Developing a Green Lab Certification for a Research-Intensive University

by
Sally Albright

A THESIS

submitted to

Oregon State University

Honors College

in partial fulfillment of
the requirements for the
degrees of

Honors Baccalaureate of Science
Environmental Sciences
&
Honors Baccalaureate of Science
Earth Science: Ocean Science Option
(Honors Scholar)

Presented November 20, 2019
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Sally Albright for the degree of Honors Baccalaureate of Science in Environmental Sciences & Honors Baccalaureate of Science in Earth Science: Ocean Science option presented on November 20, 2019. Title: Developing a Green Lab Certification for a Research-Intensive University.

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Laurence C. Becker

Oregon State laboratories are responsible for a significant portion of the university's overall resource and energy consumption, and therefore minimizing waste in a sustainable way should be a top priority for the university while aiming for carbon neutrality by 2025. This study addresses major factors that should be considered when implementing an effective Green Lab Certification program for a research-intensive university, specifically Oregon State University. Encouraging and normalizing pro-environmental behavior in labs is crucial to maintaining waste minimizing techniques in these workspaces. Accomplishing this in the form of a certification program maintains accountability, establishes a definition and standard of sustainability in the context of labs, and facilitates a network of support that ensures stability of the program over time. The OSU Green Lab Certification program centers around a comprehensive survey that assesses sustainable practices in six (6) categories – energy conservation, water conservation, waste management, lab purchasing, transportation, and education & engagement. Four (4) labs from the representative College of Earth, Ocean, and Atmospheric Sciences participated in the development and testing of the OSU Green Lab Certification survey prior to

university-wide implementation. Upon completion of the survey, each lab earned a score that correlated to a certification level – no certification (0-49%), Copper (50-59%), Silver (60-69%), Gold (70-79%), or Platinum (80-100%). Each lab also received specific feedback regarding improvements that could be made in order to proceed to a higher certification level in the future. Involving OSU labs in the development, amendment, and testing of the Green Lab Certification survey ensured that this program was clear, concise, applicable, and effective. The OSU Sustainability Office plans to implement this Green Lab Certification program university-wide in Winter of 2020 via Qualtrics, a program regularly used by the university for official surveys.

Key Words: Sustainability, Laboratories, Green, Universities, Certification, Research
Corresponding e-mail address: albrighs@oregonstate.edu

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APPROVED:

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Laurence C. Becker, Mentor, representing the College of Earth, Ocean, and Atmospheric Sciences

_____

Rick Colwell, Committee Member, representing the College of Earth, Ocean, and Atmospheric Sciences

_____

Brandon Trelstad, Committee Member, representing the OSU Sustainability Office

_____

Toni Doolen, Dean, Oregon State University Honors College

I understand that my project will become part of the permanent collection of Oregon State University, Honors College. My signature below authorizes release of my project to any reader upon request.

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Sally Albright, Author

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I. ACKNOWLEDGEMENTS

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II. INTRODUCTION

Higher education institutions both within the United States and internationally have recently recognized the need for sustainable practices in their laboratories. According to the Association for the Advancement of Sustainability in Higher Education (AASHE), hundreds of universities have made commitments on minimizing energy use and greenhouse gas production since the organization began in 2006 (Bridgestock, 2012). Since no two universities are alike, it is important to identify components that contribute most significantly to each university's overall carbon footprint in order to meet these commitments. In a large, research-intensive university, laboratory-related work contributes significantly to overall waste and resource consumption for the university. Oregon State University (OSU) is the largest public research university in Oregon, and one of only two universities in the United States with Land-, Sea-, Space-, and Sun-Grant designations as of 2019 (OSU Research Office, 2019). With eleven (11) academic colleges at Oregon State University, research is an integral component of this university and most of these academic colleges. In 2019 alone, the university received a total of over $400 million in competitive research grant funding and an overall funding increase of 15 percent (OSU Research Office, 2019). Laboratories typically consume anywhere from five (5) to ten (10) times as much energy per square foot as typical office spaces of similar size (PG&E, 2011). Laboratory work is an integral part of the OSU community, as well as a significant component of the university's carbon footprint.

In 2007, Oregon State University President Ed Ray signed the American College and University Presidents Climate Commitment (ACUPCC), an effort to address climate change by creating a network of universities and colleges committed to neutralizing greenhouse gas emissions and encourage pro-environmental behavior on campus (Second Nature, 2007). One of

the requirements of this commitment was to "take immediate interim steps to reduce campus greenhouse gas emissions… and reach carbon neutrality by 2025," (Smith & Trelstad, 2009). The first sustainability report for Oregon State University was published in 2009 by the OSU Sustainability Office, and since then a report has been issued on an annual basis assessing the progression of OSU toward the 2025 goal (AASHE, 2019).

Since 2011, sustainability assessment for the overall university has been conducted via the Sustainability Tracking, Assessment, & Rating System (STARS), a program of the Association for the Advancement of Sustainability in Higher Education. AASHE is an organization that encourages sustainable practices in higher education institutions. Its STARS program encourages pro-environmental and waste minimizing behaviors in universities through a self-reporting framework that measures sustainability performance (AASHE, 2019). Once the college submits its report, this program assigns a rating, in order of lowest to highest, of either no rating, Bronze, Silver, or Gold. Within each rating, a number value out of 100 is given so the institution can see exactly where it lost points and how to improve in the future. As of 2019, 971 institutions have registered to use the STARS reporting tool and of these institutions, 662 are AASHE members that must renew this membership every three years. As of January 31, 2018, OSU received a Gold rating and scored 72.23 out of 100 points (AASHE, 2019). The results of the overall university assessment suggested that the university focus on energy efficiency, waste management, investment/divestment, and purchasing (AASHE, 2019). The STARS program has proven to be an effective tool for assessing pro-environmental behavior and efforts to minimize waste across the entire university.

As of 2019, the university was still not on track to reach the 2025 carbon neutrality goal, despite efforts to assess sustainability across the university and create resources that incite

positive change. According to Brandon Trelstad of the OSU Sustainability Office, one of the largest challenges faced by the university is the inability to develop a universal planning and implementation process that applies to all the colleges and offices across the university (Nelson, 2018). The OSU Sustainability Office advocates for individual departments and offices to develop their own strategic plans for reducing their carbon footprint. To follow this recommendation, the Sustainability Office decided to approach this challenge through methods that emphasized "bottom-up" solutions that address sustainability on campus as a sum of its parts. In other words, initiatives could likely be more successful if they were more catered to specific audiences and encouraged specific, actionable changes. As a result, the Office implemented the university's first ever Green Office Certification, which focuses on improving sustainability in individual offices and departments at OSU (OSU Sustainability Office, 2019). This certification process involves the use of a comprehensive online survey to assess the current state of office practices and is broken down into the following categories each with five (5) to fifteen (15) questions: energy, water, waste management, purchasing, transportation, and outreach/education. Since the Green Office Certification was implemented in 2017, ten (10) offices and/or departments have been certified and are being recognized for their efforts to improve sustainability in their workspaces. The Sustainability Office is aiming to increase coverage of sustainability initiatives across OSU's campus. This includes areas such as laboratories, residence halls, dining halls, and Greek life communities.

Given that organizations like Pacific Gas & Electric (2011) have identified labs as major contributors of waste and resource consumption relative to other workspaces, a sustainability initiative that focused primarily on pro-environmental behavior and waste minimization in OSU's labs was needed. The next step was to develop an effective approach to designing a

Green Labs program for Oregon State University. To accomplish the goal of waste minimization in OSU's labs, encouragement of lasting pro-environmental behaviors in laboratories would be necessary to sustain those techniques in waste minimization. In order to maintain accountability, allow for adaptability in the program, and maintain a standard of sustainability in laboratories, the program would be implemented via a certification program. The goal of this study was to determine which factors should be considered when developing a comprehensive and effective Green Lab Certification program for a research-intensive university, specifically Oregon State University.

III. MINIMIZING WASTE IN LABS

In this context, "waste" refers to unwanted or unusable excess that gets circulated back into the local ecosystem. Typical forms of waste produced in laboratories include hazardous liquid and solid waste, non-hazardous liquid and solid waste (including water), and energy waste. Proper waste management is essential to environmental and public health, especially in places that include many individuals and departments that contribute heavily to the overall waste stream, such as research-intensive universities. However, comprehensive waste management programs are among the greatest challenges to achieving sustainability on college campuses, including Oregon State University (Nelson, 2018). Since it is very challenging to create campus-wide waste management systems that effectively serve workplaces of varying purpose, size, and output, an alternative approach would be to create programs that are catered to the needs of individual components of these institutions.

Laboratories are a viable and imperative target for waste minimization efforts as well as environmental education and engagement efforts in higher education institutions more so than

other workplaces of comparable size. Labs in research-intensive universities are often major consumers of energy and materials for each university's overall waste stream. During the 2007-2008 academic year, the University of Northern British Columbia (UNBC) Prince George Campus, a small, research-intensive university, produced between 1.2 and 2.2 metric tons of waste per week, over 70% of which could have been diverted through waste minimization, recycling, and composting practices (Smyth et. al, 2010). A 2015 study published in *Nature* suggested that plastic waste from scientific research facilities accounted for 1.8 percent of total global plastic production, equivalent to that of 67 cruise ships per year (Urbina et. al, 2015). Labs contribute to a significant amount of resource use and waste production, and therefore require direct and immediate attention for sustainability-related endeavors at OSU.

In addition to the sheer volume of waste produced as a result of lab work, there is also a disconnect in collective environmental awareness in these workspaces that prevent sustainable minimization of waste. A survey was conducted at the Harvard School of Public Health to investigate issues regarding standards of high-performance laboratory design and maintenance, and the results highlighted that there was confusion around interpretations of sustainable lab guidelines and standards, and this confusion has direct financial, environmental, and human health consequences (Woolliams et al., 2005). The Green Lab Certification for OSU should include assessment and recommendations for improvement in both waste management and education/engagement to minimize confusion and increase inclusivity of the program.

The primary goal of the OSU Green Lab Certification program is to encourage lasting pro-environmental behaviors that maintain waste minimizing actions in laboratories within the university. Creating a universal system for certifying "green labs" is challenging because laboratories and universities employ different scientific equipment and techniques, different

systems of waste management, and different environmental health and safety standards. Oregon State University's Environmental Health and Safety (EH&S) Department focuses on "…maintaining a safe and healthy university environment for staff, faculty, students, and visitors…" (EH&S, 2019). This department not only coordinates the management of various types of waste across the university, but also establishes and enforces regulatory health and safety requirements established locally and nationally. EH&S currently has a "Hazardous Materials Disposal Guide" and other related sources on how and where to properly dispose of various chemicals disposed of from labs. In addition to chemicals, EH&S also offers services for recycling specific products that are not regularly recyclable, such as pipette tip boxes, non-hazardous used latex gloves, Styrofoam coolers, and others. Although these services are invaluable in the way of university-wide laboratory waste management, they are not publicized or regularly utilized by the university's laboratories. Given the current strengths and weaknesses of OSU's existing waste management system, the Green Lab Certification for this university should include information and guidance about how to access such resources to familiarize lab members of the opportunity for pro-environmental behaviors and actions in the labs.

IV. ENCOURAGING PRO-ENVIRONMENTAL BEHAVIOR

Pro-environmental behaviors are defined as "behaviors that consciously seek to minimize the negative impact of one's actions on the natural and built world" and are often adopted in workplaces that prioritize development and maintenance of workplace sustainability programs (Loverock, 2012). These behaviors, typically inspired by environmental knowledge and awareness, vary significantly based on several demographic factors, including both internal and external influences. Women and young people, for example, tend to be stereotyped as

environmentalists, excluding those who don't fit into those demographic groups from support and resources necessary to increase pro-environmental behavior and action (Barr, 2003). There are also certain workplace cultures that are more (or less) conducive to encouraging lasting pro-environmental behavior, especially regarding leadership and communal support (Blok et al., 2015). Understanding which factors most heavily influence pro-environmental behavior and behavioral change is crucial to developing a Green Lab Certification program that is effective and sustainable.

There are specific pro-environmental behaviors that are "normative" and accepted, however, some behaviors and actions are still rejected. For example, recycling has been very well-received by the public, partially because the infrastructure was embraced by politicians and businesses in a way that made it easy for people to participate (Goldman et. al, 2018). Waste reduction and minimization, however, are not quite as normative. A study published by researchers at the UK's Royal Geographical Society found that waste reduction behaviors show evidence of counter-productive stereotyping, specifically linking to age and gender (Barr, 2003). Waste minimization techniques and behaviors have been found to be closely linked to the limitations set on certain individuals in the workplace and household. Societally accepted stereotypes have isolated young people and women as the most environmentally active demographic groups, isolating those outside of these groups from support and resources to further their awareness and action in minimizing waste (Barr, 2003). Additionally, "waste reduction and minimization" is a poorly defined term in waste-related policy, and it has several alternative dimensions – recycling, minimization, and reuse of materials (Barr, 2003). Inclusivity is imperative when aiming to encourage pro-environmental behavior and excluding major groups from sustainability will only support polarization of the issue at hand.

The likelihood of observing pro-environmental behavior in the workplace has been found to be largely predictable. A 2010 study by Dr. Paul Maiteny of UK's Open University investigated the relationship between emotional engagement in promoting pro-environmental behavior change. Results suggested that emotional engagement includes (1) experiences that prompted an urge to reduce one's carbon footprint through lifestyle/behavior change, and (2) how those experiences relate to one's greater beliefs, meanings, and convictions (Maiteny, 2010). In encouraging pro-environmental behavior, it is crucial to foster some form of relationship between people and the environment through impactful experiences. Another study by Block et al. (2015), focusing primarily on pro-environmental behavior among university employees, found that the "theory of planned behavior" (connecting one's beliefs to their behavior) explains such behavior in the workplace and that these predictors of workplace behavior differ from that of a household. Specific techniques predicted to significantly impact pro-environmental behavior among university employees focus on leaders in the workplace (department heads, administrators, etc.) exhibiting exemplary behavior and supporting pro-environmental efforts in the workplace (Blok et al., 2015). In the Green Lab Certification, the survey is designed to be completed by those responsible for the laboratories in question.

A study focusing on the influence of green school certification on environmental literacy and behavior found that recycling was the primary pro-environmental behavior adopted by students, and the students overall did not connect their personal consumption with the environmental consequences of that consumption (Goldman et. al, 2018). Although recycling is a popular action, it is considered a "light green" action, or one that only addresses a portion of the waste-stream issue. Schools with the 'green school certification' were encouraged to advance to higher-level, upstream solutions for waste minimization and sustainable consumption. The

proposed OSU Green Lab Certification will provide specific metrics of addressing waste reduction and minimization in labs that go beyond the light green action of recycling.

Understanding which techniques are most likely to elicit pro-environmental behavior in the workplace is invaluable to developing a Green Lab Certification and predicting its potential efficacy at Oregon State University. Pro-environmental behaviors are most predictable based on influence from leadership, impactful environmental experiences, and how those experiences influence beliefs and feelings toward the environment. The OSU Green Lab Certification aims to leverage these predictors to encourage higher-level, upstream solutions for waste minimization and management in laboratories at Oregon State University. This survey is designed to encourage pro-environmental behavior and avoid penalizing inaction, which is why it is important to provide clear and accessible resources so that laboratories can be confident in implementing waste minimization techniques in whatever ways deemed feasible.

V. WHY CERTIFICATION?

Certifications are used across virtually all fields in order to assess knowledge and skill, to ensure that those who are certified perform at a given standard, and to communicate the values of an organization to consumers and/or the public. As of 2010, 10% of timber, 7% of coffee, and 12% of wild fish products circulated in international markets were certified as being sustainably produced (Eilperin, 2010). Researchers investigating the evidence on the efficacy of certification of goods and services found that certification of products improved the producer's environmental, social, and economic performance at varying degrees (Blackman and Rivera, 2011). The International Organization for Standardization (ISO is the globally used acronym) is an organization that certifies environmental management systems via their program, ISO 4001

(ISO, 2019). Arimura et al. (2007) found that the effect of ISO 4001 implementation and reporting on environmental performance in the areas of natural resource use, solid waste generation, and wastewater discharge in Japanese facilities has resulted in significant reduction across all three metrics. Environmentally focused certification programs inform participants of their options when exploring how they may implement sustainable practices in the workplace while also acknowledging efforts that have already been made.

Green offices and buildings, specifically, have been shown to yield both economic benefits and psychosocial benefits in the workplace. A 2018 study surveying employees of green-certified office buildings versus conventional buildings found that employees of green-certified buildings were found to score higher on survey outcomes related to job satisfaction, value to clients and stakeholders, evaluation of management, and corporate engagement (Newsham et.al, 2018). In voluntary programs, certifying buildings and office spaces with regards to sustainability and environmental consciousness have proven to be an effective tool for developing and maintaining a Green Lab program (Arimura, 2008).

"Green Laboratories" are a relatively recent concept compared to other environmentally related certification programs. One of the original and leading programs that spearheaded a Green Laboratory certification program was My Green Lab, a 501c3 non-profit organization founded in 2013. My Green Lab's certification program is the global standard for sustainability best practices in labs, as recognized by AASHE, the American Energy Society, and the International Institute for Sustainable Laboratories (My Green Lab, 2019). My Green Lab reports similar data as PG&E, stating that, "…the opportunity for energy reduction is enormous and untapped, as laboratories consume as much as five times more energy per square foot than typical offices…" emphasizing that laboratories have a great need and potential as a result of a

Green Laboratory Certification program. Since green lab programs are so new and laboratory conditions can vary so greatly, a standardized format has not yet been accepted for certification of Green Labs. Many individualized Green Lab programs are built off Green Office and Green School initiatives. Developing an effective Green Office Initiative includes consideration of scientific evidence, top-down governance, and bottom-up governance approaches (Zen et. al, 2016). The 'green school project' was first introduced in 1994 by the Foundation of European Environmental Education. The purpose of this project was to ultimately develop a comprehensive environmental management system for schools (Zhao et. al, 2015). According to the Center of Green School U.S. Green Building Council, general characteristics of a green school include conserving energy and natural resources, improving indoor air quality, removing toxic materials from areas in contact with children, making use of daylight, and encouraging recycling (Zhao et. al, 2015).

VI. GREEN LAB CERTIFICATION METHODOLOGY

A. Survey Development

Oregon State University's customized and comprehensive Green Lab Certification survey references both techniques and behaviors associated with minimizing waste in laboratories. The survey included six categories – energy conservation, water conservation, waste management, lab purchasing, transportation, and education & engagement – each with several general and university-specific questions that assess the state of overall sustainability within the laboratory. Each section includes quantitative assessment and scoring of these categories. Each category was built with reference to various sources on waste management best practices specific to laboratories, existing certification programs of similar focus, and services available through

Oregon State University. The point values and scoring system were adapted from a series of existing Green Office and Green Lab Certification programs (Oregon State University, 2017; UC Boulder, 2019; University of Washington, 2015; Villanova University, 2015; Yale University, 2018). The scoring system for the OSU Green Lab Certification program is detailed below. The point value of each question complements the challenge environmental impact of the individual action. Actions that have a more significant impact and/or are more challenging to complete are given higher point values than actions that are easier to complete and/or yield a less significant environmental impact. The amount of questions in each section do not reflect the value of the section overall, but instead reflect the well-roundedness of the categories themselves and the values of the actions within the sections.

Adjusted Overall Score Range (%)	**Certification Level**
80-100	Platinum (Pt)
70-79	Gold (Au)
60-69	Silver (Ag)
50-59	Copper (Cu)
0-49	No certification

According to sources such as Pacific Gas & Electric and My Green Lab, labs consume approximately five (5) times as much energy as regular office spaces of similar size (PG&E, 2011; My Green Lab, 2019). This difference is most likely due to the relatively high-energy equipment required for many lab procedures, which is why most of the quantitative questions in the category of energy conservation focus on minimizing use of high-energy equipment, specifically fume hoods, autoclaves, freezers/refrigerators, and computers. This section also includes questions regarding energy efficiency of overhead and task lighting, highlighting that

the OSU Sustainability Office provides CFL and/or LED bulbs to offices across campus upon request. This section accounts for 12 of the 35 quantitative questions in the survey.

The water conservation category emphasizes minimizing use of water, specifically regarding deionized water because it uses a considerable amount of energy. Capacitive deionization (CDI) is a common method used to deionize and sterilize water, and it also consumes a relatively lower amount of energy than other deionization techniques (Yu et al., 2016). This technology still requires a minimum of 1 kilowatt-hour of energy per meter-cubed of water processed (Yu et al., 2016). Each lab may implement a different technique to minimize soap and water usage when hand-washing equipment, and therefore one question in this category requests that the user describe how water use is minimized in order to ensure applicability of the question across a variety of labs. This section accounts for 3 of the 35 quantitative questions in the survey.

The waste management category assesses utilization of available recycling services offered by OSU's Department of Environmental Health & Safety, minimization of single-use items, and proper disposal of material waste such as pipette tips, disposable gloves, and paper. In addition to general recycling (paper, cardboard) and chemical disposal, EH&S also offers services for "special" recycling specific products that are not regularly recyclable, such as pipette tip boxes, non-hazardous used latex gloves, Styrofoam coolers, and others. Pro-environmental behavior is most effectively encouraged when waste minimizing action is normalized and made easily accessible. In order to go beyond "light green" waste minimizing actions like recycling, these questions are designed to provide specific metrics and actionable changes that lab representatives have the freedom of implementing where practical. This section accounts for 11 of the 35 quantitative questions in the survey.

The lab purchasing category focuses on sharing resources and environmentally conscious purchasing (or avoidance of purchasing) on behalf of the lab. Creating networks of communal spaces and equipment not only cuts down significantly on redundancy and waste across OSU's labs, but it also introduces an opportunity to foster the normalization of pro-environmental behavior and connection of collective values with collective action. Questions in this section also encourage users to incorporate environmentally preferred products into regular circulation in the lab, specifically energy-efficient equipment and eco-friendly cleaning products. This section accounts for 3 of the 35 quantitative questions in the survey.

Transportation is the most significant generator of greenhouse gas emissions in the United States, accounting for approximately 29% of total emissions in 2017 (EPA, 2017). Travelling for research, conferences, presentations, and other work-related trips is a common occurrence associated with lab work. The transportation category of the survey prioritizes methods of transportation alternative to single-passenger vehicles, as well as emphasizing minimization of travel and instead, utilizing video/phone conferencing technology whenever possible. This section accounts for 4 of the 35 quantitative questions in the survey.

Continuous education and engagement of lab members is imperative to ensuring lasting pro-environmental behavior. The inability of many labs to meet standards of energy efficiency and waste minimization is often attributed to confusion regarding sustainable guidelines and standards (Woolliams et al., 2005). The education & engagement category of the survey prioritizes clarifying standards of sustainable best practices in labs. Questions in this section encourage labs to place informational signage in strategic locations around the laboratory, as well as ensuring that at least one person in the lab is well-informed on recent waste management

policies and services available at the university. This section accounts for 3 of the 35 quantitative questions in the survey.

In order to ensure that the Green Lab Certification would be an effective tool for Oregon State University, this program was reviewed, amended, and tested prior to implementation. One of the research-intensive colleges within Oregon State University is the College of Earth, Ocean, and Atmospheric Sciences. Referencing the college's website, "…[CEOAS] is built on a foundation of outstanding faculty who work together to solve today's complex, interdisciplinary environmental challenges," (CEOAS, 2019). Being that CEOAS is a research-focused college within Oregon's largest comprehensive research university, CEOAS served as an effective proxy to reference when developing a metric and set of standards to inform an OSU Green Laboratory Certification available to any laboratory across campus.

B. Amendment and Testing

Once an initial draft of the survey was arranged, ten (10) laboratories were contacted in the College of Earth, Ocean, and Atmospheric Sciences for pre-survey review. Of the ten (10) laboratories contacted, four (4) of them participated in meetings where the survey was introduced. The classifications of these labs included a physical oceanography garage/workshop, an environmental biochemistry lab, a microbial ecology lab, and a microbiological lab. The feedback from these labs indicated that the six (6) categories of the survey provided a complete and comprehensive assessment of pro-environmental behavior and action within each lab. Each lab representative expressed the importance of focusing on the encouragement of positive action rather than penalizing lack of action, and their feedback was considered when ensuring that the survey was flexible and accessible enough to be effective in a wide variety of laboratory and

research settings. Each question was also assessed for applicability and clarity, and several questions were consequently amended with more inclusive terminology.

Involving perspectives from multiple labs in the development and revision of the Green Lab Certification survey served to be an invaluable step in the process, and what makes this a unique program for the university. This feedback proved to be a critical step in ensuring that the Green Lab Certification program was representative of the accomplishments and needs of labs specifically at Oregon State University, as well as creating a direct avenue for lab representatives to communicate their needs, suggestions, and insight to those at the OSU Sustainability Office. Many of these labs also depend upon and have little control over services provided by the department/building in which they are housed, such as communal printing services, building-wide HVAC systems, and/or university-owned computers. These representatives also expressed that they would be significantly more likely to implement and maintain pro-environmental actions in their labs if the university prioritized encouragement of positive action rather than penalizing inaction. Users also expressed that they would be more likely to pursue new methods of waste minimization if published research and easy-to-follow links accompanied each question as needed. For example, if a lab were to be encouraged to decrease the ultra-low-temperature (ULT) freezers from -80 to -70 degrees Celsius for the sake of energy conservation, they also would require supplemental information that ensures this action wouldn't compromise precious samples.

After amendments were made with perspectives of CEOAS lab representatives in mind, a final survey was officially administered to those same laboratories in order to help determine scoring guidelines, which are detailed in Appendix B. Once the scoring guidelines were finalized using the results gained from the administration of the survey during this study, it was

implemented by Oregon State University as the pilot Green Lab Certification program, available in Appendix A. Oregon State University's Sustainability Office plans to make the OSU Green Lab Certification accessible campus wide via Qualtrics, a system regularly used by the university for official surveys by the end of Winter of 2020. Once the survey is completed by a lab representative, employees at the OSU Sustainability Office will convert the answers into quantitative scores that helped to determine which Certification Level – None, Copper, Silver, Gold, and Platinum – accurately represents the overall sustainability of that laboratory, as well as which suggestions would be appropriate for future improvement. Laboratories will be welcome to resubmit thee survey at any time if they aim to increase their score after implementing new sustainable practices.

VII. SURVEY RESULTS

The Green Lab Certification survey was completed on behalf of three (3) OSU labs prior to university-wide implementation. The first lab to complete the survey was Dr. Ed Dever, a physical oceanographer at OSU, on behalf of the Ocean Observing Center (OOC), an oceanographic workshop within the OSU system but located a few miles south of the school's main campus. This lab marked four (4) of the thirty-five (35) questions as not applicable based on limitations set on them by the university, as well as types of equipment that are not used in the lab. For example, this lab does not control purchasing decisions regarding work computers because computers are provided by the university. Additionally, this lab does not require the use of high-energy sterilizers (such as autoclaves), and therefore that question was not applicable. For these four (4) questions, the point values were removed from analysis so as not to penalize the lab for not meeting the expectations set by the survey. Once these values were removed, the

total maximum point value decreased from 113 to 100 possible points. This lab scored most highly in the category of lab purchasing with an adjusted score of 100%, followed by waste management with an adjusted score of 80.6%. The lab scored lowest in the water conservation category with an adjusted score of 31.5%, and the second lowest-scoring category was in transportation with an adjusted score of 34.4%. Dividing the combined earned points (65.43 points) by the adjusted total (100 points), this resulted in a score of 65.43%, or a Silver certification level.

The Green Lab Certification survey was also completed by Ms. Kylie Welch, the lab manager for chemical oceanographer Dr. Miguel Goni's biochemical lab within the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. The lab does not require the use of toxic or volatile chemicals, and therefore no concerted efforts were needed to minimize use. This lab also receives computers from the university, and therefore has essentially no control over the energy ratings of these devices. This lab does, however, source computers from OSU Surplus, a department on-campus where used equipment is refurbished and cycled back into the university when possible. Removing the point values associated with these questions brought the total maximum point value decreased from 113 to 103 possible points. This lab scored most highly in the category of lab purchasing with an adjusted score of 100%, followed by waste management with an adjusted score of 80.6%. The lab scored lowest in the transportation category with an adjusted score of 33.2%, and the second lowest-scoring category was in water conservation with an adjusted score of 45%. The lab then proceeded to answer all questions that were applicable and earned 72.2 points. Dividing the combined earned points (72.2 points) by the adjusted total (103 points), this resulted in a score of 70.1%, or a Gold certification level.

The third lab to complete the Green Lab Certification survey during this trial period was Dr. Rick Colwell's biogeochemistry lab within the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. This lab representative reported that all questions were, in fact, applicable to the lab, and therefore the total possible points remained as 113 points. This lab scored most highly in the category of lab purchasing with a score of 100%, followed by waste management with a score of 75%. The lab scored lowest in the education & engagement category with a score of 16.7%, and the second lowest-scoring category was in transportation with a score of 33.3%. Dividing the combined earned points (64.1 points) by the total (113 points), this resulted in a score of 56.7%, or a Copper certification level.

	Scores Earned per Category (%)							
Lab Name	Energy	Water	Waste	Purchasing	Transportation	Education	Overall	Certification Level
Dever (OOC)	63.3	31.5	80.6	100	34.4	100	65.4	Silver (Ag)
Goni	75.1	45	86.2	100	33.2	58.3	70.1	Gold (Au)
Colwell	59.4	45	75	100	33.3	16.7	56.7	Copper (Cu)

VIII. DISCUSSION

The Silver certification level earned by the Ocean Observing Center effectively acknowledges the existing efforts made to encourage pro-environmental behavior and action in this lab while also allowing for future improvement. Based on these results, the Ocean Observing Center would receive feedback suggesting that it prioritizes bringing up scores in these categories, with specific feedback including a gradual transition to 100% LED or CFL lighting

sources, enabling power management settings on work computers, and encouraging alternative methods of transportation among lab members.

Dr. Goni's lab scored most highly overall among the labs that participated in the survey during this study, earning a Gold certification level. This lab has made exceptional efforts to minimize energy consumption and production of waste, and the high score earned reflects those efforts made. Based on these results, Dr. Goni's lab would likely receive feedback geared toward the categories in which the lab scored lowest, transportation and water conservation. This feedback could include suggestions such as retrofitting faucets with aerators rates at 1 gallon per minute or less, exploring alternatives to travelling to conferences (such as requesting recordings of seminars, teleconferencing, or requesting minutes/notes from the meetings), and assigning someone in the lab to undertake the role of Green Lab Representative to implement and maintain these practices.

Dr. Colwell's lab received a Copper certification level, earning points in every category and over half of the possible points in the survey overall. Feedback from these results would prioritize increasing scores in the category of education & engagement, with specific recommendations including identifying a Green Lab Representative for the lab, informing staff of special materials that can be recycled through OSU, and installing signage that encourages pro-environmental behavior in the lab such as reminders to turn off the lights near switches and/or water conservation tips near faucets. All the labs that complete the Green Lab Certification program, including those that participated during this study, may respond to this feedback, request assistance for implementing sustainable practices as needed, and improve its certification level at any time.

Upon implementation of the OSU Green Lab Certification program, the next and most important step is creating and maintaining motivation for laboratories on campus to participate in the OSU Green Lab Certification program. This survey is designed to allow for continuous feedback, and as more users work with this program, the Sustainability Office will be able to fine-tune the survey to be adaptable over time. Depending on resources available, there could even be awards to recognize outstanding sustainability efforts on the individual, laboratory, office/departmental, college, and even residence hall levels across campus. Green lab representatives from certified green labs across campus can form as liaisons for the OSU Sustainability Office when pursuing future initiatives that support sustainability in OSU's labs.

All three labs that completed the OSU Green Lab Certification program over the duration of this study indicated that travel associated with lab work exceeds 5,000 miles per year. Since transportation and travel accounts for such as major percentage of the United States overall carbon footprint, Oregon State University may use travel and transportation data gained from this survey to inform future campus-wide legislation that supports offsetting the cost of carbon emissions associated with work-related travel. Along with the focus on transportation and travel, this survey may become a source of data that helps the Sustainability Office and others at OSU learn where the opportunities for future sustainability initiatives exist across campus. Moving forward from this study, more defined research may be conducted on the cost of offsetting the carbon emitted by work-related travel, and how much travel tends to occur with the "average" lab on OSU's campus. This could potentially help inform whether including the cost of "offsetting" carbon emissions related with travel in research proposals would have any impact on the competitiveness of these proposals with granting agencies.

IX. CONCLUSION

The concept of "environmental sustainability" in laboratories is a recent one, but a very important one. Research-intensive universities can find value in prioritizing sustainability in laboratories because these research settings tend to account for very large portions of their overall waste accumulation. Rather than working to devise university-wide solutions, this study focuses on an important entity within this research-intensive university – laboratories.

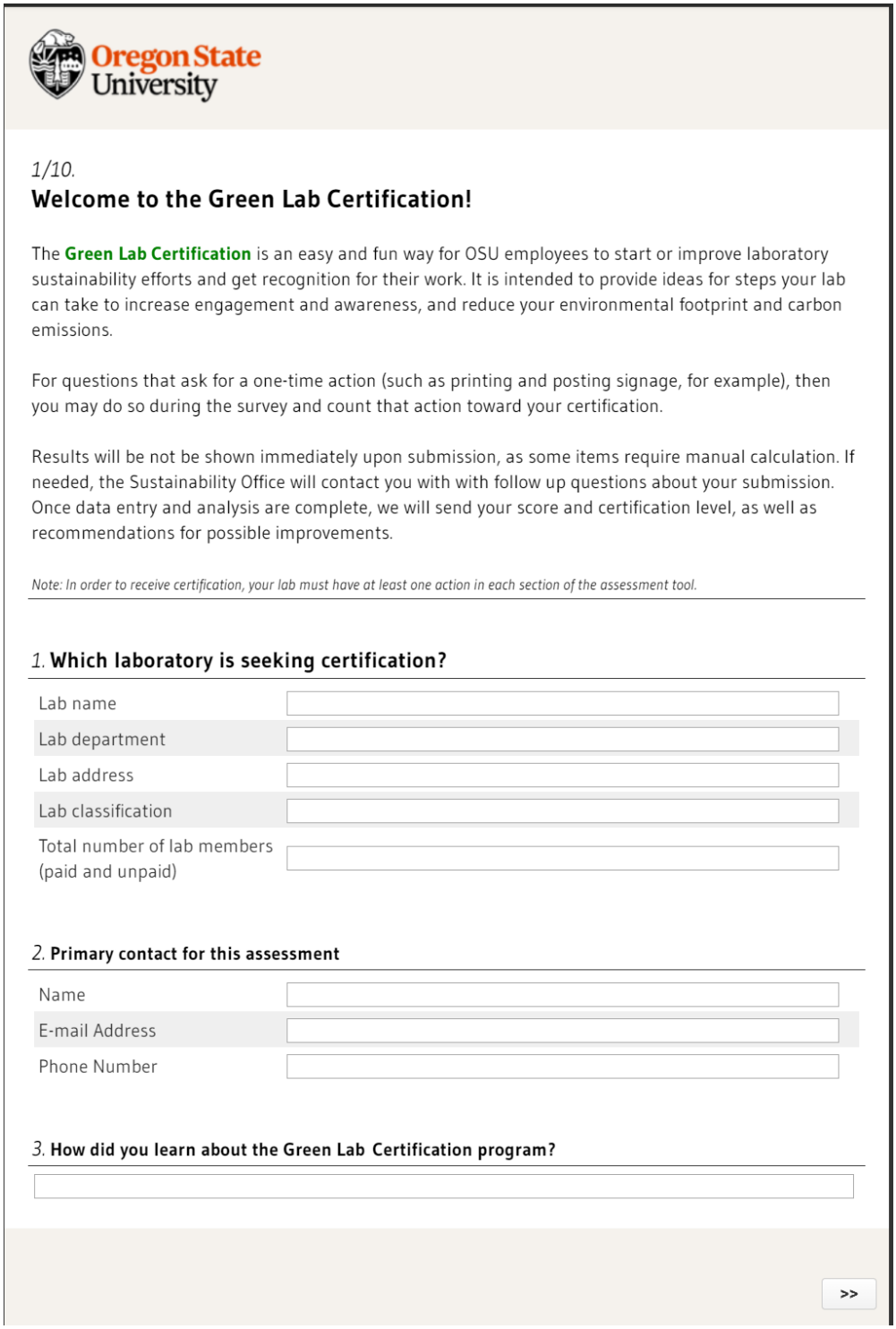
According to studies by Pacific Gas & Electric, laboratories can consume at least five (5) times more energy and resources than other offices of similar size, and university laboratories are important opportunities to encourage and maintain pro-environmental behavior. Factors that encourage pro-environmental behavior include establishing relationships between humans and the environment, encouragement over criticism, and normalization of eco-friendly actions and behaviors. Certification programs have also proven to be effective in maintaining accountability and consistency in standardized practices, as well as a helpful tool in evaluating and rewarding pro-environmental behavior. With these considerations, the OSU Green Lab Certification program was designed.

Results gained from administration of the OSU Green Lab Certification survey during this study indicated that the survey provided effective and comprehensive assessment of waste minimizing action and pro-environmental behavior in OSU's labs. Three (3) labs participated in the survey, each reporting different strengths and areas for potential improvement with regards to sustainable best practices. These results guided the determination of personalized recommendations for each lab that accompanied the certification level received by each lab. The results of this survey also have the potential to inform the development of future initiatives and regulations that support pro-environmental behavior across the OSU campus and community.

Involving OSU labs in the development, amendment, and testing of the Green Lab Certification survey served to be an invaluable step in the process because it ensured that this program was clear, concise, applicable, and effective. OSU Green Lab Certification is the first of its kind at Oregon State University due to this collaborative process, and it serves as a comprehensive assessment of sustainable practices in the university's laboratories. This program was built with consideration of factors that encourage pro-environmental behavior, best practices in waste minimization, and accountability via university-wide certification. The OSU Green Lab Certification program will join a three-part initiative by the OSU Sustainability Office, including the existing Green Office program and an upcoming Green Greek program.

X. APPENDIX

A. The OSU Green Lab Certification Survey:



Oregon State University

1/10.

Welcome to the Green Lab Certification!

The **Green Lab Certification** is an easy and fun way for OSU employees to start or improve laboratory sustainability efforts and get recognition for their work. It is intended to provide ideas for steps your lab can take to increase engagement and awareness, and reduce your environmental footprint and carbon emissions.

For questions that ask for a one-time action (such as printing and posting signage, for example), then you may do so during the survey and count that action toward your certification.

Results will be not be shown immediately upon submission, as some items require manual calculation. If needed, the Sustainability Office will contact you with with follow up questions about your submission. Once data entry and analysis are complete, we will send your score and certification level, as well as recommendations for possible improvements.

Note: In order to receive certification, your lab must have at least one action in each section of the assessment tool.

1. **Which laboratory is seeking certification?**

Lab name	
Lab department	
Lab address	
Lab classification	
Total number of lab members (paid and unpaid)	

2. **Primary contact for this assessment**

Name	
E-mail Address	
Phone Number	

3. **How did you learn about the Green Lab Certification program?**

>>

Oregon State University

2/10.

ENERGY CONSERVATION

This section assesses how efficiently energy is utilized and conserved in the lab. Laboratories typically consume 5 to 10 times more energy per square foot than typical office buildings, and we encourage any efforts made to conserve energy where practical in your lab.

EN1. **We either enable power management settings, switch off or manually put to sleep electronic devices such as computers, laptops, monitors, copiers and printers after one hour of inactivity.** Please indicate what portion of electronics are off or asleep after one hour of inactivity (0-100%).

For more info on how to set office electronics to automatic sleep mode, visit here.

0 25 50 75 100

% ☐ Not Applicable

EN2. **Task lighting (such as desk lamps) use CFL or LED bulbs.** Please estimate the percentage (0-100%) of task lighting uses energy-efficient (such as CFL or LED) light bulbs.

Replacing incandescent bulbs with energy-efficient bulbs can use up to 80% less energy, and last up to 25 times as long! The sustainability office has free CFLs and LEDs for your office; please contact us if the bulbs you are currently using are not CFLs or LEDs.

0 25 50 75 100

%

EN3. **Overhead lighting utilizes energy-efficient bulbs.** Please estimate the percentage (0-100%) of overhead lighting that uses energy-efficient (such as CFL or LED) light bulbs.

The Sustainability Office has free CFLs and LEDs for your office; please contact us if the bulbs you are currently using are not CFLs or LEDs.

0 25 50 75 100

%

EN4. **We turn off lights and use natural lighting whenever practical.** Please estimate the average number of hours that lights (excluding emergency lights) are on in your lab.

0 6 12 18 24

Hours

EN5. **We close windows when heating or air conditioning is active.** Please indicate the percentage (0-100%) of time during work hours when heating or air conditioning is active that the windows are closed. Select "Not applicable" if you do not have operable windows.

0 25 50 75 100

% ☐ Not Applicable

EN6. **We wear layered clothing and adapt to varying lab temperatures.** Please indicate the percentage (0-100%) of time employees wear layered clothing to adapt to office temperatures.

0 25 50 75 100

% ☐ Not Applicable

EN7. **Appliances are Energy Star certified when practical. If so, which appliances in your lab are currently Energy Star Certified?**

- ○ Yes, please list the appliances.
- ○ No
- ○ Not applicable

EN8. **Freezers/Refrigerators are cleaned out of samples that are no longer needed/viable at least annually.**

- ○ Yes
- ○ No
- ○ Not applicable

EN9. **Freezer/refrigerator doors are inspected for frost accumulation around door seal gaskets at least monthly.**

- ○ Yes
- ○ No
- ○ Not applicable

EN10. **None of the refrigerators/freezers in the lab were built earlier than 15 years prior to the current date.**

- ○ Yes
- ○ No
- ○ Not applicable

EN11. **High-energy sterilizers (combustion ovens, autoclaves, etc.) are only used when your lab (or group of labs) can run a full load.** Please estimate the percentage (0-100%) of times when your lab is able to run high-energy sterilizers at (safely) full capacity.

Rarely		Sometimes		Most of the time	Always
0	25		50	75	100

% ☐ Not Applicable

EN12. **Any comments, questions, etc. specific to this section? If you selected "Not Applicable" for any questions in this section, you have the option to explain why you chose that/those answer(s) here.**

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Oregon State University

3/10. WATER CONSERVATION

This section assesses how efficiently water is utilized and conserved in the lab.

WC1. **Efforts are made to minimize water/soap usage when hand-washing equipment; if so, please describe.**

For example, you can have a container with soapy water next to the sink when washing equipment, rather than putting concentrated soap on everything you wash.

- ○ Yes, please describe
- ○ No
- ○ Not applicable

WC2. **Faucets are retrofitted with aerators rated at 1 gallon per minute or less.**

An aerator screws onto the tip of the faucet; the flow rate, in gallons per minute (gpm), is typically stamped on the side of the aerator. For additional assistance identifying your building's aerator flow rates, please email the Sustainability Office.

- ○ Yes
- ○ No
- ○ Not applicable

WC3. **Estimate the percentage (0-100%) of water usage that is deionized and/or Ultrapure treated water.**

0 25 50 75 100

Percent DI/Ultrapure water (%)

WC4. **Any comments, questions, etc. specific to this section? If you selected "Not Applicable" for any questions in this section, you have the option to explain why you chose that/those answer(s) here.**

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Oregon State University

4/10.

WASTE MANAGEMENT

This section focuses primarily on how efficiently different forms of material waste are managed in the lab. This assumes that your lab follows existing guidelines for waste management as set by Environmental Health & Safety.

WM1. **Our lab participates in the OSU Department Composting program.**

To learn more about Department Composting and how to sign up, see this link.

- ○ Yes
- ○ No
- ○ We compost, but not through this program
- ○ Not applicable

WM2. **We recycle the following items (Ctrl+Select all that apply).**

To learn about which items can be recycled through OSU's services, please see this page. To request a pick-up service of any of these items, please refer to this form.

- Paper
- Cardboard
- Aluminum
- Glass
- Pipette tips
- Disposable gloves (non-biohazard only)
- Ink cartriges
- Packing peanuts
- Other
- Not applicable

WM3. **Pipette tip refills are purchased instead of new boxes from supplier.**

- ○ Yes
- ○ No
- ○ Not applicable

WM4. **All trash cans in common areas are paired with recycling bins, as space allows.**

- ○ Yes
- ○ No
- ○ Not applicable

WM5. **We have a designated area in our lab for sharing and reusing office supplies such as file folders, binders, pens, paper clips, etc.**

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

WM6. **We have a scrap paper bin near printers to be reused for scrap or internal memos.**

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

WM7. **Our break rooms and/or kitchens provide reusable dishes and silverware.**

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

WM8. **We use OSU Surplus to:**

For details on OSU Surplus, visit here.

- ☐ Find needed furniture and office supplies before purchasing new.
- ☐ Dispose of unneeded furniture and office supplies through OSU Surplus.
- ☐ Neither
- ☐ Other

WM9. **We use rechargeable batteries in place of disposable ones when possible.**

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

WM10. **We recycle all of our used batteries by taking them to collection bins at designated locations across campus.**

To find the locations of collection bins visit here.

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

WM11. **Efforts have been made to limit the number and toxicity/volatility of chemicals in the lab; if so, please describe.**

- ○ Yes, please describe.
- ○ No
- ○ Not applicable

WM12. **Any comments, questions, etc. specific to this section? If you selected "Not Applicable" for any questions in this section, you have the option to explain why you chose that/those answer(s) here.**

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Oregon State University

5/10. LAB PURCHASING

This section focuses on the efficiency of purchasing specific to your lab. Since labs account for major users of overall resource use in universities, we encourage being conscious of what resources are purchased and brought into the cycle of waste in university laboratories.

LP1. **We only purchase computer-related equipment that is EnergyStar compliant and/or with an EPEAT rating of at least Gold.**

Learn more about Energy Star and EPEAT products at www.energystar.gov and www.epeat.net.

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

LP2. **For our lab and common area(s), we use environmentally preferred cleaning products when possible.**

To find "environmentally preferred" products, look for phrases such as "contains no phthalates," "phosphate free", and "biodegradable in 10 days." Terms such as "natural," "eco-friendly," and "nontoxic" aren't regulated terms in the United States and may or may not indicate some level of environmental sensitivity. Additionally, baking soda and vinegar can substitute for harsher cleaning chemicals in many cases. OSU custodial products are Green Seal certified.

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

LP2. **For our lab and common area(s), we use environmentally preferred cleaning products when possible.**

To find "environmentally preferred" products, look for phrases such as "contains no phthalates," "phosphate free", and "biodegradable in 10 days." Terms such as "natural," "eco-friendly," and "nontoxic" aren't regulated terms in the United States and may or may not indicate some level of environmental sensitivity. Additionally, baking soda and vinegar can substitute for harsher cleaning chemicals in many cases. OSU custodial products are Green Seal certified.

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

LP3. **We utilize equipment communally among multiple labs (for example, autoclaves) when possible.**

- ○ Yes
- ○ No
- ○ Other
- ○ Not applicable

LP4. **Any comments, questions, etc. specific to this section? If you selected "Not Applicable" for any questions in this section, you have the option to explain why you chose that/those answer(s) here.**

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Oregon State University

6/10. Transportation

This section works to emphasize that it is good to use alternative modes of transportation or to take advantage of telecommunications when possible. Transportation is the leading source of CO2 Emissions in the U.S., and it is best to stray from SOVs (single occupancy vehicles) when practical. For information about transportation services available at OSU, please visit *Transportation Services*.

TR1. **Estimated percentage (0-100%) of employees in our lab who routinely get to campus using something other than a single-occupancy vehicle (SOV).**

Examples of non-SOV modes include riding a bicycle, walking, carpooling, vanpooling, or using public transit.

0 25 50 75 100

%

TR2. **Estimate the number of miles that are flown by plane as a result of work in your lab per year (this would be a total of all your staff's lab-related trips).**

- ○ <100 miles per year
- ○ 100-500 miles per year
- ○ 500-1,000 miles per year
- ○ 1,000-5,000 miles per year
- ○ >5,000 miles per year
- ○ Our work has not required us to travel by plane yet.

TR3. **Estimate the percentage (%) of meetings that are held locally and/or via teleconference versus travelling by car or plane.**

Never	Sometimes	About half the time	Most of the time	Always
0	25	50	75	100

Percent teleconference (%) ☐ Not Applicable

TR4. **We utilize University Motor Pool vehicles and carpools for university-related travel, rather than driving alone in personal vehicles.**

Visit here for more information on Motor Pool.

Never	Sometimes	About half the time	Most of the time	Always
0	25	50	75	100

% ☐ Not Applicable

TR5. **Any comments, questions, etc. specific to this section? If you selected "Not Applicable" for any questions in this section, you have the option to explain why you chose that/those answer(s) here.**

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Oregon State University

7/10. EDUCATION & ENGAGEMENT

This section prioritizes placing informational signage in strategic locations around the laboratory, as well as ensuring that at least one person in the lab is well-informed on recent waste management policies and services available at the University. There are also resources provided within each question to assist the user in the completion of that task as needed. Increasing awareness is often considered the first and most valuable step in practicing pro-environmental behavior!

ED1. **A Green Lab Representative has been designated to maintain progress on sustainability goals and efforts in the lab. Who? What is a good point of contact?**

A Green Lab Representative would be the primary liaison between your lab and the OSU Sustainability Office. This person's role serves to implement and maintain sustainable practices in your lab, as well as keeping up-to-date with OSU waste management policies and services. This can be anyone in your lab, including yourself.

- ○ Yes (please list name and contact information)
- ○ No
- ○ Other (please specify)
- ○ Not applicable

ED2. **Our staff is informed on the special materials (such as Styrofoam, ink/toner cartridges, and electronic media) that can be recycled at OSU and know how to complete service requests for these materials.**

For more details on special materials, visit here.

- ○ Yes
- ○ No
- ○ Other

ED3. **We have installed signage, stickers or visual prompts in the following locations:**

- [ ] All kitchens and bathrooms to encourage water conservation.

  Please visit here to download a water saving sign.

- [ ] On or near all shared space light switches as reminders to turn off the lights.

  For help with printed reminders, please contact the Sustainability Office.

- [ ] Near workstations to remind us to turn off office electronics during periods of inactivity over one hour.

  For help with printed reminders, please contact the Sustainability Office.

- [ ] Near waste receptacles to encourage proper recycling of waste.

  For a downloadable and printable version of the OSU Recycling Guide, click here.

- [ ] Near fume hoods advising to shut the sash when not in use, which can save up to 60% of the energy used by the hood.

  For printable signage, click here.

- [ ] None
- [ ] Other

ED4. **Any comments, questions, etc. specific to this section? If you selected "Not Applicable" for any questions in this section, you have the option to explain why you chose that/those answer(s) here.**

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A. The OSU Green Lab Certification Scoring Guidelines:

	A	B
1	**Raw Score:**	=100*(SUM(B30,B40,B58,B68,B79,B89))/(SUM(B31,B41,B59,B69,B80,B90))
2	**Adjusted Score:**	=100*(SUM(B30,B40,B58,B68,B79,B89))/(SUM(B32,B42,B60,B70,B81,B91))
3		
4	***Percentage***	***Level of Certification***
5	80+%	Pt
6	70-79%	Au
7	60-69%	Ag
8	50-59%	Cu
9	0-49%	-
10		
11	***LAB INFORMATION***	
12	**Lab Name:**	
13	**Lab Classification:**	
14	**Primary Contact:**	
15	**Email:**	
16		

Scoring Guidelines

1. Read through the "Data Entry Instructions" for each question.
2. Input answers in "Answer" sections from Qualtrics as indicated by the "Data Entry Instructions."
3. Highlight "NA" rows in GRAY, but still put "0" in the "Answer" box.
4. Subtract "NA" Max Points from the "Adjusted Total" equation in EACH section.
5. Raw and Total Scores will be available above.

	A	B	C	D	E	F
6						
7			***ENERGY CONSERVATION***			
8	**Question:**	**Brief Description:**	**Data Entry Instructions:**	**Answer:**	**Max Points:**	**Points earned:**
9	EN1	enabling power management settings on computers	Input raw number, NA=0		3	=(D9/100)*E9
10	EN2	task lighting using LED/CFL	Input raw number, NA=0		3	=(D10/100)*E10
11	EN3	overhead lighting using LED/CFL	Input raw number, NA=0		3	=(D11/100)*E11
12	EN4	using natural light when possible	Input raw number, NA=0		3	=(D12/100)*E12
13	EN5	closing windows when HVAC is in use	Input raw number, NA=0		2	=(D13/100)*E13
14	EN6	layered clothing to adapt to room temp	Input raw number, NA=0		3	=(D14/100)*E14
15	EN7	Energy Star Certified appliances	Yes=1, No=0, NA=0		4	=D15*E15
16	EN8	freezer/fridge cleanouts	Yes=1, No=0, NA=0		3	=D16*E16
17	EN9	freezer/fridge door frost inspection	Yes=1, No=0, NA=0		3	=D17*E17
18	EN10	no freezers/fridges older than 15yrs	Yes=1, No=0, NA=0		3	=D18*E18
19	EN11	autoclaves only used when full	Input raw number, NA=0		3	=D19*E19
20	EN12	section-specific feedback	No point value	0	0	0
21	**Points Earned:**	=SUM(F9:F19)				
22	**Raw Total:**	=SUM(E9:E19)				
23	**Adjusted Total:**	=SUM(E9:E19)-0	Removes NA max points (change the equation "-0" to "-# removed")			
24						
25			***WATER CONSERVATION***			
26	**Question:**	**Brief Description:**	**Data Entry Instructions:**	**Answer:**	**Max Points:**	**Points earned:**
27	WC1	water conserved while hand washing	Yes=1, No=0, NA=0		3	=D27*E27
28	WC2	faucets with efficient aerators	Yes=1, No=0, NA=0		4	=D28*E28
29	WC3	DI/Ultrapure water minimized	Input raw number, NA=0		3	=(D29/100)*E29
30	WC4	section-specific feedback	No point value	0	0	0
31	**Points Earned:**	=SUM(F27:F29)				
32	**Raw Total:**	=SUM(E27:E29)				
33	**Adjusted Total:**	=SUM(E27:E29)-0	Removes NA max points (change the equation "-0" to "-# removed")			
34						

	A	B	C	D	E	F
34						
35			***WASTE MANAGEMENT***			
36	**Question:**	**Brief Description:**	**Data Entry Instructions:**	**Answer:**	**Max Points:**	**Points earned:**
37	WM1	department composting	Yes=2, Not through OSU = 1, No=0, NA=0		4	=D37*E37
38	WM2	recycling	1 point per type of item recycled		8	=(D38/8)*E38
39	WM3	pipette tip refills	Yes=1, No=0, NA=0		1	=D39*E39
40	WM4	trash paired with recycling	Yes=1, No=0, NA=0		1	=D40*E40
41	WM5	shared supplies space	Yes=1, No=0, NA=0		1	=D41*E41
42	WM6	srap paper bin	Yes=1, No=0, NA=0		1	=D42*E42
43	WM7	reusable dishes/flatware	Yes=1, No=0, NA=0		3	=D43*E43
44	WM8	OSU surplus	1 point per item checked		4	=(D44/2)*E44
45	WM9	rechargeable batteries	Yes=1, No=0, NA=0		3	=D45*E45
46	WM10	recycling batteries	Yes=1, No=0, NA=0		3	=D46*E46
47	WM11	limiting toxic/volatile chemicals	Yes=1, No=0, NA=0		3	=D47*E47
48	WM12	section-specific feedback	No point value	0	0	0
49	**Points Earned:**	=SUM(F37:F47)				
50	**Raw Total:**	=SUM(E37:E47)				
51	**Adjusted Total:**	=SUM(E37:E47)-0	Removes NA max points (change the equation "-0" to "-# removed")			
52						
53			***LAB PURCHASING***			
54	**Question:**	**Brief Description:**	**Data Entry Instructions:**	**Answer:**	**Max Points:**	**Points earned:**
55	LP1	efficient computer-related equipment	Yes=1, No=0, NA=0		3	=D55*E55
56	LP2	eco-friendly cleaning products	Yes=1, No=0, NA=0		2	=D56*E56
57	LP3	shared equipment among labs	Yes=1, No=0, NA=0		3	=D57*E57
58	LP4	section-specific feedback	No point value	0	0	0
59	**Points Earned:**	=SUM(F55:F57)				
60	**Raw Total:**	=SUM(E55:E57)				
61	**Adjusted Total:**	=SUM(E55:E57)-0	Removes NA max points (change the equation "-0" to "-# removed")			
62						

	A	B	C	D	E	F
62						
63			***TRANSPORTATION***			
64	**Question:**	**Brief Description:**	**Data Entry Instructions:**	**Answer:**	**Max Points:**	**Points earned:**
65	TR1	non-SOV transportation	Input raw number, NA=0		4	=(D65/100)*E65
66	TR2	miles flown per year	No travel=6, <100mi=5, 100-500mi=4, … >5000mi=0		6	=(D66/6)*E66
67	TR3	teleconferencing	Input raw number, NA=0		4	=(D67/100)*E67
68	TR4	OSU motor pool	Input raw number, NA=0		4	=(D68/100)*E68
69	TR5	section-specific feedback	No point value	0	0	0
70	**Points Earned:**	=SUM(F65:F68)				
71	**Raw Total:**	=SUM(E65:E68)				
72	**Adjusted Total:**	=SUM(E65:E68)-0	Removes NA max points (change the equation "-0" to "-# removed")			
73						
74			***EDUCATION & ENGAGEMENT***			
75	**Question:**	**Brief Description:**	**Data Entry Instructions:**	**Answer:**	**Max Points:**	**Points earned:**
76	ED1	Green Lab rep	Yes=1, No=0, NA=0		3	=D76*E76
77	ED2	informed on special recycling	Yes=1, No=0, NA=0		4	=D77*E77
78	ED3	signage	1 point per item checked		5	=(D78/5)*E78
79	ED4	section-specific feedback	No point value	0	0	0
80	**Points Earned:**	=SUM(F76:F78)				
81	**Raw Total:**	=SUM(E76:E78)				
82	**Adjusted Total:**	=SUM(E76:E78)-0	Removes NA max points (change the equation "-0" to "-# removed")			

REFERENCES

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