

## Lab Report

Title: Forest Disturbances and the Drinking Water Supply from Forests in Minnesota

Notice: Dr. Bryan Runck

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Date: September 28, 2022

**Project Repository:**

**Google Drive Link:**

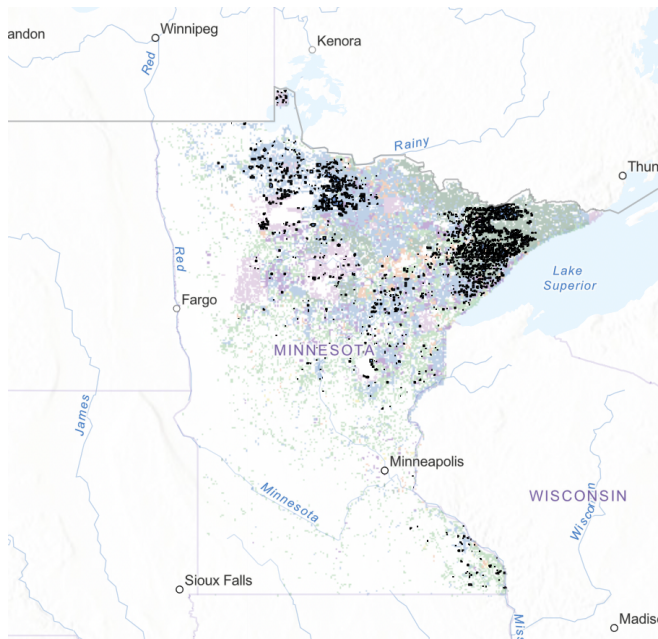
**Time Spent:** 2 hours

### Abstract

Minnesota between the years 2020 to 2022 have lost a total of 0.6-percent of tree cover (Global Forest Watch, 2022). Forests are a valuable and reliable resource for quality drinking water. Forests provide the most stable and highest quality water supplies among all the land uses, thus it is important to understand how forest disturbances like climate change, pests, diseases might be impacting the water supply coming from forests. By quantifying the surface water supply originating from forest lands and analyzing forest disturbances we can gain useful information on how we can mitigate these issues.

### Problem Statement

Forests provide the most stable and highest quality water supplies among all the land uses, thus it is important to understand how forest disturbances like climate change, pests, diseases might be impacting the water supply coming from forests. By quantifying the surface water supply originating from forest lands and analyzing forest disturbances (i.e. climate change, pests, and diseases) we can gain useful information on how we can mitigate these issues.



*Table 1. Required Data*

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	Streamlines in Minnesota	Streamlines	Lines	N/A	Vector	None
2	HUCs in Minnesota	Hydrologic Unit Code	Polygons	TBD	Vector	None
3	SGSF Flow Data for Minnesota	Water Yield, Water Supply	Lines and Points	TBD	Vector	TBD
4	Forest Disturbances in Minnesota	Forest Disturbances	Polygons	Wind, harvest, etc.	Vector	TBD
5	Areas of Drought in Minnesota	Areas of Drought	Polygons	TBD	Vector	TBD
6	Flooding in Minnesota	Areas of Flooding	Polygons	TBD	Vector	TBD

## Input Data

The data below

*Table 2. Flow and Impact Analysis*

#	Title	Purpose in Analysis	Link to Source
1	SGSF Flow Data for Minnesota	Raw input dataset for flow analysis	<a href="#">USDA</a>
2	Streamlines in Minnesota	Raw input dataset for flow analysis	<a href="#">USDA</a>
3	HUCs in Minnesota	Raw input dataset for flow analysis	<a href="#">USDA</a>
4	Most Fast Recent Forest Disturbances in Minnesota	Raw input dataset for impact analysis	<a href="#">Minnesota Geospatial Commons</a>
5	U.S. Drought Monitor	Raw input dataset for impact/severity analysis	TBD
6	Forest Health Survey 2019, Minnesota	Raw input dataset for impact analysis	<a href="#">Minnesota Geospatial Commons</a>

7	Forest Health Survey 2021, Minnesota	Raw input dataset for impact analysis	<a href="#">Minnesota Geospatial Commons</a>
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## Methods

Figure 1. Data flow diagram.

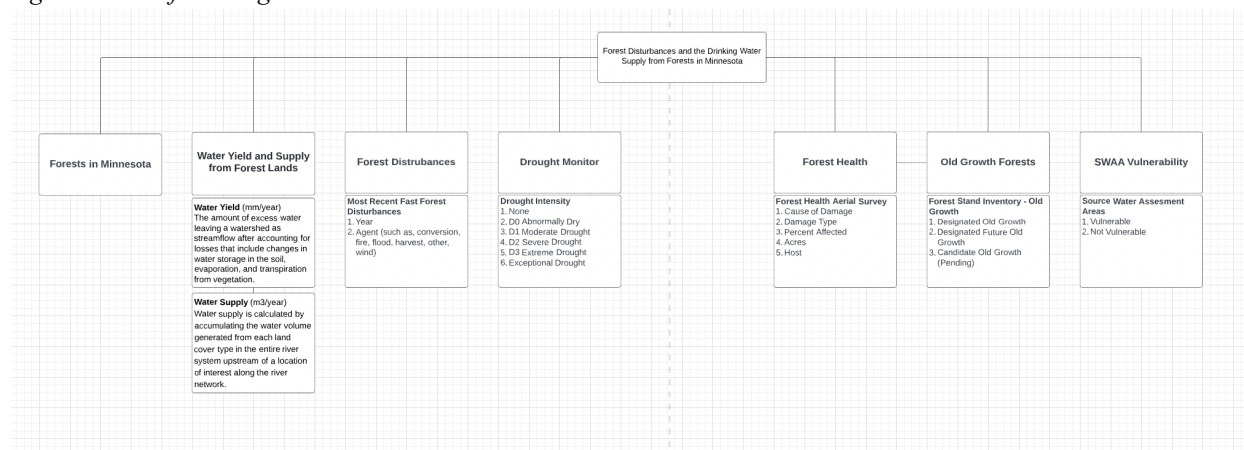
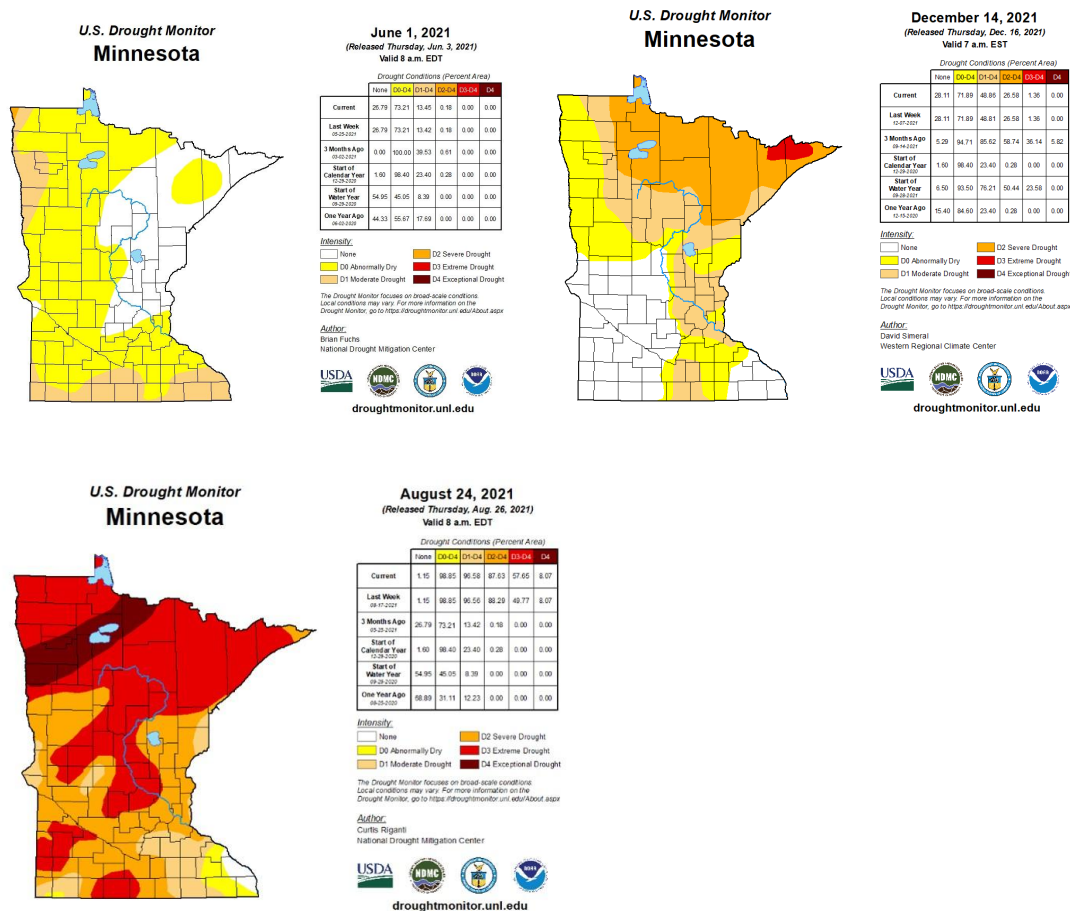
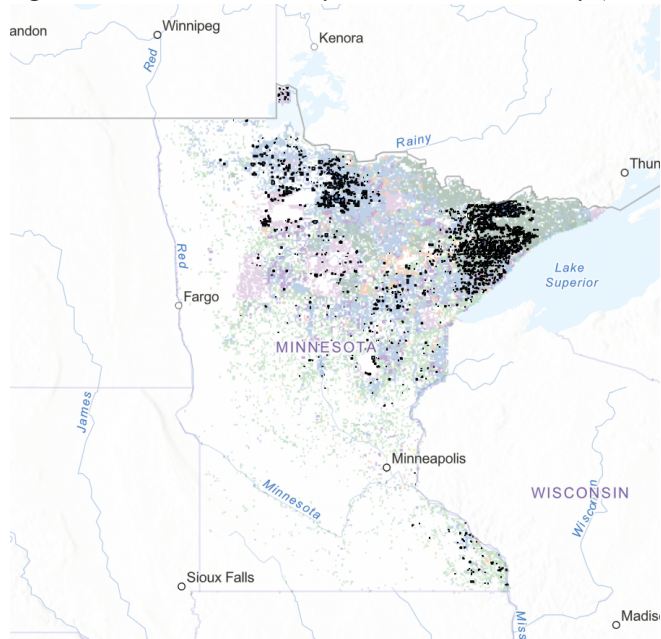


Figure 2. U.S. Drought Monitor - Minnesota



*Figure 3. Forest Health Survey with a Forest Underlay (Forest by Ownership Group)*



## Results

The results I expect to see from the flow and impact analysis are correlations between: (a) surface water supply from forest lands and forest disturbances, (b) surface water supply from forest lands and climate change (i.e., droughts and floods). These results will help to identify areas of concern such as Northeastern Minnesota.

## Results Verification

For now, the results will be verified qualitatively by carefully looking at all of the attributes in the map to see if they seem correct. The analysis could also be replicated using ArcGIS Pro or an open source application to verify the results.

## Discussion and Conclusion

This project helped to shed light on the percentage of surface water Minnesota receives from forested land, gain a better understanding of how severe droughts and floods impact the forest canopy, and show how damaging a pest can be in a forest environment.

## References

- Minnesota Department of Natural Resources. 2021. 2021 Forest Health Annual Report.  
<https://www.leg.mn.gov/docs/2022/Other/220224.pdf>
- USDA. Federal, State, and Private Forest Lands in the Upper Mississippi River. 2022.  
<https://storymaps.arcgis.com/stories/88306d1a163c4b889093aa480b23dfc9>

**Self-score**

<b>Category</b>	<b>Description</b>	<b>Points Possible</b>	<b>Score</b>
<b>Structural Elements</b>	All elements of a lab report are included ( <b>2 points each</b> ): Title, Notice: Dr. Bryan Runck, Author, Project Repository, Date, Abstract, Problem Statement, Input Data w/ tables, Methods w/ Data, Flow Diagrams, Results, Results Verification, Discussion and Conclusion, References in common format, Self-score	28	<b>28</b>
<b>Clarity of Content</b>	Each element above is executed at a professional level so that someone can understand the goal, data, methods, results, and their validity and implications in a 5 minute reading at a cursory-level, and in a 30 minute meeting at a deep level ( <b>12 points</b> ). There is a clear connection from data to results to discussion and conclusion ( <b>12 points</b> ).	24	<b>22</b>
<b>Reproducibility</b>	Results are completely reproducible by someone with basic GIS training. There is no ambiguity in data flow or rationale for data operations. Every step is documented and justified.	28	<b>26</b>
<b>Verification</b>	Results are correct in that they have been verified in comparison to some standard. The standard is clearly stated ( <b>10 points</b> ), the method of comparison is clearly stated ( <b>5 points</b> ), and the result of verification is clearly stated ( <b>5 points</b> ).	20	<b>19</b>
		100	<b>95</b>