprise Office
Web Address	https://spatialdata.oregonexplorer.info/geoportal/details;id=7a82c1be50504f56a9d49d13c7b4d9aa
Attributes Used	N/A

Table 2. Oregon 10m Digital Elevation Model (DEM)

-GIS Methodology-

NFIE-Geo Pacific Northwest Region- This dataset combines information of all hydrologically-related information needed to perform flood and watershed analysis.

Name	NFIE-Geo Pacific Northwest Region
Description	Hydrologic Information for the NFIE-Geo Pacific Northwest Region
Type	Vector- Point
Map Projection	Lambert Conformal Conic
Unit	Foot
Author	NFIE, Cassandra Fagan
Web Address	https://www.hydroshare.org/resource/6a38890c0ce24c22badf89cb1da6be79/
Attributes Used	Flowlines

Table 3. NFIE-Geo Pacific Northwest Region

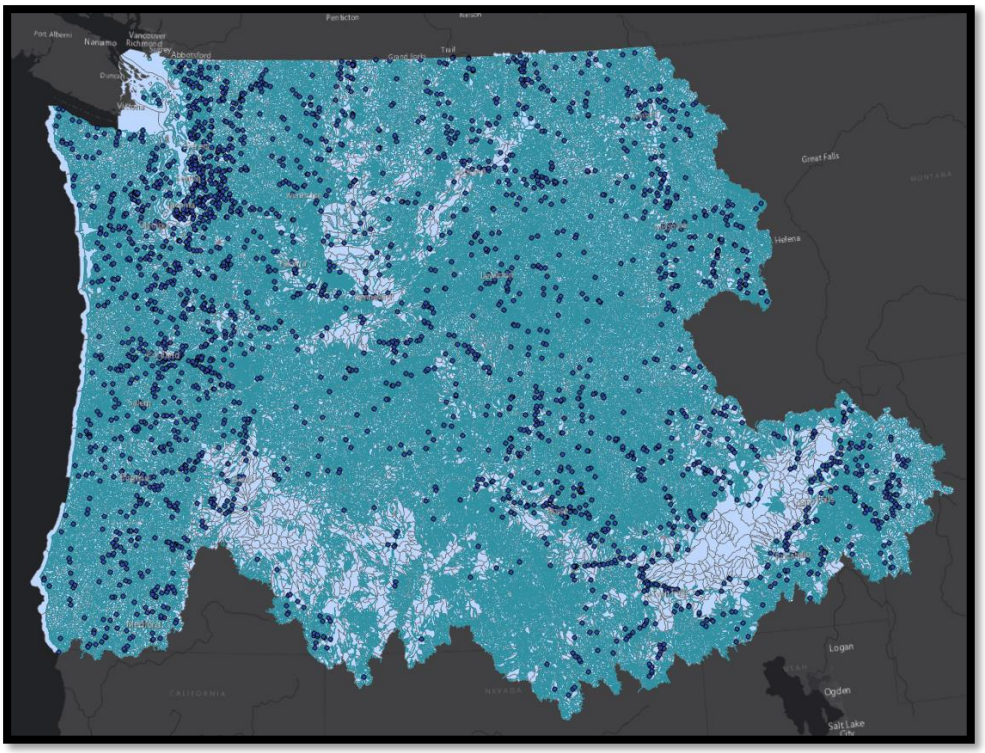


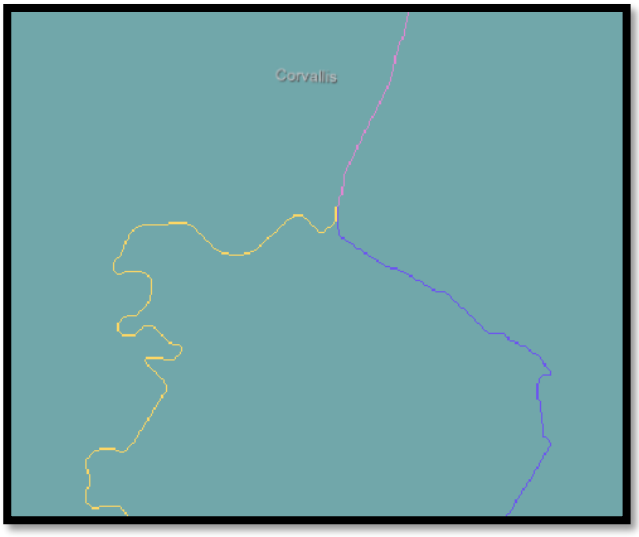
Figure 6. NFIE-Geo Pacific Northwest Region

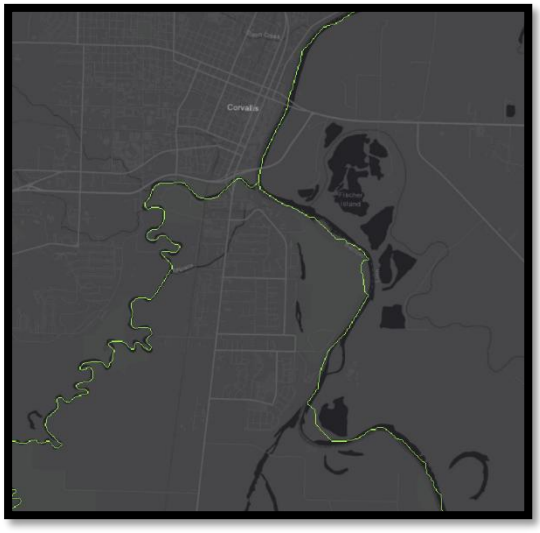
Methodology

The main objective of this analysis is to identify regions impacted by flooding within the Corvallis area. It is presumed from personal observations during past events, that the downtown area will experience minimal flooding, and regions such as South Corvallis will bear the brunt of the majority of the flood. To perform this analysis, it is necessary to collect data from the Hydroshare database, as well as elevation data in the form of a 10x10m DEM of the Oregon. After unzipping and importing the source data, one can now start working with it.

Initially, all data is in the original size in which it came. This can be reduced to just Benton County to speed up processing. Additionally, Dixon Creek in Corvallis must be removed, because it's elevation does not allow for the HAND raster to be accurate when it is displayed. This can be done by selecting and deleting the line, as well as any lines and points feeding into it. After cleaning up the data, analysis can begin. First, one must use the "Feature Vertices to Points" tool to add a point to the end of each flowline, using the dangling vertices method. Next, these points must be converted to raster form to create the flowpath for the waterways. Following that, flow accumulation can be done, using a slope raster in D8 form from the 10x10 DEM.

The output for flow accumulation (figure 7) is not in its final form however, since it is in 7 different colors, and flowlines are not congruent. This can be resolved using the Con function, which cleans up the data, and gives our streams layer (figure 8).





(Left) Figure 7. Flow accumulation output
(Right) Figure 8. Streams layer

-GIS Methodology-

Following the completion of the streams layer, a map of the flow distance can be obtained, using the streams, DEM and a DINF flow direction raster. Layer symbology has been modified to reflect the various flood stages of the Willamette River.

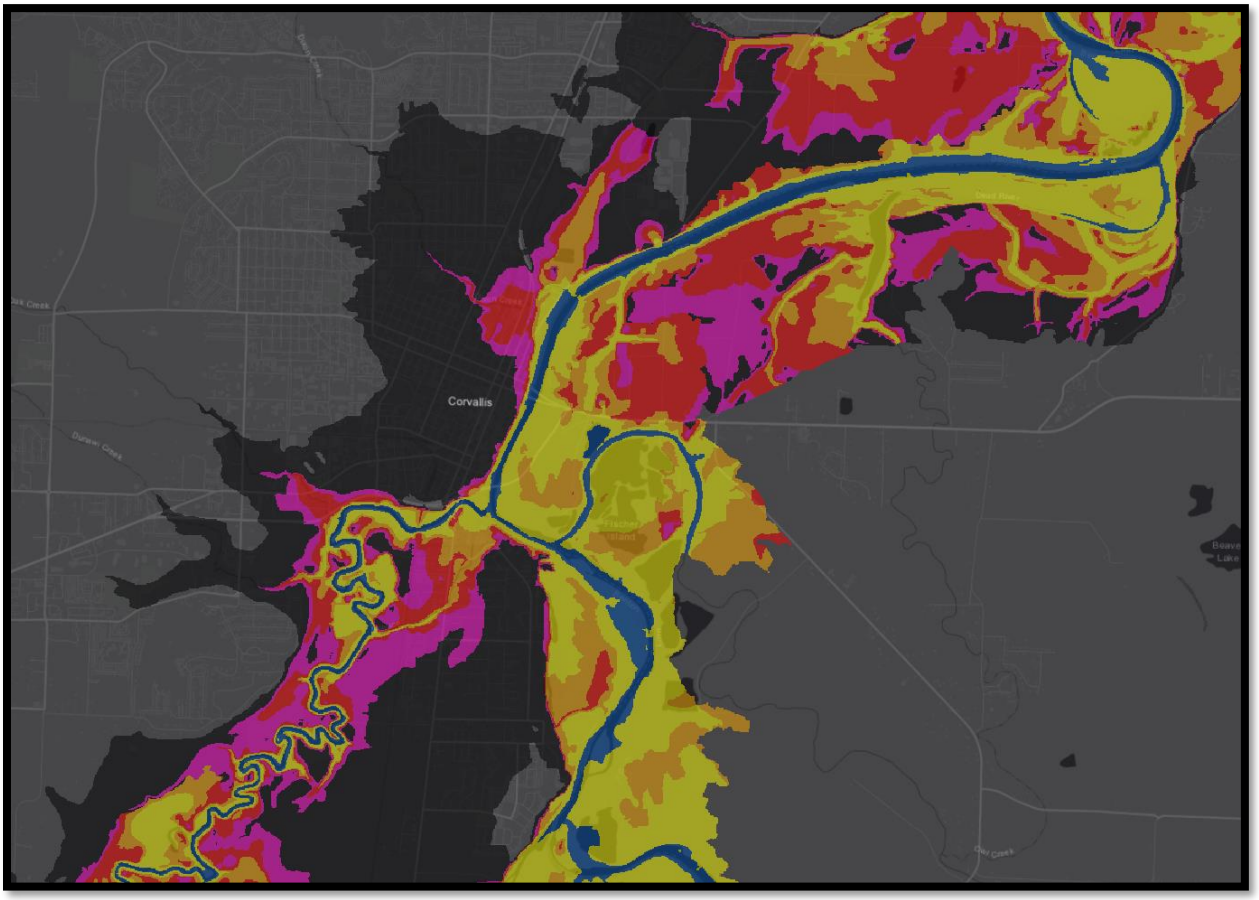


Figure 9. HAND Layer

Model Builder

This model displays how one would perform this analysis on another location and was used in the creation of this map. The flowlines that need a HAND calculation done are selected as an input, along with a DEM of the interest area. It is recommended that both the flowline and DEM features be limited in size as much as possible to speed up processing time.

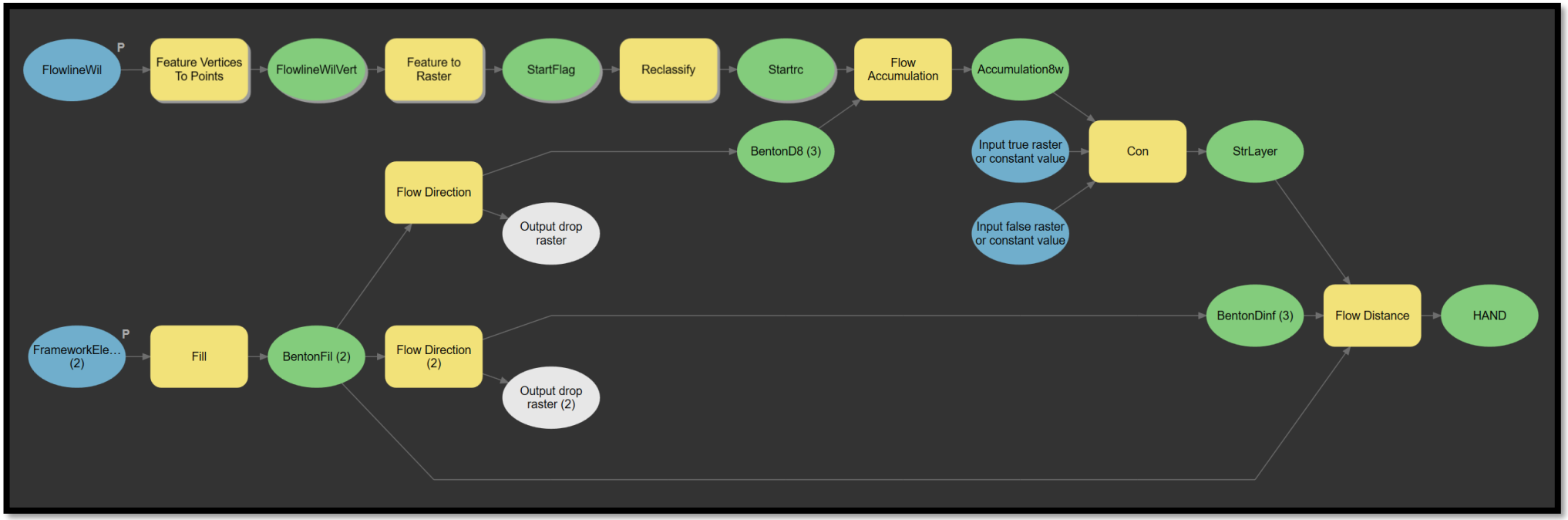


Figure 10. Model Builder

-Outcomes-

Outcomes

After performing a GIS analysis, I am able to view locations projected to flood during various levels of flooding in Corvallis. When selecting the flood gauge values to use for analysis, I subtracted the mean water height from the gauge value to set the symbology, since the DEM elevation gives me the surface elevation of the water, and I have to assume that flow conditions were average at the time the image was taken. Following the selection of the symbology, I then explored the map, and investigated certain locations projected to be affected by flooding.

After identifying a few select locations of interest, I was able to compare and validate my results from past flood conditions. Photos from the flood in 2019 allowed me to better understand my map, and images of Hwy 34 West of Corvallis underwater (figure 11), and the mapped depth (roughly the moderate flood stage) matched closely to confirm that my map (figure 12) was accurate.

Figure 11. Hwy 34 Underwater (KVAL)

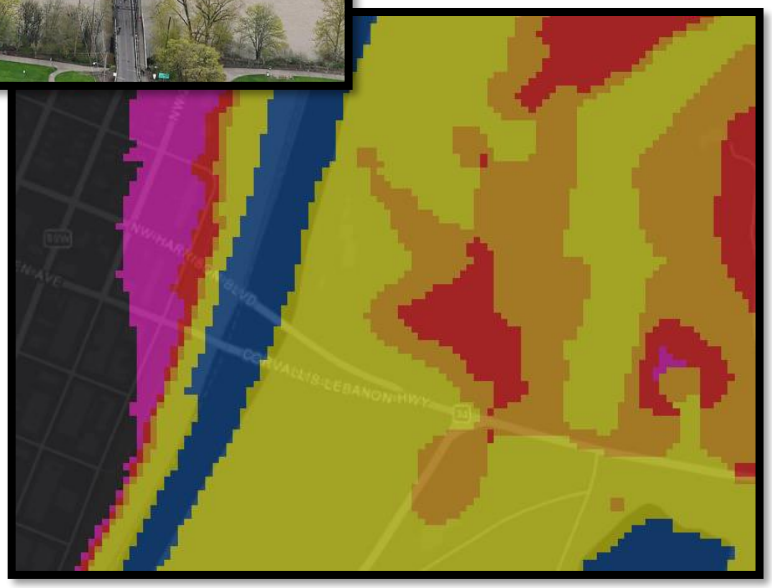


Figure 22. GIS map of the west side of the HWY 34 bridges. All areas not shown in pink or black are underwater.

-Outcomes-

Despite ensuring that the map is similar to real-world flood conditions, I still remain unsure of the overall accuracy of the map, since I am unsure what the height of the Willamette was at the time the DEM was captured. This map remains a helpful resource for those trying to ascertain what risk they are for a flood during certain conditions but should not be used as the sole resource when determining flood risk.

-Bibliography-

Works Cited

"Oregon Secretary of State." State of Oregon: County Records Guide - Benton County History, https://sos.oregon.gov/archives/records/county/Pages/benton-history.aspx.

Rose, Joseph. "Remembering Oregon's Epic 1996 Flood (Photos)." Oregonlive, 5 Feb. 2020, https://www.oregonlive.com/history/2016/02/oregon_flood_of_1996_20_years.html.

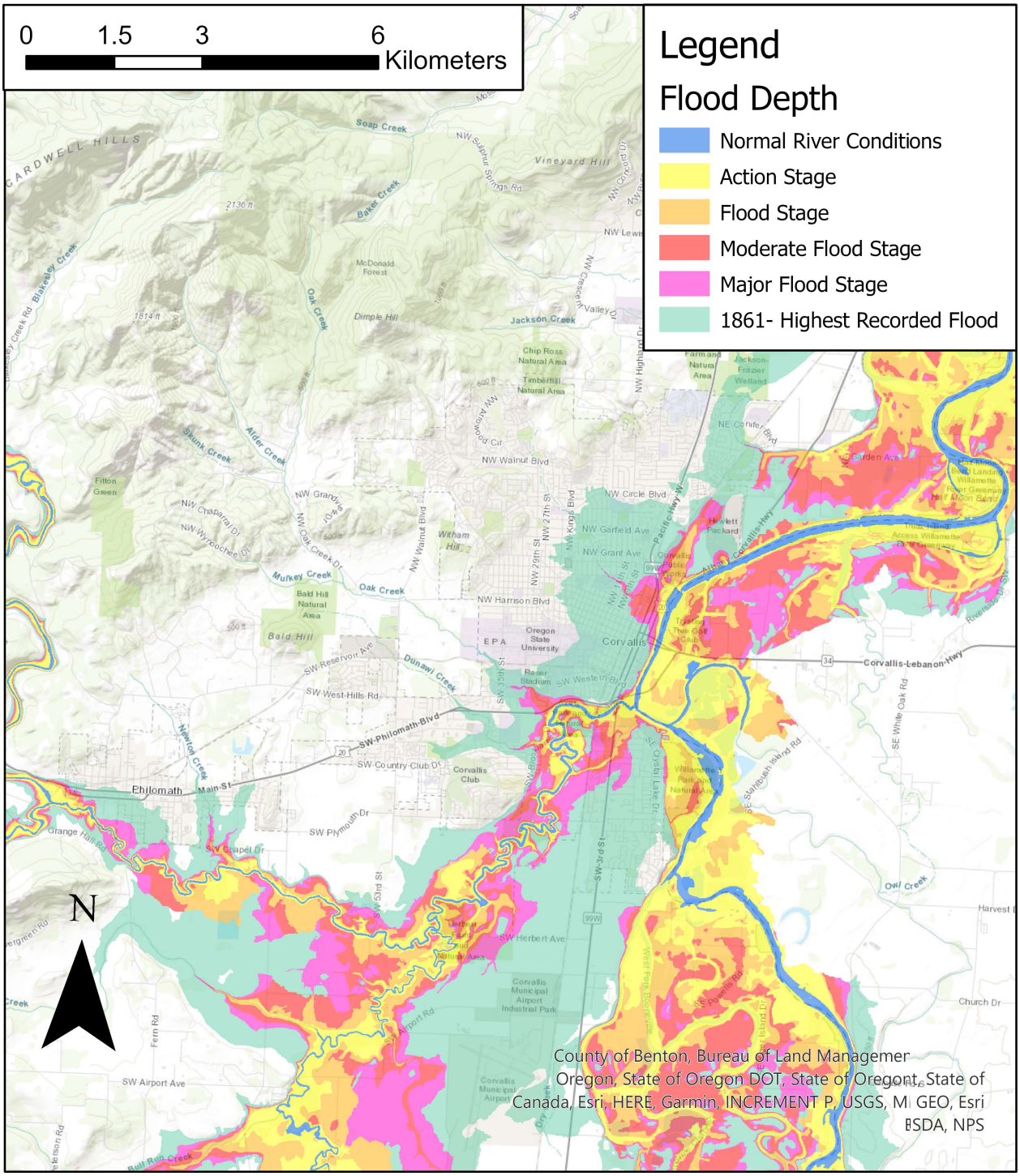
Shao, Elena. "How Is Climate Change Affecting Floods?" The New York Times, The New York Times, 26 July 2022, https://www.nytimes.com/article/flooding-climate-change.html.

Cover Photo: Oregonian

Willamette River in Eastern Benton County

Eastern Benton County as the Willamette River Floods

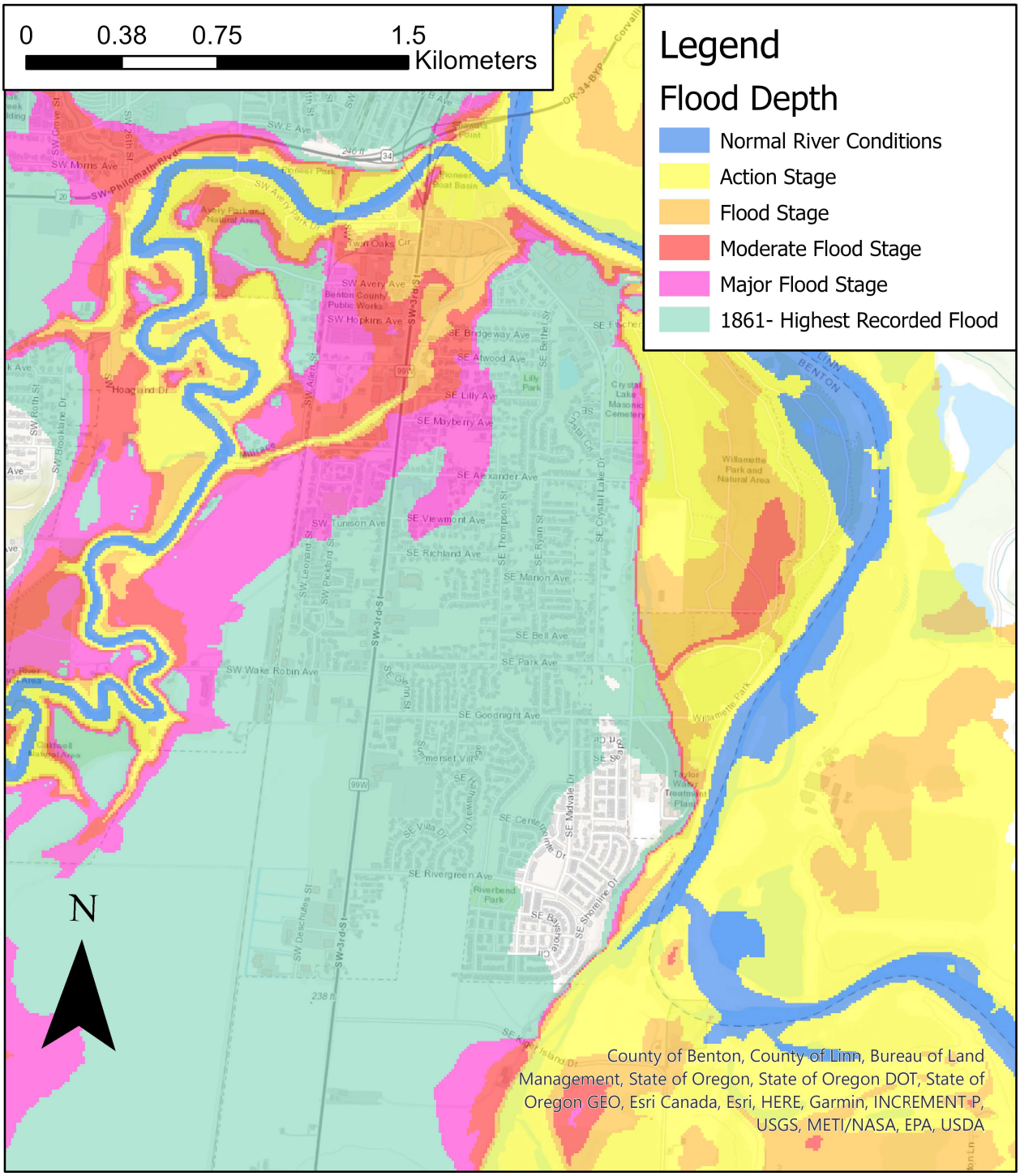
Benjamin Fryback, CE 413 Winter 2023



Flood conditions in East Benton County at different stages of the Willamette River

Willamette River in Corvallis

South Corvallis, OR as the Willamette River Floods
Benjamin Fryback, CE 413 Winter 2023



Flood conditions in South Corvallis at different stages of the Willamette River