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## Section 1 – Program Mission and Educational Objectives

### Program Mission

The Bachelor of Science program in Environmental Sciences (BES) prepares students for immediate employment and graduate studies in the assessment and monitoring of environmental conditions and problems, including research, mitigation and restoration. The BES program focuses on interdisciplinary scientific study of ecology, natural resources, and sustainability with emphasis on management, research, and communication. The curriculum is comprised of four integrated core areas in ecology & natural resources; data analysis & statistics; geographic information systems (GIS); and social sciences.

Students within the Environmental Sciences program put their knowledge into practice in the best place possible—the great outdoors. Emphasis is placed on active experiential learning. The program offers numerous and diverse opportunities for students to engage in applied research and resource management projects with the support of faculty and professionals through local and regional partnerships.

**Mission Statement:** *Students analyze environmental conditions and problems through applied research and fieldwork, all within the stunning natural setting of the Klamath Basin.*

We believe there is a place in our program for everyone with an interest in natural resources, environmental issues, conservation and sustainability, or just being in the great outdoors! Environmental science and natural resources is a huge field that can accommodate a wide range of individual interests and skills whether it's working with wild animals, plants, people, or computers and technology. Our faculty and partners are here to help build an impressive resume of academic and work experience that will place students in the job or graduate program of their choice.

Within Environmental Sciences there are six tracks students can choose from to specialize their degree to their career goals:

- Wildlife Fisheries and Natural Resources
- Recreation and Science Ambassador
- Environmental Business and Economics
- Environmental Policy and Governance
- Water and Wetland Resources
- Environmental Chemistry

Graduates can expect to find employment in federal, state, and tribal government agencies, non-governmental organizations (NGOs), and education and research institutions. Students are also well prepared to enter graduate school. Students graduating from our program have taken positions with the U.S. Geological Survey, U.S. Bureau of Reclamation, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, Oregon Department of Forestry, Oregon State Police Wildlife Enforcement, Klamath County Health Department, Klamath Irrigation District, Klamath County Soil and Water Conservation District, and the Nature Conservancy.

### Mission Alignment

The BES program mission closely aligns with the Oregon Tech mission: *Oregon Institute of Technology (Oregon Tech), Oregon's public polytechnic university, offers innovative, professionally-focused undergraduate and graduate degree programs in the areas of engineering, health, business, technology, and applied arts and sciences. To foster student and graduate success, the university provides a hands-on, project-based learning environment and emphasizes innovation, scholarship, and applied research. With a commitment to diversity and leadership development, Oregon Tech offers statewide educational opportunities and technical expertise to meet current and emerging needs of Oregonians as well as other national and international constituents.*

Our students experience active and applied learning in natural environments. They develop the collaboration and communication skills necessary to work on diverse teams to address environmental issues. Many students participate in

research with faculty and agency partners (Table 1). Further, BES faculty and students engage with professional communities through publications and conference presentations (Table 2). These research and scholarly activities are in direct alignment with Pillars II & III of Oregon Tech's strategic plan which state:

Pillar II COMMITMENT TO INNOVATION: Oregon Tech strives to be entrepreneurial and on the leading edge of student engagement, innovative teaching, and collaborative research.

Pillar III COMMITMENT TO COMMUNITY: Oregon Tech is an active member of the communities that it serves. Students, faculty, and staff are encouraged to contribute to their physical, professional, scholarly, and social communities via leadership and active participation through their academic and professional expertise.

Table 1: Environmental Science faculty and student research projects 2024-25.

| Project                                                                                                                           | PIs                                                 | Agency Partners                                                               | Grants or gifts in kind                                                              | Number of OT students |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------|
| Carnivore Study –tracking large and meso carnivores around campus                                                                 | Jherime Kellerman – NSC<br>Nate Bickford - NSC      | Forest Service                                                                | 10 game cameras with new rechargeable batteries and SD cards from the Forest Service | 5                     |
| Halictidae Study – monitoring native pollinators and Apis mellifera on campus. Students are curating an entomological collection. | Christy VanRooyen - NSC<br>Terri Torres - MATH      | Klamath Basin Beekeeping Association<br>Oregon State Beekeeping Association   | GoodWill organization - \$400                                                        | 5                     |
| Pollinator Habitat Development on Campus                                                                                          | Christy VanRooyen - NSC<br>Chad Mattox - Facilities | Various student and community groups volunteered to plant pollinator habitat. | Gifts of time from the Klamath Basin Beekeepers Association and The Master Gardeners | 27                    |
| Bee Hive Insulated Cover Project                                                                                                  | Christy VanRooyen - NSC                             |                                                                               | RBC Grant - \$540                                                                    | 5                     |
| Western Yellow Rail migration using stable isotopes.                                                                              | Jherime Kellerman - NSC                             | US Fish and Wildlife Service<br>Bureau of Land Management                     | \$3000                                                                               | 1                     |

|                                                                                                                                                                                                                                       |                                                       |                                                                           |                                                                  |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------|-----|
| Klamath Falls City Parks Department- established a system of permanent vegetation monitoring plots in Moore Park. Provide the city with vegetation metrics that can help inform their management, in particular with fuels reduction. | Kerry Farris - NSC                                    | Klamath Falls City Parks Department                                       | Summer Creativity Grant                                          | 2-5 |
| Avian response to riparian restoration, Cascade-Siskiyou National Monument.                                                                                                                                                           | Jherime Kellerman - NSC                               | Bureau of Land Management                                                 | 4-year Cooperative agreement - \$12,000 in year 1                | 1   |
| Post-fire vegetation recovery in a western juniper/sagebrush/bitterbrush community - 20 years after the KAGO fire.                                                                                                                    | Kerry Farris - NSC                                    | City of Klamath Falls; Klamath Chapter of the Oregon Native Plant Society | Time assisting in surveys by members of the Native Plant Society | 2-5 |
| Factors associated with non-native grasses and forbs in a western juniper/sagebrush/bitterbrush community.                                                                                                                            | Kerry Farris - NSC                                    | City of Klamath Falls; Klamath Chapter of the Oregon Native Plant Society | Time assisting in surveys by members of the Native Plant Society | 2-5 |
| Effects of a silvicultural-based forest restoration treatment on the small mammal prey of key mesocarnivores and forest raptors.                                                                                                      | Kerry Farris – NSC<br>Calder Smith – Graduate Student | USDI National Park Service Lassen Volcanic National Park                  | 2-year cooperative agreement – 56,000                            | 1-2 |
| Sprague River water quality monitoring.                                                                                                                                                                                               | Ross Wagstaff- NSC                                    | Klamath Soil and Water Conservation District                              | \$6,000                                                          | 3   |
| Northern Waterthrush distribution and trends                                                                                                                                                                                          | Jherime Kellermann -NSC                               | Pacific Northwest Research Station, US Forest Service                     | \$150,000                                                        | 2   |
| Ecological seed dispersal community dynamics                                                                                                                                                                                          | Jherime Kellermann -NSC                               |                                                                           |                                                                  | 2   |

|                                                     |                                               |                                                                                    |                                                                                                                                                 |                                                                   |
|-----------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Post-Fire Treatment Effect on Water Quality         | Travis Owen – NSC                             | Green Diamond Resource Company                                                     | OIT Start Up Funds                                                                                                                              | 6                                                                 |
| Walking Wetlands                                    | Travis Owen – NSC                             | Lakeside Farms, Tule Lake National Wildlife Refuge                                 | OIT Start Up Funds, Oregon Lakes Association                                                                                                    | 3                                                                 |
| Mountain Pine Beetle Impacts                        | Travis Owen – NSC                             |                                                                                    | OIT Start Up Funds                                                                                                                              | 2                                                                 |
| Novel Dye Sensitized Solar Cells                    | Travis Owen – NSC                             |                                                                                    | OIT Start Up Funds                                                                                                                              | 8                                                                 |
| Low Temperature Thermochemical Production of Fuels  | Travis Owen – NSC<br>Kangjae Lee – EREE       |                                                                                    | Faculty-Student Innovation Grant                                                                                                                | 2                                                                 |
| Carbon Dioxide Flow Battery System                  | Travis Owen – NSC<br>Feng Shi – EREE          |                                                                                    | Summer Creativity Grant                                                                                                                         | 1                                                                 |
| General Chemistry Atoms First Curriculum            | Travis Owen – NSC<br>Rachel Edwards – BHS     | Oregon OER                                                                         | OER Grant - \$5,000                                                                                                                             | 2                                                                 |
| EPA – Community Change Grant - Air Quality Research | Christy VanRooyen – NSC<br>Kyle Chapman - HUM | City of Chiloquin<br>Klamath Tribes<br>Chiloquin Visions in Progress<br>United Way | \$16.34 Million<br>OIT to receive \$833,236<br><br>This grant was awarded in Jan. 2025 and then defunded in Feb. 2025 due to changes at the EPA | Would have supported 2 grad students and 4 undergrad researchers. |

Table 2: Environmental Science faculty and student publications and conference proceedings.

| BES Publications and Conference Proceedings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Environmental Science faculty names in bold and *identifies student name.</p> <ul style="list-style-type: none"> <li>Harris A.*; Sterling, D.*; <b>Kellermann, J.</b> 2024. <i>Thinking Inside the Box: Granivore Community Experiment Along a WUI</i>. Poster presentation at the Oregon chapter of the Wildlife Society Conference and the Oregon Tech Environmental Research Symposium.</li> <li>Smith, C.* and <b>K.L. Farris.</b> 2025. Effects of a silvicultural-based forest restoration treatment on the small mammal prey of key mesocarnivores and forest raptors. Oral Presentation. Oregon Chapter of the Wildlife Society.</li> <li>Setka, A.*, Johnston, N. *, Woltjer, P. *, &amp; <b>VanRooyen, C.</b> 2025. Pollinator Richness Across Cultivated and Natural Habitats at Oregon Tech, Klamath Falls. Poster Presentation. Oregon Chapter of The Wildlife Society annual conference. February 5-7, 2025.</li> <li><b>VanRooyen, C.</b>, Corzatte, L., Torres, T. Bee School. Klamath Basin Beekeepers Association. Cotaught an introductory beekeeping class. March 8, 2025.</li> <li>Setka, A.*, Johnston, N.*, Woltjer, P.*, &amp; <b>VanRooyen, C.</b> 2025. Pollinator Richness Across Cultivated and Natural Habitats at Oregon Tech, Klamath Falls. Environmental Science Symposium. January 24, 2025.</li> <li><b>VanRooyen, C.</b> Tropilaelaps Mites. Klamath Basin Beekeepers Association. January 25, 2025. Educational talk given to professional and hobbyist beekeepers on how to identify and reporting requirements for tropilaelaps mites. This presentation was based on training I received at the American Beekeeping Conference to mitigate the effects this mite could have on bees and pollination services if it eventually finds its way to the U.S.</li> <li>Hevern, J. *and <b>K.L. Farris</b> 2025. Fuel-reduction Treatments Increase Growth of Ponderosa Pine (Pinus ponderosa Poster Presentation. Oregon Chapter of the Wildlife Society.</li> <li>Heaton, I.*, B. Pierson, and <b>K.L. Farris.</b> 2025. Can Native Vegetation Resist Invasives Post-Fire? Poster Presentation. Oregon Tech IdeaFest.</li> <li>Hevern, J. *, S. McBride*, and K.L. Farris. Trends in Soil Moisture Across Three Forest Types. Poster Presentation. Oregon Tech IdeaFest.</li> <li>Bishop, G.*; <b>Owen, T.</b> 2025. <i>The Role of Rotational Wetlands in Supporting Waterfowl and Agriculture in the Klamath Basin, OR</i>. Poster presentation at the Oregon chapter of the Wildlife Society Conference.</li> <li>Maplethorpe. T.*; <b>Owen, T.</b> 2025. <i>Forest Resilience Factors to Mountain Pine Beetle in the Southern Oregon Cascade Range</i>. Poster presentation at the Oregon chapter of the Wildlife Society Conference and at Oregon Tech IdeaFest.</li> <li>Running, T.*; Collin, C.; Gamble, A.*; Maplethorpe, T*.; Bishop, G*.; <b>Owen, T.</b> 2024. <i>Using Water Quality to Investigate a Unique Approach to Post-Fire Stream Protection</i>. Poster presentation at the Oregon Chapter of the Wildlife Society Conference and at the Oregon Tech Environmental Research Symposium.</li> <li>Morris, K.*; <b>Owen, T.</b>; <b>Lee, K.</b> 2025. <i>Low Temperature Performance Characterization of Redox Materials for Thermochemical Production of Fuels</i>. Poster presentation at the Spring National Conference of the American Chemical Society.</li> <li><b>Owen, T.</b> 2025. <i>Getting a Handle on the State of Water in the Klamath Basin</i>. Poster presentation at Oregon Tech IdeaFest.</li> <li>Beard, C.*; Dalin, S.*; Bencomo, X.; Collin, C.; Maier, J.; Snyder, A.; Wiley, A.; <b>Owen, T.</b> 2025. <i>Development of Transition Metal Complexes and Dye-Sensitized Solar Cells Using a Custom Built Analog to Digital Converter</i>. Poster presentation at Oregon Tech IdeaFest.</li> </ul> |

## Section 2 – Program Student Learning Outcomes

Upon completion of the program, students will have demonstrated the following abilities:

- PSLO 1 - Foundational knowledge**  
 Attain applicable foundational knowledge, technical skills, information literacy, and experience in several core areas of ecology, natural resources, & environmental sciences.

- **PSLO 2 - Collaboration**  
Actively collaborate with local and regional agencies, organizations, and community members that represent a diversity of perspectives.
- **PSLO 3 - Science Advocacy**  
Make and advocate for science-based and sustainable solutions to local and global environmental issues.
- **PSLO 4 - Data Analysis**  
Apply, interpret, and communicate appropriate analytical and statistical techniques to answer data driven scientific questions.
- **PSLO 5 - Geospatial Literacy**  
Demonstrate geospatial literacy through the utilization of appropriate technology to identify and address environmental problems.

PSLOs are reviewed annually to maintain relevance in a rapidly evolving job market. Our agency partners advise on essential skills and desired qualifications to ensure that our graduates are successful on the job.

## Section 3 – Curriculum Map

Table 3: Mapping of ISLOs and PSLOs to the environmental science curriculum. Level of application: F – Foundational P – Practicing C – Capstone

| University           | ISLO<br>1 - Communication | ISLO<br>2 – Inquiry & Analysis | ISLO<br>3 – Ethical Reasoning | ISLO<br>4 – Quantitative Literacy | ISLO<br>5 - Teamwork | ISLO<br>6 – Diverse Perspectives |        |        |
|----------------------|---------------------------|--------------------------------|-------------------------------|-----------------------------------|----------------------|----------------------------------|--------|--------|
| Program              |                           | PSLO 4                         | PSLO 3                        | PSLO 4                            | PSLO 2               | PSLO 2                           | PSLO 1 | PSLO 5 |
| COURSE               |                           |                                |                               |                                   |                      |                                  |        |        |
| COM 111Z             | F                         |                                |                               |                                   |                      |                                  |        |        |
| SPE 321              |                           |                                |                               |                                   | P                    |                                  |        |        |
| WRI 121Z             | F                         |                                |                               |                                   |                      |                                  |        |        |
| WRI 122Z or 227Z     | P                         |                                |                               |                                   |                      |                                  |        |        |
| WRI 345, 410, or 327 | P                         |                                |                               |                                   |                      |                                  |        |        |
| ECO 201 or 202       |                           |                                |                               |                                   |                      |                                  | F      |        |
| MATH 111             |                           |                                |                               | F                                 |                      |                                  |        |        |
| MATH 112             |                           |                                |                               | F                                 |                      |                                  |        |        |
| MATH 361             |                           | F                              |                               | F                                 |                      |                                  |        |        |

|                                   |   |   |   |   |   |   |   |   |
|-----------------------------------|---|---|---|---|---|---|---|---|
| MATH 362                          |   | P |   | P |   |   |   |   |
| PHY 201                           |   |   |   | F |   |   | F |   |
| BIO 211                           |   |   |   |   |   |   | F |   |
| BIO 212                           | F | F |   |   | P |   |   |   |
| BIO 213                           |   |   |   |   |   |   | F |   |
| ENV 108                           |   |   |   |   | F |   |   |   |
| ENV 111                           |   |   |   |   |   |   | F |   |
| ENV 217                           |   |   | F |   |   |   | F |   |
| ENV 224                           |   | F | P |   |   |   | P |   |
| ENV 226                           | P | P |   | P |   |   | P |   |
| ENV 314                           |   |   | P |   |   | P | P |   |
| ENV 355                           |   |   | P |   |   | P | P |   |
| ENV 434                           |   | C |   |   |   |   |   |   |
| ENV 485                           |   |   | P |   |   |   |   |   |
| GEOG 105                          |   |   |   |   |   |   |   | F |
| CHE 221-223                       |   | F |   | F |   |   |   | F |
| CHE 315                           |   | P |   | P |   |   |   |   |
| GIS 105                           |   |   |   |   |   |   |   | F |
| GIS 134                           |   |   |   |   |   |   |   | F |
| GIS 205                           |   |   |   |   |   |   |   | P |
| Plant elective                    |   |   |   |   | C |   | P |   |
| Wildlife<br>elective              |   | C |   |   |   |   |   | C |
| Water elective                    | P | P |   | P |   |   |   |   |
| ENV 466                           | C |   |   |   |   |   |   |   |
| ENV 485                           |   | C |   |   |   |   |   |   |
| ENV 420                           | C | C |   |   | C | C | C |   |
| ENV 495 or<br>BIO 255,<br>355,455 | C | C |   | C | C |   |   | C |

## Section 4 – Assessment Cycle

Table 4: BES assessment cycle 2025-2028. Level of application: F – Foundational P – Practicing C – Capstone

| ISLO                          | PSLO          | 2025-2026                                                                                   | 2026-27                                                                                              | 2027-28                                                                                                                   |
|-------------------------------|---------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Communication</b>          |               |                                                                                             |                                                                                                      | BIO 212 L – F<br>ENV 226 – Final Presentations - P<br>ENV 420 – Extern - C<br>Research classes – C<br>Exit Interviews – C |
| <b>Inquiry &amp; Analysis</b> | <b>PSLO 4</b> |                                                                                             | ENV 226<br>BIO 212L<br>CHE 315<br>ENV 434<br>Exit Interviews                                         |                                                                                                                           |
| <b>Ethical Reasoning</b>      | <b>PSLO 3</b> | ENV 111 -F<br>ENV 355 - P<br>ENV 375 - C<br>ENV 484 – P<br>Exit Interviews                  |                                                                                                      |                                                                                                                           |
| <b>Quantitative Literacy</b>  | <b>PSLO 4</b> |                                                                                             | ENV 226 - P<br>BIO 212L – F<br>CHE 315 - P<br>ENV 434 – C<br>Research classes - C<br>Exit Interviews |                                                                                                                           |
| <b>Teamwork</b>               | <b>PSLO 2</b> |                                                                                             |                                                                                                      | ENV 108 – F<br>BIO 212 L – F<br>ENV 375 – P<br>Research Classes - C<br>ENV 420 - C<br>Exit Interviews                     |
| <b>Diverse Perspectives</b>   | <b>PSLO 2</b> | ENV 217 - F<br>ENV 314 – P<br>ENV 355 –P<br>ENV 420 – C<br>Exit Interviews                  |                                                                                                      |                                                                                                                           |
|                               | <b>PSLO 1</b> | Assessed annually through curriculum completion.<br>Exit Interviews                         | Assessed annually through curriculum completion.<br>Exit Interviews                                  | Assessed annually through curriculum completion.<br>Exit Interviews                                                       |
|                               | <b>PSLO 5</b> | GEOG 105 – F<br>GIS 205 – P<br>Wildlife Elective - C<br>Research Classes<br>Exit Interviews |                                                                                                      |                                                                                                                           |

## Section 5– Assessment Data Collection Processes

In 2024-25 data was collected on two of six ISLOs and two of five PSLOs:

- ISLO 1 - Communication
- ISLO 5 - Teamwork
- PSLO 1 - Attain applicable foundational knowledge, technical skills, information literacy, and experience in several core areas of ecology, natural resources, & environmental sciences.
- PSLO 4 - Apply, interpret, and communicate appropriate analytical and statistical techniques to answer data driven scientific questions.

### **Performance Target:**

The overall standard of success established by BES faculty members was a minimum of 80% of students assessed would score 75% or higher on the chosen artifact. However, when assessing the capstone level of communication and teamwork in professional settings such as conferences and externships, we would like to see 100% of the students who take on these extracurricular activities to meet the competent or exceptional levels on the evaluation rubric (see Appendix B).

### **Activity:**

Annually, students demonstrate the attainment of foundational knowledge (PSLO 1) through the successful completion of curriculum. Data for the assessment of this PSLO includes enrollment and retention data. Each year the faculty review the curriculum to ensure that students are obtaining the skills necessary for job success. In the future we will also be collecting data through a graduation interview process with our students which we implemented for the first time in June of 2025. See sample interview questions in Appendix A.

Direct assessment data for the Communication ISLO 1 which corresponds to the communication portion of PSLO 4 was collected in: BIO 212, ENV 226, Research Courses, ENV 420, and at the ENV Symposium.

Direct assessment data for the Teamwork ISLO 5 was collected in: ENV 108, BIO 212, CHE 355, ENV 355.

The assignments used to collect assessment data can be found in Appendix A.

### **Sample:**

Here are the sample sizes for each of the courses where assessment data was collected. One challenge of doing assessment within a relatively small program like BES, is that when we collect data within courses, the sample size is not generally statistically significant.

- ISLO 1 Communication and PSLO 4 communication of analysis
  - BIO 212L -
  - ENV 226 – 12 students
  - ENV 355 – 10 students
  - ENV 420 - 3 students
  - ENV Symposium – 10 students
- ISLO 5 Teamwork
  - ENV 108 – 38 students
  - BIO 212L – 58 students
  - Research Courses – 12 students
  - ENV 355 – 10 students
- Exit Surveys - 2 of 7 graduating seniors
- Exit Interviews – 5 of 7 graduating seniors
- First year retention rates – 12 students

**Reliability:** The instructor of record was responsible for assessing the artifacts for their classes. At the end of the term, each instructor recorded their data in a Qualtrics survey created for ENV Assessment. The Environmental Science assessment coordinator is responsible for gathering all other provided assessment data.

**Rubric:** Rubrics for the BIO 212L project, the ENV 226 Lab assignment, and the ENV 434 assignment are provided in Appendix B.

## Section 6– Assessment Data

ISLO and PSLO data:

Table 7: ISLO and PSLO data for 2024-25

| Performance Criteria           | Assessment Methods                              | Application Level | Performance Target                                                                                  | Results | Met? |
|--------------------------------|-------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------|---------|------|
| ISLO -Teamwork                 | Research Courses                                | P                 | 80% of students scoring a 75% or higher                                                             | 100%    | Yes  |
| ISLO -Teamwork                 | ENV 108                                         | F                 | 80% of students scoring a 75% or higher                                                             | 100%    | Yes  |
| ISLO -Teamwork                 | BIO 212L – Rapid Ecological Study               | F                 | 80% of students scoring a 75% or higher                                                             | 94%     | Yes  |
| ISLO - Teamwork                | ENV 355                                         | C                 | 80% of students scoring a Competent or Exceptional on all categories of the professional evaluation | 88%     | Yes  |
| ISLO - Communication<br>PSLO 4 | ENV 226 – Final project presentations           | P                 | 80% of students scoring a 75% or higher                                                             | 93%     | Yes  |
| ISLO – Communication<br>PSLO 4 | BIO 212L – Rapid Ecological Study               | F                 | 80% of students scoring a 75% or higher                                                             | 93%     | Yes  |
| ISLO - Communication<br>PSLO 4 | ENV Symposium Poster and talk sessions          | C                 | 100% of students presenting at symposium provided professional level communication                  | 100%    | Yes  |
| ISLO - Communication<br>PSLO 4 | ENV 420 - Professional evaluation from employer | C                 | 100% of students scoring a Competent or Exceptional on all                                          | 100%    | Yes  |

|                                    |                                      |   |                                                                                         |                                                                                       |                                                                                                                                                                        |
|------------------------------------|--------------------------------------|---|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    |                                      |   | categories of the professional evaluation                                               |                                                                                       |                                                                                                                                                                        |
| ISLO - Communication PSLO 4        | ENV 355 – Professional Presentations | P | 80% of students scoring a 75% or higher                                                 | <b>80%</b>                                                                            | Yes                                                                                                                                                                    |
| <b>Student Success Indicators</b>  |                                      |   |                                                                                         |                                                                                       |                                                                                                                                                                        |
| Enrollment Data                    | Week 4 Headcount                     |   | 60 students                                                                             | <b>40</b>                                                                             | No, this has been a challenging year for ENV professionals, with many changes at government agencies and environmental regulations. Even so, our enrollment is stable. |
| BES 4-year Graduation Rate         | Equity Dashboard Data                |   | Natural Science department goal of 50%                                                  | <b>23.5%</b>                                                                          | No – With an increase in transfer students who join our program this rate becomes more difficult to achieve.                                                           |
| BES 6-year Graduation Rate         | Equity Dashboard Data                |   | Oregon Tech goal of 50%<br>Natural Science department goal of 75%                       | <b>47.1%</b>                                                                          | No                                                                                                                                                                     |
| BES first year retention rate      | Equity Dashboard Data                |   | 75% goal set by Oregon Tech                                                             | <b>72.7%</b>                                                                          | No. After collecting years of data on why students leave, it is almost always financial or personal reasons and out of programmatic control.                           |
| DFWI rate in BES specific courses. | Equity Dashboard data                |   | Less than the institutional average of 12%                                              | <b>2.2%</b>                                                                           | Yes                                                                                                                                                                    |
| ENV Conference Presentations       | Reported by PIs                      |   | Provide opportunity for undergraduates to present research at professional conferences. | <b>16 students were listed as authors on 14 abstracts at 5 different conferences.</b> | Yes. This is a grand achievement for a program of our size.                                                                                                            |

#### History of Results:

In the last 5 years the Environmental Science program has undergone major revisions to accommodate the changing needs in industry. Each year we review the program learning outcomes with guidance from our agency partners. Further, we are

continually improving our assessment processes. This means that we do not have much historical data related to these specific PSLOs.

Table 5: History of results for BES assessment data.

| Performance Criteria                                     | Previous Action Plan                   | 2019-20          | 2020-21        | 2021-22          | 2022-23          | Current data     | Interpretation                                                                                                                                                       |
|----------------------------------------------------------|----------------------------------------|------------------|----------------|------------------|------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISLO – Communication<br>PSLO 4 – Communication component | None Given                             |                  |                | Average 93.2%    |                  | Average 93.2%    | Students' skills communication remain strong.                                                                                                                        |
| Teamwork                                                 | None Given                             |                  |                | Average 99%      |                  | 95.5%            | Students are successful with teamwork. Variance likely tied to specific individuals.                                                                                 |
| 4-year BES Graduation Rate                               | None Given                             | 2014-15<br>27.3% | 2015-16<br>40% | 2016-17<br>22.2% | 2017-18<br>42.9% | 2018-19<br>23.5% | Rates below goal. The influx of transfer students is likely impacting these numbers. We have also had more students reporting financial difficulty than in the past. |
| 6-year BES Graduation Rate                               | None Given                             | 2014-15<br>54.5% | 2015-16<br>50% | 2016-17<br>55.6% | 2017-18<br>71.4% | 2018-19<br>47.1% | Government policies related to environmental issues has shifted dramatically in the last year changing funding and available positions in this field.                |
| BES first year retention rate                            | Write a Natural Science Retention Plan | 45%              | 50%            | 60%              | 75%              | 72.7%            | Improving retention continues to be an important focus for ENV.                                                                                                      |
| DFWI rate in BES specific courses.                       | None Given                             | 3%               | 1%             | 3%               | 4.3%             | 2.2%             | ENV classes have very low DFWI rates.                                                                                                                                |

## Student Success Stories:

We continue to have amazing students within the BES program. Below are two selected success stories about students in the program. In Appendix C, you can view the Environmental Science Research Symposium program which highlights the diversity and complexity of extracurricular work our students have been doing.



Bella Tenold was the 2025 Oregon Tech President's Senior Cup Award Recipient. Not only did Bella maintain an exceptional GPA while at OIT, she was also a wildland firefighter, acting as an incident commander on a type 5 fire. She went on to utilize her field skills and environmental knowledge to secure a competitive Range Technician Position with the Bureau of Land Management where she followed scientific protocols to assess valuable rangelands within the Upper Klamath Basin. Upon graduating, she stepped directly into the role of Klamath Basin Grazing Lands Conservation Specialist with Intermountain West Joint Venture.



Isabella Heaton received a 2025 Student Achievement Award from Oregon Tech. for her work as an Integrated Pest Management Technician for the U.S. Fish and Wildlife Service. She worked at the Lower Klamath National Wildlife Refuge banding waterfowl and mitigating the spread of botulism among bird species in our region. Summer of 2024 was a record year for botulism kills at the refuge with over 80,000 birds lost. This number would have been higher if it wasn't for Isabella and her colleagues efforts.



Figure 1: Natural Science faculty and students at the Estacion Biologica Monteverde. Summer 2025 Costa Rica Study Abroad.

## Section 7– Action Plans

The BES first year retention rate was 72.7% which is less than the university target of 75%, however is improving. One of the things we implemented this year were interviews with our graduating seniors. At these interviews we collected lots of helpful information on what is working well within the program, and areas where we can improve. At our convocation session, we discussed their feedback and made plans to implement some of their suggestions. The low DFWI rates within BES courses indicate that our retention issues are not associated with program specific curriculum. This means that students are either facing attrition in their general educational requirements or are leaving Oregon Tech for reasons other than failing their classes. I would highly advocate for improvements to the assessment process in general education classes so that program directors can determine if general education courses are leading to attrition in programs.

2025 has been particularly challenging in the field of environmental sciences. Major shifts in government policies and agencies altered how environmental work is being both funded and accomplished nationally. The faculty in our program are committed to adapting to this new landscape and have been seeking out new opportunities for student engagement and employment. For example, this year a local nonprofit donated to the Oregon Tech Foundation to fund a student intern position to collect data on waterfowl in the region. Previously this work would have been done through the US Fish and Wildlife Service. It is important as we market this program to potential students that we share the message that there are still many opportunities within the environmental and natural resource domains.

The ENV graduation rates are of particular concern. Some of the decline in numbers may be attributed to attracting more transfer students to the program which generally prolongs the time it takes for them to reach graduation. We have been developing partnerships with some regional community colleges to try to make transfers easier. For example, last year we developed a new articulation with Mt. Hood Community College. We continue to work diligently with students through advising to get students to graduation in a timely manner.

Our action plans for the coming year will focus on recruitment, retention, and graduation rates.

### Action Plans for 2024-2025

Goal 1: Increase enrollment in the program.

- Continue to improve marketing materials – including the creation of marketing materials which showcase the hands on learning opportunities in our program.
- Improve the ENV website and make sure it is separated from the Natural Resource program.
- Improve our online social media presence.
- Host a STEM day on campus where students and high school counselors have the opportunity to visit and participate in an activity.
- Provide Marketing tools to area high school counselors.
- Offer the general biology series and ENV 111 to rural high schools online.
- Engage with area K-12 schools through science nights.

Goal 2: Improve retention rates

- More actively connect with first year students through events and advising.
- Assess the effectiveness of new MATH courses within the ENV curriculum – MATH 105 and MATH 110.
- Have an ENV meeting focused on best practices in ENV advising and develop an advising manual for the program.

Goal 3: Improve Graduation Rates

- Use graduation exit interview data to better understand roadblocks to graduation.
- Develop a programmatic advising manual to hopefully improve the quality of advising.

ISLO data on Ethics and Diverse perspectives will be collected during the 2024-25 academic year. See Table 4 for more information on the classes where assessment data will be collected.

## Review of 2023-2024 Action Plans

### Goal 1: Increase enrollment in the program.

- Continue to improve marketing materials – including the creation of marketing materials which showcase the hands on learning opportunities in our program.
- Work with admissions to develop custom communication plans for potential BES students.
- Make visits with prospective students more impactful by focusing on interactive experiences.
- Develop or improve articulation agreements with regional community colleges to facilitate transfers.
- Increase our presence in area K-12 schools.

### Goal 2: Improve retention rates

- More actively connect with first year students through events and advising.
- Create an annual schedule so that students can better plan for courses.
- Explore options to help students be successful in MATH classes. We have seen a decrease in placement test scores since COVID.

## Section 8– Closing the Loop: Reflection on previous work

We continue to increase the number of community partnerships which provide experiential learning opportunities for our students through research and internships. This year we had 10 students and 3 faculty who traveled to Costa Rica for a study abroad focused on Sustainable Ecology and Permaculture (Figure 1). 4 of these students had never left the country before prior to this trip. We had 7 undergraduate students present research at the Oregon chapter of the Wildlife Society Conference in Feb. of 2025.

While Goal 1 to increase enrollment remains a priority, our numbers remained relatively stagnant in 2024-25. We have made some improvements to the website and will continue to work on this in 2025-26. We developed a campaign with the admissions office to run texting sessions where potential students could communicate with faculty. This campaign specifically targeted students who had been accepted to the program but not enrolled. For the ENV program, this campaign did not seem to have any positive effect on our enrollment.

In 2025 we participated in a STEM night at Conger Elementary School, where 4 OIT students and two faculty set up and ran science demos. More than 100 students rotated through our room at this event. Highlights were Boo Bubbles and using kinetic power to turn on a lightbulb. We are hoping to increase public awareness of Natural Science programs at OIT through these outreach efforts with K-12 schools.

As noted above we implemented a communication plan, where prospective students could text with program directors to get their questions answered. This campaign was targeted at students who had been accepted to the majors but had not deposited or registered. While we didn't feel that we got much of a return on these efforts, we are going to try to refine the process slightly this year and try again to see if this is a worthwhile recruitment tool.

We did a better job making college visits more interactive with lab tours and experiments. A few demonstrations that we added to these events this year were building match stick forests to model wildland fires, chemistry titration experiments, and a study where students examined which aspect of a tree has the most lichen. Students and parents who participated had positive things to say about these events.

We developed an articulation with Mt. Hood Community College to make transferring easier.

Related to Goal 2, we adjusted the ENV curriculum to allow for students to take either MATH 111 and 112 or MATH 105 and 110. This provides an opportunity for students who place into a lower math to avoid falling behind in our curriculum.

We also changed the pre-requisites for chemistry to accommodate the new math options. Over the next couple of years we will attempt to collect some data on how effective these changes have been for student success. We did develop an annual schedule which we continue to refine as courses are added and instructors change. It is my hope that in the next couple of years, this will be fairly consistent which will greatly help with advising and planning.

ENV 108 continues to be an important class for fostering connection between students and faculty. In 2024-2025, we camped at the Lava Beds National Monument and had the opportunity to do some spelunking and stargazing. In the evaluations for this class, students commonly note that this course helps them to build community within the program. In 2024-25 we purchased matching coveralls for all the students who took this class and then gave out patches to decorate their coveralls for programmatic achievements at the end of the year. We are hoping that helps with both connection and honors reaching checkpoints while in the program.

The environmental science program has a reputation for producing exceptional graduates who have the professional and technical skills to address environmental challenges and manage natural resources.

## Appendix A— Assessment Artifacts

## Part I: An Introduction to the RES Project

Biology is the study of the phenomena of life, and biological scientists – researchers, teachers, and students – observe living systems, ask questions, and propose explanations for those observations. The scientific method is a way of testing proposed explanations and the primary goal of this term's project is for you to gain experience with each step of this important process. During the course of this term project, you will:

- Formulate a research question on a topic relevant to topics covered this term
- Conduct a literature search
- Develop a study design
- Perform original peer-group research in the field
- Analyze data
- Present results via a peer-group presentation AND an *individual* scientific paper

The unique aspect of this project is its intended length and scope - RAPID. While scientific research can often take months or years to complete, you will conduct your field or lab research over just a few hours, or days. Similarly, many published scientific papers in ecology are over 5,000 words. Your paper will be only 500 words – yet it will contain all the typical aspects of a scientific article including: abstract, introduction, methods, results, and discussion, plus one or two figures or tables.

In addition to your scientific paper, you will present your project via an oral presentation, which will be evaluated by both your instructor and your peers – an essential aspect of science. Finally, you will play the role of critical reviewer, providing constructive feedback to your fellow lab students.

## Part II: Project Steps

This term project encompasses the 8 steps of the scientific process outlined in lab 1's exercises. You and your group will work through each step in the process over the next 8 weeks by completing in-lab exercises and a series of associated assignments.

| Step 1 – Observe and Ask Questions About the Natural World |               |                        |                            |
|------------------------------------------------------------|---------------|------------------------|----------------------------|
| <i>Associated Assignments</i>                              | <i>Due</i>    | <i>Submission Type</i> | <i>Submission Location</i> |
| List of three potential research topics                    | end of week 2 | Individual             | Canvas                     |

Any scientific inquiry begins with an observation we are trying to understand and explain. Scientists use their study of previous research or personal observations of natural phenomena as a basis for asking questions about the underlying causes. Recall from Lab 1 that for a question to be pursued by scientists, it must address phenomena in the natural world that are **well defined** and **testable**. When selecting a topic for research this quarter, it's extremely important to consider several constraints:

- Topic – you are free to come up with your own topic, keeping in mind that the overarching theme of this quarter is *ecology* – the branch of biology that deals with the *relations of organisms to one another and to their physical surroundings* – so your project should fit this general definition.
- Time - while this course is 10 weeks, if you plan your project according to the timeline provided in the RES project guidelines, then you only have 2 weeks (3 at the absolute most) to collect your observations and data. If you plan out all the details of your project very early in the quarter, it may buy you another 1 or 2 weeks for observation. Essentially, your project needs to be something that can be observed in a short period of time. Ideally, you will **complete your observations by week 7**.

- Group Coordination – making sure all members of your group can adequately participate in the project is essential, so please consider the following when selecting your research topics and the logistics that may be involved with it.
  - Will your study be conducted on campus or off campus? If off campus, does everyone have transportation?
  - Will you need access to the lab? If so, will everyone in the group (including your instructor) be able to meet you in the lab at the required intervals so your group can conduct the study?
  - Does everyone’s schedule allow for the time it will take to collect the data?
- Costs and Equipment – we don’t expect you to spend significant sums of money on this project. Effective research projects can be done with little to no cost if well planned. That being said, *we may be able to help you* with the provision of equipment and some supplies, so please ask your instructor once you narrow down your questions.
- Short List of Possible RES Projects – the following is hardly an exhaustive list of potential topics for your RES project but are provided as examples to get you thinking.
  - Study the behavior (response to a stimulus of some sort – temperature, light, food, etc.) of small, easily managed animals like aquarium fish, hermit crabs, isopods, or annelids.
  - Study the population ecology of those same small, easily managed animals placing different densities in habitats and observing their behavior, aspects of their health, etc.
  - Study the growth of fungi to various environmental factors (light, moisture, temperature, etc.)
  - Examine whether the density and/or community composition of trees or other easily identifiable plants change in relation to some abiotic factor (e.g., aspect, elevation, soil type, snowpack, etc.).
  - Examine whether the microorganisms that live in lichen differ between habitat types (e.g., will lichen collected on rocks have a different microorganism community than lichen collected on trees).
  - Compare the survival of trees in areas of varying burn severity of a local wildfire (e.g., 2-4-2, Bootleg, Caldwell, etc.)
  - Examine the habitat use of easily observable birds during the winter (e.g., American Robin, Dark-eyed Junco, etc.).
  - Explore the variables that might affect tree well (the space around a tree under its branches that does not get the same amount of snow as the surrounding open space) formation (e.g., tree diameter, tree height, surrounding tree density, tree species).
  - Examine whether snow pack in burned areas differs with burn intensity.
  - Explore winter habitat use of burned areas by small mammals differ with burn intensity.

| <b>Step 2 – Conduct Background Research</b>                                  |                            |                        |                            |
|------------------------------------------------------------------------------|----------------------------|------------------------|----------------------------|
| <i>Associated Assignments</i>                                                | <i>Due</i>                 | <i>Submission Type</i> | <i>Submission Location</i> |
| Evaluation of three primary literature sources                               | End of week 3’s lab period | Peer-group             | Canvas                     |
| 1 <sup>st</sup> draft of introduction and literature cited sections of paper | End of week 4              | Individual             | Canvas                     |
| 1 <sup>st</sup> draft of discussion and literature cited sections of paper   | End of week 7              | Individual             | Canvas                     |

Conducting background research, sometimes called a “literature review”, is a valuable step in any research project. Familiarizing yourself with the system of interest through the gathering of published literature provides baseline knowledge of the topic, helps refine hypotheses, and can assist in the design of an effective experiment. Week 2’s lab and its associated exercises and assignments will outline effective methods for finding reliable information using OIT’s library and other internet sources.

| Step 3 – Develop a Hypothesis |               |                 |                     |
|-------------------------------|---------------|-----------------|---------------------|
| Associated Assignments        | Due           | Submission Type | Submission Location |
| Project hypothesis            | End of week 3 | Peer-group      | Canvas              |

Recall from our Lab 1 exercises that a scientifically useful hypothesis must be **testable** and **falsifiable**. In order to be falsifiable, it must be possible that the test results do not support the explanation. In our example lichen study, the *test* was to compare the abundance of lichen on trees across the four primary aspects (north, south, east, and west). If the abundance of lichen was equal across all aspects, then the hypothesis was *falsified*. Conversely, if we found more lichen on the north side of our sample trees, then the hypothesis was *supported* by the data.

| Step 4 – Define Variables and Generate Predictions    |                            |                 |                     |
|-------------------------------------------------------|----------------------------|-----------------|---------------------|
| Associated Assignments                                | Due                        | Submission Type | Submission Location |
| Definition of variables and generation of predictions | End of week 4's lab period | Peer-group      | Canvas              |

In order to make predictions and design an experiment to test a hypothesis, the investigator must identify and define the **dependent**, **independent**, and **controlled** variables.

*Dependent* variables are those that are measured, counted, or observed in response to experimental conditions (e.g., the number of lichen on a given aspect of a tree). The *independent* variable is considered the most important variable, as it is used to test the investigator's hypothesis. It is the variable that is manipulated by the scientist (e.g., the aspect on the tree where lichen are found).

*Controlled* variables are alternative independent variables that might have an effect on the dependent variable but are not part of the hypothesis being tested. For example, other conditions might affect the frequency of lichen on a tree that are not related to our independent variable of interest such as: tree species, depth of bark furrows, or the amount of shade cast on the surface from neighboring trees or structures. To effectively test the effect of sun exposure on lichen abundance, these other variables must be held constant, or be *controlled*. This could be accomplished by ensuring that observations are recorded on the same tree species, with similar bark complexity, shading, etc.

Finally, an effective research hypothesis should have an associated **prediction**. A prediction is what you expect to see in the data if your hypothesis is supported. One way to easily formulate a prediction from your hypothesis is to think of it in terms of if/then statement that predicts the outcome of your test if the hypothesis is supported. For example, "If the abundance of lichen is inversely related to sun exposure, then there will be significantly more lichen on the sides of the tree that are shaded (north aspects) than the sides of the tree that receive more sunlight (south aspects).

| Step 5 – Design Tests of the Predictions       |                            |                 |                     |
|------------------------------------------------|----------------------------|-----------------|---------------------|
| Associated Assignments                         | Due                        | Submission Type | Submission Location |
| Study design, equipment list, project timeline | End of week 4's lab period | Peer-group      | Canvas              |

A study design is a specific plan or protocol for *testing your predictions*. It allows the investigator to translate the conceptual hypothesis into an operational one. This step often requires some background knowledge of your topic, either through personal observations, experience, or a search of the literature – a step that your peer-group conducted during week 2's lab. While it may seem daunting at first, begin by recalling the hypothesis your group decided to test (step 3, above), then using the variables defined in step 4's assignment, think about how you will measure, observe,

and/or control them. For example, to examine the effect of sun exposure on lichen abundance, we needed to:

1. Define an area or population of trees from which to draw lichen samples.
2. Ensure that the trees are the same species, of similar ages, and share similar light exposure patterns (controlled variables).
3. Determine a method of quantifying lichen on each tree.

Recall from lab 1 that drafting a data collection sheet can be helpful in organizing the required information. Be sure to think about what you are measuring and why. For example, in lab 1, we quantified lichen at predetermined heights around the entire circumference of the tree which enabled us to effectively evaluate the hypothesis that lichen abundance is inversely related to sun exposure. In addition to the core variables, is there other ancillary information that would help contextualize and organize your data? In the lichen study, we recorded information such as tree number, sample height, and tree circumference as they were useful in determining in which aspect lichen were most abundant.

| Step 6 – Conduct Test by Observing or Measuring in the Field |               |                        |                            |
|--------------------------------------------------------------|---------------|------------------------|----------------------------|
| <i>Associated Assignments</i>                                | <i>Due</i>    | <i>Submission Type</i> | <i>Submission Location</i> |
| Spread sheet of collected observations (raw data)            | End of week 5 | Peer-group             | Canvas                     |

During this step, your group will collect data in the field according to the study design created in step 5's assignment. Observations (data) will be entered into a spreadsheet and submitted to your instructor.

| Step 7 – Examine the Results  |               |                        |                            |
|-------------------------------|---------------|------------------------|----------------------------|
| <i>Associated Assignments</i> | <i>Due</i>    | <i>Submission Type</i> | <i>Submission Location</i> |
| Tables and Figures            | End of week 6 | Peer-group             | Canvas                     |

Once data is collected, they must be organized and summarized so that your group can determine if the hypothesis has been supported or falsified. This step can be daunting for many, fun for others. This is where you get to examine the data your group collected and look for relationships between your variables. Scientists typically use tables and figures to achieve this goal. These tools assist in analysis and interpretation, in addition to enhancing the clarity with which results are presented to the reader or evaluator.

**Tables** – are useful for displaying **summarized** results (NOT RAW DATA) when the quantitative values, rather than trends, are the focus. For example, when the average number of some variable is a useful measure of the experiment's success (e.g., the mean abundance of lichen on north aspects is greater than the mean abundance of lichen in the south, west, and east aspects).

The following guidelines will help you construct a successful *table*:

- All values of the same kind should read down the column, not across a row. Include only data that are important in presenting the results and for further discussion.
- Information and results that are *not* essential (e.g., test tube number, subject's name, etc.) should be *omitted*.
- The heading of each column should include units of measurement, if appropriate.
- Tables are numbered consecutively throughout a lab report or scientific paper.
- The title, which is located at the top of the table should be clear and concise, with enough information to allow the table to be understandable apart from the text.

**Figures** – graphs, diagrams, drawings, and photographs are all called figures. They provide visual representation of the results. Often, characteristics of the data that are not apparent in a table become clear in a graph. The results of an experiment usually are presented graphically, showing the relationships among the independent and dependent variable(s).

The following guidelines will help you construct a successful *graph*:

- The independent variable is graphed on the x-axis and the dependent variable on the y-axis.
- The numerical range for each axis should be appropriate for the data being plotted. Choose your intervals and range to maximize the use of the graph space. Keep intervals spaced such that interpretation remains clear.
- Label the axes to indicate the variable and units of measurement. Include a legend if colors or shading are used.
- Choose the type of graph that best presents your data. Line and bar graphs are the most frequently used. This choice of graph depends on the nature of the variable being graphed.
- Compose a title for your figure and place it below your graph. Figures should be numbered consecutively throughout lab reports or scientific papers. Each figure is given a caption or title that describes its contents, giving enough information to allow the figure to stand alone.

| Step 8 – Interpret and Communicate Results                                   |                                                           |                 |                      |
|------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------|----------------------|
| Associated Assignments                                                       | Due                                                       | Submission Type | Submission Location  |
| 1 <sup>st</sup> draft of introduction and literature cited sections of paper | End of week 4                                             | Individual      | Canvas               |
| 1 <sup>st</sup> draft of discussion and literature cited sections of paper   | End of week 7                                             | Individual      | Canvas               |
| Peer Group Presentation                                                      | During weeks 9 & 10                                       | Peer-group      | In lab and on Canvas |
| Final Paper                                                                  | End of the day of your assigned lab period during week 10 | Individual      | Canvas               |

The final step of your RES project is to communicate your results. There are two major ways that scientific information gets communicated among colleagues and the general public. The first is an oral presentation, often conducted during a conference gathering of scientists with similar interests (The Ecological Society of America, for example). The second is a written publication in a peer-reviewed scientific journal. For the RES project, you will synthesize everything you have done into a brief, yet informative, *oral presentation* AND a 500-word<sup>1</sup> *scientific paper*.

#### Oral Presentation

Your **peer group** will create a concise 15-minute visual summary of your research project for presentation to your peers during the last two lab sessions of the quarter.

#### Scientific Paper

You will **individually** write a concise 500-word<sup>1</sup> summary of your project and include the following *seven key aspects of a successful scientific paper*:

1. **Title:** Strive for a concise, yet informative title that lets the reader know what the paper is about.
2. **Abstract:** This is a very brief summary of the entire paper. It should include a sentence that states the research question and why it is important to the larger topic being studied; a sentence describing the methods; one or two sentences about your results; and a concluding sentence. Literature is not cited in the abstract.

<sup>1</sup> Note that the 500-word count only applies to narrative sections. It does not include the paper's title, the abstract, references, figure captions, etc.

3. **Introduction:** This section establishes the context for your research and includes the following:
  - a) A statement of the importance of the topic you are studying. Why should the reader care?
  - b) A brief summary on the current knowledge on your topic by citing at least 3 peer reviewed papers.
  - c) Justification for your hypothesis and/or an explanation of how your specific research question will fill an existing gap in or contribute to the overall body of knowledge on your topic.
  - d) A clear statement of your research question and hypothesis.
  - e) A clear statement of at least one prediction based on your research hypothesis.

In essence, an introduction starts “big” introducing your general field of research and works down to how your specific study fits into that large picture. This is the opposite of your discussion (see hourglass figure below). A primary element of the introduction is a review of the current scientific literature that builds justification for your hypothesis; thus, you will be citing the primary literature frequently throughout this section of your paper. Essentially, any statement of fact needs to include a citation. For example, the following sentence asserts how and why lichen are important and backs up the statement by citing published research.

*Lichen are key components of terrestrial ecosystems due to both their pioneering and engineering capabilities (Asplund et al. 2017).*

When the source paper is authored by only one researcher (as above) simply include the author’s last name and the year of publication. If the paper has two authors, list both, followed by the year (Sheard and Jonescu 1974). A paper with more than two authors only lists the first author’s name followed by et al. and the year (Schoustra et al. 2005). A statement that is supported by more than one source separates *each source* with a comma (Barrow 2000, Leu and Murray 2006, Dettman et al. 2007).

4. **Methods:** Describe where and how you set up your study design, exactly how you collected your observations, and the materials and supplies used. *It should have enough detail to allow a reader to replicate your study.*
5. **Results:** This section *narratively summarizes* your results from the analysis of your data. It reports the facts of what you found. Your description of results will refer to your tables and/or figures that also *summarize* your data. For example, “Lichen abundance was greatest on north aspects with a mean of 5.7, and lowest on south aspects with a mean of 0 (Table 1 and Figure 1).” This lets the reader know they should refer to both Table 1 and Figure 1 in your paper for a visual representation of your findings. This section presents summarized, *not raw* data. This section does not interpret your results in any way. That is saved for the discussion section. Raw data is *NOT* reported – only summaries of data.
  - a) **Figures and/or Tables:** You must include at least one figure or table in your paper. Figures and tables should *summarize* your data and emphasize your key results. They should not show raw (the full set of unanalyzed

**Table 1.** Mean lichen abundance across four directional aspects sampled from three trees on the Oregon Tech campus, Klamath Falls, Oregon.

| Tree | Aspect |      |       |      |
|------|--------|------|-------|------|
|      | North  | East | South | West |
| 1    | 5      | 0    | 0     | 3    |
| 2    | 3      | 2    | 0     | 0    |
| 3    | 9      | 1    | 0     | 2    |
| Mean | 5.7    | 1.0  | 0.0   | 1.7  |

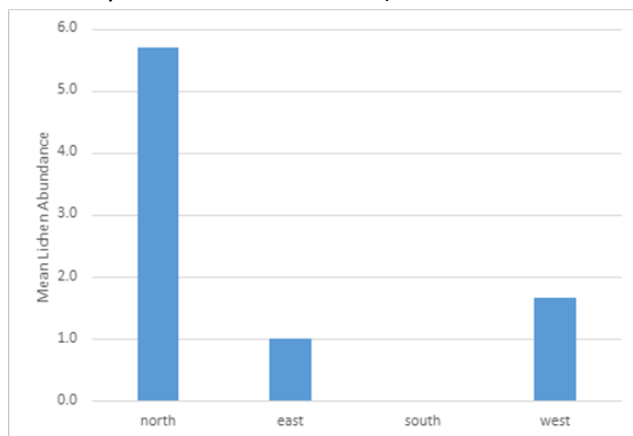


**Figure 1.** Mean lichen abundance across four directional aspects sampled from three trees on the Oregon Tech campus, Klamath Falls, Oregon.

data) data. Figures and tables also *require a caption*. Captions must be numbered and should completely describe the figure or table such that they could stand alone, independent of your paper, and the reader would still have an idea of the question your study examined. Placement of captions differs between tables and figures. Table captions are placed above the table, while figure captions are placed below (see example below).

6. Discussion/Conclusion: This section reiterates your key results using brief, summarizing statements. It does **not** report hard numbers or statistics. Did your observations support or refute your original hypothesis and prediction? How do your results compare with other studies examining similar questions (this is where you will cite other studies)? If your results were not as you expected speculate and discuss why. Was it your methods? Study sites? The time of year? What would you do differently if you repeated this study?
7. References: Here you will list, in alphabetical order by author, all the papers you cited within your RES report. We will use the official format and style of the Ecological Society of America (ESA) which publishes numerous professional journals in the field of ecology. ESA style formatting is as follows and needs to be followed EXACTLY:

Journal article with one author:

FORMAT: Last name, First initial. Second initial. Date. Title. Italicized journal title volume number(issue- if applicable): inclusive page numbers.

EXAMPLE: Smith, V. H. 1986. Light and nutrient effects on the relative biomass of blue-green algae in lake phytoplankton. *Canadian Journal of Fisheries and Aquatic Sciences* 43:148–153.

Journal article with two or more authors:

FORMAT: Last name and initial(s) of author, followed by initials and then Last name of additional authors. Year of publication. Title of article. Italicized journal title Volume number(issue – if applicable): Inclusive page numbers.

EXAMPLE: Elser, J. J., and K. Urabe. 1999. The stoichiometry of consumer-driven nutrient recycling: theory, observations, and consequences. *Ecology* 80:735–751.

EXAMPLE: Elser, J.J., K. Urabe, and D.B. Cooper. 1999. The stoichiometry of consumer-driven nutrient recycling: theory, observations, and consequences. *Ecology* 80:735–751.

Online journals that don't have volume, issue, or page numbers

FORMAT: Last Name, First Initial. Second Initial. Year of publication. Title of article. Italicized Title of Journal. DOI number.

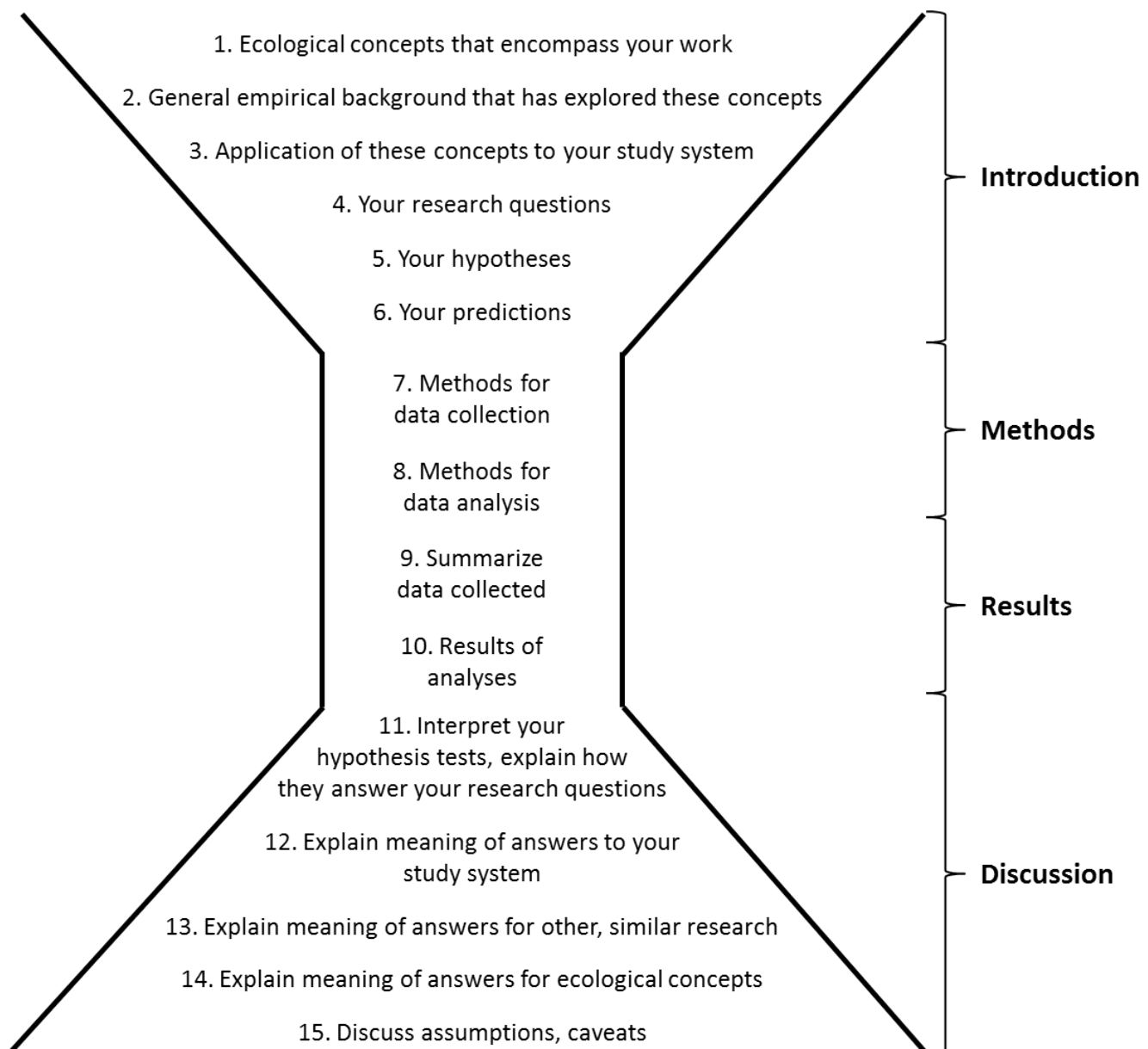
EXAMPLE: London, J. M., J. M. Ver Hoef, S. J. Jeffries, M. M. Lance, and P. L. Boveng. 2012. Haul-out behavior of harbor seals (*Phoca vitulina*) in Hood Canal, Washington. PLoS ONE 7:e38180.  
doi:10.1371/journal.pone.0118883.

Notes on ESA Style

- Always list the author names in the order in which they appear on the paper. Researchers carefully determine the order of authorship on a paper, and you need to preserve it to ensure that the article is recognizable, findable, and fairly credited.
- Note that all author names are listed as first initials and last names. Even if you know the whole first name, the Ecology format dictates that using initials only in the Literature Cited list. Note also that the first name is given last name first, then initials and any additional authors are listed initials first, then last name.

- Note that there are spaces between the initials.
- Note that the journal name is written out completely. In older issues of Ecology, citations included bold font for volume number of journal articles. In recent issues, the volume number has not been bolded. Note that issue numbers for journal articles are not listed.
- Always italicize species names.
- Please DO NOT follow your citation with a weblink to the article! DOI numbers are permitted, but not full weblinks.

**Putting It All Together.** Illustrated in the figure below is a helpful way to organize your thoughts when writing your paper. The scientific process goes from a broad concept about your topic and narrows when we formulate our hypothesis. Our focus then becomes very specific while we collect and analyze our data but begins to expand back out as we draw conclusions and relate our findings to the broader body of knowledge on the topic. One of the most helpful things you can do while writing your own paper is to examine published literature. Strive to pattern your writing after the articles you have read and cited in support of your paper. How do those authors organize their introduction? What aspects of their methods do they describe? How do they describe their results?



### Part III: Overview of RES Project Requirements and Due Dates

The following table provides an overview of all the activities and assignments required of you and your peer group in order to successfully complete the RES project this term. Specific details of each assignment are posted on canvas.

| Week | In Lab RES Activity                                                 | In Lab RES Assignment                      | Submission Type            | Due Date           | Homework Due Before Next Lab                                    | Submission Type          | Due Date                                    |
|------|---------------------------------------------------------------------|--------------------------------------------|----------------------------|--------------------|-----------------------------------------------------------------|--------------------------|---------------------------------------------|
| 2    | Basics of Scientific Investigation                                  | Skills Inventory                           | <i>Individual Hardcopy</i> | Before Leaving Lab | Step 1. Observe and Ask Questions About Natural World           | <i>Individual Canvas</i> | End of week 2                               |
| 3    | Step 2. Background Research                                         | Evaluation of Three Primary Sources        | <i>Group Hardcopy</i>      | Before Leaving Lab | Step 3. Develop a Hypothesis                                    | <i>Group Canvas</i>      | End of week 3                               |
| 4    | Step 4. Define Variables and Generate Predictions                   | Defined Variables and Predictions          | <i>Group Canvas</i>        | Before Leaving Lab | Step 8. Interpret and Communicate Results – <i>Introduction</i> | <i>Individual Canvas</i> | End of week 4                               |
|      | Step 5. Design Tests of the Predictions                             | Study Design                               |                            |                    |                                                                 |                          |                                             |
| 5    | Step 6. Conduct Test by Observing of Measuring in the Field         | Collect Data<br><b>NO LAB THIS WEEK</b>    | None                       | None               | Step 6. Conduct Test – <i>Raw Data</i>                          | <i>Group Canvas</i>      | End of week 5                               |
| 6    | Step 7. Examine the Results – <i>Data Organization and Analysis</i> | None                                       | None                       | None               | Step 7. Examine the Results – <i>Tables and Figures</i>         | <i>Group Canvas</i>      | End of week 6                               |
| 7    | Step 8. Interpret and Communicate Results – <i>Discussion</i>       | None                                       | None                       | None               | Step 8. Interpret and Communicate Results – <i>Discussion</i>   | <i>Individual Canvas</i> | End of week 7                               |
| 8    | Step 8. Interpret and Communicate Results – <i>Presentation</i>     | None                                       | None                       | None               | Step 8. Interpret and Communicate Results – <i>Presentation</i> | <i>Group Canvas</i>      | End if week 8                               |
| 9    | Step 8. Interpret and Communicate Results – <i>Final Paper</i>      | <i>Group Presentation</i> (half the class) | <i>Group Canvas</i>        | Before Leaving Lab | Final Paper                                                     | <i>Individual Canvas</i> | End of your assigned lab day during week 10 |
| 10   | Step 8. Interpret and Communicate Results                           | <i>Group Presentation</i> (half the class) | <i>Group Canvas</i>        | Before Leaving Lab | Final Paper                                                     | <i>Individual Canvas</i> | End of your assigned lab day during week 10 |

## ENV 108 Group Project 2024

This year, I would like each group to identify an ENV programmatic problem or an environmental related issue on campus which your group would like to address. Remember to choose something that can be completed in our relatively short timeline with little to no budget. Confer with me prior to submitting your project proposal. Problem examples could include but are definitely not limited to:

- Challenges with programmatic communications
- Lack of ENV social media presence (we do have Instagram and Facebook)
- Lack of opportunities for community building
- Advising challenges
- Particularly challenging classes in the curriculum and how to promote student success.
- Disorganized labs or research spaces
- Unkept gardens/green spaces

Create a solution to the problem and then implement it over the course of the term.

Upload proof of your solution. This could be a variety of products depending on the problem you choose to focus on.

Examples might include:

- Pictures of your group doing the work or of a completed product.
- Documents or spreadsheets
- Links to online content
- Counts of attendees at an event or sign in sheets

## ENV 226 Practical 3 Designing a Project

- ✓ LO 9.1 Combine the principals you have learned in this class about data analysis and presentation to design your own research project based on available data.
- ✓ LO 9.2 Present your findings in a PowerPoint presentation.
- ✓ LO 9.3 Critically evaluate the analysis done by your peers.

### Part 2 – Background Research and Methods

Conducting background research, sometimes called a “literature review”, is a valuable step in any research project. Familiarizing yourself with the system of interest through the gathering of published literature provides baseline knowledge of the topic, helps refine hypotheses, and can assist in the design of an effective experiment.

Do a search using Google Scholar or the Oregon Tech Library search engine for journal articles which relate to your question. Find at least 3 related articles. Read them carefully paying particular attention to the types of data they used and how they ran their analysis. Think about these questions as you are reading and take notes.

- How does your question fit into this broader context of this research?
- What are some important highlights related to the topic that you learned by reading these articles?
- Do you need to refine your hypothesis based on what you have learned?

**Turn it in:** Today’s assignment focuses your introduction and methods sections.

Open the final project PowerPoint that you created last week.

Go to the Intro Slide 2 that you left blank and fill it in with some background information that you learned from these other studies. Site at least one piece of information from each of the three articles. You should include APA in text citations for each item given. You are welcome add an additional intro slide if you find that there is too much info for one slide.

Refine your hypothesis if needed based on your increased knowledge of the subject.

Add a References slide to the end of your presentation and provide the full APA reference list for the journal articles on this slide. References should be listed in alphabetical order.

Now that you have a well-developed question and hypothesis, it’s time to create your methods section. Remember the constraint from your last assignment that your question must be testable.

- ✓ Testable – You need to be able to apply a statistical method for testing your hypothesis. All the tests that we have learned have assumptions associated with them such as the data points are independent and/or that the data is normally distributed. Certain tests are better for different types of data. You must take all these points into consideration when choosing a method for analysis.

Normally, methods would include both data collection and analysis methods, but since we are using available data, you just need to identify the data source and choose the best test for your question.

Add Methods slide 1 which identifies the data you are using with in text citations for the source of the data. Be sure to add a full reference on your References slide.

Add Methods slide 2 which will describe the test you are going to use for your analysis and provides the reasoning for why you are using this test.

**Turn in your PowerPoint on Canvas with these new slides included.**

## ENV 226 Practical 3 Designing a Project

- ✓ LO 9.1 Combine the principals you have learned in this class about data analysis and presentation to design your own research project based on available data.
- ✓ LO 9.2 Present your findings in a PowerPoint presentation.
- ✓ LO 9.3 Critically evaluate the analysis done by your peers.

### Part 3 – Results and Conclusions

Once data is collected, they must be organized and summarized so that you can determine if the hypothesis has been supported or falsified. This is where you get to examine the data and look for relationships between your variables. Scientists typically use tables, figures, and statistical tests to achieve this goal. These tools assist in analysis and interpretation, in addition to enhancing the clarity with which results are presented to the reader or evaluator.

Tables – are useful for displaying summarized results (NOT RAW DATA) when the quantitative values, rather than trends, are the focus. For example, when the average number of some variable is a useful measure of the experiment's success (e.g., the mean abundance of lichen on north aspects is greater than the mean abundance of lichen in the south, west, and east aspects).

The following guidelines will help you construct a successful table:

- All values of the same kind should read down the column, not across a row. Include only data that are important in presenting the results and for further discussion.
- Information and results that are not essential (e.g., test tube number, subject's name, etc.) should be omitted.
- The heading of each column should include units of measurement, if appropriate.
- Tables are numbered consecutively throughout a lab report or scientific paper.
- The title, which is located at the top of the table should be clear and concise, with enough information to allow the table to be understandable apart from the text.

Figures – graphs, diagrams, drawings, and photographs are all called figures. They provide visual representation of the results. Often, characteristics of the data that are not apparent in a table become clear in a graph. The results of an experiment usually are presented graphically, showing the relationships among the independent and dependent variable(s).

- The following guidelines will help you construct a successful graph:
- The independent variable is graphed on the x-axis and the dependent variable on the y-axis.
- The numerical range for each axis should be appropriate for the data being plotted. Choose your intervals and range to maximize the use of the graph space. Keep intervals spaced such that interpretation remains clear.

- Label the axes to indicate the variable and units of measurement. Include a legend if colors or shading are used.
- Choose the type of graph that best presents your data. Line and bar graphs are the most frequently used. This choice of graph depends on the nature of the variable being graphed.
- Compose a stand-alone caption. Figures should be numbered consecutively throughout lab reports or scientific papers. Each figure is given a caption that describes its contents, giving enough information to allow the figure to stand alone. Captions should include an in-text citation for the data.

Tests – We have learned about a variety of statistical tests this term including Chi Square, Fisher's Exact, T-tests, f-tests, and correlation coefficients. You should run the statistical test that best answers your question given the type of data you have. Present your results from your analysis in APA format.

**Turn it in:** We are continuing to add to your Final Project PowerPoint presentation.

Add a Results 1 slide after your methods and present a table with appropriate summary data related to your analysis. This could include descriptive statistics or might be a contingency table.

Add a Results 2 Slide which has a graph which best displays the data in your analysis.

Add a Results 3 Slide which presents the results of the test you used in APA format.

Finally, add a Discussion slide: This section reiterates your key results using brief, summarizing statements. It does not report hard numbers or statistics. Identify the limitations of the data if any. Did your observations support or refute your original hypothesis and prediction? How do your results compare with other studies examining similar questions (this is where you will cite other studies)? If your results were not as you expected speculate and discuss why. What would you do differently if you repeated this study?

Upload a completed draft of your PowerPoint on Canvas.

## Appendix B— Project Rubrics

**Title (3%, or 1.0pts)**

- Effectively describes the project.

**Abstract (5%, or 1.5pts)**

- Concisely reviews of *all components* of paper (1pt)
- Proper length - e.g., 1-2 sentences from each section (0.5pts)

**Introduction: (20%, or 6pts)**

- Establishes the context for the research topic
- Includes a statement of the importance of the topic
- Briefly summarizes the current knowledge of topic and cites at least 3 peer reviewed papers
- Justifies hypothesis and/or explains how hypothesis will contribute to existing knowledge.
- Clearly states research hypothesis
- Clearly states a prediction based on hypothesis

**Methods (10%, or 3pts)**

- Describes study design
- Lists equipment and supplies used
- Describes each step of data collection in enough detail that study could be replicated

**Results (20%, or 6pts)**

- *Narratively describes summarized data* in terms of total numbers, means, etc. (2pts)
- Refers to table(s) and/or figure(s) in narrative description of results (1pt)
- Table(s) and figure(s) have *numbered, detailed captions* that can stand alone (1pt)
- Table(s) and figure(s) have units (e.g., mm, cm, g, etc.) clearly defined (1pt)
- No raw data is shown or reported (1pt)

**Discussion (20%, or 6pts)**

- Clearly states whether results support or refute research hypothesis (1pt)
- Compares results to other published studies (2pts)
- Speculates on reasons for similarities and/or differences in results - methodology, mistakes, etc. (2pts)
- Draw reasonable conclusions (1pt)

**Lit Cited (5%, or 1.5pts)**

- Contains *at least 3 peer-reviewed sources* (0.5pts)
- *Exactly* follows format outlined in RES Guidelines (e.g., placement of initials, commas, periods, dates, etc.) (1pt)

**Overall presentation (17%, or 5pts)**

- Proper length – not well over or under 500 words, keeping in mind there was no minimum (1pt)
- Proper grammar and spelling (1pt)
- Good organization, flow, and transition –doesn't feel like it was written carelessly and without review (2pts)
- Ideas clearly communicated (1pt)

## Final Project Presentations

Student:

Topic:

|                                                                                                                  | pts possible | pts earned |
|------------------------------------------------------------------------------------------------------------------|--------------|------------|
| All 5 sections of a scientific presentation were present: Intro, methods, Results, Discussion, References        | 1            |            |
| Nicely formatted title slide with author and affiliation shown.                                                  | 1            |            |
| Question was clearly stated.                                                                                     | 1            |            |
| Introduction included a reference to at least one scientific paper with a citation for this research.            | 2            |            |
| Variables examined appropriately address the question.                                                           | 2            |            |
| Accurately stated null hypothesis.                                                                               | 2            |            |
| Alternative hypothesis clearly identifies the expected trend in the data beyond just that the data is different. | 1            |            |
| Student provided acceptable reasoning for their analysis methods.                                                | 3            |            |
| Student addressed the uncertainty of the data                                                                    | 2            |            |
| Student clearly stated the results of their analysis using APA formating as appropriate.                         | 2            |            |
| Student correctly interpreted the results of any tests used.                                                     | 3            |            |
| Relevant figures/tables were provided to support the analysis and each included the following things:            | 2            |            |
| Appropriate title and axis labels for graphs                                                                     | 1            |            |
| Captions that were detailed enough that if the figure were taken out of context it could easily be interpreted.  | 2            |            |
| Captions included sources for the data.                                                                          | 1            |            |
| No grammerical mistakes on slides.                                                                               | 2            |            |
| Numbers shown on slides were expressed to an appropriate significance.                                           | 1            |            |
| Student used a professional looking design for their slides.                                                     | 1            |            |
| Presentation was between 7-9 minutes (failure to do this results in a 3pt deduction)                             | 0            |            |
| Reference page was included. (failure to do this results in a zero score on the assignment).                     | 0            |            |
|                                                                                                                  |              |            |
| Average Evaluation Score from Peers                                                                              | 5            |            |
|                                                                                                                  |              |            |
| <b>Total</b>                                                                                                     | <b>35</b>    | <b>0</b>   |

Feedback to Student:

## Appendix C– ENV Research Symposium Program

# ENVIRONMENTAL SCIENCE SYMPOSIUM

January 24, 2025

Students analyze environmental conditions and problems through applied research and fieldwork, all within the stunning natural setting of the Klamath Basin.

Oregon Tech  
BH 108  
5:30p.m.

<https://www.oit.edu/academics/degrees/natural-resources>



# Presentations



**Bella Tenold**

## **Summer as a Rangeland Technician for The Bureau of Land Management**

Bella Tenold, BLM Rangeland Specialists

This talk by **Bella Tenold** explores the roles of Rangeland Technicians in the sustainable management of public lands, specifically within the Bureau of Land Management (BLM). Rangeland health and maintenance is not only essential for local communities that depend on grazing and farming, but it is also crucial for maintaining healthy habitats and ensuring that land is not overused, which could negatively affect other species and ecosystems. The work of Rangeland Technicians involves monitoring land conditions to ensure its long-term sustainability. Key monitoring includes utilization studies, Proper Functioning Condition (PFC) assessments, and Multiple Indicator Monitoring (MIM), all aimed at evaluating vegetation, soil health, and riparian systems. This approach combines ecological knowledge with hands-on management, such as fencing projects and compliance checks, to support the resilience of rangeland ecosystems.



**Isabella Heaton**

## **U.S. Fish and Wildlife IPM Technician Work**

Isabella Heaton, John Vradenburg

In this presentation, **Isabella Heaton**, will share her experience as a technician at the Klamath Basin Wildlife Refuges over summer 2024. Waterfowl management is an important component of work on the refuge including responsibilities such as conducting surveys, banding waterfowl, monitoring disease outbreaks, and more. The goal of these efforts is to support waterfowl populations and their habitats in the Klamath Basin while contributing long-term data for research and management.



**Carley Rogers**

## **Identification of Cyanobacteria in the Upper Klamath Lake**

Carley Rogers, Gage Delzotti, Dr. Kamal Gandhi, Dr. Ken Usher

This research project aims to collect and analyze cyanobacteria samples from Upper Klamath Lake (UKL). UKL is known for yearly algal blooms of *Aphanizomenon flos-aquae* (AFA) and *Microcystis aeruginosa* (MA). AFA is harvested as a nutritional supplement, whereas MA is known to produce a cyanotoxin. This past summer, student research assistants, **Carley Rogers** and **Gage Delzotti**, collected water samples with the addition of inorganic water quality data in hopes of finding a correlation between the algal bloom season and different water quality markers. Being presented is the water quality data collected and its interpretations. On display, graphs depict the inorganic condition of the lake throughout the anticipated algal bloom season (May 2024–Sept. 2024). This information will be further useful in drawing conclusions about the upcoming DNA extractions and quantification of the microcystin cyanotoxin in the collected lake water, for which we will be utilizing qPCR lab techniques.



**Gage Delzotti**

# Posters



Theo Rogers

## **Fuel-reduction Treatments Increase Growth of Ponderosa Pine (*Pinus Ponderosa*)**

Theo Rogers, Israel Ornelas, Jordan Hevern, Prof. Kerry Farris

A century of fire suppression has altered forest structure throughout western North America resulting in unnaturally dense stands capable of carrying high intensity crown fires. Klamath Falls' Moore Park exemplifies this situation. In response to this, the City of Klamath Falls Parks Department (KFPD) implemented mastication treatments between 2005 and 2012 that successfully removed areas of dense shrubs, thereby reducing the probability of a ground fire spreading to overstory tree canopy. While the primary goal of these treatments was to decrease wildfire threat, they may also carry the added benefit of enhancing tree growth. Dense understory vegetation can directly compete with overstory trees and has been shown to negatively affect growth in several conifer species. Previous research has documented the negative effects of understory vegetation on overstory tree growth using metrics such as tree diameter and stand volume. We use estimates of yearly wood production (basal area increment) to examine the effects of shrub removal on the growth of ponderosa pine in Moore Park. We hypothesize that shrub removal treatments will have a positive effect on yearly wood production and predict that basal area increment will be significantly greater in the years following treatment than in the years preceding treatment.



Iseal Ornelas



Nicki Johnston

## **Pollinator Richness Across Cultivated and Natural Habitats at Oregon Tech**

Nicki Johnston, Angelina Setka, Peter Woltjer, Prof. Christy VanRooyen

Habitat and floral resource availability plays a vital role in pollinator foraging behavior. The difference between cultivated and natural habitats can be extreme. During the summer of 2024, undergraduate researchers surveyed native pollinators at three different sites on the Oregon Tech Campus. Two of these sites are pollinator gardens planted specifically with a pollinator wildflower seed mix. The third site is our native plant garden, a juniper-sagebrush hillside with native forb species. This study compares pollinator species abundance and richness across all three sites and highlights the value of having diverse floral resources to promote pollinator conservation.



Angelina Setka

## **Using Water Quality to Investigate a Unique Approach to Post-Fire Stream Protection**

Tegan Running, Abby Gamble, Dr. Travis Owen

The 2021 Bootleg Fire burned for five weeks, consuming over 400,000 acres of forest and shrublands in eastern Klamath County, Oregon. This extensive wildfire resulted in a dramatic loss of vegetative cover, which serves as essential habitat for diverse terrestrial and aquatic species. In riparian systems, the fire's negative effects include destabilized streambanks, accelerated erosion, increased sedimentation, and deteriorated water quality, posing significant challenges to ecosystem stability and species recovery. Local entities responded by felling burned trees and placing them in and across stream channels to serve as barriers, mitigating the downstream flow of debris and sediment. This project measures resultant water quality from the placement of these felled trees to better understand the impacts on aquatic species, especially the bull trout (*Salvelinus confluentus*) known to have stable habitats in these streams. Water quality measurements were conducted at over twenty sites across five streams during two sampling trips. Parameters included pH, dissolved oxygen, conductivity, turbidity, nitrate, and phosphorus. This project aims to provide critical data on post-fire impacts to aquatic systems, equipping private landowners, government agencies, and non-profit organizations with the knowledge needed to develop timely and effective mitigation strategies to conserve the habitat of the bull trout.



Tegan Running



Abby Gamble