

Possible project ideas

Below are outlines of several suggestions I've received for possible 176C projects. If a point of contact is listed that person would be able to supply more information.

Sedgwick Soil Mapping (Sam Prentice, sep@umail.ucsb.edu)

“Ironically, this occurred to me after I approached you about 176C after Thursday's class. I'm with Oliver, working on a geospatial approach to quantifying soil spatial variability at Sedgwick Reserve. Essentially I'm addressing a legacy issue with publically available soil survey data: it contains no info on uncertainties, assumptions, or variability within and between soil map units and therefore can't be used to parameterize spatially explicit ecosystem models. This may be beyond the scope of a 176C problem, however there's a paucity of spatially coherent soils info at Sedgwick despite its heavy use by UCSB (Dar and Carla D'Antonio come to mind). Some ideas offhand that could serve the community and interested group of students, such as:

- An interactive, spatially explicit soil map of Sedgwick integrating soil property info and ongoing research (hosted by geog...?)
- Below-ground carbon estimates for the entire reserve and/or classified by veg type using map unit polygon and generalized lab data
- NRCS uses an Arc plugin SoilDataViewer to run spatial queries. This is their most 'advanced' method of disseminating spatially explicit technical info. It's seemingly explicit but in fact generalized, and a project could be just to see how effective it is for end users with critical spatial thinking skills.

I created a lab for 114A last fall addressing how NRCS soils data is accessed, and its limitations, but didn't get into the Arc extension.”

UCSB Wireless Access Point Tracer (Blake Regalia, blake.regalia@gmail.com)

“The UCSB Wireless Web transmits wireless radio waves throughout campus by broadcasting from many different devices spread about campus. These devices are called wireless access points. If we equip a mobile/wifi-enabled device with software, we can collect data about each one these wireless access points such as where they are located, how strong their signals are, and what areas of campus do they service?

I have developed a mobile application that records the signal strength of all nearby wifi access points, along with the geographic location from which those signals are received. As a user moves away from an access point, the signal fades; as they move closer, the signal increases. This data provides a discretized heat map of signal strengths, allowing us to pinpoint the location of each access point and figure out what areas they service.

Once you know the location of wireless access points, you can calculate the precise location of a mobile/wireless device through the process of trilateration. GPS is limited; it does not work indoors, next to tall buildings, or in alley-ways. Finding a user's position based on nearby wifi signal strengths is substantially more reliable and accurate. With enough data, we will be able to compose phenomenal applications such as: pedestrian dynamics simulators (evacuation effectiveness, real-time traffic predictions, migration pattern estimates, time-dependent population density maps) & located-based mobile services ("phone, navigate me to the nearest restroom". OR: "phone, where can i study

nearby that isn't crowded right now?")

The intention is for students to contribute to the data by deploying our smart phone app to their peers and collecting data throughout the quarter. The students may pursue any objective they see fit, and will likely be working closely with me and some other grad students to compile and analyze sets of data. I think it is best if I come to present the proposal to the class so that I may be concise, demonstrate some up-to-date visualizations and answer any questions the students may have. Please keep me in contact so I can be prepared to present."

Easter Island Soil Mapping (Oliver Chadwick, oacenator@gmail.com)

"I have been working with archeologists on Easter Island to develop a dataset on soil fertility as influenced by age of lava flows, amount of rainfall and perhaps human landuse. The island is about 164 sq km and we have about 400 datapoints that provide an unequal coverage (one volcano which covers about 20% of the island has no samples although we can predict the general character of the fertility there). Data collection is spatially clumped near for the most part with a few cross island transects. There are good geological maps of the island, but rainfall is poorly known but could perhaps be predicted using a simple orographic rise model with and without a wind direction component (that then should feedback into differences in soil fertility at equal elevations on different sides of the island). Age of volcano matters - younger ones have higher fertility than older ones, something we have shown conclusively in Hawaii.

The collapse narrative for Rapa Nui is quite controversial and becoming more so. There just is not a lot of evidence for catastrophic erosion. There is evidence for low soil fertility compared to the young islands in Hawaii. We (Peter Vitousek and I) approached analysis of Rapa Nui cautiously because we did not want to impose a strong Hawaii bias there, but we have become convinced that there are strong comparisons between the two areas. In essence, we believe that the Polynesians on Rapa Nui had to work harder per calorie of production (both in terms of labor and capital investments, such as rock mulching) than did the Polynesians on Hawaii. And that may have mattered in both development of political complexity and overall survival. It is not clear what happened in terms of culture shift on Rapa Nui and one real possibility is that it was disease brought by Europeans that caused the collapse - only 70 years separates the best date on the collapse and the first European contact.

In any case, a project could plot our data across the island and evaluate them with respect to volcano age, elevation, rainfall (with some creative interpolations) and the distribution of agricultural sites. I do not know if this is appropriate for the interests of 176 students but if it is I can think about sharpening the questions that could be addressed."

Departmental Tile Server (Ben Adams, badams@cs.ucsb.edu)

"Here's a project idea for more computationally inclined students. It would require the use of a server, so we'd need to find an available computer for that.

In this project students will set up a web map tile server for the department of geography that can be used by anyone in the geography department to generate interactive web maps. There will be three main steps: 1) generate custom web map tiles from openstreetmap data, 2) set up a map tile server that allows the tiles to be

downloaded, 3) implement a sample interactive web map that uses tiles from the tile server. This project will give students the opportunity to learn many technical aspects of developing web map applications. It could potentially be combined with others if another project has an interactive web map component.

Links:

http://wiki.openstreetmap.org/wiki/Ubuntu_tile_server

<http://mapbox.com/tilemill/>

<http://tiledrawer.com/>

<http://leaflet.cloudmade.com/>”

Campus Sustainability Dashboard (Mo Lovegreen, lovegreen@geog.ucsb.edu)

“I have the sustainability dashboard I'd like to get help with. This is to pull in electricity, gas, and water/chilled water data in from FM and spatially display the data (along with a display for GHG produced). If we have enough students interested, we could extend this to incorporate additional sustainability points for the campus: update/improve the recycle bin locations, campus compost sites, dumpsters type and locations, a model for energy used in a standard lab/office/dorm room. locations for organic food offerings, organic garden site, e-waste collection points, zipcar locations, update of the bus route information, vernal pools, coastal access points, dorm energy and water competition results, locations for xeriscaping and bioswales, reclaimed water use locations, pv arrays and their production, areas of preserves, solar how water generation sites.”

13th Century Paris Textile Workers (Sharon Farmer, farmer@history.ucsb.edu)

“As Indy indicated, I have a project that I would love to have your students work on in Geography 176c: mapping 13th-century Parisian textile workers (whose street addresses are known to us through a series of tax assessments) onto a map of thirteenth-century Paris (which, I understand from Indy, would need to be superimposed onto the current topography of Paris in order to establish the correct co-ordinates).

Although I already made some rough maps plotting the locations of these workers by hand, I would be interested in having the students re-do the project with GIS, adding some detail (distribution of workers by gender, for instance), that I didn't include in my hand-drawn maps. Also, to date I've only worked on the locations of silk textile workers, but would be interested in having the students create something that I could use myself, adding to it as my research moves into other categories of workers, such as wool and linen textile workers.

I'll need most of spring break to get the lists of textile workers ready for the students to use. If, however, you'd like to meet with me late next week, let me know.”

Hydrology Ontology (Wenwen Li, wenwen@spatial.ucsb.edu)

“Within this project, the students will learn how to formally model river entities into a spatial ontology. Specifically, the students will first have an understanding of what an ontology is, what it can be used for and how to develop an ontology using existing software tools, e.g. Protégé or CMap. Then in terms of developing a spatial ontology of rivers, the students need to figure out what properties/attributes (e.g. length, tributaries, topography etc) should be used to describe a river feature and to distinguish one river

feature from another (e.g. Mississippi River v.s. Amazon River)? The next step would be grabbing and retrieving needed information (both spatial and descriptive) from Internet (e.g. Wikipedia) and encode them into a spatial ontology using software tools. According to the size of the team, the size of the spatial ontology (the number of rivers to be modeled) can be adjusted.

From here, if time allowed, a Google map based portal can be set up to show the locations of rivers that have been modeled and basic ontology based queries can be provided. For example, queries like “which river is the most similar to Mississippi river in terms of performance of flow” can be supported.”

CCBER (Lisa Stratton, stratton@ccber.ucsb.edu)

We have been working on a wildlife linkages/corridor project over the past year and have some interesting layers that students might be able to build on (attached is a pdf of a ppt talk on what we've been doing with some map images to give you an idea of the layers) based on road kill records, wildlife observation records, and culvert/bridge size info.

Our GIS person, who is multi-tasking in a phd program in Arizona, has been working on doing a little circuitscape mapping to look at corridors, but as a manager of some local open space areas, I'm interested in an additional angle to this topic, which is: Given the size and habitat types and connectivity, what animals/wildlife would we EXPECT those areas to be able to support, in what numbers, and how sustainably if the areas are completely isolated or very connected. How well would the existing corridors function for certain animals. Below are some smaller project ideas that the students might take on that would lead toward answers to these questions:

1.a GIS class: Map barriers other than roads -- e.g. fences/walls -- that might influence the 'permeability' of a landscape to wildlife movement.

1.b. GIS class: Synthesize road kill data from weekly driving routes by mile segment and combine with historical road kill data to see if patterns from regular monitoring differ from historical collections in terms of where the hot spots are. Characterize from all data the seasonality of road kills (full moons, spring?, etc). We have about a year of weekly road kill route data (yes/no on 1 mile segments with type of wildlife observed if observed, so you can get % kill rate for particular 1 mile segments).

2. GIS class: Characterize open space areas by habitat type (e.g. shrubs, trees, grass, water, development from California wildlife habitat relationship website) - which could be used in determining which wildlife species might be best supported in those areas. They can use websites for data from remote sensing for this: Calif. wildlife habitat relationship website. - info on wildlife needs and remote sensing on actual habitats on the ground.

3. BREN or GIS class -- Assess capacity of different local open space areas * to support wildlife by integrating info on habitat needs of wildlife -e.g. home range, habitat type, density info (from Habitat suitability relationships) - with characterization of open space areas - area, habitat types, connectivity to other areas. They could organize this by focus on specific animals or open space.

Animal species list for them to consider:

Snakes - gopher, garter, king, ringneck

Rodents - vole, field mouse/house mouse, weasel, ground squirrel
middle size/urban pests - skunk, opossum, raccoon
larger/predators - bobcat, coyote, grey fox, Hawks

Open space areas of interest:

More Mesa
Campus Lagoon
Goleta Slough
COPR
Ellwood/Devereux
Lake Los Carneros
Bishop Ranch

4. A different project idea: We have GPS'd most of the native trees we've planted on campus and have species and size info in an excel file. Have students link size, date planted, tree number, and location information on a couple of maps that we could use for future monitoring.

Reservoir Capacity and Runoff (Jeff Dozier, dozier@bren.ucsb.edu)

An idea for a Geog 176C project is to analyze and portray the relationship between reservoir capacity and runoff in California's drainage basins (or a selection of them, for example those that drain the Sierra Nevada). Resilience to drought particularly depends on reservoir capacity, so one way of expressing reservoir capacity is as a ratio to mean annual runoff in that particular river. If the group is ambitious, they could consider autocorrelation between years and thereby consider probabilities of successive dry years. Because the reservoirs are also used for flood control, they could also consider sizes of flood peaks.

Data sources:

Polygonal outlines of the drainage basins are available from <http://cain.ice.ucdavis.edu/calwater/> (California Interagency Watershed Mapping Committee, current version is CalWater 2.2.1 although there is a new California part of the National Watershed Boundary Dataset at <http://www.atlas.ca.gov/download.html#/casil/inlandWaters>).

Reservoir information:

The same link - <http://www.atlas.ca.gov/download.html#/casil/inlandWaters> - has shapefiles for the reservoirs and other hydrologic features. Data on reservoir capacities are at <http://cdec.water.ca.gov/reservoir.html>, although you have to hunt a bit to get to the capacities of the individual reservoirs.

River flow data:

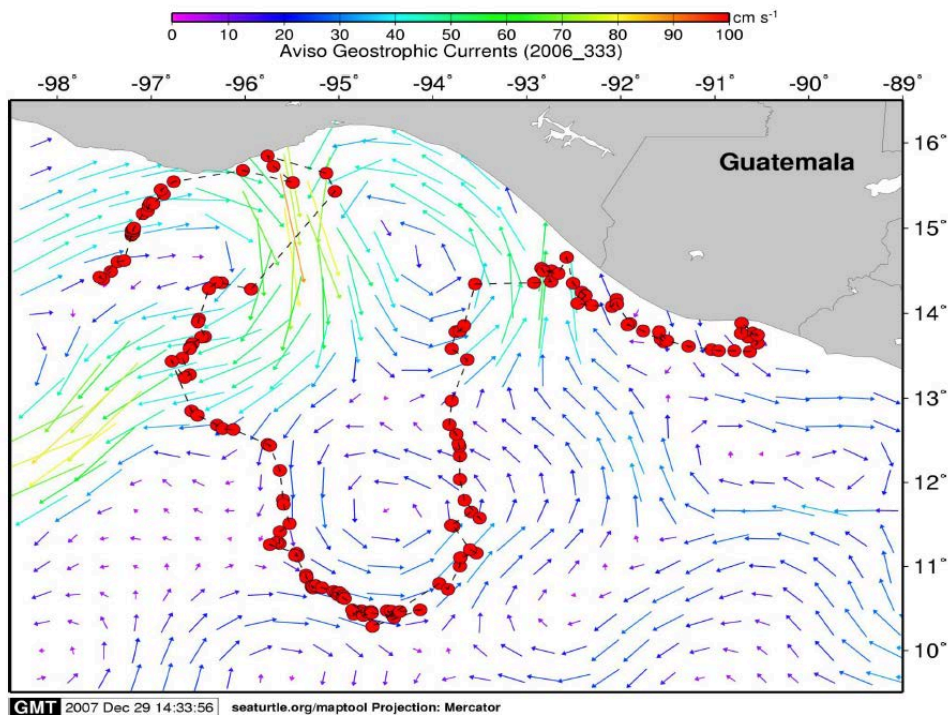
http://cdec.water.ca.gov/riv_flows.html. Probably the information on the Full Natural Flows is the most useful.

My availability: I'd be happy to meet with the students every couple of weeks to provide guidance. To tie in with my own research, I would be most interested if they would tackle the Sierra Nevada, but I would still help if they chose some other region. Depending on the size and ambition of the group, I think they could do the whole state.

Characterizing olive ridley sea turtle tracks in the eastern tropical Pacific Ocean (Lindsey Peavey, lpeavey@bren.ucsb.edu)

In 2006 I deployed satellite transmitters on three adult olive ridley (*Lepidochelys olivacea*) sea turtles in the eastern tropical Pacific (ETP) in an effort to learn more about the movement patterns of this pelagic species, and to try and infer what dictates their movement. This species of sea turtle is listed as “vulnerable” on the IUCN Red List, and is commonly caught accidentally in fishing gear in the ETP. This is a problem for both the turtles and the fishing industry. Better understanding where the turtles go while in the open ocean, and why, will help environmental managers reduce the accidental deaths of turtles.

To date, I’ve overlaid the turtle tracks with snapshot (seasonal) oceanographic data and physical features including sea surface temperature, productivity (chlorophyll *a*), depth and distance-from-shore. For instance, see the figure below:



While this was an interesting first pass at analyzing the data, I’m seeking to complete a more in-depth analysis to more aptly answer this research question. To this end, I would like to propose this project to a group of 176C Geography students. I will work with the team to determine tasks that fit their interests and are accomplishable in one quarter. For example, if ARGOS data filtering (using GIS and/or an R package) and processing (using GIS) is skill that the team would like to practice, I can provide raw ARGOS data. However, if the team would like to dive right in to processing remotely-sensed oceanographic and physical data layers, I can provide filtered track data. I would like to

take this analysis to the next level in terms of resolution, scope, and inference. For example, creating a more dynamic picture of what is happening, versus the simplified seasonal snapshot I have previously done. Another possibility is developing a state-space movement model. The data processing and biophysical characterization that this team completes will be the foundation for the analysis of this dataset.

I have some products that I'd like to have completed by the end of the quarter, but I am most interested in working with undergrads on developing skills that will help them advance their careers while having the opportunity to work with actual data and towards products that will appear in a peer-reviewed publication. This project is a collaboration between myself and NOAA's Southwest Fisheries Science Center. UCSB Geography graduate and current NCEAS staff member and Gaines Lab Masters student Shaun Walbridge will also be advising this project. The team of students who work on this project will have an opportunity to be co-authors on the resultant publication.

Data layers: ARGOS satellite data; remotely-sensed oceanographic data (surface currents; sea height anomaly; etc.); existing physical feature data (e.g. study area shape file; bathymetry; etc.).