

Compostable Utensil Evaluation and Feasibility Report for Humboldt State University

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1. Abstract

Plastic poses environmental, health and social impacts from everyday use of products. In this paper we have identified the main sources of cutlery options and evaluated the associated environmental impacts of, silverware, plastic, bio-plastic, and wooden utensils.

The objectives of this study were identified as 1) Replace free plastic cutlery on campus with a more environmentally friendly option, 2) Increase campus community awareness of compostable products, 3) Inform campus community about the impacts of waste consumption, and 4) Reduce contamination in the compost waste stream. There are some constraints surrounding the implementation of providing more eco-friendly cutlery options on campus, including dispensing method, price, and facility limitations.

Initial Data Collection methods include comparing the lifecycles of bioplastics to wooden cutlery, meeting and contacting constituents involved in ordering dining cutlery on campus, and organizing and creating a video for HOOP (Humboldt Online Orientation Program).

The findings through initial studies and assessments shown previously show a definitive need for the replacement of plastic utensils. Several options are not feasible because of campus limitations and poor compostability of materials used. These proposed actions will also help maintain a positive eco-friendly atmosphere on campus as well as lowering the overall carbon footprint. Based on the options available, compostable wooden cutlery is the best alternative. The implementation should also be followed by educational outreach on campus.

2. Introduction

2.1 Problem Statement

Plastic cutlery and products used in the dining services present a problem to Humboldt State University, especially in the image as an environmentally conscious and progressive academic establishment. Plastic utensils are improperly disposed on campus into the compost waste stream. In addition there is a need for biodegradable and more eco-friendly alternatives to plastic utensils.

2.2 Background

Plastics have had a strong presence in everyone's lives for a long period of time and for good reasons. The products that are produced with plastics in general are made to be economically efficient and convenient. Plastics date back to the 1860's, but the conveniences that we are accustomed to started in the 1940's (Andrady, 2009). The increases in use are related to advances in technology and innovations with the use of polypropylene in production. The redistribution of the American populous away from agrarian lifestyles into urban settings continue to provide more of a demand for plastics (Andrady, 2009).

The impact of these products can be seen in the decomposition rates and impacts on ecosystems worldwide, but more so in coastal and marine systems. The Ocean Conservancy estimates the rates of decomposition of things like plastic cups at 50 years, plastic bottles at 450 years, and plastic cutlery takes 50-100 years (Ocean Conservancy, 2013). These are also dependent on the type of plastic being used and conditions present for decomposition. According to the Environmental Protection Agency (EPA), plastics make up 13 percent of the

municipal solid waste stream and an overall plastics recycling rate of only 8 percent reported in 2011 (EPA, 2013). The problems can also be seen worldwide in the relation to petroleum in the production of plastics. The U.S. Energy Information Administration reported in 2010 that 2.7% of U.S. petroleum consumption was attributed to the production of plastics (EPA, 2013). This is also compounded by the use of electricity used in the processes. In 2010, 65 billion kilowatt-hours were used for the production. This is equal to 1.7% of total U.S. electricity consumption (EPA, 2013).

Despite plastics adverse affects to the environment, plastic is cost-effective compared to other alternative products because of ease of production and materials. Most plastics are derived from petrochemicals produced from fossil oil and gas. Relatively 4% of annual petroleum production is converted directly into plastics (British Plastics Federation, 2008). Approximately 50% of plastics are used for disposable applications and items such as packaging, agricultural films and disposable consumer items (Plastics Europe, 2008). With the reliance on petroleum and fluctuating prices, these costs are often subsidized and make it more convenient for production (Norberg-Bohm, 2002). The cost of wooden utensils is averaged at around 1,000 pieces for \$65.99 compared to plastic cutlery, which is around 960 pieces for \$32.07. At Humboldt State University (HSU), the dining halls such as the College Creek Marketplace, Depot, Library Cafe, and Hilltop Marketplace provide free plastic cutlery. HSU also provides compost, recycling, and trash bins at these locations. These easy to grab forks, spoons, and knives are being improperly disposed of in the compost bins.

Many plastic items are being incorrectly composted, the most common one being the one-time-use plastic cutlery (figure 1, appendix). Juliette Bohn, the Humboldt Waste

Management Authority Project Manager, identified a need to reduce Humboldt State's contamination of compost. Targeting the plastic cutlery would be the next big step toward reducing the contamination in our compost. Through further correspondence, Juliette has expressed that diverting the waste from the compost is taking more work hours than expected. If this continues, we may lose composting at HSU. Many students are attracted to HSU for the sustainable community and lifestyle it offers, which our compost practices directly affects. Our proposed action is to implement a more sustainable choice of cutlery such as wood on campus, while no longer providing plastic cutlery.

According to Ron Rudebock, the director of Dining Services at Humboldt State University in an email correspondence, "We currently use about 12 to 14 cases of forks, 8 to 10 cases of spoons and 6 to 8 cases of knives per month during the academic year. A case has 960 pieces. We receive shipments from this supplier three times per week but we tend to order 2 to 3 cases at a time. They cost us \$32.07 per case." In comparison, compostable products from Aspenware is available for \$62.99 and includes 1,000 pieces in a case. Another alternative is Ecoware which is available for \$39.95 - \$59.95 for a case of 1,000 forks, and \$39.95 - \$69.95 for a case of 1,000 knives or 1,000 spoons. Other California State Universities, such as Chico State and UC Davis have implemented Aspenware. HSU has a reputation for being environmentally friendly and progressive and in order to compete with other schools and communities, steps should be taken to ensure a continuing environmentally friendly atmosphere and reputation. Another option is also to increase awareness in the campus community about disposable products and encourage the use of reusable products and have them available for

purchase. This would be in conjunction with other alternatives as it is not feasible to only implement reusable utensils on the Humboldt State campus.

The life cycle of plastic utensils is intensive to the planet and its environment. Plastics are made from two monomers, polypropylene and polystyrene through a process called polymerization (Bernier, 2011). The extraction process of plastic is very damaging to the earth's crust; which contains fossil fuels. After extracting and refining the fossil fuels, it gets shipped to a production factory for molding the plastic. Once the plastic is molded into plastic utensils, it is wrapped in a plastic covering and shipped on its way to be sold through different companies (Bernier, 2011). polypropylene emits 1.67 pounds of CO₂ and uses 9.34 kWh of energy during production, and polystyrene emits 2.51 pounds of CO₂ and uses 11.28 kWh of energy during production (Worldcentric.org, 2013). The ultimate destination for plastic utensils is the landfill. Typically, plastics with polypropylene and polystyrene are recyclable, but most recycling facilities won't take plastic utensils because it is not economically feasible to recycle them and is a tedious process (Worldcentric.org, 2013).

Several new innovations have been achieved in polymer production for plastics. PHA (polyhydroxyalkanoate) polymers are produced within bacterial cells and can be extracted and processed as adhesives, films, and polymers (Vink, 2003). PLA (Polylactide) is a polymer made from renewable resources such as cornstarch and is a common polymer in what companies assert as biodegradable (EPA, 2013). Research by Bohlmann and others in 2001 done into life cycle assessments of polymers determining if biodegradable PHA requires more energy input in production (Bohlmann et al., 2001). According to the study, PHA was found to have a fossil fuel energy cost of 50.4 MJ/kg and PLA was found to have an energy cost of 54-56.7 MJ/kg

(Bohlmann et al., 2001). NatureWorks has been able to supplement fossil fuel energy dependence with wind power and biomass production and estimate their PLA cost of 27.2 MJ/kg (Natureworks, 2013). Polyethylene, Polypropylene, and other traditional polymers have a cost of around 85.9 MJ/kg (Bernier, 2011).

Aspenware uses wood grown in Canada from sustainable growing methods and fair employment methods. Most of their logs used are from trees previously cut down by timber industries while trying to reach more valuable species such as spruce, pine and fir. All the wood is sourced from local Canadian sustainable forest partners. These logged trees would normally be burned or left to rot by the timber companies, but Aspenware uses them for a more sustainable purpose (Aspenware, 2013). The cutlery is able to decompose in less than 49 days under a commercial composter, and in less than 90 days under at-home compost conditions (Aspenware, 2013). The remaining trees used to make Aspenware come from First Nations group, Wabauskang in Ontario. The group harvests poplar trees in their forests. This gives native tribes steady income for both their nation and future generations. Not only does this product support a First Nations community, but also contributes to an environmentally conscience product. Aspenware's products are 100% compostable in fewer than 90 days, and unlike the disposable plastic utensils, the final destination of compostable cutlery is back in the earth as nutritious soil (Dizak, 2013). (See figure 2 in appendix.)

It is important to change the habits of HSU campus community for the better of our environment. Phasing out plastic cutlery on campus is one step toward becoming a more sustainable campus. HSU has always been a model of exemplary environmental practices. In today's fast paced world, it is important to recognize new alternatives while reducing one's carbon

footprint. Transitioning to wooden cutlery on campus will not only benefit the environment but encourage students to be more aware of what they are consuming.

2.3 Objectives & Constraints

- Replace free plastic cutlery on campus with a more environmentally friendly option
- Increase campus community awareness of compostable products
- Inform campus community about the impacts of waste consumption
- Reduce contamination in the compost waste stream

When dealing with change in a university setting, the proposed change needs to be feasible, attainable, and practical. In any organization, change can be an arduous process involving many tiers of communication and a significant amount of time. The implementation of replacing disposable plastic cutlery with compostable wooden cutlery presents many constraints, some of which being; compostability of the product, economic feasibility, practicality, dispensing methods, and harvest practices.

Ideally, a reusable product would be implemented that would significantly cut down on the carbon footprint of the University. A cheaper alternative such as bioplastics has a major constraint concerning actual compostability and does not meet the objective outlined. Bioplastics are 60% compostable and leave toxins behind in the compost and soil (Worldcentric.org, 2013). Because of this, wooden cutlery and reusable cutlery are classified as the two most environmentally sound options. Of our proposed locations, the Depot is currently the only facility capable of handling reusable utensils, as they are equipped with a dishwasher. Space and facility size is an issue as new equipment would be necessary. Reusable silverware presents many infrastructure constraints to the current facilities and is not a viable option in the

foreseeable future without significant remodeling. As a result, wooden cutlery meets the objectives of our project best.

According to our current inventory, the school purchases a case of 960 spoons, forks, and knives at a cost of \$32.07 per case (Rudebock, 2013). A wooden cutlery alternative involves many different brands. Through research, we have found the most expensive option to be \$80.00 for 1,000 piece (Aspenware) and our lowest option at \$39.99 for 1,000 piece (Ecoware). This of course, is raw numbers not including shipping costs from our dishware supplier. According to this information, switching to wooden cutlery at the lowest possible option would still be economically feasible.

Another major concern is whether or not the current supplier Humboldt State works with will provide the proposed wooden cutlery. Sysco, our current distributor does offer Aspenware, a Canadian-based wooden cutlery company. This product is the more expensive option, but according to our dining services director Ron Rudebock, he has already considered implementing this product on campus. UC Davis has been using Aspenware as their main disposable utensil option for over 2 years; Chico State recently purchased their first order for the fall 2013 semester, as well as many schools in Canada. Several schools in California are exploring the idea of switching to Aspenware (Dizak, 2013).

The major concern voiced by dining services regarding implementation of new cutlery is keeping the cutlery sanitary for individual students. Currently, the plastic utensils are ordered in bulk, as would the wooden utensils. The utensils that are in use are dispensed singularly, per person to avoid contamination. These dispensers are custom to the current utensils used, so if new utensils are implemented, new dispensers will also have to be procured (Rudebock, 2013).

Choosing between different wooden cutlery products not only involves investigating economic feasibility, practicality of purchase and use, but also the products environmental footprint. The purpose of the proposed project is to replace unsustainably harvested and made cutlery like plastic, with a more environmentally friendly option. Through research, wooden cutlery proves to be the most sustainable and feasible option for the university. In order to decide which product is the most sustainable within this category, harvesting methods must also be investigated. Aspenware, the most expensive option, harvests their wood from previously logged trees. The trees are cut down by sustainable forest partners to reach more valuable trees like fir. The leftover trees (aspen trees), are what is made into the cutlery. The other portion of harvested trees Aspenware uses comes from First Nations reservations in Canada. Aspenware employs the First Nations groups to harvest their wood, providing economic growth to the local Canadian economy (Aspenware, 2013). This is an example of sound harvesting practices that proves their product isn't a green-washing campaign, but is a truly an environmental and socio economic benefit.

Considering Humboldt State University's responsibility of being environmentally and socially conscious, implementing a more sustainable product on campus will not be a hard battle. Many students have mentioned wanting a more environmentally friendly option to cutlery, and the dining services director is also willing to switch over to compostable utensils (Rudebock, 2013). Our biggest constraints we will face are the price difference between plastic and wooden cutlery and ordering/making new dispensers for the cutlery.

3. Methods

3.1 Timeline

- **November:** contact video production professor and department chair, Victoria Salma about the viability of creating a video to implement in HOOP (Sean)
- **November:** Contact HOP/HOOP staff about the feasibility of incorporating an informational video for incoming students about correctly composting and disposing items (cutlery, bottles, gloves, etc.) (Sarah)
- **November:** Contact Ron and dining services about implementing preferred alternatives to be ready by next semester. (Corinne)
- **December:** Work with video production staff to create a one minute video about the importance of composting products on campus correctly. (Group)
- **December:** Work with dining services to create an alternative in keeping utensils sanitary. (Group)
- **December:** Create informational prompts to assure consumers will be conservative with amount of utensils used. (Group)
- **December:** Create informational prompts to assure consumers will dispose utensils in the correct bin. (Group)
- **Spring Semester 2014:** Implement orientation video through HOOP. (Group)
- **Spring Semester 2014:** Distribute survey online through Humboldt State University for monitoring protocols. (Group, or future students)
- **Spring Semester 2014:** Contact Dining services about effectiveness of implementation of Aspenware in Dining Services. (Group, or future students)

3.2 Product Comparison

There are many options when considering the type of utensils to implement at the campus dining halls. The product must be affordable in order to provide free utensils to students. In accordance to Humboldt State University's mission and values, the product must also respect those aspects such as compostability, level of greenhouse gas emissions, and types of sourcing. Dividing products by categories along these lines is the first step in choosing a preferred type of utensil. The four main types of utensils are silverware, bioplastics, plastics, and wood. Five categories of importance are price, types of sourcing, disposal/compostability, amount of GHG emissions, and ease of implementation. Each of the five categories have different levels of

importance. The “disposal/compostability” category of the product is weighted the highest because of the issues with current utensils used on campus, specifically the waste it generates along with the contamination of the compost waste stream. Sourcing and GHG emissions were given a weight of ‘4’ because of the associated environmental impacts.

Chart 1. Ranking System for 4 different products: 1 (lowest level of importance), 5 (highest level of importance)

Products	PRICE	SOURCING	DISPOSAL / COMPOSTABILITY	GHG	IMPLEMENTATION	Overall Score of Importance	Score of Importance (Ron's Weight)
Silverware	5	3	0	3	0	39	38
Bioplastics	3	2	2	2	4	47	52
Plastic Cutlery	4	0	1	1	5	36	48
Wooden Cutlery	2	5	5	4	3	76	70
Our Weight:	3	4	5	4	3		
Ron's Weight:	4	3	4	3	5		

The overall score reflects not only the sum of each category, but also the weight associated with each category. This was done by calculating sum of each category multiplied by the relative subjective weight on a scale of 1-5. Ron Rudebock was contacted and asked to give input on his weights associated with these categories. His weighting emphasized implementation primarily, and also price and disposal. A score was calculated with both weights (Overall Score of Importance), and the options ranked in the following order: wooden Cutlery, bioplastic,

Plastic, and silverware for Ron's associated weights. The only change with the first weights assigned were, the reversal of plastic and silverware in the ranking. This identifies wooden cutlery as the preferred option.

3.3 Implementation Plan

The primary objective of our project is to provide free, low environmental impact cutlery to students. Incorporating education to the campus community regarding waste consumption and reducing contamination of the University's compost is also an important factor of our project. Implementation of compostable cutlery and associated goals require a three-step process: 1) communicate with involved constituents 2) educate incoming students 3) outreach to current campus community. These implementation steps outlined, along with associated goals for this project will further provide education and outreach to the campus community.

The primary step considers actual implementation. This will be through communication with identified dining services personnel. In the case of purchasing inventory, the director of dining services, Ron Rudebock is the main contact for this stage in the project. We have identified concerns for a variety of options and weighted the categories accordingly. The subjective weighting system also includes a side-by-side analysis of categories identified as most important to Dining Services in order to clearly identify the most practical and environmentally friendly utensil option. Rudebock has expressed that "implementation" is the most important facet in switching to compostable cutlery. Keeping utensils sanitary are an important aspect to dining services. They have overcome this by purchasing utensil dispensers. These dispensers meet sanitation concerns and also allow a large group of consumers to use the products that are

purchased in bulk. Currently, dispensers found at HSU dining locations are made to fit plastic cutlery. According to Rudebock, new cutlery will no longer fit the provided dispensers.

The second step of implementation consists of educating incoming students through the Humboldt State University's online orientation program (HOOP). Incorporating the school's zero waste program on campus is an important aspect that should be implemented within the orientation. Educating students beforehand through this is an excellent opportunity to assure contamination of compost will be reduced. For transfer students who do their orientation online, a quick one-minute video can accomplish the goal of educating students about what is and what is not compostable on campus.

The video production class given through the College of Arts and Humanities at HSU provides an outlet for public service announcements and other important information to be heard throughout campus. We have contacted the professor and department chair of this class and are waiting to hear back if this is a viable option. Another option is to procure a camera and do the video independently if the department cannot be contacted. The video would include actual footage of products provided through dining services to clearly identify items that are compostable, or recyclable, or that go to the landfill. This type of video is engaging and straightforward and will provide results for comparable little effort. Freshman students who complete their orientation on campus would be required to go to the dining halls and get a quick tutorial on what is and isn't compostable on campus. The tutorial includes information on where our waste goes and how Humboldt State is one of the leading schools in zero waste efforts.

The third segment of implementation concerns public awareness to the current campus community. A very successful way of informing the campus is by monitoring the waste bins at

dining halls during high traffic periods like lunch and dinner. This could be done during the first few weeks of each semester. Monitoring the bins increases awareness and forces people to make a conscious effort of putting their waste in the correct bin. It also provides an opportunity for the monitor to educate students, faculty, staff and visitors using the facilities about waste divergence and HSU's efforts in reducing waste consumption.

4. Monitoring and Evaluation

The monitoring and evaluation associated with this project will focus specifically on each objective. The main goal of this project was to reduce the school's carbon footprint. Our objective to achieve this goal was to replace free plastic cutlery on campus with a more environmentally conscious option, like wood. In doing so, we wanted to increase campus awareness on waste diversion and consumption. In order to evaluate if our main goal was achieved, monitoring the compost waste stream and quantifying students consumption can be done.

A broad survey will be utilized to determine the efficiency of informing the campus community about waste diversion and consumption. Informing the campus community can be divided into three components; signage, physical monitoring, and incorporating HOOP/HOP. The survey will be analyzed to help determine which of the three methods used on campus had the biggest impact on personal waste diversion. This will help to refine techniques and focus efforts if one method is not providing noticeable outcomes. The survey will be distributed at the end of each semester online through the Humboldt State email system. With each subsequent

semester the results can be compared to previous years and used to alter current efforts if necessary or for a change in trend to be most efficient.

Of the three components, signage on trash, recycling, and compost bins has the highest potential effect for behavioral change. Students, faculty, staff and guests of the campus see a sign on every bin located on campus. This ensures awareness among those who use these bins. Currently, the signage is ambiguous and inconsistent with similar signs on campus. Modifying the signs by working with dining services staff to identify which items are, or are not compostable is imperative. Waste Reduction and Resource Awareness Program, (WRRAP) a student-led organization on campus focusing on waste reduction through education and outreach, could help with creating better signs. The multi-media arts project manager for WRRAP, with the help of the Marketing and Communications department at HSU would provide the technical support for these signs. As stated above, a survey will be given to the students, faculty, and staff at the end of the semester to evaluate how signage has helped in educating students about waste diversion.

Targeting dining halls during high traffic areas to monitor (“bin man”) students diverting their waste is a great way to increase awareness and change. We believe that “bin manning” can be more effective in raising awareness about properly diverting waste. If there is any question in interpreting the signs, the trained monitor will know how to properly respond. It is also an opportunity for curious individuals to ask questions to the trained monitor concerning waste. In addition to evaluating the signage on campus, a broad survey will be given to the campus community about the efficiency and effectiveness of “bin manning”.

After email correspondence with the HOOP (Humboldt Online Orientation Program) coordinator, it was decided that a short video concerning compostable items on campus would be beneficial. We will hopefully have the convenience of working with the video production department at HSU to create the quick video; we are still waiting to hear if it is possible to create a video for HOOP Spring 2014 semester. Since HOOP is required for incoming students, it ensures they will be aware of compostable items at school. We would evaluate the effectiveness of this video by requiring the student to answer 2-3 questions regarding waste consumption/diversion provided in the video. Implementing a tour or lesson about what is and is not compostable during the Humboldt Orientation Program (HOP) session was deemed impractical. According to the HOP coordinator, there isn't enough time to include the proposed tour and lessons about properly composting items in the orientation.

Reducing contamination in the compost waste stream is another major objective in this project. Currently, Humboldt Waste Management Authority (HWMA) receives the Humboldt State's compost, where it is manually looked through to pick out contamination such as plastic utensils. The frequency of HSU's contamination was first brought to the school's attention by HWMA authorities. Asking HWMA to monitor changes in frequency of contamination after a few weeks of using wooden cutlery in dining halls would be the most feasible way to monitor compost contamination. Localized efforts on campus through organizations such as CCAT (Campus Center for Appropriate Technology) are also ongoing for sorting through the waste stream to monitor for areas of concern.

A major concern in switching from the utensils currently used to the proposed wooden utensils is the method of dispensing. The primary concern is that when utensils were left in an

open vertical case, students were wasteful and grabbed more than needed. Dining Services on campus found that using automated dispensers that provide a single utensil at a time, students were less likely to take excess utensils. Keeping a record of this behavior change can be accomplished by asking staff from dining services to compare how many utensil cases were purchased after a semester of using dispensers, with a semester not using dispensers.

5. Conclusion

The preferred alternative is identified as Aspenware. For the reasons identified above, the other alternatives such as silverware are not practical for implementation campus wide, and other disposable options have been identified as less preferable because of relative adverse effects to the environment and higher carbon footprint overall. Aspenware has been identified as the preferred brand within wooden cutlery because of sustainable sourcing and ease of implementation. The implementation and methods for informing the campus community described will help alleviate compost stream contamination and help lower Humboldt State's overall environmental impact.

The implementation should be followed by the monitoring and evaluation proposed to enable efforts in the future to further reduce compost stream contamination and boost effectiveness of the overall efforts on campus. Through the monitoring efforts, Humboldt State can alleviate concerns about dispenser method and sanitation. It will also provide quantitative and qualitative information that can aid in implementation of other products on campus.

6. Appendix

6.1 Figures and charts



Figure 1 Humboldt State University's plastic cutlery diverted from the compost

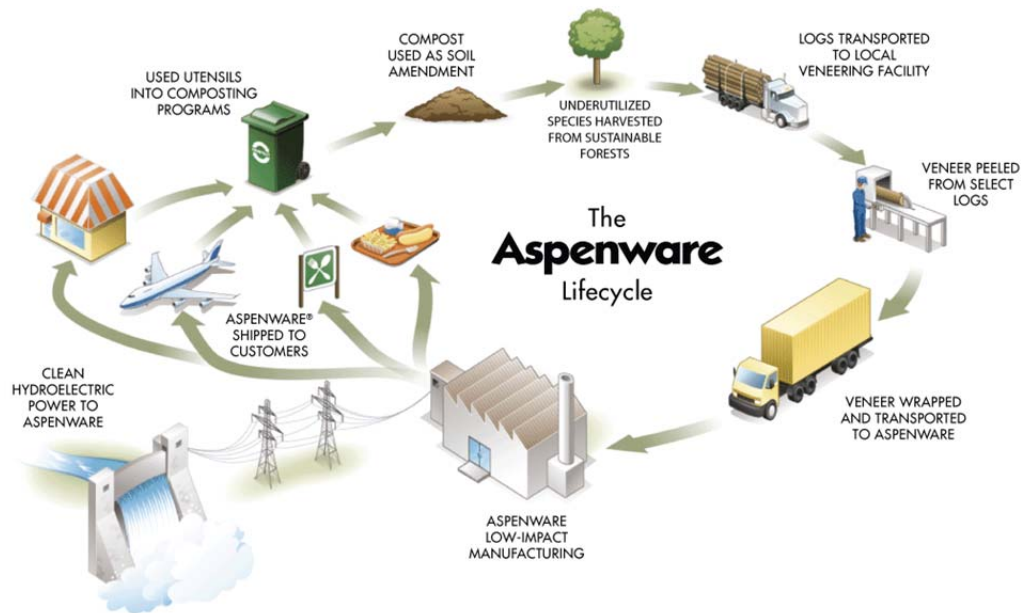


Figure 2 The Aspenware Lifecycle

6.2 Survey for Compostable Utensil Implementation,

Humboldt State University

Please circle one

Effectiveness of Compost on Campus

1 2 3 4 5 6 7 8 9 10

Availability of compostable/recyclable materials in Dining Services

1 2 3 4 5 6 7 8 9 10

Effectiveness of accessible compost bins

1 2 3 4 5 6 7 8 9 10

Overall ease of recycling and compost on campus

1 2 3 4 5 6 7 8 9 10

Effectiveness of information and public outreach

1 2 3 4 5 6 7 8 9 10

Knowledge of what is compostable/recyclable

1 2 3 4 5 6 7 8 9 10

Have you been instructed or informed of what is compostable/recyclable on campus?

If you have, how?

Any suggestions for compost/recycling efforts on campus?

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