Provost's Initiative on Undergraduate Research
Undergraduate Research Collaboration Award Application
Spring 2018 Awards

Applications will be due to ██ at noon. Questions about this program may be forwarded to ████████████████████ Assistant Provost and chair of the Undergraduate Research Advisory Board. All proposals will be evaluated by a subcommittee of the Undergraduate Research Advisory Board.

Name of Faculty Applicant: ██
████████

Do you have experience researching collaboratively with an undergraduate in the past? If so please list your past experiences.

██
████████████████████

Name of Proposed Student Applicant(s):

████████████████████

Have you worked with this student before? **No, I have not.**

Does this student have experience collaborating on faculty research? ████████████

Title of Proposal:

Salmon recovery efforts in the Willamette River Basin. Will they withstand climate change?

Will you receive financial support from another source (university or external) for this project during the spring semester?

No, I will not.

If so, what is the source of the funding?

I. Please provide a brief summary of the proposed research project; include any potential deliverables for the project.

Salmon plays an important role in the Pacific Northwest. The fishing industry including commercial and touristic fishing is substantial (Oregon Department of Fish and Wildlife, 2016; TCW Economics, 2008) Salmon fishing forms an integral part of tribal culture and more generally has its place in the local iconography providing cultural value (National Research Council, 1996).
However, salmon populations have been negatively impacted by overfishing as well as a number of land use changes which began with the arrival of settlers in the late 19th century. Examples include mining, logging and removal of riparian woodland along streams, all of which are related to the destruction of salmon habitats, as are the construction of dams that prevent salmon migration (Lichatowich, 2001).

Consequently, a number of salmon and steelhead species in the Pacific NW have become listed as threatened or endangered under the Endangered Species Act since the early 1990s Washington State 2009, "in danger of extinction throughout all or a significant portion of its range", or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (US Fish and Wildlife Service, 1973). This listing requires the responsible agencies to develop and implement recovery plans for salmon and steelhead to restore the threatened and endangered species to the point that they are again self-sustaining elements of their ecosystems (NOAA, 2016).

By 1999, US$ 3billion had been invested in recovery efforts for salmon species in the Pacific Northwest (Lichatowich, 2011). Nearly twenty years later, in 2017, the number is likely nearing US$10 billion. Recovery efforts include a wide spectrum of measures from removing dams and other barriers to reconnecting fish habitat (to allow for salmon migration), as well as planting riparian woodland to reduce erosion and increase shading and generally improving the water quality of the stream.

Recovery efforts aim to restore salmon abundance based on historic environmental conditions but climate change has begun to alter environmental conditions and will increasingly do so in the future. Climate change impacts include increased stream temperatures which negatively impact salmon survival rates as well as changes in inter-annual flow rates and related to this increased flood risk which may negatively impact salmon habitat(Battin et al., 2007; Mantua, Tohver, & Hamlet, 2010; Mote et al., 2003). The success of recovery efforts may, therefore, be limited if the impacts of climate changes are not taken into account.

Given the legal requirement of the ESA to restore salmon populations and the magnitude of expenditures for recovery efforts, it is paramount to identify recovery efforts which are most likely to provide significant benefits going forward. This research project, therefore, proposes to analyse the recovery efforts for the Willamette River sub-basin in Oregon to identify the salmon recovery measures which will likely perform well under different climate changes outcomes. The research project would fill a gap in the existing literature. Research has predominantly focused on either the impact of recovery measures under historic environmental conditions (Lackey, Lach, & Duncan, 2006) or the impact of climate change on salmon (Martin, 2006) rather than on the potential benefits of different recovery measures under climate change. Our aim is to build a framework that allows us to identify a set of best practices for salmon recovery measures under climate change. In addition to adding to the existing research on climate change and salmon, we believe that a portfolio of climate-proof recovery measures

will prove useful to policy-makers when prioritizing investments for salmon recovery in order to increase their economic efficiency.

For the research project in spring semester 2018, we suggest using the Willamette River sub-basin (of the Columbia River) as a local case study area. For all Columbia River sub-basins, there exist extensive sub-basin management plans (NW Power & Conservation Council, 2004). The plans were produced in cooperation with different stakeholders and describe the specificities of the sub-basin such as existing stream conditions, as well as provide precise suggestions on how to increase salmon stocks. The sub-basin plan for the Willamette River will be the key resource for the research project to identify local recovery efforts. We will then use peer-reviewed literature as well as expert knowledge in the Department of Environmental Studies at the ███████████████ to identify the climate change impacts on the different recovery measures and to assess qualitatively the resilience of different recovery efforts in the Willamette River sub-basin under climate change. Based on the information gained from the sub-basin plan, and the literature on climate change impacts on salmon, we will develop a framework that identifies climate change resilience of different salmon recovery measures in the Willamette River basin. To this end, we will build on the existing literature for concepts on resilient climate change measures (Dittrich, Wreford, & Moran, 2016; Fankhauser, Smith, & Tol, 1999; Ranger et al., 2010; Reeder & Ranger, 2010; Watkiss, Hunt, Blyth, & Dyszynski, 2015). This includes for example determining best practices which will include 'no-regret measures' which provide benefits independent of any climate change outcomes, as well as a range of measures which will be characterized according to their vulnerability to different climate change outcomes.

While the focus for the Spring semester 2018 would be on the Willamette River, there is scope to extend the work to a larger number of sub-basins of the Columbia River in order to create a more representative study of climate-proof salmon recovery strategies. There is extensive documentation for as many as 40 sub-basins of which we could select a number of representative sub-basins for different environmental conditions. Starting with a small case study on the Willamette River would enable us to develop the climate resiliency framework as well as to troubleshoot any methodological challenges before scaling up the project geographically. Given the extended time period of a summer project, this would allow us to add interviews with the authors of the sub-basin reports in order to receive additional information on the selection process of the recovery measures, as well as on the progress of the recovery efforts. The Environmental Studies Department at the ███████████████ well linked with representatives from Fish and Wildlife Services, Forest Services, NOAA Fisheries and the NW Power and Conservation Council, organizations which all contributed to the Columbia River sub-basin reports, and would thus be able to significantly facilitate the interview process.

In sum, we suggest that this research project has both scientific and policy-related merit. The project will add to the scientific literature by developing a framework that determines the climate resiliency of salmon recovery efforts using the Willamette River basin as an initial case study. Beyond the scientific impact, we will provide important insights for policymakers to guide investment decisions on salmon recovery in the Pacific Northwest. Subsequently, this framework could be applied to a larger number of sub-basins of the Columbia River during a Summer project in 2018 to increase the representativeness of the work.

II. Describe why this project is appropriate for collaborating with a student researcher?

The described project is well suited for a research project with an undergraduate student researcher as it strikes the balance between intellectual challenge and feasibility.

On the one hand, the research question for Spring semester 2018 is clearly defined and limited in its scope. As shown in the timeline, the project can be completed within one semester. Being very familiar with the topic myself, I will be able to point the student researcher to the literature resources he needs to familiarize himself with and help him guide his thought process.

On the other hand, the research project will extend the skill set of the student researcher. ▮will learn how to design and set up an extended research project in cooperation with me. While the student is familiar with obtaining key information for term papers, the research project requires synthesizing larger amounts of information which will lead him to effectively analyze data. Most importantly, the project requires the student to conduct original research. While the components of the research projects are clearly defined, ▮ will have the opportunity to design the proposed framework, always with my support, but based on ▮intellectual efforts.

Finally, the research project is designed in a way that allows for an easy extension to the summer which fits well with the schedule of a student researcher.

III. Please explain why you believe this student is the right student to conduct intensive research?

I have known ▮ since the start of the academic year 2▮ ▮ was a student in both my ▮ Through interactions with ▮ during class and during office hours, I believe ▮ has the following qualities that qualify ▮ very well for intensive research.

- **Analytical skills**: ▮ is able to interpret information in the form of data or text and suggests conclusions which demonstrate▮ ability to link and further develop arguments.
- **Writing skills**: In writing ▮ arguments clearly and logically. In addition, ▮ used his English writing skills to▮ advantage to communicate▮ arguments.
- **Curiosity**: ▮ showed a strong interest in many of the topics that we discussed in class and posed questions which showed that▮ engaged fully with the topics and was curious to develop the intellectual arguments further.
- **Confidence**: ▮ shared▮ opinion in the classroom in front of▮ peers on various topics but also helped me with direct feedback on my teaching. I believe that confidence is important for collaborative research with a student so that the student feels prepared to engage in constructive discourse with the faculty member to discuss different ideas and approaches.
- **Interest**: I discussed the research project with ▮ who showed a very strong interest because of its outcome driven scope, i.e. to support salmon recovery but also as a mean to determine whether graduate school may be an option for him.
- **Timing**: ▮ is a ▮ student and will therefore be at ▮ for another ▮ after the end of the project as it has been described. This provides the potential to pursue the research collaboration further and write a research paper together.

IV. What are the specific roles and duties of the student with regard to this project? Stating the student will read and write or conduct research is insufficient. Please be specific with regard to the specific skills and tasks the student will be engaged in.

- Literature review of the sub-basin report of the Willamette River basin to summarize the following information:
    o Specificities of the Willamette River basin
    o Proposed recovery efforts in the Willamette River basin

- Literature review of pre-selected journal articles on climate change impacts on salmon in the Pacific NW to obtain the following information.
    o Environmental factors which are altered under climate change and impact salmon.

- Literature review on a number of pre-selected journal articles on categorizing climate change adaptation measures.

- Development, in cooperation with the faculty member, of a framework to categorize the recovery actions with respect to their climate resiliency.

- Identification, in cooperation with the faculty member, of climate resilient recovery measures.

- Production of a short paper on the results of the project.

V. What knowledge and skills do you hope the student will get out of the project?

- **Confidence**: Undertaking and achieving in a research project can boost the confidence of a student. By taking ownership of the project, the student researcher will realize that ▮ is capable of carrying out independent research which will help ▮ to approach further (research) projects in the future with increased confidence.
- **Structuring a research project:** The student will start to internalize the design and implementation of a research project as a way of thinking that will prove useful for future assignments at university and also for other projects.
- **Improving literature analysis skills**: Given that the core of the project relies on reviewing and synthesizing literature, the student will become more effective at literature analysis.
- **Critical thinking**: Engaging in original and rigorous research requires the researcher to critically evaluate the ideas of others and his/her own in order to reach defendable results and conclusions.
- **Knowledge on salmon and climate change**: Reading and analyzing literature on salmon and climate change will deepen ▮ knowledge on the topic. This will help ▮ to appreciate the challenges of salmon recovery and climate change adaptation.
- **Potential for graduate school**: Carrying out a research project will allow ▮ to determine whether he should consider attending graduate school, where research is a key component.

VI. Please outline a tentative work plan (week by week) for the semester that includes both the faculty member and student responsibilities.

Week	Proposed work
Week of Jan. 15th	Initial meeting/Discussion of the research project and the timeline/Communication of expectations/Assignment of reading of the sub-basin report.
Week of Jan. 22nd	Progress report on the reading/summary of the sub-basin report.
Week of Jan. 29th	Summary of the key information of the sub-basin report with a focus on recovery measures are due and are discussed. Assignment of readings of literature on climate change and salmon.
Week of Feb. 5th	Progress report on the reading/summary of the literature on climate change and salmon.
Week of Feb 12th	Progress report on the reading/summary of the literature on climate change and salmon.
Week of Feb 19th	Summary of the key information of the climate change/salmon literature. Assignment of readings of literature on climate change adaptation concepts.
Week of Feb 26th	Progress report on the reading/summary of the literature on climate change adaptation concepts.
Week of March 5th	Summary of the literature on climate change and salmon is due. Initial discussion on how to design the resiliency framework.
Week of March 12th	Spring vacation (student hopefully thinks about the framework)
Week of March 19th	Discussion and development of the proposed framework. Assignment of matching recovery measures with the developed framework.
Week of March 26th	Discussion of the results and further development. Assignment of developing a detailed outline for a term paper.
Week of April 2nd	Discussion of the outline and assignment to write a first draft.
Week of April 9th	Discussion of the first draft. Assignment to improve the first draft.
Week of April 16th	Discussion of the second draft.
Week of April 23rd	Left open in case of unexpected delays.
Week of April 30th	Finals week/ Project output is due.

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