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Geospatial Analysis for Disaster Planning

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Project Overview

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Project Overview

Vision Statement:

"A geospatial analysis tool will provide emergency managers with a systems level view of the impact of disasters on their jurisdiction's lifeline networks. Thus, our software will help them in creating robust response plans by identifying critical intersections of lifeline networks that may cause bottlenecks in recovery, as well as by providing estimates of time and resources required for debris clearance."

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What Does this Mean?

- Main Goal
  - Create a tool that emergency managers can use to help estimate the most effective way to clean up an area if a disaster were to happen
  - Show the best routes possible for clean up along with the amount of time it will take to clear the area assuming the debris spread and the amount of clean up resources available
- How do we achieve this?
  - Use a software that provides Geodata (ArcGIS Pro) and that's used in industry
  - Create a toolbox that is based in ArcGIS Pro so that emergency managers can just add our tool to their already existing software
  - Using mostly python scripting
    - Python libraries within ArcGIS pro

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System Diagrams

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Sequence Diagram

Our project will utilize ArcGIS and interacts with a couple of tools in the toolbox. The ArcGIS Pro software can visualize the disaster simulation and help emergency managers to make better-informed decisions and plans. We created the toolboxes directly in ArcGIS Pro. The toolboxes include different scripts for specific uses. The user mainly deals with the toolboxes interact with ArcGIS Pro for making necessary layers. The toolboxes handle available resources and different kinds of requests from the user, then return results to users.

On the left side of the diagram, you can see the column of Hazus and other simulation tools. We are no longer using Hazus for your project, but our ArcGIS tool still can receive data from Hazus.

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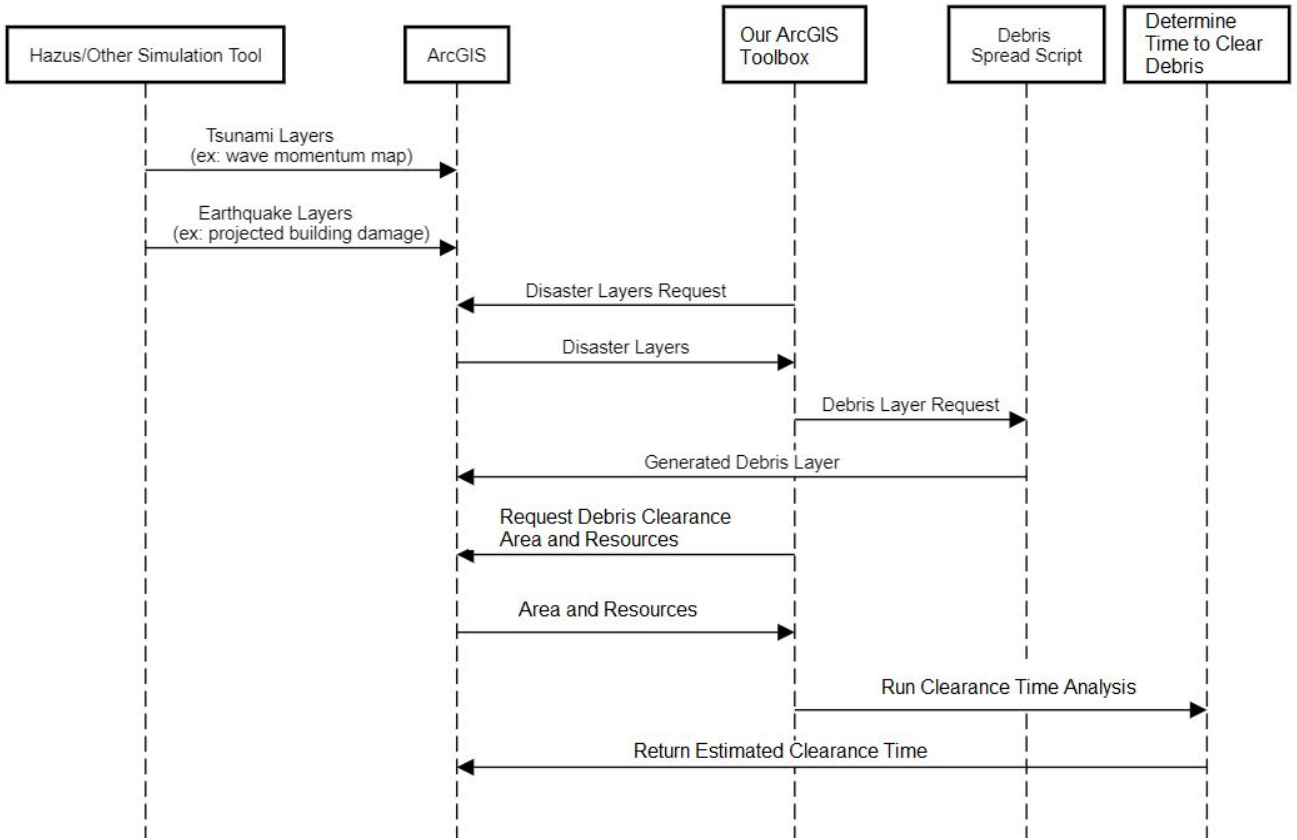

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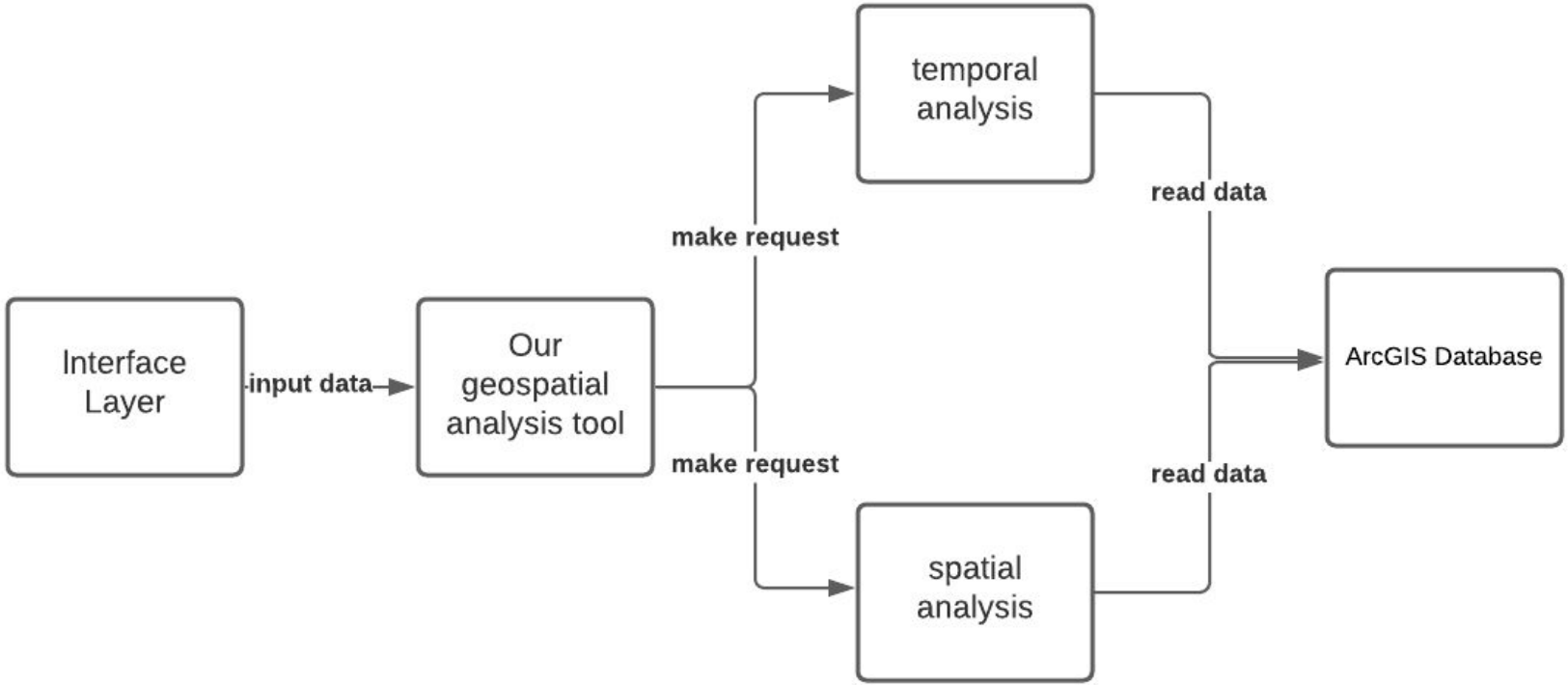
Process Flow Diagram

Our project will provide the user an interface, in the form of an ArcGIS toolbox pane. This interface allows emergency managers to input data such as debris spread data or a location to do analysis. The user needs to enter the parameters for the specific geospatial analysis tool. Then the tool will run a script. The script may print the result to the output of the toolbox, or create new layers and add them to the current ArcGIS project.


temporal analysis
read data
make request
Interface Layer
input data
Our geospatial analysis tool
ArcGIS Database
make request
read data
spatial analysis

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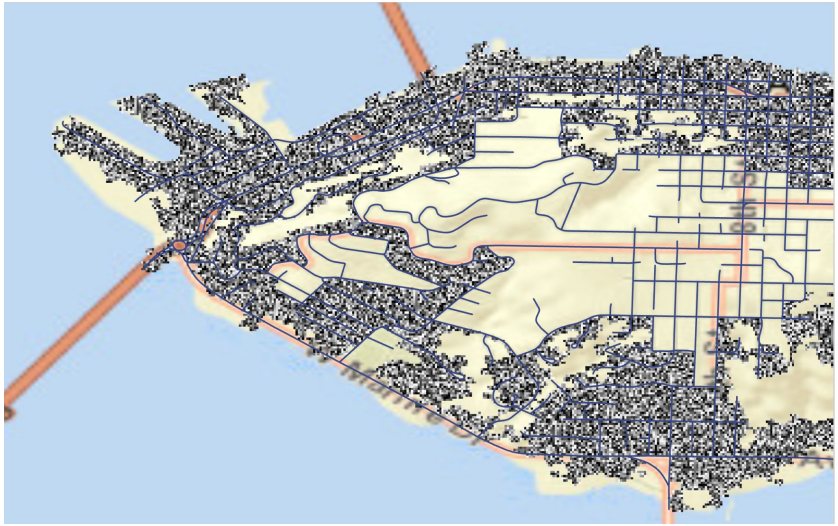
Walkthrough

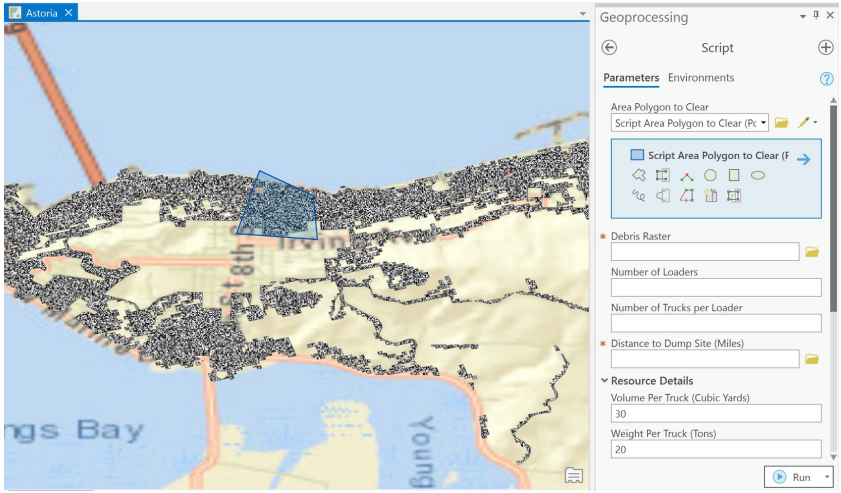
1. Create Debris Spread Data

The user can run the CreateRandomRaster script to randomly estimate debris spread or obtain a raster of debris spread data from elsewhere.



2. Select Area to Clear

The user draws an area to clear using ArcGIS Pro's built in draw tool.

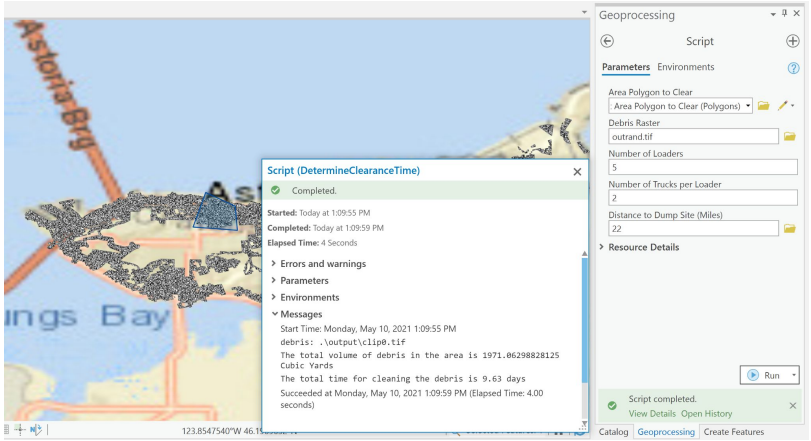


3. Find Debris Information

The user runs the DetermineDebrisVolume script to get a calculation of the debris inside of the area based on the debris raster file.

And/Or

The user runs the DetermineClearanceTime script to get a calculation of the amount of time it would take to clear the area of debris given by the debris raster file.



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Challenges

- Finding debris spread data
- Choosing external software
- Intersections that cause bottlenecking

- To fix this we just implemented our own fake data so we could move forward in the project
- Needed to find software that was used in industry and that could aid us when creating our project
- Our tool can find the debris spread over roads but we have not been able to find critical intersections. As a work around, we found how to clear all the debris in the area as a starting point in order to move forward with this project.

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Future Plans

- Our project partner, Dr. Louis, is interested in continuing the project further to add more features or polish existing ones.

- Some potential avenues the project could go down
  - Addition of shortest/efficient route calculations
  - Addition of more in depth management of dump sites
  - Diversification of construction equipment used in clearance calculations
  - Inclusion of tsunami damage in calculations
  - Clearance of additional lifeline networks
  - Ability to prioritize debris clearance