TO: Dr. Ames
FROM: Team Three-Toed Sloth (Alex Fisher, Chris Edwards, Jake Lewis)
DATE: 1/17/19
SUBJECT: Snowmelt App Proposal

Proposal:

We the team, Three-Toed Sloth, in order to develop a more perfect snowmelt web app do propose using snow related raster and point data for a specified area in Utah to asses the volume of water generated by a snowpack and the effect on related streams, rivers and roads. Judging by the volume of water generated from the snowpack, a given stream and/or road will be assigned a threat level and will be reported for the user specified area in our proposed app.

Vector and Raster Data Analysis Required:

- Gather Relevant Information for Area specified (Snow Runoff to Rivers/Area Impact):
    - SNOTEL - Vector Data
      https://www.wcc.nrcs.usda.gov/snow/snotel-data.html
        - Retrieve user specified time and historical snow data from snow gauges including total precipitation, average air temperature and theoretical water generated from the snowpack.
    - GIS Utah Roads - Vector Data
      https://gis.utah.gov/data/transportation/roads-system/
        - Isolate roads in a user specified area.
    - GIS Utah Rivers/Streams - Vector Data
      https://gis.utah.gov/data/water/lakes-rivers-dams/
        - Isolate Rivers and Streams within a user specified area.
    - GIS Utah Watersheds - Vector Data
      https://gis.utah.gov/data/water/watersheds/
        - Asses relevant watersheds affected by snowmelt for a user specified area and connection to local rivers, streams and roads.

- Other useful data that may be used:
    - National Snow Analyses (NOAA)
        - https://www.nohrsc.noaa.gov/nsa/
    - NOAA Operational Model Archive and Distribution System (NOMADS):
        - http://nomads.ncep.noaa.gov/
        - Global Forecast System (GFS)

            - Snow Depth (SNOD)
            - Water equivalent of accumulated snow depth (WEASD)
        - North American Mesoscale (NAM)-North America
            - Snow Depth (SNOD)
            - Water equiv. of accum. snow depth (WEASD)
            - Categorical snow (CSNOW)

- NLDAS Snow Melt Data:
    - https://disc.gsfc.nasa.gov/datasets/NLDAS_MOS0125_M_V002/summary?keywords=Hydrology
    - This shows monthly snowmelt data.

- NRCS 10 Digit Watershed Boundary Dataset
    - https://datagateway.nrcs.usda.gov/GDGOrder.aspx?order=QuickState
    - These are catchment basins as defined by the NRCS.

Data Distributed to the App:

The app will principally use the points of snow depth and the snow extent data from NASA. We will also look into the feasibility of simply using the snow water equivalent data. Calculated watersheds would also be sent to the app to use in volume calculations. Finally, historical averages would be used within the app as a comparison tool.

Geoprocessing Workflow on the Server:

Once the snow depth points and snow extent data have been sent to the server, the depth over the entire snow field will be interpolated. A total volume of snow will be calculated converted into a snow water equivalent (it is also possible that the snow water equivalent data will be used in place of this). From there, the server would divide the snowfields by defined watersheds. Using these watershed snow volumes, melted runoff models would be calculated. For instance, if the snow melted instantaneously, the entirety of the snow water equivalent would be released into the watershed. The user would be able to define melting periods by weeks or months and runoff would be calculated accordingly. These runoff volumes would be compared to historical data, and watersheds would be marked as high or low runoff against the historical average.

Interface Functionality:

The goal of the app is to allow users to see how current snow conditions will affect streamflow the following melt season. For a given area, the user will be able to view the snow data, historical and current. They would also see watershed boundaries and streams of interest. Watersheds or streams will be colored in such a way to show the user which areas will have higher than average or lower than average flows.

Additionally, we would like to add a feature where the users can select different melting scenarios and see how that would affect the flows. For example, they could say all the snow will melt in one month, or two months, and see what difference that would make.

Code Storage and Licensing:

The code for our app will be stored on Chris Edwards' GitHub account (https://github.com/chris3edwards3). We will license our source code using an MIT license. It is the most simple, and we are not too worried, for now, about others stealing our code.

Distribution of Responsibility:

Alex is going to take the lead in the overall design. There is still a lot of work to be done figuring out what exact data we can use and what useful results we can produce. We also need to figure out how to incorporate the historical data to provide context for each year's snowpack.

Jake will lead the actual GIS processes. Once we determine the exact product, Jake will be in charge of figuring out each step of the workflow. He will also lead the web design and visualization techniques.

Chris will take the lead on the programming. This includes the basic app framework, data retrieval, processing, and visualization.