

Determining Extent of Summer Amphibian Habitat in Sierra Nevada Meadows

Nick Santos, UC Davis Center for Watershed Sciences

Note: This example is meant to show one potential structure and the general types of content and information to include in your proposal. Your proposal does not need to look exactly like this to get all the points for the assignment. Nor does your writing need to be in the same style. Pay attention to the components and what types of details are included. Boxes in orange are notes for you to pay attention to and aren't to be included in your proposal.

Headings are not required, but can help you structure your proposal for clarity

Background Information

Amphibian species such as frogs and toads in California are in systematic decline, with numerous species on the Endangered Species List. Mountain meadows in the Sierra Nevada provide habitat and refuge for many of these species. Climate change places additional stress on these habitats though, altering the timing of snowmelt and causing additional heat and water shortage stress in the summers. This project proposes to explore the potential to use publically available satellite imagery to monitor changes in the ecosystem that may affect amphibians. Specifically, **this project seeks to answer whether amphibian habitat in meadows in California's Sierra Nevada Habitat can be detected using satellite imagery and whether the availability of the habitat throughout the summer in recent years declines faster than in prior years.** I expect that due to the low-resolution of Landsat imagery relative to amphibian habitat, habitat will be difficult to detect directly from imagery, but a trained classifier using ground-truthed data collected by teams in my office may allow us to find habitat and detect changes throughout the summer. Further, I expect that habitat availability has declined more rapidly in recent summers, either as a result of climate change, or of the state's 4 year drought.

You don't need to put your research question in bold like this, but a single concise phrasing of your question or hypothesis will help keep you on track

Potential Data Sources

In this analysis I will make use of two public data sources: Landsat imagery (from both Landsat 7 and Landsat 8) and imagery from Sentinel 2. While Sentinel 2 doesn't have the history of Landsat 7, it provides higher resolution that can inform the feasibility of classifying amphibian habitat. Landsat is available at <http://earthexplorer.usgs.gov/> and Sentinel is available at <https://sentinel.esa.int/web/sentinel/sentinel-data-access>

I will also use a comprehensive meadows dataset released by the University of California Davis Center for Watershed Sciences to limit the scope of my analysis to meadows boundaries. This data is available at <http://meadows.ucdavis.edu>

Finally, I will also use data collected by my colleagues and by partners at the United States Forest Service on amphibian locations as a way to validate the results of the remote sensing classifications.

It's OK to use datasets you or your colleagues collected – just make sure they can be shared publicly for this assignment!

Planned Methods

I will attempt to detect amphibian habitat in meadows in California's Sierra Nevada mountains using multiple methods:

- A trained classifier based on hand-digitized locations of amphibian habitat in a few meadows spanning the Sierra Nevada
- A trained classifier based on collected field data that shows the locations of amphibian habitat.
- An analysis based on [NDWI](#) to detect open water and determine shallow breeding locations.
- An analysis based on wetness, possibly using a [tasseled cap transformation](#), to determine pixels that are wetter, but where detecting open water is difficult due to resolution.

Providing links to any sites or research you're using for methods will help you find that information when you reach your analysis phase.

These methods will be repeated for monthly time intervals through the summer (June-September) in order to assess availability of habitat at each interval. This process will be repeated across 3 years: 1996, 2006, and 2016 to assess changes in the last 2 decades. Once complete, I will measure the total area of detected amphibian habitat at each interval and graph the year over year changes for each month.

I expect there will be problems with the low resolution images matching the detail of meadow boundaries. In order to speed processing, I plan to mask out non-meadow pixels, but may need to resample/downscale images first or else too few pixels will be included in narrow stretches of meadow.

Including your expected challenges isn't required, but is a good way to help make your time and effort estimates better. If you expect specific challenges, you'll know better how long the project may take to complete.

Expected Results

First, I expect that training classifiers based on digitized locations will likely not be successful in identifying habitat, largely due to a resolution mismatch between the satellite images and the landscape features. Instead of features that are present in at least 4 pixels (2x2) as is often necessary, I expect much of the habitat will only exist in single pixels, making it difficult to detect with this imagery. If we can detect amphibian habitat using one of the methods above, I expect that there will be significant decreases in habitat available in each month (comparing June 1996 to June 2006 to June 2016). It's possible that these results may be confounded by the choice of years for analysis.