Notes from Geospatial/GIS Meetup
February 9, 2023

Rivera Library, Room 140 and Zoom

Attendees: Janet Reyes, facilitator;

In person: Advyth Ramachandran, Clay Noss, Rich Minnich, Shanon Langlie, Siddharth Kishore, Taylor Oliver, Tom Scott, YueMeng Yang
Via Zoom: Andrea, Arin Glass, Canserina Kurnia, Debbie Johnson, Devan Velji, Ed Reyes, Elia Scudiero, Gerald Winkel, Jay Farago-Spencer, Krystal Boehlert, Laura Chansavang, Mary A, Mike Lewis, Vanessa Gomez-Alvarado, and a phone number but no name

Announcements

This meeting was recorded; video is available here. The passcode to view is gcPFl!r3

A new **Scholarly Technology and Research (STAR) Lab** is slated to open in Orbach Science Library in the next month or two. It will feature four bookable computers with high-end software, including ArcGIS Pro, Google Earth Pro and QGIS.

Currently four **free passes are available** to UCR affiliates for the Esri User Conference, July 10-14. They are available on a first come, first served basis. After April 1, the UC campuses might pool their remaining available passes.

Next week, **UC Love Data Week** features two geospatial workshops along with many other data-related presentations.

There will be a **Redlands Water User Group meeting** on February 15 from 9:30 am - 2:00 pm on the Esri campus.

A workshop on **using Planet imagery in ArcGIS** will be offered by Esri staff in Watkins 2111 on February 23 from 1:00-3:00 pm. Spaces are limited for this in-person only event. Preference will be given to students in Environmental Sciences and in Computer Sciences. A Planet account is needed to participate in the workshop; obtain one at ai4sa.ucr.edu/about-planet. Register to attend by emailing ai4sa@ucr.edu. If you have questions about this event, contact Elia Scudiero at elias@ucr.edu.

The **Los Angeles Geospatial Summit**, being held near USC on February 24, provides great networking opportunities for students.

The **Esri Developer Summit** will be held March 7-10 in Palm Springs.

CalGIS is being held in Monterey on March 13-15.

Clay Noss, a post-doc with the Center for Conservation Biology, shared that he is starting a reading group open to UCR affiliates regarding species situation models. He can be contacted at clayn@ucr.edu.

Presentation

Dr. Richard Minnich, a Professor of Geography in the Department of Earth and Planetary Sciences at UCR, presented on his **Tree Atlas of the Californias.**

Dr. Minnich started by saying he has been mapping vegetation since before GIS was around. Given the many factors that are impacting vegetation, there's a continuing need to update large area surveys. Another motivation to map vegetation is to confirm scientific models with empirical data.

The first comprehensive survey of California was the Vegetation Type Map survey, conducted in 1929-1934. It included all the forest species as well as other vegetation types. Many existing vegetation distribution maps end at the international border, but in this effort Dr. Minnich mapped the full extent of several tree species' ranges into Mexico. His study spanned from the latitude of the Bay Area down to Baja California and Baja California Sur.

The advent of Google Earth, in which vegetation can be mapped directly on the computer, provided mapping capabilities that were a vast improvement over the multistep methodologies of the past. Google Earth provides imagery acquired over the years that can be viewed at many different scales from any direction. Using Google Earth enabled Dr. Minnich to produce unprecedented high-resolution (5 hectare) maps of 87 tree species, including the first imagery-based maps of 25 species. He also was able to identify and map extensions to previously mapped ranges for 31 species.

Dr. Minnich's approach was to map one tree species at a time, manually scanning Google Earth imagery from north to south at the highest perspective possible without losing the tree's distinctive signature. He viewed imagery from the time of year in which the species was most distinct from other trees with which it might be confused. One example of this: riparian trees are most distinctive on imagery acquired in autumn. Species signature characteristics included plant stature, bole shape, crown shape, crown perimeter, crown apices, foliage color, branching habit, shadows, and phenology. He started the mapping effort with the easiest species and progressed to the ones that were most challenging to map.

Rich provided several examples of how he mapped various deciduous, riparian, and coniferous tree species. The most radical map he created was of the distribution of cypress species in Baja California; he found cypress to be much more widespread than previously thought. He also was the first to map *Quercus kelloggii* in Mexico, in Sierra Juarez.

The following information is included for each species in the atlas: a review of the Tertiary fossil record, taxonomy, identification criteria, distribution, ecology/pattern of disturbance, and species migration since the LGM (Last Glacial Maximum). The atlas will be printed by the University of California Press, but Rich would also like the public to be able to view the tree species layers in Google Earth and would welcome feedback on improving the accuracy of the maps.

By overlaying different layers in Google Earth, we can see where the species in question do and don't overlap. The stability of tree stands can be assessed by comparing the stands recently mapped with historic aerial photography, such as photography of California flown in 1938. The effect of pathogens on tree stands can also be assessed by viewing imagery over time. It would be very helpful if Google Earth added historic imagery; currently their imagery only goes back to 1990 or so.

Discussion

Tom pointed out that models can be erroneous if the maps they are based on contain large errors in the supposed distribution of a species. An example was the belief that the range of *Quercus agrifolia* extended into the Sierra. Also, models that work in one area of a plant's distribution may not hold up in another, where different factors take primacy.

The question was raised about comparing the tree atlas to botanic collections. That might be useful, but Rich hasn't done it yet. Botanists use different criteria for how they determine the occurrence of species on the landscape.

At this point, the University of California Press hasn't shared an expected publication date.

Contact information:

richard.minnich@ucr.edu

Supplemental Content

The following is a write-up that Dr. Minnich provided in advance of the meetup.

TREE ATLAS OF THE CALIFORNIAS

Richard A. Minnich, Department of Earth and Planetary Sciences, UC Riverside

This atlas is a compilation of unprecedented high resolution maps of 87 tree species in the three Californias along the North American Pacific coast—California south of San Francisco, Baja California, and Baja California Sur—interpreted from Google Earth™ imagery. These species represent diverse plant assemblages found in western North America, including California oak woodland, Mexican oak woodland, riparian forest, palm oases, closed-cone conifer forest, mixed evergreen forest, mixed conifer forest, subalpine forest and pinyon-juniper woodland. Google Earth is a transformative platform for broad scale ecological research. The capacity of virtual scaling permits the viewing of vegetation at high resolution both at large scales for broad spatial pattern, and local scales for taxonomy, population characteristics, and map accuracy. The achievement of this software is the ability to electronically digitize geographic data directly on the computer screen. Imagery resolution permits the identification of tree species on the basis of resolution, morphological properties, color, and shadows. Using the history function one can observe vegetation dynamically on georeferenced time-series imagery including growth, recruitment, mortality, vegetation response to disturbance, and long term vegetation dynamics. Because imagery can be mobilized by use of a cursor, one can scan extensive areas of the Earth's surface, bringing vantage and access into both well-known and poorly explored regions, and permitting spatially explicit analysis of large regions. Boundary data can be assessed as an overlay of imagery for distributions and visual properties of species.

In the mapping process, imagery is analyzed one species at a time. The examination of single taxa allows the interpreter and reader to focus on species properties including crown structure, color and phenology. Maps are created on Google Earth imagery through manually raster-scanning. Interpretation from multiple georeferenced temporal coverages using the history function expands the morphological identification process to dynamic plant properties such as phenology and deciduousness. While raster scanning requires multiple scans of the study area, species by species, the eye automatically captures "surprises" subliminally and this led to discovery of 31 species range extensions not reported in previous surveys or in botanical collections. This approach enables the updating of distributions for error and changes in vegetation, following the footprint of the geological sciences. The species approach permits the analysis of single taxa and deconstruction of *a priori* defined plant assemblages. The kml/kmz software gives capability to separate maps of species as independent files that can be aggregated into plant communities in a geographic information system (GIS).

Accomplishments include the following:

· High resolution species maps.

· Extension of California tree distributions to their natural limits in Mexico.

· Documentation of the transition of California species in Mediterranean climate to Mexican species in summer rain climates of Baja California.

· Realization of "living atlas" on an ideal platform of Google Earth, for correction, revision, and to trace future vegetation change from climate change, disturbance, pathogenic perturbations.

· Providing a baseline for comparison of forest and woodland ecology in two countries having divergent land use and land policies.

· A methodological approach with Google Earth that can be applied globally.