USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences
Spatial Sciences Institute

June 21, 2019

Spatial Sciences Institute (USC Spatial) is now accepting applications for undergraduate student researchers to work with USC Spatial faculty on their funded research projects for the 2019-2020 academic year.

We are looking for students who have excellent academic records, show interest in participating in cutting-edge research projects at USC Spatial, and are eager to take advantage of the opportunity to work directly with faculty on their research projects.

Priority will be given to USC Dornsife GIS and Sustainability Science minors, Spatial Studies minors, Human Security and Geospatial Intelligence minors, and GeoDesign majors. However, applications from all majors, minors, and academic programs throughout the University are encouraged. Students of all class standing (including incoming freshmen or transfer students) are welcome to apply.

The research stipend is $12/hour, and the projects generally are structured for an average of 5 – 10 hours/week. **Accepted students will work out their specific work schedules for each semester with the supervising faculty or staff member and will be expected to honor the weekly time commitment for the duration of the academic year.**

USC Spatial student researchers are expected to submit their research work for presentation. Venues for presentations include such the Esri Geodesign Summit held in January in Redlands; the Spatial Science Institute's LA Geospatial Summit on February 28, 2020 at the USC Hotel; the USC Undergraduate Symposium for Scholarly and Creative Work held in April on the USC campus; and the Esri User Conference held in July in San Diego. Students also are encouraged to submit their work to appropriate student research competitions, such as the 2020 USC Esri Developer Center Student of the Year Competition and the United State Geospatial Intelligence Foundation 2020 GEOINT Symposium.

Past student researchers have presented their results at international conferences such as the American Association of Geographers annual meeting, the SIGSPATIAL conference, and the GEOINT Symposium, and have co-authored published research.

To apply

Please provide:

- A resume which includes your name, contact information, major/minor, year in school, software and programming language competencies, and relevant course projects/skills;
- A current STARS report (not required for a new incoming student); and
- A statement of interest indicating the project(s) for which you are applying. You may apply for more than one project; please indicate the priority of your preferences. If selected, you will be selected for one project only.

Please email your complete application materials to Susan Kamei, Spatial Sciences Institute Managing Director, at kamei@usc.edu, by **5:00 p.m., Friday, July 26, 2019**.

Students selected by the faculty will be notified by mid-August so the research teams can be organized by the start of the Fall 2019 semester.

Questions?

Please email Susan Kamei or call her at (213) 740-1375, or email Ken Watson, Spatial Sciences Institute Academic Programs Director, or call him at (213) 740-8298.

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Dr. Jennifer Bernstein, Lecturer, and Dr. Jennifer Swift, Associate Professor (Teaching) of Spatial Sciences
"Solar Development in Southeastern California: A field-based learning experience combining quantitative and qualitative methodologies"

Project Description

Americans are becoming increasingly concerned about climate change (Leiserowitz, 2003; Saad 2013), and one of the most widely championed ways to address it is through renewable energy. Americans are highly supportive of solar power. In a recent Gallup poll, solar energy was endorsed by the public more than any other alternative energy source. In the same poll, solar energy was backed by a large majority in each political party, and even more so in the West (79%) than in other regions of the country (Swift 2014). In 2016, the Renewable Energy Action Team, consisting of California Energy Commission, California Department of Fish and Wildlife, the U.S. Bureau of Land Management, and the U.S. Fish and Wildlife Service, identified potential renewable energy development areas in eastern California based on multiple criteria, including quality of resources, land ownership, slope, access, transmission, and capacity for production. These criteria were mapped and used as a guide for locating future solar energy installations. However, local opposition has resulted in a general attitude of distrust between alternative energy developers, community residents, and government authorities. Thus, better understanding of attitudes towards solar development -- including the underlying demographic and psychological variables associated with support or opposition can both address climate change and create a less contentious atmosphere in which industrial solar and local residents could engage.

This project, broadly situated within the digital humanities, will engage with the technical aspects of solar installation siting and include an immersive, field-based experience enabling the understanding of the technical, political, economic, and social aspects influencing solar power's evolution. The stages of experiential education include action, reflection, and the application of the experience to a broader set of circumstances (Stehno 1986). Experiential education has been documented as a vehicle for meaningful environmental change. Further, experiential education is ultimately interdisciplinary, lending itself to the nature of solar siting and development.

The student selected to work on this project will research solar development in Eastern California, build their own solar array, visit solar installations in the Mojave desert region, interview stakeholders, and ultimately develop a publicly-available story map to communicate their research and experience to decisionmakers, the general public, and the USC community. The story map will merge publicly available data, maps, photographs, and interviews, as well as first-hand experiential learning, to create an engaging and accessible narrative about the political, cultural, economic, and ecological implications of solar development in the region.

The undergraduate researcher will become proficient in contemporary technologies within the spatial sciences, interview techniques, and digital science communication. The student will conduct a site visit to Eastern California within the DRECP to speak with local residents, tour solar facilities, and conduct face-to-face interviews. The student will also learn the technical aspects of small-scale solar by building their own solar array, able to power small electronics. The student will emerge with a sophisticated and unique skill set that spans the spatial and social sciences. Ultimately, the student will have a field-based experience that enables a strong understanding of the way in which ideas of place influence the public policy creation process, as well as the way land-use decisions are made using a variety of criteria. They will apply their knowledge to the art of digital storytelling, incorporating both quantitative and qualitative sources of data.

Roles of Undergraduate Researcher

One student will be selected for this project. The project will span Fall 2019 and Spring 2020. The student will receive a stipend of $350. The remaining $650 will cover the cost of the supplies to create a minor solar array and fund field-based learning and research in the Mojave Desert including transportation, lodging, and food. The dates of the field study will be decided based on the schedules of the faculty supervisors and student.

Stage 1: *Background Research*
The student will begin by doing background research on solar development in Eastern California to establish a knowledge base for the Story Map and field experience.
This will include, amongst other things:

- Reading the text, Mulvaney, D. (2019). *Solar power: Innovation, sustainability, and environmental justice*. University of California Press.
- Reading government reports, especially those associated with the DCREP (Desert Renewable Energy Conservation Plan)
- Reviewing message boards, public comments, and op-eds to familiarize him/herself with public attitudes towards solar development
- Researching publicly available data sources of criteria that relate to the siting of solar installations
- Using ArcGIS to develop basic maps illustrating the criteria that influence solar siting for inclusion in the resulting story map
- Contacting relevant individuals and organizations in Eastern California with requests for interviews and/or site visits

<u>Stage 2</u>: *Building a Solar Array*
The student will gain hands-on experience in solar development through building a small (100 watt or less) solar array. This will be similar to the "Solar Camp" conducted at the EnergyPath conference in Pennsylvania, though on a smaller scale. Steps include building the template and assembling the frame, putting together the solar cells, identifying the electric site, installing a junction box, and other minor tasks needed for functionality. Ultimately the student will be able to use this array to power small electronics. This will truly allow the student to learn how solar works, and enable him or her to engage with vested interests at a higher level of sophistication. Faculty will advise and assist the process, and provide access to the necessary tools and workspace.

<u>Stage 3</u>: *Field Study*
A 2-3 day field trip will be conducted to visit areas of interest within Eastern California. A limited number of qualitative interviews will occur to gain a better sense of the underlying attitudes towards solar development in the region. Alternative energy sites will be toured to better understand the technical and procedural aspects of solar installation siting. The student will be accompanied by faculty, who will coordinate the logistics of the trip.

<u>Stage 4</u>: *Story Map*
Finally, to communicate the results, the student will create an Esri story map. Story maps are highly flexible templates that enable users to combine text, media, photographs, and maps. The map will tell the story of solar development in Eastern California, and incorporate photographs and text from the experiential aspects of the URAP. The student will gain skills in public communication and the technical aspects of the creation of story maps. It will also be an exercise in synthesizing information from multiple sources and storytelling. The resulting story map will be hosted by the Spatial Sciences Institute, and a publicly available web address will communicate student findings to interested parties and showcase the degree to which experiential education can complement technical spatial analysis for undergraduates in SSI at USC.

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Dr. Yao-Yi Chiang, Associate Professor (Research) of Spatial Sciences
“Homelessness and the Access to: Water, Sanitation, and Hygiene (WaSH)”

Project Description

We propose to build on our previous work to conduct both qualitative and quantitative analysis to study the relationship between water access/insecurity and health among the homeless population in Los Angeles. In 2018, we interviewed a total of 137 participants in three census tracts encompassing the Skid Row community of downtown Los Angeles. We performed an initial analysis to explore the association between a number of demographic attributes, difficulty accessing WaSH resources, and the built environment.

Role of Undergraduate Researchers

The project aims to take place in a different geographic setting to show differences in coping mechanisms to survive in water scarce environments. These environments are based on the accessibility of resources and services, spaces of survival (sleeping spaces), and neighborhood interference (policing, NIMBYism, etc.). We will integrate these conceptualizations of urban spaces as a means to examine the role different geographies and or spaces play in the provision of WaSH services to meet homeless persons’ basic needs.

The result will be 1) interview data collected from field studies, 2) data analysis methods that jointly study the interview data with the data about the built environment, and 3) data visualization products such as story maps on the web.

Special considerations will be given to students of diverse backgrounds and female students in engineering and science.

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Dr. Su Jin Lee, Lecturer of Spatial Sciences
“Monitoring the Sustainability of the USC Campus Using Geospatial Technologies”

Project Description

The environmental benefits of trees and other forms of green cover play a crucial role in improving residents’ quality of life and in maintaining urban environmental amenities (Akbari et al. 1997, 2001, Longcore et al. 2004, Simpson and McPherson, 1996). Abundant trees help to maintain the environmental benefits, such as reduction in energy use, improvement in air quality, reduction in noise, control of stormwater runoff, provision of habitat for wildlife, and enhancement of aesthetic values (Rowntree 1984, Simpson and McPherson, 1996). Sustainability has emerged as a way of living and working regarding the environmental challenges such as climate change, the loss of green cover that may have caused the loss of biodiversity, the increased urban heat island effects, the increased power usage, the increased impermeable surfaces, and the increased flooding risk.

According to the USC Facility Management Services (FMS), there are more than 6,800 trees on the University Park Campus, the Health Science Campus, and the Wrigley Institute on Catalina Island. USC FMS is responsible for the day-to-day operation, repair, and maintenance of buildings, infrastructures, trees, etc. FMS has spent numerous amount of money to maintain trees and sustain the trees' healthy condition. The continuous effort of FMS to sustain the USC campus has provided students, staffs, and faculty with a livable, pleasant, and comfortable campus life.

This research seeks not only to develop a model using geospatial technologies to maintain trees across the USC campus but also to provide another way to sustain the USC campus. Geospatial technologies such as geographic information system (GIS), global navigation satellite system (GNSS), and remote sensing (e.g., satellite image, drone image) can provide a variety ways to collect, manipulate, manage, and visualize data as well as support decision-making.

Project Goals

First, we collect accurate locations and characteristics of trees using GNSS across the USC campus in terms of spatial data acquisition. Second, one of the tree benefits is decreasing the heat island effect by tree shades that can cause a reduction in energy use. Hence, we monitor land surface temperature using a thermometer. Third, we estimate air quality such as CO_2, PM2.5, and PM10 that can be absorbed by trees using a portable meter across the USC campus. Fourth, we measure permeable surface using remotely sensed data (e.g., DRONE image) to estimate potential infiltration capacity on a rainy day. Fifth, we measure line of sights from the surveillance cameras on the USC campus to provide the best locations for new surveillance cameras and to indicate trees that are required to be trimmed.

We will closely work with USC FMS. Ultimate goals of this research project are efficiently sharing invaluable data with USC FMS and providing tangible solutions for maintaining and sustaining the USC campus. Furthermore, we propose this idea as a multiple-year project to monitor the environmental benefits of trees across the USC campus and the City of Los Angeles.

Role of the Undergraduate Researcher

The execution of this research will cover five main components:

1) spatial data acquisition;
2) data cleaning;

3) data manipulation;
4) spatial data analysis; and
5) demonstrating the findings.

One student will be selected for this project. This project will provide valuable research opportunities for undergraduate researchers with respect to designing a research project, determining the fitness of use for data, analyzing, and interpreting findings. In the end, the student may have a summer internship opportunity with USC FMS.

The undergraduate researcher will review the various literature to understand the fundamental knowledge on this topic and learn how to build appropriate data dictionary to collect data. (10 hours per person per week: between September 2 and September 15).

Spatial data acquisition: The undergraduate researcher will collect spatial data using geospatial technologies (10 hours per person per week: between September 16 and October 13).
Data cleaning and manipulation: The undergraduate researcher will store, clean, and manipulate the spatial data under the ArcGIS environment (10 hours per person per week: between October 14 and November 3).

Spatial data analysis: The undergraduate researcher will analyze data to demonstrate the benefits of trees across the USC campus (10 hours per person per week: between November 4 and December 8).

Producing a poster and writing a research report: The undergraduate researcher will create a poster and write a report to demonstrate and summarize the significant findings. The undergraduate researcher will present their results at the annual Undergraduate Symposium at USC. The researcher will write a research paper for submission at the 2020 Esri User Conference in July 2020 in San Diego (10 hours per person per week: between January 6 and April 5).

The ideal student applicant should have taken SSCI 301, SSCI 382, or SSCI 383, or relevant knowledge of geographic information system. Also, students should be available to work at least 10 hours per week.

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Dr. Andrew Marx, Associate Professor of the Practice of Spatial Sciences, and Dr. Parveen Parmar, Associate Professor of Clinical Preventive Medicine
"Leveraging High-Cadence Data to Detect and Track Mass Migration"

Project Description

Unexpected mass migrations continue to occur with entire towns and cities quickly fleeing sudden conflict (Myanmar village burnings 2017), natural disasters (Haitian earthquake 2010), manmade disasters (Chernobyl nuclear accident 1986) or unsafe conditions (Mexican migrant caravans 2018). Often these migrations take place in remote areas of the world where inaccessibility or unsafe conditions prevent on-the-ground observers and reporters. Additionally, information outflow is often limited or controlled by the government who is sometimes the perpetrator of the violence that individuals are fleeing. As a result, the international community struggles to react and position aid/services for large groups fleeing, having little to no warning of the migration and poor knowledge of their destination.

In response, the research proposes to leverage frequent, or high-cadence, data which directly and indirectly detects and tracks mass migrations. It will leverage two existing collaborations with private data providers: Planet.com (daily imagery of the entire Earth's surface) and Cuebiq.com (cellphone-based geolocation information). Firstly, the research will build upon ongoing work (partially supported with URAP 2018-2019 funding) to which continually monitors villages at-risk of attacks in Nigeria and Myanmar. Such attacks typically cause a mass migration from that location. Ground-reference information is provided by Human Rights Watch and Co-PI Dr. Parveen Parmar.

Secondly, the research will work through an existing collaboration with Cuebiq to provide detailed, anonymous location data on individuals in Nigeria and Myanmar. In the United States, data are collected on 1 in 3 cellphone owners, providing their location 100 times/day to within 30 ft. A city the size Atlanta, can produce more than 1 million rows of location data/day on individual movements.

These two data streams will be brought together to monitor villages at-risk of mass migration. Specifically, it will use the Planet satellite algorithm to detect if/when different villages are attacked. It will then analyze location records to detect what percent of town residents, where they are going and when they will arrive. Typically, this is groups of individuals walking distances to the nearest international border. An early detection of an attack, coupled with knowledge of where, when and how many refugees or migrants are fleeing will significantly aid the international community in positioning aid and services.

Students will work as part of a lab, designing and implementing algorithms to harvest this massive stream of data into an alerting system that can inform the international community and ultimately reduce the suffering of those fleeing their homes.

Role of Undergraduate Researchers

The undergraduate research assistants will undertake all aspects of the research project. Under the direct supervision of Dr. Marx, they will:

- monitor smallsat imagery algorithm feed for attacks;
- create custom geospatial workflows to:
    - ~ detect when a large percent of a village's population flees and

~ analyze the heading and speed of those fleeing to estimate arrival at the displaced person's or refugee camp

- implement the workflow and work with international partners in the event of a natural or manmade disaster in the study area; and
- Co-author a manuscript.

Criteria for Selecting Student Researchers

In selecting the students, the lab is looking for students with three traits:

- passion for preservation of human rights and reduction of human suffering;
- some background in Python coding in the Jupyter environment; and
- the ability to think spatially and temporally about streams of geospatial data.

Oversight and Supervision of Student Researchers

Undergraduate researchers will join Dr. Marx's Human Security and Geospatial Intelligence Lab (hsgi.usc.edu) and will operate under its current practices. Specifically, they will meet weekly (as
a group) with Dr. Marx in SSI for an hour lab session where they will go over weekly progress and next steps. In the intervening period, students use a shared Google Drive folder to record their "worklog." In this log they write how much they worked, when and what they did. Students not abiding by the policies are removed from the lab. Students share a $8,000 computing environment housed in the lab providing data storage, processing and software necessary for the research project. It is possible to work remotely on this project.

Integrative and Group Activities

Undergraduate researchers will have several opportunities to collaborate. Students will work closely with Co-PI Dr. Parmar, as her on-the-ground expertise informs the algorithms and workflow development. They will meet weekly with other graduate and undergraduate researchers as part of the Human Security and Geospatial Intelligence Lab (hsgi.usc.edu). The lab also regularly interacts with others on campus interested in human rights work, including the Shoah Foundation and the USC Levan Institute for Humanities and Ethics (Dr. Boyd-Johnson).

Final Research Report

Students will present a poster at Spatial Science Institute's LA Geospatial Summit in February 2020 and the USC Undergraduate Symposium for Scholarly and Creative Work in April 2020. Students will also be co-authors on a peer-reviewed journal article submitted Spring 2020.

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Jennifer Swift, Associate Professor (Teaching) of Spatial Sciences, and Emily L. Lindsey, Adjunct Assistant Professor of Earth Sciences and Assistant Curator and Excavation Site Director, Rancho La Brea, Natural History Museum of Los Angeles County

"3D Geovisualization and 3D Spatial Analysis of Ice Age Fossils Excavated From La Brea Tar Pits, Los Angeles CA"

Project Description

This project seeks to further the impact of previous real-world projects successfully completed by USC Spatial Sciences students that resulted in a detailed methodology for managing La Brea Tar Pits and Museum fossil collections as high-resolution 3D objects to support geovisualization in 2-dimensional (2D) and 3-dimensional (3D) digital maps in their pre-excavation, in-situ locations (La Brea Tar Pits and Museum 2019). During the last century, millions of fossils have been collected and stored in museums archives. To date, two masters' students have worked closely with scientists at the La Brea Tar Pits and Museum in Los Angeles as part of their MS theses (Pham 2015; Hill 2018). The outcomes of those projects include the design and implementation of a 2D fossil excavation spatial database, digitally curated 2D and 3D data that previously only existed in paper form, display of fossil data in an interactive web GIS application, and development of a protocol for georeferencing previously excavated fossils using Geographic Information System (GIS) software that supports 3D spatial analysis as well as geovisualization of subsurface 2D and 3D objects.

Handling of 3D data is now a crucial skillset recommended for all GeoDesign majors and Spatial Studies minors (Huang et al. 2019). A critical area addressed through this URAP project is further research into efficient digital import, storage, manipulation and spatial analysis of high-resolution, 3D digital scans of fossil specimens collected in the past according to traditional, manual measuring and recording methods. The La Brea Tar Pits and Museum fossil collections offer a wealth of prehistoric information that previously was difficult and expensive to recreate digitally in high resolution using computers (Pham 2015). Protection and preservation of prehistoric, physical materials are imperative, so to-date fossils typically can only be viewed by museum visitors if at all; the vast majority of most museums' fossil collections are off display, accessible to researchers only. Since direct interaction of the public with physical specimens is rare, providing interactive digital versions of collections has captured the collective imagination (Hill 2018; Lindsey 2018).

This project seeks to provide undergraduate researchers with the next critical step in this effort: to learn how to carry out spatial science research activities in 3D geovisualizations and 3D spatial analysis using real-world spatial objects. Accurate representations of objects in the ground, *in-situ* prior to removal from soil, rock, and other substrates are required in disciplines such as GeoDesign, paleontology, archeology, geology, and geochemistry, and in many forensic sciences (e.g., Voorhies 1969; Apollonio et al. 2012; Sacchi and Nicosia 2013; Barnosky et al. 2016; Harvey et al. 2017).

New opportunities exist for Spatial Sciences students to collaborate with related cutting-edge research projects now being conducted at the La Brea Tar Pits and Museum (e.g., Lindsey 2018). The continuation of this advanced GIS-enabled research and the proposed collaborations would offer a valuable applied learning experience for the undergraduates, which could also could be parlayed into a research topic for a program practicum for undergraduate and/or graduate education. The existence of the ongoing 3D fossil geovisualization research efforts at the La Brea Tar Pits and Museum upon which additional spatial science and GeoDesign research questions can be explored in greater depth represents an enormous advantage in being able to assess and rapidly disseminate the outcomes of this project.

Role of Undergraduate Student Researchers

The undergraduate student researchers will:

- use the results of the previous 2D and 3D research projects using GIS and other advanced geospatial tools to support further development of an efficient 3D spatial data structures for the museum's research activities;
- work closely with the museum scientists to develop advanced methodologies for importing, storing and manipulating 3D objects as high-resolution, 3D digital scans of fossil specimens that can support hands-on user interaction with individual or large numbers of objects;
- develop 3D spatial analysis workflows, models or tools such as GIS-enabled graphical user interfaces (GUI's) that directly support 3D research underway at the museum, so that new questions about fossil provenance and the encompassing physical environment (e.g., asphalt) can now be asked (e.g. Lindsey 2017);
- create innovative designs or prototypes of 3D educational tools that make use of the proposed 3D spatial data structures and GIS-enabled tools to collaborate with current projects related to future 3D virtual museum exhibits;
- produce a final report and presentations about project outcomes. The presentations will highlight the importance of innovation in approaches 3D geovisualization and 3D spatial analysis of real-world 3D objects. The ultimate intention of this project is to continue to support the La Brea Tar Pits and Museum's ongoing research into Ice Age fossils and development of educational activities for the scientists and ultimately the general public.

The research will culminate in a one-day workshop at which the undergraduate students will present outcomes of their research and receive feedback from the La Brea Tar Pits and Museum scientists. The students, as a team, will produce a 3D data management plan in the form of a technical report documenting the methodologies, spatial data structures and geospatial tools developed as results of this project. The report will be provided to interested parties, available upon request. The student researchers will also be encouraged to present their results at events in spring and summer 2020 such as the February Esri GeoDesign Summit held in Redlands, CA, the LA Geospatial Summit held in Los Angeles, CA, and the Esri User Conference held in July in San Diego, CA. The students will also be encouraged to submit their work to appropriate student competitions.

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Dr. John P. Wilson, Professor of Spatial Sciences and Sociology, and Beau MacDonald, GIS Project Specialist
"Superblocks" for Los Angeles? — Sustainable Urban Alternatives Evaluated with GeoDesign Year Two: San Fernando Valley, City of Los Angeles"

Project Description

"Superblocks" are defined as people-oriented public spaces and single- or multi-family residences contained within clusters of city blocks, bounded by a perimeter of arterial roads, with automobile through-traffic limited on smaller interior streets. They are part of a larger planning strategy implemented in Barcelona, Spain, where a government program has placed Catalan "Superilles" within neighborhoods across the city, integrated with rerouted bus and bike lane systems to encourage "active transportation" (Rueda 2018; Glazener & Khreis 2019).

The overarching project goals are transformation of the city's relationship with cars and more-sustainable urban mobility, yet other objectives are equally ambitious, among them:

- benefits to health and well-being through greater reliance on human-powered transport options;
- improved environmental quality, increased biodiversity and urban green space; revitalization of public space;
- promotion of local neighborhood governance;
- resource self-sufficiency; and
- improved social interaction and cohesion (Bausells 2016; Roberts 2017; Rueda 2019).

These goals and objectives are extremely relevant for the City of Los Angeles. The Los Angeles Mayor's Sustainability pLAn (2015; 2018) contains a set of complementary visions intended to transform the city within the next two decades. Long-term aspirations are grouped by topic area that include Air Quality; Housing & Development; Mobility & Transit; Livable Neighborhoods; Carbon & Climate Leadership; Environmental Justice; Urban Ecosystem; Preparedness & Resiliency; and five more – most if not all of which align well with projected outcomes from Barcelona's plan.

We are at a special moment in our city: willingness to confront serious local, regional, and global issues; bond funds to support transportation, green space, and housing initiatives; and extra motivation with the 2028 Olympics on the horizon.

Early results from implementation of Barcelona's Urban Mobility Plan indicate cycling and walking are safer for residents (Rueda 2019); since 2007, traffic within superblocks dropped by 26%, while measurements of walking and cycling have shown increases of 10% and 30% respectively (Brass 2017). The plan aims to encourage active lifestyles and reduce motor vehicle traffic by 21% in order to achieve a 40% reduction in CO_2 emissions by 2030. Barcelona superblocks are proportioned city blocks in a 3 x 3 grid; main roads around the perimeter allow a maximum speed of 50 km/hour and interior roads that dissect the grid into nine blocks restrict speeds to 20 km/hour and do not allow vehicles to travel across superblocks (Kostandinovic 2017; Glazener & Khreis 2019).

Better air quality is expected to become a major benefit. Barcelona will host one of five European pilot studies on environmental factors and health, supported by citizen science, focused on the interrelation between air pollution and health (ISGlobal 2019). Densely populated, traffic-congested street grids where many superblocks are being established have high pollutant levels, including hotspots for NO_2 and particulate matter ($PM_{2.5}$), which includes car tire and brake particles that lodge deep in the lungs when inhaled (Domene et al. 2017). Causal links are suggested between near-roadway air pollution, heart disease (Perez et al. 2012; Ghosh et al. 2016), diabetes (Chen 2016), neurological issues and respiratory illnesses (Glazener & Khreis 2019). In Los Angeles, ambient air pollution levels have progressively declined over two decades, resulting in improved respiratory health for children, yet near-roadway pollution remains a problem in many neighborhoods (Gauderman et al. 2015).

In Year 1, we asked these questions:

What is the potential for superblocks in Los Angeles? Could we reorganize our roads and streets to support a healthier population with a more-sustainable and equitable future?
Can a street be a park? Could an intersection become a community garden or a plaza where neighbors gather? Can we change our binary logic to embrace this multi-purpose vision?
We propose to investigate the potential for creating superblocks within existing Los Angeles cities and communities. Where are the best locations for proof-of-concept or pilot project neighborhoods? Where are changes needed and desired? Who will benefit? How shall we incorporate demographics and densities, single and multi-family residential clustering, economics and transportation planning? What public-space amenities are important for individual neighborhoods? What alternatives are unacceptable? How shall we learn this?

During the 2018-2019 academic year, our "Superblocks" research students have done a stellar job. Based on extensive research and fieldwork – on skateboard, foot, and public transportation – they identified preliminary locations within the communities of Boyle Heights, Historic South-Central, East Hollywood, Koreatown and Downtown as potential sites for Superblocks within the City of Los Angeles. They are now implementing raster-based site suitability models in ArcGIS Pro software and learning to code Python and R to automate geoprocessing and mapping. Their models incorporate factors they identified as most important, including population density, median household income, walkability, parks and greenspace needs, transportation corridor parameters, and the number of collisions between pedestrians and cars. In the next set of models, each variable will receive a suite of weights ranging from 10% to 90% to then produce final outputs. Final products also include an interactive Story Map describing the project.

Roles of Undergraduate Researchers

For the 2019-2020 academic year, we envision another extraordinary student team experience. In addition to the presentation for the symposium, maps and a Story Map, we intend for students to submit results to a scholarly journal, with target publications most likely from the urban design and environmental planning realm. We propose the San Fernando Valley as our study area, a self-contained city subset with 34 communities and all of the diversity, challenges and opportunities to be had in the City of Los Angeles. Our research approach will be to delineate thresholds for “real estate” that could change by superblock implementation – 10%-20%-30% – as defined by road length. We will use geospatial tools and data to model downstream effects of those changes and assess whether reported European outcomes would likely hold true in Los Angeles’ Valley – where and why.

Students on research teams work in an environment that emphasizes creative problem solving through collaborative effort and individual innovation, valuable skills for all future endeavors. They learn to collect and analyze data from multiple sources and develop a portfolio of work that enhances their future job placement. They employ a scientific paradigm to conduct primary research and learn about the process, including how to identify the problem, work on a team, and share findings and creative accomplishments. Team meetings are held biweekly, with presentations. Superblocks students are directly supervised by SSI Director Dr. John Wilson and GIS Project Specialist Beau MacDonald. Dedicated research lab space is provided and students are encouraged to consider it their work environment.

Students will identify potential locations using geospatial techniques and interdisciplinary skills that will require them to acquire, represent, organize, analyze, model, and visualize spatial information. Data-gathering, outreach, and research will be done in local communities. Tools will include web-based survey and mapping tools and applications along with various advanced techniques to create models (e.g., Shook et al 2016, Kong & Sui 2017). Students evaluate parameters, build geodatabases, and learn modeling and code-based cutting-edge technologies that enable the integration of multiple data sources. Visualizations begin with a small-scale model and proceed to larger-scale detail with high levels of accuracy. The process is iterative with feedback loops for all members of the geodesign team.

This project is particularly well-suited for student research involvement, as students need to understand and apply underlying principles of geography, architecture, landscape architecture, urban planning, computer science, and spatial sciences. This research would be particularly appropriate for our GeoDesign majors, but would also appeal to talented students from other most disciplines including environmental studies, earth sciences, and health-related majors.

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Dr. John P. Wilson, Professor of Sociology and Spatial Sciences and Beau MacDonald, GIS Project Specialist
"The Los Angeles GeoHub and the City of Los Angeles Mayor's Office Data Science Team: Using Geospatial Analysis to Make Data-Driven Decisions, Advance Civic Engagement and Impact Policy"

Project Description

We're pleased to announce the opportunity to participate in USC Spatial's ongoing research partnership with the City of Los Angeles Mayor's Office and Esri. One of the nation's most comprehensive municipal mapping platforms, the Los Angeles GeoHub is a core component of the Mayor's effort to make LA a world leader in civic innovation and open data, and incorporates a multifaceted geographic information system (GIS) platform that makes more than 630 types of city map data publicly available for real-time analysis. The goal of the LA GeoHub is to share data between City departments and create applications that allow users — including residents, private industry, and decision-makers — to get information about systems that interact with one another to target their work more effectively and to improve strategic planning. Along with Esri founder and president Jack Dangermond, LA Mayor Eric Garcetti announced the launch of the LA GeoHub in 2016.

Since then, four USC Spatial student research teams have worked closely with the Mayor's Data Science Team and other city entities, and received outstanding reviews for innovative work, creative mapping applications, and excellent presentations. Six students have been selected for internships and jobs, with the quality of their work well known by their research contributions.

We'll address another interesting challenge in 2019–2020 with the City of Los Angeles Department of Neighborhood Empowerment. To make LA government more responsive to local needs and promote increased citizen participation, the newest City Charter established the Department of Neighborhood Empowerment (DONE) and the Neighborhood Council System. LA Neighborhood Councils now number 97 and consist of residents, business owners, and property owners, with participants empowered to advocate directly for real change to make a positive impact in their communities. According to DONE, "local engagement is important because no one understands a neighborhood better than the people who live, work and play there. Neighborhood Councils are strengthening democracy in Los Angeles by embracing and supporting the diversity of neighborhoods that comprise the City of Los Angeles." We will have more information later in July about the specific focus of this research, but we invite you to apply now.

Past SSI GeoHub projects

Last year, one of our student teams created a Community Science Tree Inventory mapping application, working with the Bureau of Street Services Urban Forestry Division to iteratively create and test an app which we envision will be most valuable as a tool for community outreach to promote neighborhood-level street tree stewardship in our city. LA has approximately 700,000 street trees. The app includes features requested by Urban Forestry, collects uploaded photos plus specific attributes based on City Tree Inspection and ISA Tree Hazard evaluation forms, and integrates existing City street tree data. The app can be deployed in the field on a smart phone or tablet using a map-, smart-forms-, or browser-based interface; builds on several data capture platforms (e.g., Esri Collector, Survey 123); displays data using one GIS-based hosted feature service that can also be accessed, mapped, and edited on a desktop computer, and shared with the LA GeoHub. The team demonstrated their app to City representatives that included executives from the Board of Public Works, a Deputy Mayor, and the Mayor's Directors of Infrastructure and Sustainability, and they have been invited back to continue their collaboration in the fall. These ladies also received an Undergraduate Research Associates Symposium Interdisciplinary First Prize for their work.

A second student team worked with the Mayor's Office of Community Business to conduct a geospatial exploration of economic development's effects on small business vitality in selected regions of particular interest to the City of Los Angeles. The 'Macro of Micro' examined micro and small business resilience across a fifteen-year time frame, 2003–2018, looking at the effects of big businesses on small business growth, as well as exploring whether the level of development in the neighborhood surrounding the retail environments influenced small business growth and persistence; community-level factors considered included income and other economic indicators, demographic data, transportation, and overall gentrification. The team selected commercially zoned corridors along Crenshaw Blvd., Van Nuys Blvd., East First St., and Larchmont Blvd., each representing a different level of development. Site visits and extensive data analysis of historical business data suggested that big business growth played a part in small business decline, specifically through business revenue, and that development level was correlated with small business growth, revenue, and persistence. The team's recommendations to increase the resiliency of small and micro businesses were enthusiastically received by the City.

The prior year's research drew from the Mayor's Sustainable City pLAn — a transformative strategy to address environmental concerns over the next 20 years within a sustainability framework that includes a social equity and a healthy economy. 'Local water' is at the top of the list and the vision is to lead the nation in water conservation. By capturing seasonal rainfall for irrigation or to recharge groundwater, we increase local availability, reduce imported water dependence, and create sustainable alternatives to routing rainwater to streets, where debris accumulates to become urban runoff that drains to the river and ocean. USC Spatial was asked to recommend ways to disseminate information about holistic values of enhanced stormwater capture for a public engagement campaign. Students explored green infrastructure; parameterized selected scenarios and solutions; and created maps, apps, visualizations, and videos. We focused on simple ways to capture stormwater and showed the potential impact that one home or neighborhood can have to help achieve conservation goals. We used an online 'story map' to explain benefits of rainwater-capturing containers and to incorporate interactive maps and geospatial analyses that allow users to enter an address or click on their home or neighborhood to calculate potential catchment and savings. One student presented at URISA GIS-Pro & CalGIS 2018 and spoke at the Los Angeles Geospatial Summit; all demonstrated their app at the City of LA Sustainability Tools Launch and at the Provost's Undergraduate Symposium for Scholarly and Creative Work, where they received the USC Schwarzenegger Institute for State and Global Policy First Place Award.

Our first year, we completed an innovative street segment network analysis of violent and property crime (2012–2017 data) in the City of Los Angeles. Students conducted spatial and statistical analyses and produced an app for the Los Angeles Police Department and Mayor's Data Science Team and Office of Budget and Innovation. Crime patterns were categorized by their change over time; by time of day; and by day of the week. The mapping app is a descriptive tool that allows stakeholders involved in public safety to understand the temporal and spatial patterns of crime and their determinants at a small but meaningful geographic level. The tool also allows users to overlay street-segment and census block group layers related to the city's built and socioeconomic environment onto the street network. In this case, the application can be used not just to examine the spatial distribution of crime in the city, but also to examine associations between increasing and decreasing crime and environmental factors including place-based programs. This knowledge enhances the ability of the Mayor, LAPD, other civic leaders, and other stakeholders to deploy City resources and make policy changes to improve public safety. Student research assistants participated in multiple meetings with LAPD and Mayor's Office teams; presented their app at City Hall, at USC, and at the Los Angeles Geospatial Summit; and were contributing authors on a "Methods Protocol for the Los Angeles City Crime Street Network."