This magazine was made possible thanks to,

Campus Sustainability Council

As well as generous contributions from,

CAO/Provost Fund
Crown Senate
Stevenson Senate
Porter Senate
Kresge Senate
College Eight Senate

Photo By Amanda Davatolahgh
Gaia Magazine is the student-run environmental magazine at the University of California, Santa Cruz. It aims to provide coverage of sustainability-related issues and initiatives on, or linked to, the UCSC campus, as well as the broader community, in order to further awareness and inspire constructive action. Gaia expresses and promotes the student vision of sustainability at UCSC, as determined by sources including the Blueprint for a Sustainable Campus. Gaia strives to practice the sustainability it promotes by printing locally on recycled paper using soy-based ink and conserving resources via online expansion. Gaia welcomes submissions from UCSC students and publishes a print issue annually in the Spring.

The edge is where life is truly lived. There, we have room to grow, vision of what is just beyond our reach, and the possibility to achieve it. This year at Gaia we are talking about living on the edge. Whether it be the edge of a natural ecosystem, of the next scientific breakthrough, or of a great adventure we hope to celebrate the possibilities that arise from living on the edge and the thrills that come with the courage to jump off into the unknown.

Krista Rigsbee

We would love to hear your thoughts regarding this year’s magazine. Please take the time to send us feedback here: https://www.surveymonkey.com/s/7LB3CMD
Meet the Team

EDITOR IN CHIEF
Krista Rigsbee

OUTREACH COORDINATOR
Maddy Starr

BUSINESS MANAGER
Carla Céspedes

DESIGN COORDINATOR
Allison Titus

INTERNS
Jesi Bautista
Monica Cho
Victor Rivera-Diaz
Dannah Rosales
Sara Sullivan
Diane Terry

JOIN THE TEAM
Come to a meeting or email us to inquire about current opportunities. Based on your skills and interests we will find you an internship or volunteer position on our team.

SUBMIT CONTRIBUTIONS
Since Gaia is all student work, we depend on student contributions each year to make this magazine a success. See our online contributor’s packet for more information and email us your work.

Contact us:

gaiamagazineucsc@gmail.com
Contents

6 CARBON FUND: PROJECTS ON THE EDGE

7 THE PERKS OF ADVENTURE

12 STUDENT PHOTOGRAPHY

15 THE PLIGHT OF THE MONARCH

18 GAIA’S KITCHEN

19 A GUIDE TO THE CAMPUS NATURAL RESERVE

22 NATURE WITHIN
   A Poem

26 RESEARCH AT UC SANTA CRUZ

31 SANTA CRUZ ECO TOUR

33 THE HOMELESS GARDEN(ING) PROJECT
   A Photo Journal

37 STUDENT ESSAY:
   Hydroponics
The Carbon Fund at UC Santa Cruz is a valuable resource for students, staff, and faculty to receive funding for their projects that work to reduce greenhouse gas (GHG) emissions either on campus or in the Santa Cruz community. This school year, the Carbon Fund has allocated over $200,000 to over 20 new projects that work to reduce the carbon footprint. Here are some of the projects funded in 2013-2014:

**Green Labs Certification Program**
By monitoring the energy usage statistics in six main laboratory buildings, the Green Labs Certification Program is able to better understand the impacts of energy conservation programs. By identifying actual energy usage patterns and making efforts to conserve energy, GHGs will be reduced.

**Retrofitting Kresge Natural Foods Cooperative**
Serving over 500 Kresge students, as well as staff and faculty, the Kresge Natural Foods Cooperative is an important source for affordable, local, organic food. By updating freezers, using reusable storage bins, and hosting workshops, the Food Co-op saves energy and educates the Kresge Community.

**Green Building Carbon Laboratory**
Using aquaculture, this project is implementing a closed loop organic system for food production and laying a foundation for future innovation in food production systems and resource optimization. The materials are primarily sourced materials from local companies, the energy is provided by the sun and the water reserve is filled with harvested rainwater.

**Compost Heated Water System**
This project is attempting to compost woody biomass and plant material or "green-waste" in aerobic conditions and high heat. This energy can be used to heat water for various purposes such as cleaning and washing. It will take place at the Center for Argroecology and Sustainable Food Systems Farm on UCSC campus to produce hot water. This project will help UCSC reduce its carbon footprint and achieve its goal of Zero Waste by 2020.

**Harbor High Grow Quad**
Grow Quad is small edible forest commons at Harbor High School. It will serve to educate students and the local community about permaculture guided food production and sustainability. It will be an enjoyable space for students and teachers alike.

**Ocean Scales**
Through artistic expression Oceanic Scales is educating the public about ocean ecology and the importance of protecting life under the sea. This project encourages people to make simple environmentally aware choices daily. Opening days for this exhibit will be held May 1st and May 2nd. For more information, visit the website: http://genefelice.com/art/2013/02/22/oceanic-scales/
As college students, we are essentially here to learn as much as we can manage in a handful of years. More often than not, this results in hours upon hours of cramming information into our brain without having much time to figure out what it all means for us. As students of a renowned university, there is potential in every one of us to do great things. But as we stumble through the vast amount of knowledge offered at our campus, it becomes a struggle to grasp how all of this knowledge applies to our personal lives, and what it means for our future. I am merely a sophomore with nineteen short years under my belt, but every day I feel the conflict of longing to know my place in this world and the reality of having no clue.

Despite my despair, I recognize the importance of having to back off from this mind-numbing mind-set. One of my favorite ways to accomplish this is by spending a couple of hours out on the water, paddling in an outrigger canoe. Although there is much to be said about lessons learned from a formal education, I have learned the most about myself, my character, interests, and desires, when I step outside and interact with the world, face to face. Personally, I tend to feel overwhelmed by this huge world that we live in. As I attempt to understand it all, I lose myself in the process. However, when I’m paddling my heart out with a great group of people out on the ocean, I remember who Diane is and what she wants to do. When we paddle next to a family of humpback whales, so close that we see their barnacles and the way their mouths curl up in a smile, that long bridge distancing myself from the rest of the world crumbles. There’s a sense of peace that I walk away with after a morning paddle that I can’t accurately describe to you.

It’s something I can’t achieve by reading a textbook or listening to a lecture; it’s something unique to my own adventure.

As I spend my second year in this beautiful campus and community, I begin to realize that almost everyone I encounter takes advantage of an outdoor experience like I do. Maybe for different reasons and with different lessons, but these people carry that same peace. Recently, I met with four students who have had varying experiences with different outdoor passions. For some, it’s been a routine set in stone, and for others they’ve only just begun. Either way, their stories have inspired me, and I hope they inspire you too.
Upon entering the pool deck, I’m greeted with the overwhelming scent of chlorine in the air; the sounds of splashing, and a smiling Syver Pearson. Syver is a 23 year old transfer student enjoying his second and last year here at UCSC as a Plant Science major. Originally from Anchorage, Alaska, he tells me that rafting and fishing were common activities growing up, especially since his friend’s dad owned a shop specializing in rafting. Naturally, the numerous adventures sparked a flame in Syver. He continued to teach himself everything there was to know about kayaking, which he tells me worried his parents as first, but as time went on, it was clear that his natural talent would keep him safe. As soon as he turned eighteen, he became a rafting guide at American Whitewater Expeditions. Due to the fact that Syver was co-teaching a roll class in about fifteen minutes, I would have never guessed that he was self-taught. The energy with which he told his stories was almost contagious, and I found myself smiling and feeling the same excitement he was feeling. It was very clear that not only was he good at kayaking, but he was passionate about it as well. For Syver, he’s learned a lot from the dynamic character of a river, of which he tells me, “You really learn how to gain an ability to remain comfortable within yourself, where you have adrenaline to help you but you’re not nervous and you have this great focus. This really helps in your normal life because everything becomes a little less serious, a little slower, you can take things in a little bit more. You get to know yourself really well.”
As I drive into the quiet neighborhood near the base of campus, there isn’t a soul in sight and everyone seems to be taking advantage of the foggy Sunday morning by sleeping in. Everyone but Rika, of course, who greets me in a tie-dye shirt and is equally as relaxed as her surroundings. Rika is a 20 year old who is in her second year at UCSC double majoring in Molecular, Cell, and Developmental Biology as well as Marine Biology. Although I know Rika because she’s on the soccer team with my house mates, I’m not here to interview her for soccer. She’s recently entered the world of backpacking as well. She tells me that getting outside and camping is not out of the norm for her family; however, she’d never been on an overnight hike. So when she saw the Backpacking Club at OPERS festival during her freshman year, she knew she had to try it out. Despite being a beginner, the club lent her a backpack and welcomed her just like they would an experienced backpacker. For her very first backpacking adventure, they went to Sykes hot springs in Big Sur, which was a 10 mile journey both ways. Having only been in Big Sur once before, Rika was excited to be there again. And the adventure didn’t disappoint! As she tells me the stories about racing back and forth from the hot springs to the tent in an attempt to stay out of the cold air, and staying up late with strangers-turned-friends, a smile spreads across her face. As for her next journey, she tells me she wants to take her dad backpacking because he’s never done it before and it’s something they’ve always wanted to do together. Now that she has the experience, it’s a feasible plan for them.
A 22 year old halfway through his fourth year at this campus, Mykhaylo (Mike) seems pretty familiar with the winding trails that weave through our campus. We veer off the sidewalk down a steep hill and come upon a worn trail, a place where he often bikes. He tells me he’s been mountain biking since sophomore year of high school, resulting from necessity rather than being a hobby. Being from Big Bear, a woody mountainous area in southern California, he says mountain biking is the best form of transportation. But for Mike, it’s also become more than just a form of transportation, and he describes it as a high or a rush unlike anything else. As an Astrophysics major with a math minor, the third year is infamous for it’s intense course; as a result, he didn’t have much time for exercise. So mountain biking became pretty important to him as a way to relieve stress. As he told me about some of his favorite trails and experiences, it became clear that this was more than a way to get those endorphins flowing or to blow off some steam. For Mike, mountain biking has taught him a few life lessons as well. He was mountain biking with the Cycling Team one day and they were going down a hill tauntingly named “Super-G”. This is where he says he learned to “let go” of the bike. He didn’t truly let go of the bike, of course, but he let go of the idea of trying to have complete control over the bike. This is a lesson he’s applied to other aspects of his life, and he’s come to terms with the fact that you can’t and shouldn’t try to control everything. At the end of our conversation, we started to talk about all the recreational opportunities that our campus offers for a very small price. Other than mountain biking, he has also taken sailing classes, a massage class, and is currently taking a swimming class. This gives him more to do on top of his busy course load; therefore, sleep becomes a rare concept for him. However, looking back on his past couple of years at this campus, he sees all that he’s done and tried, and it makes it all worth it for him.

Mike shows that one wheel is just as fun as two
When we decided to meet at Natural Bridges, I didn't know that would mean trespassing on a trailer park and pretending to be visiting the “Jensen’s”. But looking out over the cliffs, I could see why this was the place to be. Good waves, but the energy in the air was very relaxed, something that can’t often be said for this hustling beach town of Santa Cruz. Brendan is a 19 year old in his second year, majoring in Environmental Studies, and has been surfing since he was eight years old. Since his dad surfs, he started young. He tells me about the first time he got barreled, which happened at the ripe age of ten years old. As he felt the wave curl around him and made it out the end of the wave, he was so excited that he immediately fell off the board. It was a funny story, but it shows how surfing changed for Brendan in the following years. For a while, he tells me he treated his passion as a sport. He was part of the surf team at his high school in Long Beach, and tells me that he spent every weekend competing in contests. By sophomore year, he resented surfing and was over the whole idea of it. However, he soon realized that it wasn’t surfing that he hated, but it was what he had turned surfing into. So, he stopped doing it for a score and started doing it for fun again, because even though he wasn’t as good as when he was younger, he realized he had a lot more fun. By changing the meaning of surfing to more of a “spiritual practice”, as he puts it, he has approached life differently as well. The idea of having a balanced life is key, much like how you wouldn’t want to lean too much one way or the other when surfing. Brendan sums it up perfectly by ending the interview with: “If you ride too fast, you don’t get to enjoy the wave for what it is; but if you go too slow you get sucked over the falls. If you ride perfectly in the pocket, you get to enjoy the wave to its fullest potential, so that’s kind of my metaphor for living too.”
STUDENT PHOTOGRAPHY

Amanda Davatolhagh

Courtney Lemon
If you walk down the old wooden pathway and down to the tall eucalyptus grove at Natural Bridges State Beach, you are in for a surprise. At first, to the untrained eye, it looks like any other park. However, if you wait just a little longer, you will see it come alive. What looked like dead leaves before is suddenly illuminated as huge dumps of monarch butterflies hanging from the eucalyptus branches; what you thought were falling leaves are actually butterflies floating through the air. You realize quite suddenly that you are absolutely surrounded by thousands of monarch butterflies.

Imagine the extraordinary sight of Natural Bridges today multiplied twenty-five times. While it is still impressive to see four thousand of any creature grouped in one place, Natural Bridges used to host one hundred twenty thousand overwintering monarch butterflies. That’s right: the numbers show that there has been a 70% decline in the monarch butterfly population at Natural Bridges over the last two decades, according to the Xerces Society.

If these numbers aren’t setting off alarm bells in your head, they should be. However, it’s important to understand monarch butterfly life history patterns and habits before diving into the details of monarch butterfly decline.

The monarch butterflies we see here at Natural Bridges fly down from the Northern United States and the Canada border, west of the Rocky Mountains. That’s a journey of up to 2,500 miles. But how does that tiny insect make that impossible trip? Here’s the catch: no one butterfly makes the entire migration. Female monarchs mate, lay their eggs on milkweed along the journey, and die before reaching their final destination. Their offspring then feed on the milkweed plant after hatching, turn into a chrysalis, and metamorphose into the adult butterfly form to pick up the journey where their parent left off.

Monarch butterflies come to the California coast during the fall to avoid the freezing temperatures inland and to go into a phase of diapause. They remain here throughout the winter months, forming clusters in the trees for warmth and protection from predators. When springtime rolls around, monarch butterflies head back north to find milkweed for their young once again.

This bar graph, compiled from data gathered by the Xerces Society in their Western Monarch Thanksgiving Count, illustrates the dramatic drop in monarch butterfly populations.
Why are we seeing such drastic changes in the population of monarch butterflies here at Natural Bridges and other groves along the California coast? There are several different factors that scientists and researchers believe to be contributing most to this devastating phenomenon. Number one is the increased use of pesticides and herbicides. Martha Nitzberg, head interpreter at Natural Bridges, says “Visitors to the park share their memories of abundant milkweed growing on roadsides, railroad tracks, orchards and in open spaces inland. Now, these sites are treated with herbicide so nothing can grow and the orchards and open spaces are within people’s backyards.”

Milkweed plants are essential to the monarch butterfly life cycle, and the loss of many of these plants could very likely be a cause of their decline. Herbicides also eliminate many species of wildflowers that adult monarch butterflies obtain nectar from, which may also be contributing to the decline.

Nitzberg added “Teachers began calling the park the year that roadsides began to be treated with herbicide rather than mowed, saying I’ve been a teacher for 32 years. I do my butterfly life cycle each year. I go to the same area (San Jose, Hollister, Gilroy) each year to get the milkweed plants and caterpillars. I have driven two and a half hours, and I can find NO milkweed...where do I get milkweed? This correlated with a drop in monarch butterflies at Natural Bridges.”

Another concern is habitat loss, not only of milkweed but also of coastal groves. Urbanization of wild places has had a negative impact on the monarchs, and this vulnerable species may not be able to cope with such intense losses of groves and reproductive sites. Groves are often a very delicate ecosystem, and the loss of a few trees can make a dramatic difference in the amount of protection it offers the butterflies.

Why should we care? In our world today, the news of yet another endangered species is hardly shocking; it’s a challenge to keep track of all the creatures that are grappling with population decline. Why should monarch butterflies in particular be a focus of preservation? If wanting to save a species for its own sake isn’t reason enough (and many might argue that it is not) there are significant other reasons to protect this population.

As a member of the Lepidoptera order, or the order of insects containing moths and butterflies, and as nectar consumers in their adult form, monarch butterflies have a role as pollinators in their ecosystems. This means they aid in the reproduction of the flowers they feed on.

Another reason to care about their decline is because the monarch butterfly is a species that is especially important to the human race. After working at Natural Bridges for a school year, I have heard many peoples’ stories about what the monarch butterflies have also become a symbol for the miracle of migration. These butterflies mean to them. Their accounts were beyond touching. Many people’s first memories of monarch butterflies is of raising them in a kindergarten classroom, or of visiting a grove with their loved ones. Also, the monarch butterfly is easily one of the most recognizable and popular forms of the Lepidoptera. Often, when many people think of a butterfly, the monarch is the image that pops up in their heads.

Monarch butterflies have also become a symbol of the miracle of migration, and have been adopted as symbols for

Monarch butterflies gather on a Monterey pine in the neighboring Lighthouse Field State Beach butterfly grove, which has also hosted many overwintering butterflies in recent years.

Photo by Allison Titus
immigration campaigns, such as Migration is Beautiful, since the monarch butterfly crosses political borders and boundaries peacefully on an annual basis.

After you have seen hyperactive children become silent and still, eyes fixated on a cluster of butterflies in the grove, grabbing on to their parent’s shirt and whispering urgently "Mom! I see one!", it is impossible to discount the importance of this insect. They are a beautiful bridge between curious children and the vast natural world.

In order to preserve this species, allow for future generations to experience the allure of a butterfly grove, and to raise a butterfly from caterpillar form in the classroom, for this animal to continue being a symbol of hope and curiosity, we need to help. The easiest way to get involved is to simply raise awareness: many people don’t even know that the monarch butterflies are in danger. If they knew, perhaps they would be more inclined to lend a hand.

Planting milkweed is another way to help, especially if you have a home that is slightly more inland. There are 13 species of native milkweeds in California, and about 40 species worldwide. Milkweed is inexpensive and easy to plant, and often even has beautiful flower blooms. You can go to your nearby plant nursery to get milkweed plants. The Natural Bridges visitor center has milkweed seeds for sale as well.

There are many groups and programs that are working to preserve the monarch butterfly through their own methods. One non-profit organization that has worked with the Natural Bridges grove specifically is the Xerces Society for Invertebrate Conservation. You can learn more about their work and how to get involved with monarch butterfly conservation projects on their website (www.xerces.org). Nitzberg endorsed the Xerces Society on behalf of Natural Bridges, stating, “the year Xerces Society started planting milkweed between the organic grape vines of some farmers in the Central Valley, the numbers of monarchs at Natural Bridges increased.”

Natural Bridges also has their own restoration programs, and welcomes all volunteers. If you are passionate about sharing the history and life cycle of monarch butterflies,

**Share the plight of the monarchs with your friends and family, visit a grove, and plant milkweed; be a part of the rise in the monarch butterfly population.**

You can become a docent at Natural Bridges. Docents lead tours of the monarch butterfly groves and educate the public and school groups on monarch butterflies.

It is not too late to save this species. Monarch butterflies are still completing their unbelievable journeys. “Even though the numbers are down from years ago, the butterflies are currently putting on a remarkable show worth seeing,” added Nitzberg. “Hopefully visitors from the Bay Area will learn of their plight and choose to grow milkweed in their gardens, businesses, and open spaces to raise more monarchs.” This issue has been caught relatively early; a little effort could go a long way in helping this species reproduce and bring their numbers back up.

All it takes is one visit to the monarch grove at Natural Bridges to become enraptured with this species. Share the plight of the monarchs with your friends and family, visit a grove, and plant milkweed; be a part of the rise in monarch butterfly population. It is about time to report a success story on behalf of the many threatened species in the world; perhaps the case of the monarch butterflies could be just that.

The easiest way to get involved is to simply raise awareness: many people don’t even know that the monarch butterflies are in danger.
**Kale, Cabbage, Citrus Salad**

_A tasty salad inspired by the warm summer temperatures! Thinly sliced Lacinato (aka Dinosaur) kale and green leaf cabbage are mixed with pine nuts and flavorful grapefruit pieces. This hardy yet refreshing salad is tossed with a golden orange sun dressing of fresh citrus juice & zest, garlic, pepper, and olive oil._

---

**Dressing:**
- ¼ cup freshly squeezed lemon juice
- ¾ cup freshly squeezed orange juice
- grated zest from 1 lemon
- grated zest from 1 orange
- 1 tablespoon of apple cider vinegar (optional)
- 2-3 garlic cloves, crushed into a paste
- ¼ cup olive oil
- 1 teaspoons black pepper
- sea salt to taste

---

**Salad:**
- 1 bunch Lacinato (same as Dinosaur) kale, de-stemmed and cut into ribbons
- 1/2 head green cabbage, shredded or cut into thin strips
- ½ cup pine nuts, raw or toasted
- 2 pink grapefruits, peeled and cut into ½ inch wedges

---

**Directions**

Combine the kale and cabbage into a large bowl. In another bowl whisk all the dressing ingredients together. Pour the dressing over the kale and cabbage and toss. Sprinkle the pine nuts and grapefruit over the top and serve!
A GUIDE TO THE CAMPUS NATURAL RESERVE

By Sara Sullivan
What are the Natural Reserves?

Being in school can be exhausting. Your hands hurt from frantically writing notes, you’re worried about a paper you haven’t even started that is due tomorrow, and you just feel cooped up! At UCSC you are surrounded by spacious meadows, gigantic redwoods, and the calming breeze of the ocean. You don’t want to be sitting inside all day. You want to be exploring and experiencing all the scenery around you. Do you ever want to see what the open land at UCSC has to offer but feel like you don’t know where to start? Don’t feel like you have to be an experienced naturalist. There are many resources available to better understand the Campus Natural Reserve.

The Natural Reserves System was started in 1965 when habitat loss was rapidly spreading and natural areas around the state were being developed and destroyed. In order to maintain land specifically used for teaching, research, and long term field studies, these areas were established. There are 39 reserves that stretch over 750,000 acres. It is the largest university-administered reserve system in the world (nrs.ucop.edu). They encompass a wide variety of ecosystems extending all along the California coastline. UCSC operates four of the locations including Big Creek, Ano Nuevo, Fort Ord, Younger Lagoon, as well as the Campus Natural Reserve. Each location is home to many sensitive species and is devoted to maintaining and protecting their environment.

Even the land on campus hold threatened and endangered species. The federally threatened red-legged frog is can be found near the Arboretum. Additionally, two meadows are home to the endangered Ohlone tiger beetle. These lands allow researchers to safely monitor and manage the populations of these sensitive species. The Campus Natural Reserve is accessible to all students here on campus and allows students to see firsthand the species, processes, and ecosystems they are studying about in class.

Meet the Expert: Q&A with Alex Jones

Alex Jones is a UCSC alumni in the Environmental Studies major. He has been working at UCSC for two years as the Campus Natural Reserve Steward.

Q: What do you do at the Campus Natural Reserve?
A: “I support research and education opportunities for faculty and students. I coordinates the UCSC Forest Ecology Research Plot internship program. I also takes 25 – 30 classes for field trips on the Campus Natural Reserve each year.”

Q: Do you offer any internships for students who want to gain more knowledge in stewardship?
A: “Yes, i do. I work with quarterly interns. We are involved with trail maintenance, erosion control, invasive species management, and forest cleanups.”

Q: As an UCSC alum, what was the most memorable part of your experience as a student?
A: “I was inspired by the Natural History Field Quarter program, a Quarter-long class where you visit multiple UC reserves and learn how to interpret the environment around you.”

Get Involved with the Natural Reserve System

Intern or Volunteer with the Campus Natural Reserve, Younger Lagoon Reserve, and Fort Ord Natural Reserve: Interns and volunteers are tasked with the restoration and conservation of sensitive lands on campus. Interns can receive credits and get to truly see how conservation efforts work.

The Restoration Ecology Class: A class in the Environmental Studies Department that focuses on developing and evaluating restoration plans for lands on campus. Students’ plans are submitted to the Campus Natural Reserve and can be incorporated into restoration projects.

The Invasive Species Management Plan: Works with the Campus Natural Reserve, Arboretum, UCSC Greenhouses, and Site Stewardship Program to manage over 80 invasive species and control populations of the high priority species on campus (UCSC Campus Natural Reserve Blog).
10 Tips for Exploring the Campus Natural Reserves

1. Get a field guide: Field guides allow you to identify critters you may see in the different habitats the CNR encompasses. “Natural History of the UC Santa Cruz Campus” is a great guide specific to our amazing campus.

2. Go outside and stay outside: Your first time hiking through the meadow you might not see anything amazing, but don’t give up. The CNR is home to hundreds of plant and animal species. The more you keep going back, the more you will see.

3. Wander through the landscape without distractions: In order to fully experience the beautiful scenery, you need to leave your headphones behind, log off the internet and just observe the atmosphere. Make your ventures outside a peaceful time to de-stress.

4. Pick a location and keep going back: Get to know your favorite location, and see how the environment changes over time. The Natural Reserves System has locations ranging from meadows, oceans, and forests. Once you find one that you connect with, get to know all you can about it.

5. Try to go home with questions and look up answers: The CNR has a website that offers maps and blogs about each location (ucscaturcruz.ucnrs.org). Or consult a field guide.

6. Find a peculiar-looking plant or organism each time you visit and get to know it: Learn about it. What was the name of that tree? Was that poison oak I picked up? The more you know about your location the further you can safely venture out.

7. Write about your experiences and draw maps: You can create your own field guide or write about how the atmosphere makes you feel and what you see.

8. Explore the landscape at different levels: As you return to your site, try to view your favorite tree from ground level or try observe the forest floor standing. Observing the landscape at different levels allows you to put into perspective how all organisms interconnect.

9. Bring along friends: Share your favorite spots with your friends, use this time to catch up and urge them to get out and take advantage of natural areas on and off campus.

10. Get involved with groups that focus on wilderness exploration: On campus there are at least three groups that focus on wildlife exploration:
   • UCSC Natural History Club: A student lead club that meets weekly in different areas of campus. You can check them out on Facebook for information on how to get involved. Lead by Kaleb Goff and Jack Mazza, juniors in the Environmental Studies program.
   • UCSC MYCO team: Lead by local fungus expert and UCSC alumni, Christian Schwarz, they enthusiastically focus on fungus. In addition to many other things, they forage and cook with mushrooms they find themselves.
   • Santa Cruz Forest Keepers: Groups of students and community members involved in environmental activism, stewardship, and education.
Nature Within

Victor Rivera-Diaz
We, in our continual affront to nature, delude ourselves in assuming that this spherical entity,

On which our species presumably thrives, offers an eternal spring, pouring forth in an uncontained torrent of pellucid water, to soothe the blistering burns of a sweltering sun.

Parched tongues tremble, with millions that stare behind an impenetrable cloud,

Of dehydrated confusion; and the toxic waste makes haste, as it leaks into the fluctuating interior of the hydrologic cycle that should ideally sustain an interconnecting system of Beating Hearts, rabidly shaking the Earth, turning it on its head to extract the finite remainder of crystalline rain drops.

Irrigating the shimmering liquid substrate for patented crops, so that we can fill that twelve-ounce bottle of sparkling water.

Are we so intent on inflicting irreparable damage?

Voraciously clear-cutting monolithic giants, whose outer bark conceals ring after wooden ring of time immemorial.

Rustling leaves, with pin-point stomata, exhaling oxygenated particles that carry the fragrant aroma of forested shrines, through dense jungles and intertwining vines. My fellow human, place your hands onto the leaf-littered
ground, and feel the cool touch of the damp soil. In between modest fingers does the rich substrate cause one to realize, our modern desires need not spoil these sanctifying temples, as they don a spectral display of hues, changing ever so slowly, riding the high, tumultuous tide of the seasons.

So that emerald green, if I may, how nice you appear today, but tomorrow doesn’t seem so clear, colors fading into a pale orange, muddy brown, cement gray.

Nature, with nurturing arms whose gentle embrace envelops each sentient being in its rightful place, instilling both breath and warm blood that runs its course through pressurized veins.

Steel pipes running beneath this fertile land on which our ancestral past, piling brick and mortar, has come to last. Though not indefinitely, for these industrial springs will run dry, and from our hands the Earth itself will pry, the foundations of our unsustainable infrastructure.
And the central heart of this mechanical beast will rupture, congested freeways, sidewalks teeming with blithe folk, the comforts of our consumptive lives coming to a screeching halt.

The individual, or the societal whole.
    Who, then, is at fault?
Don’t fret, my dear friend.
Those rays still shine forth, peeking surreptitiously from behind the hazy horizon.
Tamed and feral alike, our world is an infinitesimal microcosm; an interconnected system of life.

---

We strive, in an attempt to overcome destruction and bloody strife, so that our posterity can inherit a pristine paradise.

It is all too common that we forget, our carbon bodies in their perfect composition, will recycle into the ground.

Minerals that nourish, filtrating through leaf and stem, as they go for a second round.

We are nature.
Collars for Cubs
Tracking Movement of Puma Cubs in the Santa Cruz Mountains

By Monica Cho

IN THE SUMMER OF 2013, researchers of the Santa Cruz Puma Project (SCPP) collared their first puma cub as part of an ongoing study of habitat fragmentation effects on puma populations in the Santa Cruz Mountains.

The Puma Project, headed by UCSC Professor Chris Wilmers, tracks the movement and behavior of wild mountain lions (pumas) to further understand the impacts of habitat fragmentation as a result of human development. Forms of fragmentation include the construction of roads, houses, and agricultural farmland. These spaces impose upon the natural space of a continuous habitat. Sometimes this results in pumas being killed for preying upon livestock such as goats.

Pumas living within areas of development provide an opportunity to investigate the extent to which human activity affects the different age groups in the mountain lion population. Tracking older pumas reveals information on their reproductive, physiological, and behavioral changes overtime. In addition, tracking the cubs will provide survival data on population growth, including the causes of death in relation to human development. For the first time, researchers of this project can gather data on young cubs and follow their movement throughout the course of their entire lifespan, tracking activities such as dispersal from the mother’s territory, mating outcomes, and interactions between other pumas in the wild.

“Now that we get to collar them, we can see how they move in relation to their mom, and what their fate is, essentially.”

- Veronica Yovovich

Veronica Yovovich, a graduate student with SCPP, helped collar the very first puma cub added to the study last summer. Identified as Puma 40F, the then 4 week old cub initiated a new phase of the project that focused on nursing cubs in addition to adult pumas. “We’re interested in seeing how many cubs these females have, where the cubs go, how the cubs survive, and if there’s any sort of differences in cub survival,” says Veronica. “Now that we get to collar them, we can see how they move in relation to their mom, and what their fate is, essentially.”

While some animals dig dens to birth and nurse their cubs, puma moms make use of nursery sites found in existing grounds, such as rocky overhangs and hollowed-out logs. By observing the movement of the collared mother, one can recognize when she has given birth. In most cases, the mother will cease regular movement within her range of territory and remain in one spot for several days; she may temporarily leave but return to the same site in order to tend to her cubs. The cubs are well hidden and hard to find even with the location data from the mother’s collar. “They are very well camouflaged,
which makes them hard to see,” Veronica explains, but once
they are found, “we take them a little ways from the nursery
because we don’t want to disturb the site too much, and then
we collar and measure them.” After the sex is determined, the
cub is safely returned to the nursery site, where they await
their mother’s return from hunting.

Puma 40F is certainly not the only cub with a collar.
In early November of 2013, two male cubs were collared in a
similar manner. These brothers were fitted with expandable
tracking collars made to accommodate a growing cub. “The
elastic in the cub collar allows it to grow with the animal. It
actually can get big enough to accommodate a full adult puma’s
neck,” says Veronica, but, “often times, the collar will not last
that long.” Such was the case with Puma 40F. Researchers
received a “mortality signal” from Puma 40F’s collar, meaning
the collar had been stationary for more than 4 hours. When
this occurs, either the puma has died or the collar has come off
for some reason. It appeared that 40F’s collar fell off at the site
where her and her mom were hunting raccoons. Because the
mother could still be tracked, Veronica mentioned that, “with
any luck, she [40F] will stay with her mom for a little while
and we’ll try to catch her again to put a bigger collar on her.”

Usually, sub-adult pumas will stick with the mother until they
are about 15-21 months old. “She’s a little more than 5 months
old, so she’s got a lot of time left to be with her mom.”

A close call with a similar puma population in Florida
reveals the dangers of habitat fragmentation. The next
closest puma populations to the Florida puma population
are located in Texas; this indicates there is limited gene flow.
As a result, the Florida’s pumas suffered from inbreeding
depression. There was a lack of genetic inputs from other
puma populations which caused a buildup of deleterious traits.

“The elastic in the cub collar allows it to
grow with the animal. It actually can get
big enough to accommodate a full adult
puma’s neck.”

—Veronica Yovovich

Some of those mountain lions developed heart defects, kinked
tails, and defective sperm—all bad signs for the population.
When several mountain lions were brought from Texas to
breed with the Florida population, it was enough to replenish
the gene pool. This event serves as a cautionary tale for the
Solar or Crops? How About Both?

By Sara Sullivan

What do you think of when you hear the term “solar energy”? Do you imagine rows and rows of massive solar panels sitting in a sterile field? Michael Loik, Sue Carter, and Glenn Alers, faculty here at UCSC, are changing perceptions of solar energy with a new wavelength specific solar technology. This technology allows plants to grow beneath glass solar panels, by permitting specific wavelengths of light to pass through while absorbing others. Michael Loik and his team of student researchers are applying this design to greenhouse crops such as tomatoes and strawberries. According to Professor Loik, this breakthrough could benefit places that grow many greenhouse crops such as Northern Europe, Canada, China and Spain.

Near the Arboretum, there is a greenhouse covered with wavelength-selective solar panels being used to research the effects of this technology on certain crops. The Loik, Carter, and Alers Labs study the effect of the solar windows on biomass produced of certain crops such as tomatoes, spinach, and strawberries. In addition, they are working with local commercial growers to further observe how crops grow in these greenhouses.

The Alers Lab has observed that some varieties of tomatoes still produce the same amount of biomass, but they are smaller in size and grow in larger quantities. The feasibility of this technology used by commercial growers depends on the quantity and quality of the crop yield. Thus, it is crucial to compare crops grown in wavelength specific solar greenhouses with those grown by conventional methods.

The Loik Lab’s next research project may focus on how this technology affects desert or grassland environments. There are many opportunities for both undergraduate and graduate students to get involved with this project. Students of all majors can join, including Environmental Studies, Ecology and Evolutionary Biology, Earth and Planetary Sciences, Physics, Chemistry, and Engineering. To follow the Loik Lab check out their website: www.theloiklaboratory.net.

[2] http://saveourh2o.org/content/home
Center for Integrated Water Research

By Diane Terry

As a Southern California native, I am accustomed to a life where rain is uncommon. When I made the move to Santa Cruz, I was warned of the wet weather by family and friends, and I made sure to stock up on waterproof jackets and rain boots. However, these items sit inside my closet gathering dust. You don’t need a weatherman to notice that this year has been incredibly dry; every year seems to be drier than the one before. It is a trend that shows no sign of retreat, but we are responding with changes in the community.

The Center for Integrated Water Research (CIWR) has been making huge leaps in the field of water conservation. In the Spring 2013 Director’s Welcome Letter, Professor Brent Haddad – director of the CIWR – stated, “An ideal challenge pushes both their intellectual limits and their personal belief that they can succeed. Triumph, even partial triumph, generates confidence that their next great challenge can also be met.” The drought we currently face is an example of this ideal challenge that Professor Haddad discusses. I met with him to learn more about different research projects and opportunities at the center, and it’s clear that the CIWR is taking the challenge of drought and water conservation very seriously.

In previous years, they have worked with the Monterey Regional Water Supply to help reduce water cost for local residents. Though no longer involved in the project, the CIWR guided the county of Monterey in developing a long-term plan for water demand. Another challenge was to assess the controversial proposal for a Desalination Plant, which allows the city to obtain a steady water supply. Funded by Proposition 50, the CIWR researched this approach to water treatment and released a fully comprehensive guide for the city to use. This guide is also helpful to other cities in California that want to gain insight into this project.

Currently, the CIWR is teaming up with NASA in a collaborative project known as the Sustainable Water Technology Collaboration Project (SWTCP). In particular, CIWR is working with NASA’s Bioengineering Lab, which focuses on supplying life-sustaining elements for extended spaceflight. One goal they are working toward is to recycle limited amounts of water, since water is a fixed supply and cannot simply be created to sustain a mission to Mars. With the help of UCSC students and employees, they are making progress in the development of water recycling systems. Interested undergraduates can apply for full-time summer positions and even propose their own experiments. If NASA accepts their idea, they can begin to work on the project and learn the skills necessary to do so. No, this is not a sci-fi movie, this is reality! Although the CIWR faces many challenges very few have approached, this creates an exhilarating and beneficial experience for everyone involved with water conservation.

How Much Water Is Used on a National Average for Consumer Products?

- cup of coffee: 35 gal
- 1 lb of wheat: 102 gal
- cotton shirt: 650 gal
- 1 lb of beef: 1,600 gal
It’s a beautiful Sunday morning on the Monterey Bay. You lean against the railing and watch the sunlight glisten upon the smooth water. The boat glides effortlessly towards the deep canyon that runs beneath the surface, down the center of the bay. Suddenly they appear, the ones you were anxiously awaiting! You see a little splash, followed by what looks like a tall, black sail emerging from the ocean. Finally, you get a glimpse of her body and new calf. With tears of joy, you watch as the mother orca, the largest species of dolphin, does a perfect breach right in front of your vessel.

Such an up-close experience with wild dolphins is full of peace and enjoyment. However, scientists are uncovering a very different reality just a few meters below the surface. While it is well known that dolphins make a variety of noises to communicate under normal circumstances, wild dolphin populations may be making more sounds, such as whistles, when boats are approaching.

How could an increase in these sounds affect wild dolphin populations? Scientists, such as UCSC’s Dr. Terrie Williams, are trying to explore this question. In her latest project, Dr. Williams worked with Primo and Puka, two male Atlantic Bottlenose dolphins who live at the Long Marine Lab. Her aim was to find how much energy it costs dolphins to produce sound. This is the first study to measure the metabolic costs of dolphin communication. When it comes to food-limited populations, it is important to understand the metabolic costs of behavior because even slight changes in the energy budget can have serious effects. With more and more ships operating in marine habitats, this information is useful to understand the consequences of disturbing wild dolphins. Dr. Williams’ research will contribute to conservation efforts for dolphins and many other marine animals.

In addition to Primo and Puka, the Williams Lab also works with a Southern Sea Otter and a Hawaiian Monk Seal. The Southern Sea Otter is a local species once thought to be extinct, but is now commonly seen along the Central Coast of California. The Hawaiian Monk Seal is a critically endangered species and there is little known about them. Current research and conservation efforts will be critical for their continued survival. Animals used for research in the Williams Lab are housed at the Long Marine Lab and cared for by the Marine Mammal Physiology Project (MMPP). Through the MMPP, student volunteers can participate in animal husbandry and training internships. Best of all, you can gain free admission to the Seymour Center, which gives daily tours of these facilities with a valid student ID card!
Imagine yourself walking down West Cliff Drive, the California coastline sprawled in front of you. To your left, you see a classic lighthouse jutting out to the ocean. To your right, there are the large rocky structures that define Natural Bridges State Beach. Just past this popular local spot and its surrounding tide pools lies the Seymour Marine Discovery Center. This is the first stop on Santa Cruz’s EcoTour, a program presented by the city of Santa Cruz that features several learning centers and “green spots” the public can visit in order to learn about local history, environmental issues, and scientific research done at UCSC.

First up is the Seymour Center. It may be a bit difficult to find at first, but you’ll know you’re at the right place when you’re staring into the face of Ms. Blue, the gigantic blue whale skeleton. She’s hard to miss, considering she’s one of the largest animals to have ever inhabited the earth. Here you’ll have the chance to touch a gentle swell shark, learn about sea lion acoustics, and watch a decorator crab cover itself with pom-poms. Several opportunities exist for UCSC students to volunteer, work, and intern at the Seymour Center.

Once you’re ready to say goodbye to Ms. Blue and your new shark buddy, head down West Cliff Drive for spectacular views of the coastline via car, bike, or your own two feet. It’s about 3 miles to Lighthouse Point and along the way, you might enjoy the company of a pod of dolphins peeping out of the water as well as a host of other forms of wildlife.

If you’ve ever wondered whether the lighthouse sitting above Steamer Lane still works, it doesn’t. It doesn’t function with the intention of guiding ships back to shore, but it does house the Santa Cruz Surfing Museum, the first surfing museum in the world! Inside you’ll learn about the origins of the Santa Cruz surf culture from the Hawaiian princes who surfed at the mouth of the San Lorenzo River to the southern California migrants who brought their boards and skill sets with them as they moved north. Through historic photographs and examples of surfboards from eras gone by, the Surfing Museum chronicles the significance of a culture that helped shape the city itself. Just a few steps from the lighthouse, you can see Steamer Lane, a popular surf break, where local surfers can often be found paddling out and catching a few sets.

Walk another mile down West Cliff towards the boardwalk and you’ll find yourself in front of a LEED (Leadership in Energy and Environmental Design) certified building with a whale tail sculpture in the front and a beautiful ocean themed panel of artwork along its exterior.

The Sanctuary Exploration Center first opened in July of 2012 as the main visitor’s center for the Monterey Bay National Marine Sanctuary. Here you’ll learn about the protected waters that border Santa Cruz and a majority of the...learn about local history, environmental issues, and scientific research done at UCSC.
California coastline. Over 4,000 square miles of ocean have been preserved as marine protected area, and the sanctuary itself was established in 1992.

You can step into the center free of admission and be greeted by one of many volunteer docents. He or she will point you upstairs where all the main exhibits can be found. As you walk up, you might see a little yellow underwater robot that roams the Submarine Canyon. This remotely operated vehicle or ROV gives visitors a chance to imagine themselves as the scientists who explore the mysteries of the deep sea. At the top of the stairs you can begin your mini-tour of the sanctuary. Walking clockwise through the exhibit halls, visitors gain a sense of what the sanctuary is and what they can do to help protect it. With the help of docents, visitors will learn about various geological features, examples of environmental stewardship, the history of the sanctuary, and the abundance of wildlife that rely on the protection of its waters. This center also houses opportunities for students who are able to volunteer as docents or to work as interns.

Next up, the half-mile long Santa Cruz Municipal Wharf just across the street. Approaching its 100th year anniversary, the wharf showcases the next “green spots” on the EcoTour.

Known for its seafood restaurants and annual events, the wharf is also home to leading research on sustainable energy. The city of Santa Cruz, in collaboration with UC Santa Cruz, launched the Green Wharf Project in 2008 with the intention of making the wharf entirely self-sufficient in terms of energy. The Engineering and Environmental Studies Departments at UCSC have worked with the city to establish projects that include an energy sensor and an electric vehicle charging station on the wharf. Other “green spots” include sites along the wharf where visitors can learn about UCSC research, sea lions ecology, and ocean health monitoring. Save Our Shores, a non-profit organization dedicated to the prevention of marine pollution, is also featured at the wharf. Docents from the Seymour Marine Discovery Center, the first stop on the EcoTour, also lead free 30 minute tours along the wharf on Saturdays and Sundays.

Moving on to the last two stops of the tour, you’ll head east over the San Lorenzo River to the Santa Cruz Museum of Natural History. The exhibits here highlight native plants and animals and the geology of Santa Cruz. The lives of the Native American Ohlone tribe that inhabited Santa Cruz prior to the arrival of Europeans is also featured, along with examples of tools and crafts. The artifacts exhibited are only a small portion of the museum’s collection, which contains over 16,000 objects. The rest of the collection can be accessed for studies and research if requested ahead of time. Last stop, head to the...head down West Cliff drive for spectacular views of the coastline via car, bike, or your own two feet.

Santa Cruz Harbor, also known as the Gateway to the Monterey Bay National Marine Sanctuary. Used for both commercial and recreational purposes, the harbor is your opportunity to enjoy all that the sanctuary has to offer. Popular recreational activities include stand up paddle-boarding and kayaking, where visitors can paddle along the harbor, around the lighthouse, and out into open ocean. Various whale watching and cruise operations are also carried out and UC Santa Cruz offers sailing classes at the harbor.

From the Seymour Center to the Santa Cruz Harbor, the EcoTour is about 5.5 - 6 miles long and will vary in the time it takes to complete. To fully enjoy the tour, try allocating most of your day to it, especially if walking. Each “green spot” is an opportunity for visitors and locals alike to learn about and enjoy Santa Cruz for what it is, a city which prides itself in its unique culture, environmental consciousness, and innovation.

Approaching its 100th year anniversary, the wharf showcases the next “green spots” on the EcoTour.

...
THE HOMELESS GARDENING PROJECT

By Jesi Bautista
Learning

Cultivating

Cooking

Experiencing
Collecting

Bundling

Drying

Logging
Hydroponics is an agricultural method that grows crops without soil and provides a viable food production option that can be implemented in a city. Conventional agriculture requires acres of land, big machinery for soil tillage, and the mass use of pesticides. In hydroponics, plants simply need to be grounded, obtain nutrients, and have access to water, which can all be provided without soil. It would provide fresh food to a city, conserve resources, and could protect the public from future food poisoning outbreaks.

Conventional agriculture requires soil tillage with machines that turn over inches of soil. When soil is tilled, it releases the carbon dioxide stored in the soil into the atmosphere. Hydroponics would provide an alternative to conventional agriculture that could help cities cope with climate change. The crops would not be as heavily affected by weather changes since they are protected by a thermoregulated greenhouse.

Not only does hydroponics provide a solution to growing local food, but also saves water resources. Water is cycled in the greenhouse and can be reused, lowering the monthly water costs (Despommier 2013). This is especially important since water is increasingly in demand and depends on rainfall per year. Water is consumed by showers, sinks, pools, and other accommodations that cater to our current standard of living. Since it is a vital resource, having greenhouses that reuse water can be an effective alternative to conventional agriculture, especially during periods of unexpected drought, which some have predicted to become more frequent in various parts of the world due to climate change.

Along with reducing water costs, hydroponics produces higher crop yields. About five to ten times more crops can be produced in the same area (Harper 2013). The crops are easier to harvest since they are conveniently set up for farmers to work with them. The crops are raised since they do not need soil and can be picked without workers stooping over and potentially injuring their backs.

Nutrition for the crops is highly regulated within the greenhouse and the costs of providing plant nutrition is lower (St. John 2011). Since less fertilizer is used, nitrogen runoff would be less of a problem. Hydroponic crops would not need fertilizers and would not cause oceanic dead zones because the nutrition is controlled within the greenhouse. Another agricultural element that causes biodiversity loss is the use of pesticides. Pesticides are harsh chemicals that do their job of killing insects, but the next generation of insects evolves to resist the pesticide and the chemical is no longer as potent. This leads to companies selling a different type of chemical and the process repeats itself. Not only are insects losing valuable portions of their gene pool, but many people are unhappy about pesticides being sprayed onto the food they consume. Organic labels from organizations like the USDA Organic or the California Certified Organic Farmers have emerged to assist the public in choosing crops which rely less on dangerous pesticides. Hydroponics would eliminate the need for pesticides since the greenhouse itself would keep pests away from the crops.

Archis Acres is a hydroponic farm that was founded in 2005 by Colin and Karen Archipley. The couple runs a 30,000 acre greenhouse basil farm (Harper 2013). Located in Escondido, California, the farm provides basil to Whole Foods Retailers in Southern California. Sergeant Colin Archipley is a veteran with three completed tours in Iraq and uses his farm to train unemployed veterans in hydroponic agriculture. Since hydroponics is ideal for urban environments, it has

Hydroponics would provide an alternative to conventional agriculture that could help cities cope with climate change.

“‘I am an Environmental Studies and Anthropology undergraduate. My love for the environment came from camping trips to National Parks like Yosemite or Sequoia. My two favorite activities are running and reading. I have many amazing memories of Santa Cruz, from hiking in Upper Campus to being a teaching assistant for three Environmental Studies classes. I am graduating Spring 2014 and will be attending the Evergreen State College for their Masters of Environmental Studies program in the Fall.”

- Rhianna Hruska

Gaia 37
been proposed that empty city warehouses can be turned into hydroponic agricultural centers. The success of Archi’s Acres is an encouraging step towards the creation of more hydroponic farms. Another form of hydroponics, vertical green houses, are currently being used by pharmaceutical companies. One example is Caliber Biotherapeutics using vertical ‘pink houses’ to grow tobacco-like crops (Doucleff 2013). The pink houses get their name from the combination of red and blue tower lights that are shined on the plants. The crops are expensive and Caliber wished to improve the chances of the survival of their plants and eliminate pests without using harmful pesticides. It is in the company’s best interest to regulate their crops, since crop failure would result in the loss of a large investment. As a company that sells products catered to people with weakened immune systems, they have to ensure quality products to help alleviate the patient’s symptoms. Their drugs and vaccines rely on uncontaminated sources to keep people safe. If crops were to become contaminated and used in medications, it would potentially lead to a public relations disaster. Caliber Biotherapeutics currently has a 150,000 foot facility in Bryan, Texas which works to stop disease emergence in their plants (Doucleff 2013).

The pink houses have their pros and cons. The light towers use more energy compared to regular hydroponic farms which harness the sun’s light to grow their plants. Though it uses more energy, the red and blue lights give the plants a faster growth rate by twenty percent (Doucleff 2013). The towers save base space, but the plants are reliant on artificial lighting. Researchers have come up with efficient red and blue LED light fixtures that save energy. Since the lights only emit two color wavelengths, it takes less energy than giving off all spectrums like a regular LED light would do (Doucleff 2013). A plant’s photosynthesis can absorb red and blue light and process it easier than other color wavelengths. Light panels that are placed higher up turn on as the crops grow taller (Doucleff 2013). The pink houses recycle water and nutrients through its system and saves water like a regular hydroponic greenhouse would.

Hydroponics is a business venture that, like Archi’s Acres, can definitely pay off. Empty warehouses in cities are suggested as primary buildings to grow fresh fruits and vegetables in an urban setting. As safe pharmaceutical products and organic food demand grows, so will hydroponics. The United States will benefit from transitioning to hydroponic agriculture.

Since hydroponics is ideal for urban environments, it has been proposed that empty city warehouses can be turned into hydroponic agricultural centers.
The Bay Tree Bookstore proudly supports GAIA

Sustainability is KEY:

- Organic free trade coffee
- Healthy snacks
- Organic ready meals
- Natural health products
- Natural beauty products
- Organic apparel
- "Paper" pencils
- Used textbooks
- Recycled paper & notebooks
- Reusable shopping bags
- Reusable beverage containers

Store Hours

Monday-Friday 8:30a-5:30p
Saturday 10:00a-4:00p
Sunday Closed

slugstore.ucsc.edu
(831) 459-4544

Your on Campus Resource