Capstone Experience Introduction

• Philosophy – experiential learning

• Course sequence & units:
  • Completing 2 units of 496, 498 and 499 **before** 495
  • Units from SFS or SEA
  • Flexibility

• Planning/How to get started
  • Know what you like and what we do
  • Take the initiative

• Creative Collaboration – 12:00-2:15, T/Th April 18 & 20th, 2017
Research On Campus with Faculty

- Work with a faculty to develop a research project related to their research interests
- First step: learn about the research of faculty members in our department
- Second step: go talk to a faculty member that you are interested in doing research with
- The earlier you talk to faculty members the better, because we often have research students scheduled semesters in advance
- You can register for EOSC 496 to earn course credit for research conducted during the semester
SURE Program and Other Funded On-Campus Opportunities

- Some opportunities to be funded for research – usually during the summer

- SURE (Summer Undergraduate Research Experience)
  - Write a research proposal to conduct an independent research project with a faculty member over the summer
  - Due end of February each year

- McNair Scholars (email Ramiro Frausto: rfrausto@sandiego.edu)

- Other opportunities
  - NSF REU
  - Individual Faculty Grants
EOSC 496: Environmentally Focused Research Study Abroad Programs

School for Field Studies (SFS):
- Rainforest Studies: **Australia & NZ**
- River Ecosystems & Envi. Ethics: **Cambodia**
- Sustainable Development: **Costa Rica**
- Himalayan Studies: **Bhutan**
- Biodiversity: **Peru**
- Wildlife Management: **Tanzania**
- Tropical Island Studies: **Panama**
- Marine Resource Studies: **Turks & Caicos Islands**

[http://www.fieldstudies.org/programs](http://www.fieldstudies.org/programs)
EOSC 496: Research through Environmentally Focused Research Study Abroad Programs

Sea Education Association (SEA):

http://www.sea.edu/
EOSC 496: Research through Environmentally Focused Research Study Abroad Programs

*Sea Education Association (SEA):*
EOSC 496: Research through Environmentally Focused Research Study Abroad Programs

- Climate Change
- Cultural Sustainability
- Environmental Sustainability Policy
- Field Oceanography
- Marine Biodiversity
- Ocean Plastics and Marine Pollution
- Invasive species
- Island tourism impacts
- Land-use change and conservation

**SEA RESEARCH THEMES:**
Research Experiences for Undergraduates (REUs)

- National and International Sites
Internship (EOSC 498)
PURPOSE

1. To gain practical work experience in your field of study
2. To apply classroom knowledge to authentic work situations
3. To help focus your career goals
4. To establish contacts with professionals outside of USD
Internship (EOSC 498) Examples

PRIVATE COMPANIES
• Environmental consulting firms
• Environmental law firms
• Environmental laboratories

SCIENTIFIC RESEARCH ORGANIZATIONS
• Southwest Fisheries Science Center, National Marine Fisheries Service
• Hubbs-Sea World Research Institute
• Center for the Reproduction of Endangered Species (CRES), SD Zoo
• Space and Naval Warfare Systems Command (SPAWAR)
• Tijuana River National Estuarine Reserve
• Scripps Institution of Oceanography

EDUCATION
• Ocean Discovery Institute
• Sea Camp
• Local K-12 Schools
• Environmental camps

MUSEUMS AND PARKS
• Stephen Birch Aquarium Museum
• City of San Diego Parks and Recreation Department
• Torrey Pines State Reserve
• County of San Diego, Department of Parks and Recreation
• Tecolote Canyon Natural Park
• Cabrillo National Monument
• San Diego Natural History Museum

NONPROFIT AND POLITICAL ORGANIZATIONS
• USD Office of Sustainability
• USD Electronic Recycling
• Green Restaurant Association
• Think Green Live Clean Friends of Famosa Slough
• San Diego Coastkeeper
• The Student Conservation Association (SCA)
• Congressional Offices
• California Wolf Center
EOSC 498 Requirements

- **SET UP INTERNSHIP WITH EOSC INTERNSHIP COORDINATOR (Dr. Gray) BEFORE YOU START YOUR INTERNSHIP!**
- Work at an internship site for at least 45/hours per unit
- Attend internship class (4X per semester)
- Journals
- Biographies
- Resume & cover letter
- Presentation of a poster at Creative Collaborations
University of San Diego and the Career Development Center's Summer Internship Award

SUBMISSION DEADLINE: April 1st, 2017

The Summer Internship Award supports current University of San Diego undergraduate students as they pursue internships that advance their interest in exploring career options. Students granted this award are eligible to receive up to $3000 that will be dispersed in three payments.
Zero Waste Intern for the Office of Sustainability

Erin Sommer BA in Environmental Studies
Intern Supervisor: Paula Morrale
Intern Faculty Advisor: Sara Gray

Organization and Mission
- The Office of Sustainability was formed in Fall 2009, proposed by President Mary Lyons to make our campus more green and eco-friendly.
- The Office’s goal is to seek out retrofits and initiatives to implement that will help USD become one of the most sustainable campuses in the country.
- The Office of Sustainability is designated to plan and implement sustainable practices across campus as well as apply innovative applications to improve sustainability.
- The organization educates USD and the local community regarding various ways to be sustainable in your everyday life.
- They also run the compost and garden area behind Missions Crossroads, complete office and home energy assessments, as well as moderates the Be Blue Go Green Team on campus & started the E-waste facility.

Zero Waste Intern
- Stricker design for paper towel dispensers at USD to help increase knowledge of consumption waste and to remind people to be more sustainable.

My Job
- Expand and market Zero Waste events
- Created a Zero Waste marketing flyer
- Educate and sort waste at Zero Waste events
- Create DIY kits and signs for Zero Waste events
- Coordinate "Trash Talker" volunteers
- Initiate pre-consumer composting at SLP and Mission's Cafe
- Initiate recyclable to-go boxes for SLP dinners
- Initiate making undergraduate student teacher evaluations electronic
- Created sticker for paper towel dispensers to be displayed at Founder's Hall, Mission's gym, JSP, Sports Center and Manchester

Composting
- BYOT sign (on left) for Mission's gym, to reduce single use paper towel waste
- Zero Waste DIY signs (below & on right) to inform people what waste can be recycled & composted
Education & Animal Care Internship at the California Wolf Center
Tobias Nickel
Environmental & Ocean Sciences

What is the California Wolf Center?
The California Wolf Center is a statewide non-profit organization headquartered in Julian dedicated to the recovery of wolves in the wildlands they once roamed. The California Wolf Center envisions a landscape where wolves thrive in healthy ecosystems and wolves and people successfully coexist.
The California Wolf Center accomplishes its mission through:
- Conservation: Partnering with stakeholders to implement proactive solutions that enable wolves and people to successfully share the landscape and lead the way in endearing species recovery programs.
- Education: Increasing awareness and understanding of wolves through engaging educational programs and public outreach.
- Research: Studying wolves’ biology, behavior and history in California.

Where did all the wolves go?
Wolves used to be native to virtually all parts of North America. There are several factors that led to their decline including:
- Population growth: Unlike coyotes, wolves do not adapt well to urban development and as people moved west, wolves lost their natural habitats.
- Human-wildlife conflict: As much of wolves’ natural prey was killed off, e.g., the bison, wolves began to go after secondary prey, i.e., livestock. This led to systematic hunting and the Anti- Predator Campaigns of the early 1900’s, in which wolves were mostly extirpated in the lower 48 states.

My Role as an Intern
- Leading educational presentations and tours about wolf ecology and conservation
- Changing not nurseries, animal care for hundreds: four resident gray wolves
- Assisting fundraising efforts, processing donations and non-profit administration tasks

What skills did I learn?
- Public speaking: Conveying complex information in a way that is engaging and understandable
- Animal care: Learning how to care for and behave around large carnivores
- Ecology: Increased understanding of ecological principles, conservation practices, wildlife organizations, species survival plans, captive breeding programs, recovery of endangered species, human-wildlife conflicts, conservation strategies and environmental policy
- Non-profits administration: Insights into management and operations of a 501(c)(3) non-profit organization

How has this experience affected my career choice?
My positive experience at the California Wolf Center has strengthened my desire to pursue a career in conservation, environmental advocacy and/or natural resource management. I find this to be a very rewarding field and want to use my talents in the service of the natural world.
Watershed Trash Assessments
By Rachel Stroud

Internship Summary
Watersheds provide over $450 billion in ecosystem services, such as provision of food, materials for manufactured goods, tourism, water for drinking, agriculture and manufacturing, and habitat for birds and wildlife including many species of concern. Plastic debris contaminates watersheds by breaking down into smaller pieces that are easily ingested and transported downstream, and that more efficiently bind with other contaminants in the environment. The provision of ecosystem services depends on the watersheds remaining clean and healthy. To find solutions to pollution, we need to better understand the source and behavior of pollutants in our watersheds.

I. therefore, helped with a project that examined the sources, pathways, and fates of plastics in an urban watershed, the Chollas Creek subwatershed which runs through mid-city San Diego. We investigated the sources of plastics using trash transect surveys, the pathways by tracking the movement of tagged plastic bags, and the fate by analyzing fish guts for plastics.

Advisor: Theresa S. Talley, California Sea Grant, Scripps Institution of Oceanography, UCSD
Collaborators
San Diego Bay Debris Working Group: Christiana Boeberger (U.S. Navy); Ted VonBlint, Terra Miller Cassman, Cara Simonsen (AMEC Consulting)
USD: C. Heller, T. Miller, R. Whalen

Responsibilities
I helped to collect and categorize trash from four canyons, track pathways plastic bags along Chollas Creek subwatershed, and determine the fate of plastics in fish from San Diego Bay.

Trash Transects
- Trash along 35 m transects was enumerated and classified by plastic number and human use to lend insight into consumer sources as well as entry location into waterways.
- Volumes of major trash categories were taken.

Plastic Bag Tracking
- Set out 10 labeled biodegradable plastic bags at the head of Swan Canyon and near the I-800 overpass on Chollas Creek.
- Each bag contained a Track R device to aid in relocation. Bags were tracked after each major rain event.

Fates
- Detected three species of fish from San Diego Bay.
- Looked for plastics in guts.

Impacts of research and my internship
Source
- 10% of common plastic packaging items are single-use plastic bags revealing how common these are in San Diego’s watersheds.
- Possibilities why so many plastic bags are pollution watersheds
  - Near by residential areas not properly disposing trash
  - Wind blowing trash
  - Storm drains depositing excess plastics bags

Pathway
- All plastic bags remained entangled in vegetation and/or trapped in posts after a 0.25" rain event.
- All plastic bags remained entangled in Swan Dyne, and 2 of 6 were found in Chollas Creek after a 0.75" rain event.

Reasons for not finding some plastic bags
- Enfolding in canyon vegetation or buried out of site and begin to biodegrade
- Animals removing plastic bags
- Washed downstream during large rain events

Trash reduction strategies
- More community trash pick-ups
- Lobbying for stricter pollution prevention laws, such as a plastic bag ban
- Encourage use of reusable bags

Fate

<table>
<thead>
<tr>
<th>Types of fish</th>
<th>Total no. fish</th>
<th>No. plastics</th>
<th>% plastics in guts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotted sand bass</td>
<td>13</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>California halibut</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Round stingray</td>
<td>37</td>
<td>12</td>
<td>32</td>
</tr>
</tbody>
</table>

The results of these efforts will educate the public about the need for an adjustment in how watersheds are managed in urban areas.

Preparing to become a leader in science and conservation
Helping with this project allowed me to see first-hand the extent that San Diego’s watersheds are polluted. As San Diego’s population increases, watershed pollution rates will increase if nothing is done. There will be substantial consequences that will influence not only marine life but human life. It is crucial to educate people and start implementing more regulations to help reduce watershed pollution. I learned that without communication between organization’s studies on the impacts of pollution in watersheds would not be possible. Every organization contributes to the study and the application of the results. Interning this semester has made me interested in environmental law. I potentially see myself in the future practicing environmental law and helping implement stricter pollution prevention laws.
Senior Seminar (EOSC 495)

What is senior seminar?

One unit class on how to make a professional presentation in your field of study

Meets every Friday 2:30-4:30 for one semester in your senior year

COACHELLA
Senior Seminar (EOSC 495)

Step 1: Take 2 UNITS of

- EOSC 496 (Research)
- EOSC 498 (Internship)

Senior Seminar Poster Session
What if your research flopped or your internship didn’t allow you to collect any data that you can present?

Expand on a laboratory/field project that you started in another class

• EOSC 301W (Research Applications), EOSC 473 (Climatology)…
• School for Field Studies (SFS), Sea Education Association (SEA)…
• Conduct a thorough literature review and synthesize your own thoughts on an approved topic

Not as easy as it sounds!
Senior Seminar (EOSC 495)

What should you complete before you enroll in Senior Seminar?

• Completed data analysis (Graphs & Statistics)
• Literature Review
• Conclusion and Interpretation

(These are completed as part of your research or internship units)
What you will present

1. What your question or problem was
2. Why it was important to answer it
3. Your results and interpretation
4. How your topic relates to published literature on the topic
5. How your topic relates to your major pathway.
Senior Seminar (EOSC 495)

Examples of Presentations

- School for Field Studies
- Literature Review
- Research at UCSD
- Research at USD
- Internship
- SEA
- Research at SDSU
Colonizing the Amazon: Causes and Consequences of Andean Settlement in the Community of Pilcopata in Southeastern Peru

Rani Kuman, Environmental and Ocean Sciences Department, University of San Diego

Background

After Brazil, Peru has the largest extension of Amazonian forest (around 75 million ha). Since the 1960s, the government has sponsored many settlement programs to encourage the transformation of the forest territories into agricultural land (Smith et al. 2006). While policies have begun to shift, the Amazonian frontier in Peru remains a place of dynamic social change with many environmental concerns.

Timeline of Government Interventions in the Amazon

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>Colonization begins</td>
</tr>
<tr>
<td>1992</td>
<td>Loggers attack first group of settlers</td>
</tr>
<tr>
<td>2001</td>
<td>Pilcopata community formed</td>
</tr>
</tbody>
</table>

Deforestation and biodiversity loss as a result of migration into the Amazon is a global environmental concern. Despite these increasing problems, little attention has been paid to the motivations and experiences of Peruvian colonists who have settled the southeastern Amazon.

Objectives

- Establish a historical timeline for the community of Pilcopata
- Document personal narratives of Andean migrants
- Understand Andean colonization patterns in order to guide local conservation efforts

Study Area: Pilcopata

- Capital of the Ráquira District in the Department of Cusco
- In the Upper Amazon near Manu National Park
- Population approximately 2,900

Methods

Purposive Sampling
- Two weeks of field interviews
- 21 individuals and three public institutions

Semi-structured Interviews
- Demographics (e.g., age, place of birth etc.)
- Migratory experience (e.g., why did you move here, how did you find work?)
- Discussed emotional experiences of the transition, adjustment to the Amazonian environment, and changes they observed since migrating to the area.

Results

Demographics
- Age range: 27-90 years old
- Majority lived in the northwestern Andes
- Average period of residence: 30 years

Motivation for Migrating
- Lack of economic opportunities within home regions
- Official agricultural employment options
- Family connections, especially for women

Historical Timeline of Pilcopata

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Pilcopata community begins</td>
</tr>
<tr>
<td>1992</td>
<td>First community plan drawn</td>
</tr>
<tr>
<td>1995</td>
<td>First community-organized school opens</td>
</tr>
<tr>
<td>1997</td>
<td>First community health program established</td>
</tr>
</tbody>
</table>

Key Themes from Interviews

Positive Transition to the Amazon
- Some challenges: mosquitoes, biting flies, heat, and intense sun
- However, most interviewees focused on the positive aspects of arriving to the rainforest:

- Visit a beca de libertad: I came in search of liberty.
- La Amazonía es maravillosa, mi esperanza de vida. \(\text{The Amazon is marvelous, my life.}\)

- Me ha llevado esta suerte: This fortune called for me.
- \(\text{La Amazonía es maravillosa, misteriosa, te invita a visitar. The Amazon is marvelous, mysterious, it invites you to visit.}\)

Place-based Identity
- Sense of adventure and ‘wild-west’ frontier
- Strong connection to Andean homelands including language, traditional dress, and shareholdings
- Cultural exchange and intermarriage with local Waychiparí and Machiguenga communities
- Reintegration of outsiders and foreign conservation groups
- Many no longer feel like migrants

Conclusions

- National policy and the establishment of Pilcopata appear to coincide.
- Andean migrants have deep connections to the Amazonian environment.
- Because of this connection to the Amazon, future conservation efforts can likely create more sustainable and impactful projects in Pilcopata through community support and participation (Brooks et al. 2012).

References and Acknowledgments

I would like to thank all the respondents and the community of Pilcopata for their time, enthusiasm, and for being open to sharing their stories. Many thanks to my advisor Dr. Rina Sforni for the SFS and Villa Condesa Staff, as well as ACCA. Also, thanks to Professor Elio Collard and Dr. James Biggs for their support.

Acknowledgments

- Smith et al. (2006): New natural resource, good design, cultural community, and social change.
- Brooks et al. (2012): First community-organized school, official agricultural employment options, and their recent project to create the Technological Institute of Pilcopata and other community member.

Figure 1. Map showing the location of Pilcopata in the Peruvian Amazon.

Figure 2. Map showing the location of Pilcopata in the Peruvian Amazon.

Figure 3. Map showing the location of Pilcopata in the Peruvian Amazon.

Figure 4. Map showing the location of Pilcopata in the Peruvian Amazon.

Figure 5. Map showing the location of Pilcopata in the Peruvian Amazon.

Figure 6. Map showing the location of Pilcopata in the Peruvian Amazon.

Figure 7. Map showing the location of Pilcopata in the Peruvian Amazon.
Settlement of Barnacle Larvae Within the Southern California Rocky Intertidal

By: Diana Fontaine
Dr. Nathalie Reyns, Department of Environmental and Ocean Sciences

Introduction

- Barnacles are model organisms for understanding how larval transport processes influence adult abundances (1).
- Barnacles, like many marine organisms, have a two part life cycle. Adults release pelagic larvae (nauplii) that develop offshore and transform into cyprids which travel back to shore, settle on a hard substrate, metamorphose into juveniles, and develop into adults (Fig. 1).
- Studies have previously found that internal waves, observed through sudden increases in water temperature are important phenomena for barnacle larval transport (3, 4). In addition, increasing wave height during storms may transport larvae onshore.
- Objective: observe how changes in settlement are related to water temperature and wave height.
- Hypothesis: settlement is positively related to water temperature in the spring/summer and to wave height in the fall/winter.

Methods

- Deployed PVC settlement plates at Bird Rock on 13 rocks throughout the rocky intertidal.
- Collected plates daily during low tide and brought back to the lab to examine under microscope.
- Identified and counted the number of cyprids and metamorphs.
- Obtained temperature data (Fig. 6) from temperature logger deployed 2 m under water in intertidal.

Results

Spring/Summer
- Fig 5. Daily Barnacle Settlement
- Blue = 2014 Red = 2015

Fall/Winter
- Fig 6. Daily Water Temperature
- Fig 7. Wave height (3)
- Fig 8. Settlement and Abiotic Data across four sampling sessions

Discussion

- Barnacle settlement varied seasonally, and annually:
  - Relatively high settlement in spring/summer compared to fall/winter months (both years) may reflect the reproductive timing of Chthamalus sp.
  - Relatively high settlement in fall/winter 2015 compared to fall/winter 2014 may relate to changing oceanographic conditions due to a developing El-Niño.
- There was no correlation between settlement and temperature or wave height (p-values > 0.05) but trends indicate that:
  - Settlement peaks correspond to relatively high temperatures (Line 1) and low wave height (Lines 1 & 2).
- Other studies have observed larger barnacle settlement throughout entire sampling period (3).
  - Could be due to differences among sites.
- Future Studies will examine the currents and oceanographic conditions of the Bird Rock region to identify the mechanisms that may transport larval barnacles to the intertidal. Rapid (over several minutes) changes in water temperature may generate fronts that transport larvae, so relatively fine-scale temperature changes may be better correlated with settlement than daily average temperature.

Acknowledgements & References

I would like to thank Dr. Nathalie Reyns for her continued support, Dr. Jesu Piedra, Anthony Basilio, and Kate Heggenstaller. Funding was made possible by the National Science Foundation. Thank you Dr. Serio and Prof. Callicott for your support throughout senior seminar.


References

Landfill Redevelopment: An Assessment of Phased Approaches
Nicole Charnock, Environmental Studies
Environmental and Ocean Sciences Department

Introduction
This study looked at how phasing was being implemented during closed landfill redevelopment projects. Many communities are exploring options to repurpose closed landfill sites. This oftentimes includes achieving more efficient site utilization by establishing recreational areas.
- Phased development can reduce problems by adding amenities over time as the site changes and settles.
- Phasing should add the least impacting amenities first then add the more impacting amenities to the site.
- Phasing in this way results in greater site success rates.
- Phased development gives developers additional time to obtain proper funding.

Methods
- One small and one large landfill redevelopment project were chosen for the comparison.
- A clear timeline of the amenities added during each phase was found, providing a basis for comparison.
- The two redevelopment examples were compared to phasing in accordance with site changes and settlement.

Results
<table>
<thead>
<tr>
<th>Fresh Kills Landfill</th>
<th>North Wake Landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York, New York</td>
<td>Raleigh, North Carolina</td>
</tr>
<tr>
<td>2,200+ acres</td>
<td>200 acres</td>
</tr>
<tr>
<td>Phased due to its extreme size</td>
<td>Phased for financial reasons</td>
</tr>
<tr>
<td>Phased in 3 stages (30 years)</td>
<td>Phased in 4 stages</td>
</tr>
</tbody>
</table>

Fresh Kills:
- Phase 1: Eleven miles of bikeways and pedestrian paths, soccer fields, and park entrances, signage, lighting, and parking.
- Phase 2: Extension of paths and trails, increase in natural setting open to the public, and structures for nonprofit and commercial ventures.
- Phase 3: Expand landscaping, enhance wildlife and habitat areas, and ensure that all park areas and programs are built out and active.

North Wake:
- Phase 1: Elementary school, a community recreation complex, and athletic fields.
- Phase 2: Shelter, pathways, and vegetation.
- Phase 3: Recreational areas for kids and canines.
- Phase 4: Vehicular and pedestrian roads, pathways, landscaping, playgrounds, and a few structures.

Conclusions
- The two examples did not fully implement phasing in accordance with site changes and settlement.
- A reverse order of phasing would have allowed for the site to change and settle more before adding the most impactful amenities to the site.
- Developers are not fully benefitting from phasing.
- They are not considering how the site will change and settle over time, which could save a lot of time, effort, and money.

Future Considerations
- To allow for site changes and settlement, future landfill redevelopment projects should complete the least impacting phases first and leave structures and other significant impacts to the site for the last phase.
- Phasing due to the size of the site and for financial reasons can still be achieved when phasing in accordance with landfill site changes and settlement over time.
- By saving the largest and most impactful additions until the end of the project, even more time is given to find funding.

References
*North Wake Landfill Project Executive Summary (2011) - Wake County, North Carolina*
*References for future consideration...

Figure 1: Recreational area at North Wake Landfill Park.

Figure 2: The evolution of the landfill sites over time.

Figure 3: Phasing at Fresh Kills Landfill. Colored areas show the parts that will be completed by the end of the phases.

Figure 4: A more ideal progression of phasing.

Figure 5: Landscaping Trees Playground Roads Shelters
Using Rainwater Catchment to Promote Sustainability at USD
Spencer Dunlap
Dr. Suzanne Walther, Environmental and Ocean Sciences
Dr. Julia Gantzieler, Sociology

Introduction

California is in a state of drought. To conserve water, SDG’s Xeriscape 2020, a water conservation group founded by Stanley Fearing, Helen Gordon, Angela Resor, and myself, urges USD students to reduce their personal water consumption by 20%. This academic year, as an initiation, USD is held in the right direction, as we have reduced our water consumption by near 10% over the past 15 years.

Background

When it rains in San Diego, water runs off buildings and overland into storm drains, eventually ending up in the Pacific Ocean, and picking up trash and other contaminants on the way. As part of the EPA’s 330 Campus Rainwater Challenges, USD’s Xeriscape 2020 is collaborating with the USD Gardening Club, the Chargerball Nuts, and several faculty members, to install rain barrels at various locations around campus. By installing rain barrels, we will capture water that would normally run off and recycle that water to reduce our dependence on water from the city’s infrastructure, which is not a safe source. The USD Gardening Club’s water is harvested from reservoirs in northern California and the Colorado River.

In collaboration with the USD gardening club, WHO’s Your Turn is installing a 500 gallon rain barrel near the community garden behind Mission Commons on November 20th, 2018. This barrel is a demonstration, or proof of concept, that we intend to apply to the Shiley Center for Science and Technology (SCST).

Methods

I performed a literature review focusing on strategies employed by the Office of Sustainability at the College of Charleston in Charleston, SC, to determine the effectiveness of rainwater catchment techniques, as well as lessons learned in sustainability initiatives on college campuses. I found that a primary barrier to sustainability projects is lack of economic incentive.

Additionally, I looked at literature concerning the value of green infrastructure, focusing specifically on storm water drainage infrastructure. I discovered that the median energy cost to treat and distribute one million gallons of storm water in California is $2,700,000, or $650,000/t. Using water catchment techniques, such as rain barrels, decrease the amount of water needing treatment, thus saving energy and cutting CO2 emissions.

I used rainfall data to predict the amount of runoff that is generated at SCST during rainfall events. Average annual rainfall at San Diego field, the driest weather station in the United States, is 14.26 inches. This information is relevant, because San Diego is predicted to experience a strong El Nino event for 2015-16, based on current sea surface temperature anomaly data.

I used Google Earth to estimate the surface area of the SCST roof that drains into the proposed rain barrel locations (see figures 2 and 3). This surface area was cross-referenced using a blueprint of the SCST roof, as well as a visual survey of the SCST building and roof space.

Results

• The section of roof space (figure 2) that drains into the downspout pictured in figure 3 has a surface area of 2,800 ft². For each inch of rain that falls, approximately 1,860 gallons of runoff is collected there.

Rainwater Catchment Runoff of Thumb: 1,190 ft² of roof space captures 600 gallons of water for every 0.1 inch of rain.

• The prairie area shown in figure 4 below is an ideal location for a below-ground cistern, as water naturally flows down gradient from the SCST rain barrels to this location. Also, water could easily be accessed at this location, and transported to other areas around campus via water truck.

• If USD receives 38 inches of rain during the 2015-16 El Nino year (see figure 1), we could capture and store approximately 233,210 gallons of water using two rain barrels at the location shown in the figure below.

Conclusion

• USD is a truly beautiful college campus, consistently ranked one of the top campuses in the country in terms of aesthetics, but unfortunately this beauty comes at a price, as water demands for irrigation are very high. Furthermore, students at USD seem to lack awareness of the severity of the California drought, and have little knowledge of where their water comes from or how it travels.

My rainwater catchment proposal takes action to reduce storm water runoff and recycle water to mitigate the drought. Also, this is an ideal year to install rain barrels on campus, as scientists are predicting a strong El Nino event.

Future Implications

• Eventually, USD could install a cistern (figure 4) behind the SCST building that would store water from the building, and capture storm water that drains downhill next to the building (figure 3). This could be filtered and used as irrigation water, as well as a support a blended drip-irrigation community garden on the full immediate below the proposed cistern location (figure 5). Further contributions to USD’s mission to become a more sustainable campus by using recycled water to produce food.

Acknowledgements & References

Special thanks to WHO’s Your Turn, the USD Gardening Club, the Chargerball Nuts, Dr. Walther, D. Gantzieler, Dr. Yus, Dr. Scarry, Professor Callahan, Seth Macdonald, and Rodrigo Coherer.


Interested in being a TA?

- **EOSC490**: Undergrad. Lab Assistant
- 1 unit of credit, P/F
- See liz: Office SCST250 or ebaker@sandiego.edu
- Bring ADD/DROP form to Dr. Gray for signature **after** talking to liz.

**Fall 2017 Lower Division Labs**

**EOSC104 Natural Disasters:**
- Wed. 9:05-11:55
- Thurs. 9:15-12:05
- Thurs. 2:30-5:20 (precep.)

**EOSC110 Intro. to Geoscience:**
- Mon. 2:30-5:20
- Fri.. 2:30-5:20

**EOSC220 Intro. to Atmosphere and Ocean Science:**
- Mon. 2:30-5:20
- Fri. 2:30-5:20

**EOSC121 Life in the Oceans:**
- Thurs. 9:15-12:05
- Fri. 9:05-11:55

**EOSC123 Organisms and Ecosystems :**
- Wed. 2:30-5:20
- Thurs. 2:30-5:20 (precep.)
- Fri. 2:30-5:20
Michel Boudrias

• I have three areas of research: functional morphology & locomotion of crustaceans, marine pollution impacts on beaches, and climate change education for leaders
• Are the ecosystems in the back of the bay affected by storm drain pollution?
• Benthic cores for macro and meiofauna analysis
• Water sampling for nutrient analysis
• Sediment samples (cores or hand samples) for grain size distribution
Sarah Gray

Research: Marine sedimentology; anthropogenic impacts in coastal systems (coral reefs)

Current project: How watershed development (mostly unpaved roads affects sedimentation on coral reefs in the US Virgin Islands
Field and lab methods
Ron Kaufmann

- Responses of organisms, populations and communities to environmental variation across a range of spatial & temporal scales
- How do plankton community abundance & composition across Mission Bay vary in relation to changing environmental conditions on scales of hours to years?
- Plankton sampling (towed nets)
- Hydrographic profiling (multimeter, CTD)
- Plankton enumeration, identification (light microscope)
Beth O’Shea

- Dr. O’Shea is an environmental geochemist specializing in the investigation of metal contaminants in sediments, soil, and water.
Jennifer Prairie

- Research interests include biological and physical interactions in planktonic ecosystems on the scale of individual organisms; currently looking at bio-physical factors affecting marine snow aggregates.

- Use laboratory experiments to investigate properties of marine snow aggregates and copepod foraging behavior.
Nathalie Reyns

- research interests: understanding the biophysical factors that impact larval dispersal; invasive species in Mission Bay
- Which biophysical factors allow larvae retained within/advedted out of Mission Bay? Which invasive invertebrates persist within Mission Bay?
- Plankton nets and pump systems; measuring currents with ADCPs, CTD casts; ecological sampling with quadrats and along transects
Steven Searcy

- Early life history of marine fishes and invertebrates
- Establish a long term data set monitoring fish populations and their habitat in Mission Bay
- Trawls
- Light traps
- Standard Monitoring Unit for Recruitment of Fishes (SMURFs)
Drew M. Talley

• I am interested in issues of habitat connectivity within and between Mission Bay ecosystems.

• How does the presence of wetlands affect habitat use by mobile fauna?

• Benthic cores; Seining/Trawling; stable isotope analysis
• Research focus: studying the role of natural disturbances and human land use in shaping river system dynamics (aka fluvial geomorphology)

• How much sediment is accumulating in Tijuana Estuary and at what rate? How has El Niño influenced Tecolote canyon erosion and stability?

• High resolution GPS & imagery data collection (using a quadcopter); Sediment sampling; Remote sensing & GIS; Modeling

Project on mapping flash flooding impacts in Capitol Reef National Park
Zhi-Yong Yin

Research interest: terrestrial hydrological systems’ responses to climatic variations.

Recent projects:
- Using tree ring data to reconstruct past climate in the eastern Tibetan Plateau.
- Changes of the Asian monsoon system during geological times through modeling.
- Applications of GIS and remote sensing