

Eco-E Proposal: Reedone

Eco-E Opportunity

The Giant Reed, or *Arundo Donax*, is an invasive plant species that was brought to North America in the early 19th century. Originally introduced for erosion control and construction purposes, the plant has been studied extensively due to its rapid growth, productive yield and low sustenance requirements (Pari et al., 2015). It's ability to thrive in a wide range of environments and grow up to four inches a day has allowed it to take over many ecosystems. *Arundo* outcompetes local plants by consuming water at a rate of approximately 16.7 mm/day compared to 0.9-1.6 mm/day for mixed riparian vegetation (Giessow et al., 2011). Structurally, it is very similar to bamboo; it can grow 30 feet tall and has a one-inch diameter (McWilliams, 2004). The rhizomes spread easily taking up a large amount of land area, and the above ground shoots shade surrounding plants.

This invasive species hurts local ecosystems in many ways. Native species do not eat or nest in it (Bell, 1997). *Arundo*'s wood-like composition and contribution to aridification create an extreme fire hazard. Worse yet, the plant regrows 3-4 times faster than native vegetation following a fire, allowing it to colonize a larger space and serve as a positive feedback mechanism for wildfires (Coffman, Ambrose, & Rundel, 2010). Another area of concern is *Arundo*'s ability to clog up waterways leading to flood events (Kus & Beyers, 2005). There are strong economic incentives for proactive removal of this invasive species because of the water savings and decreased fire and flood risks (Seawright et al., 2009).

Conservation groups are hired to help with projects to remove *Arundo* from specific areas where it causes the most damage. Rogelio Ramos, a project manager at California Conservation Corps (CCC), informed us the plant is sent to a landfill upon removal, thereby contributing to another environmental problem. It is difficult to find data quantifying the amount of biomass that is disposed; however, Rogelio said each project he works on in San Diego County removes a few truckloads of raw material. This project's initial focus is on diverting the plant biomass waste.

Consumers will be presented with more sustainable product options. There is a growing market of people who prefer products made with alternative materials. A university study found 68% of consumers are willing to pay more for furniture made with sustainable wood (Aguilar & Vlosky, 2007). *Arundo* has the potential to deliver sustainable, high-quality products to target markets.

The project aims to convert the removed plant material into marketable products. More specifically, introducing a product line that creates an incentive to remove *Arundo* will improve ecosystem health, reduce water consumption, and help prevent fires and floods. Displacing unsustainable products further alleviates demand on other resources that are currently being over-harvested. Repurposing the *Arundo* waste could improve sustainability in many different industries, and once there is a large enough market for *Arundo*-based products, the next focus will be identifying and prioritizing extirpation in areas where it is especially problematic.

Objectives

The project will focus on addressing the following questions:

1. What is Arundo's geospatial distribution and how can we efficiently gather a large supply?
 2. How difficult is it to manufacture Arundo biomass into consumer products?
 3. What is the best target market for Arundo-based products?
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1. The team will research the amount of raw material removed and ways to gain access to it, including partnering with organizations in this field or identifying potential revenue streams in exchange for plant removal.
 2. A literature review and industry expert interviews will help us gain an understanding of the manufacturing process and best product options.
 3. The project will explore the potential of using Arundo in a variety of contexts. We intend to identify current uses of the plant, and markets with a high demand for such products.

Significance

Arundo has been studied for its potential as a substitute material in a variety of industries. The United States and other countries have conducted research and field tests for its potential, most notably as biofuel and paper pulp, but there are no large-scale commercial applications (Williams et al., 2008). However, government agencies and conservation groups alike have a vested interest in managing the plant. Usually, large organizations, such as The Nature Conservancy, hire smaller conservation groups, such as the California Conservation Corps, to actually handle the removal. Talia Ibarguen, an environmental specialist at the Washington State Department of Ecology and 2016 Bren graduate, was hired as a contractor for the Department of Defense to remove Arundo near a military base in Santa Barbara county. Organizations want the plant removed because of the economic and environmental benefits of clearing the land. This project seeks to find suitable and cost-effective applications for this large supply of available biomass.

This venture is important because it will establish a market for Arundo-based products. This will bring attention to the problem and expose customers to a unique type of sustainable product. The team will add to the body of research exploring Arundo's potential as an alternative material. This will give us the opportunity to conduct a spatial distribution analysis and advocate for better control of the species.

A large portion of this project will be dedicated to analyzing Arundo's potential to substitute products in a variety of markets. Given Arundo's composition, there are many possible applications to test our business model. The ideal target market would have demand for a product that has a good combination of manufacturability and marketability.

Background

Our preliminary research will include an in-depth analysis of industries that have the most literature on Arundo's applications. We will begin our research regarding its potential as paper, packaging, flooring, household products, feedstock, and biofuel. Each of these applications has environmental and industrial pros and cons. Through a literature review and market research we hope to pinpoint a product that

adds a large environmental benefit and has good market potential. These applications are also a good starting point because bamboo, which is very similar to Arundo, is a fairly common material source in these sectors (Vogtländer, van der Lugt, & Brezet, 2010).

Arundo became a problem because it was not managed appropriately when brought to North America. Interest groups have been looking to mitigate its impact, but their primary focus is removal, not finding a commercial application of the byproduct. This project will compile available data and take a holistic approach to assessing the biomass as a sustainable alternative in a variety of industries, with an emphasis on identifying the most pragmatic and viable widespread application.

Available data

The people we have interviewed are very passionate about the problem and have willingly shared contacts and information to support our project. Marc Steele, a technical policy analyst for the Energy Policy Admission Center at UC San Diego and 2016 Bren graduate, worked on a group project to help remove Arundo in the Santa Clara watershed (Bell et al., 2016). He offered to connect us with his former client: The Riparian Invasion Research Lab at UCSB. Marc's team helped this research group by collaborating with a multitude of organizations to collect data on Arundo's distribution and create models to quantify the environmental benefit of its removal. Pending external approval, he also offered to share light detection and ranging (LIDAR) aerial data of the plant's distribution in the Santa Clara area. Their team received this data from the Ventura County Watershed Protection District (VCWPD). This will help us get a firm grasp of the extent of the problem in a nearby region. Contacting organizations such as the VCWPD will help us identify other agencies that monitor the problem elsewhere, allowing us to piece together a larger picture of the situation using GIS and other tools.

This project will involve primary and secondary research. The team can study and test the plant's compatibility with existing products on the market. This research will be supplemented by existing literature on Arundo's physiology and manufacturability.

Possible approaches

The starting point for our business model development is to identify potential revenue streams. We will explore the possibility of contracting with conservation agencies to remove Arundo. Depending on the project locations, we will research methods of harvesting and transporting the extracted material. This will include an analysis of strategic locations to store and manufacture the collected material. We will continue surveying customer interest in different markets to find the most profitable space. This will lead us into researching manufacturing processes to deliver high-quality products with a large demand.

We will continue mapping out an ecosystem of organizations with a stake in Arundo eradication. Interviews with industry experts, stakeholders, and consumers will help us understand how to position ourselves to maximize impact and profit. Partnering with organizations, such as the California Conservation Corps (who have already offered to send samples) and The Riparian Invasion Research Lab at UCSB, will give us a more thorough understanding of the challenges of the removal and material conversion process and help us reach the product development stage.

References

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Interviews

Date: **1/31/19**

Interview method: **Phone**

Interviewee: **Rogelio Ramos**

Title: Project Supervisor at California Conservation Corps

Interviewer: **Sandro Lallas**

Date: **2/5/19**

Interview method: **In-person**

Interviewee: **Geoff Jewel**

Title: Help Desk Manager at Bren School

Interviewer: **Sandro Lallas**

Location: **Bren**

Date: **2/5/19**

Contact method: **Phone**

Interviewee: **Marcos Uribelarrea**

Title: Director at Paper Business at Ledesma

Interviewer: **Sandro Lallas, Javier Ureta**

Date: **2/5/19**

Contact method: **Phone**

Interviewee: **Talia Iburguen**

Title: Environmental Specialist 3 at Washington Department of Ecology

Interviewer: **Sandro Lallas**

Date: **2/8/19**

Contact method: **In-person**

Interviewee: **Tommaso Bulfone**

Title: Research Project Manager at Ophirex

Interviewer: **Sandro Lallas**

Location: **On UCSB Campus**

Date: **2/14/19**

Contact method: **Phone**

Interviewee: **Marc Steele**

Title: Technical Policy Analyst at Energy Policy Initiatives Center at UCSD

Interviewer: **Sandro Lallas**