NRT Risk and Uncertainty Quantification in Marine Science
Program Handbook
Oregon State University

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Artwork by Samantha Newton, NRT Fellow
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I. NRT in Risk and Uncertainty Quantification in Earth Systems Program

A. Vision:
Engaging graduate students in transformative research, education, and professional experiences to address the effects of human actions and climate change on marine systems.

B. Mission:
We envision a future in which scientists and managers work seamlessly using large and ever-expanding data resources, to understand the top-down effects of human actions and the bottom-up effects of climate change on the ocean system. These collaborations will have as a fundamental component quantification and communication of the risks and uncertainties that are inherent in model forecasts and policy actions, and the ultimate goal of devising management solutions in the face of these changes and uncertainties.

C. Program Synopsis and Core Concepts:
The Oregon State University (OSU) National Science Foundation Research Traineeship (NRT) award prepares a new generation of natural resource scientists and managers who combine mathematics, statistics, and computer science with environmental and social sciences to study, protect, and manage ocean systems. Besides fulfilling current educational gaps in marine science and management, the OSU NRT program promotes: 1) a transformative and scalable new marine science and policy graduate minor that teaches students to quantify and communicate risk and uncertainty of data-based model forecasts and policy scenarios; 2) the discovery of mechanisms that control the response of marine systems to climate change and human pressures; 3) the development of evidence-based practices for recruiting, training, and retaining diverse graduate students and for placing them into successful careers in Science, Technology, Engineering and Mathematics (STEM).

Trainees learn to work in transdisciplinary research groups on user-inspired problems using large and ever-expanding data resources. Through a combination of technical coursework, national and international internships, stakeholder engagement, and involvement in transdisciplinary research projects, OSU NRT trainees learn about the science of big data, risk and uncertainty quantification and communication and sustainability. They learn tools and techniques to assist communities in managing resources through change and to recover quickly in the event of a disaster. Students with diverse expertise, developed through either science or policy internships, leverage each other’s strong disciplinary knowledge and skills as they collaborate to address complex stakeholder-identified climate and policy problems. These collaborations have the ultimate goal of devising management solutions in the face of change and uncertainty.

The OSU NRT research and disciplinary training is based on three interconnected core concepts:

- **Coupled Natural Human (CNH) systems:** include human and biophysical systems, and their connections.
- **Big Data (BD):** Large volume of data with high throughput. Big data can be temporal, spatial, or dynamic; structured or unstructured.
• **Risk and Uncertainty analyses and communication (R&U):** A risk is quantified by some measure of the expected cost, involving probabilities and magnitudes, of an undesirable event. Uncertainty is driven by unknown processes and data quality.

D. **NRT Leadership Team:**
- Lorenzo Ciannelli (PI), CEOAS, Fisheries Oceanography
- Flaxen Conway (Core member), CEOAS, Marine Resource Management
- Alix Gitelman (Co-PI), Statistics, Environmental Statistics
- Julia Jones (Co-PI), CEOAS, Geography
- Ana Spalding, School of Public Policy
- Michael Banks (Core member), Fisheries and Wildlife, Genomics
- Alexander Kurapov (Core member), CEOAS, Physical Oceanography
- Juan Restrepo (Co-PI), Mathematics, Uncertainty
- Enrique Thomann (Core member), Mathematics, Stochastic Modeling
- Sinisa Todorovic (Co-PI), Computer Science, Machine Learning
- Ed Waymire (Core member), Mathematics, Risk Analysis
- Cynthia Char (Evaluator), Char Associates, Human Development
- Katherine Hoffman (NRT Coordinator), CEOAS

E. **Logic Model:**
The Logic Model below defines specific learning objectives for the Program overall and for each course in the MRM series.
NRT - Risk and Uncertainty Quantification in Marine Science, Oregon State University

Participating Groups
- Core Program Team
- Faculty Advisors and Mentors
- Core Faculty Team
- Internship Sponsors

Program Elements
- Intensive Field Course: Introduction to NRT core concepts
- Professional Development in Marine and Earth Systems Science
  - Conceptual Foundations in Risk and Uncertainty
  - Collaborative Working Structure and Functions
  - Communication of Risk and Uncertainty
- Minor in Risk and Uncertainty Quantification in Earth Systems
  - Big Data and Uncertainty Quantification
  - Risk Analysis
  - Earth Systems
  - Social Systems
- Internship
- Interdisciplinary Thesis Chapter Transdisciplinary Report

Student Trainee Outcomes
- Calculate risk and uncertainty using multiple data sources, and construct analyses of marine systems
- Combine concepts from social and natural science to conduct collaborative analysis addressing humans and climate change effects on marine systems
- Assess needs, perceptions and roles of stakeholders and communicate risk and uncertainty to stakeholders in industry, policy, and non-governmental organizations
- Gain professional skills in communication and collaborative working structures
II. **Forming Research Clusters.**

A. **General Information:**

Potential student research clusters are formed before the application process begins. This formation is not guaranteed as admission but having a particular focus in terms of an interdisciplinary project and how the students would contribute is advantageous.

C. **Student/Faculty Initial Inquiries:**

We ask that potential students and faculty mentors complete a survey of interest 4 months prior to admission. The survey can be found below. The questions specifically geared towards students or advisors are indicated.

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**NRT Initial Inquiry Survey for 2019-2020**

Name:

__________________________________________________________

E-mail:

__________________________________________________________

Department:

__________________________________________________________

Status

- Faculty (1)

- Student (2)
Display This Question:
If Status = Student

Student

- Ph.D. (1)
- M.S./M.A. (2)

Display This Question:
If Status = Student

Year

- First (1)
- Second (2)
- Third (3)
- Fourth or more (4)

Display This Question:
If Status = Faculty

Rank

- Assistant Professor (1)
- Associate Professor (5)
- Professor (8)
- Instructor (9)
- Other (11)
Name of potential conceptual project (Previous conceptual project submissions can be found here.)

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Topic and how this relates to the NRT. What is the "big idea" that would combine the Core Concepts listed below?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Display This Question:
If Status = Faculty

Do you have one or more student(s) and/or faculty in mind for potential collaboration? If so, please list them and their department(s) below. (NOTE: OSU Graduate students must be in at least their second year in order to enter the NRT Program.)

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Display This Question:  
If Status = Student

What is the name of your advisor? Do you have one or more student(s) and/or faculty in mind for potential collaboration? If so, please list them and their department(s) below. (NOTE: OSU Graduate students must be in at least their second year in order to enter the NRT Program.)

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Which area(s) is/are still needed to be addressed?

☐ Coupled Natural Human Systems  (1)
☐ Risk and Uncertainty  (2)
☐ Data Analytics  (3)
☐ None  (4)

Are you willing to be matched up with colleagues and potential students who could contribute to the other legs?

☐ Yes  (1)
☐ No  (2)
☐ Maybe  (4)
Display This Question:
If Status = Faculty

Desired Area(s) of expertise for students which complete the three “legs” (Core Concepts) of the Risk and Uncertainty Quantification in Marine Science Program.

__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

Display This Question:
If Status = Faculty

*Please Note: ALL NRT advisors are expected to:

- Participate in the NRT Professional Development classes:
  - MRM 525 (Fall): Foundational Concepts in Risk and Uncertainty: Integrated course with quantitative concepts.
  - MRM 525 (Spring): Communication in Risk and Uncertainty.
- Engagement with stakeholders and different audiences.
- Participate in the IFC.
- Actively participate and engage with ALL students in the team in mentoring activities of NRT group project, including cluster and faculty meetings, etc. The group project is the Transdisciplinary Report.
- Acknowledge that the Interdisciplinary Chapter is a vital part of a student's thesis.

Display This Question:
If Status = Student
Please keep in mind that the NRT Fellowship has been designed to require products/courses that are typically additional to your current program of study. Confirm your willingness/ability to complete them, should you be selected as an NRT Fellow. Are you willing to:

☐ complete the minor (16)

☐ complete an Interdisciplinary Chapter for your thesis? (17)

☐ participate in the IFC? (19)

☐ participate in an Internship? (18)

☐ complete a Transdisciplinary Report? (21)

☐ None of the above (22)

Any other comments?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
A. Mentoring of Students:
Mentoring all the students in the cross-disciplinary research cluster is key to the success of each student in the program. There are three levels of mentoring (see Fig. 1):
- Among faculty whose students are involved in a cluster
- Among faculty and student advising a cluster
- Among students within a cluster and within the NRT program

Figure 1: Mentoring schematic. $S$ = student, $M$ = mentor. Students are organized in cross-disciplinary research clusters. Each student is mentored by his/her respective primary faculty and other faculty whose students are also involved in the cluster.
B. **Advisor Expectations:**
Because of the important role that faculty mentors have in guiding student activities, we ask that those who are interested in being an advisor agree to the following requirements. Failure to do so will result in the reneging of your student’s fellowship.

- Faculty mentors must propose a research idea that will form the basis of the students’ collaborative research.
- Faculty mentors must develop and follow an Individual Development Plan (IDP) with the primary student.
- Faculty mentors must agree to attend the IFC (Intensive Field Course) on the day where the Student’s IDP (Individual Development Plan) is discussed. The IFC is typically held at the Hatfield Marine Science Center (HMSC) in Newport, OR, the week prior to when fall classes start; and the IDP session is usually held the first day. The NRT Program Coordinator will confirm these dates.
- Faculty mentors must be actively engaged in their student’s research cluster activities and attend all cluster meetings.
- Faculty are encouraged to engage in other training activities through MRM professional series classes. (Please see pages 8-9 of this handbook).
- Faculty mentors may be asked to serve as a student’s Minor Professor by the students in your research cluster (Please see pages 12-13 of this handbook). The student CANNOT be from the same College as the Minor professor. If a faculty is asked to serve as a Minor professor and agrees to be nominated, please contact Katherine.Hoffman@oregonstate.edu.
- Faculty mentors must understand that the interdisciplinary chapter is an important and significant part of the student’s thesis; and that the transdisciplinary report is an essential expected product for the NRT.

C. **Advisors/Students Agreement Document:**
Students and advisors must sign the Student/Advisor Agreement Document prior to student’s matriculation into the NRT Program. (Please see Appendix A).
IV. Information for Students
   A. Application and Admissions Process:
      1. Prospective Students
         The NRT program accepts graduate students who have completed at least one year of
         graduate studies at Oregon State University. We specifically seek students who are interested in
         working collaboratively to address marine related topics that encompass science and policy
         connections. Characteristics of ideal candidates include the ability to recognize expertise that
         others bring to the group, while also recognizing their own strengths; the ability to listen to
         instructions and complete tasks ahead of time; and the ability to listen and defer to others,
         but also to take initiative when leadership is needed.

         Participation in the NRT program involves the development of a group project and the
         completion of a number of training and professional activities. The main requirements for
         the group projects are that they involve some aspect of marine resource management,
         have a policy as well as a science question in it, are based on the analysis of large data
         sets, and involve risk and uncertainty quantification.

      2. Application Instructions
         Students must apply to one of the existing projects listed on our website. In preparation
         for putting together their application packets, students MUST contact the project lead as
         well as make sure that his/her advisor is engaged in a discussion of the project where all
         three of the NRT Core Concepts (Big Data, Risk Analysis, Coupled-Human-Natural System)
         of the NRT are represented.

         Complete student applications should include the following:
- Letter of interest from student
- Letter of support from student’s major advisor(s)
- Unofficial graduate and undergraduate transcripts
- Indication of US citizenship or permanent residency, if applying for a NRT fellowship (e.g. A copy of passport)
- Student ID number and e-mail address

The letter of interest from the student should include:
- Statement of your academic, research, and personal experience and interests as they relate to the NRT program. (Please visit the “Research” and “Training” pages on the NRT website for additional information on the NRT program).
- Statement of your commitment to engaging in collaborative activities (e.g. use others’ work in your work, participate in a peer colloquium, craft a collaboration chapter/publication, participate in a longitudinal evaluation, design a viable completion plan) with your peers. This is important as you will be working on transdisciplinary teams during the NRT fellowship year.
- Description of how your participation in the NRT program will help you achieve your academic and professional goals.
- Identify which project you wish to work on and how you could potentially contribute to it.
- Description of your funding plan for completing your degree. If requesting to be considered for a one-year NRT fellowship, state so in the letter. Limited number of one-year NRT fellowships are available for U.S. Citizens and permanent residents, and will be assigned based on financial needs and academic accomplishments. Fellowships include stipend, tuition and most fees, some internship and research financial support, and benefits. Research funds may be available (see Appendix F).

The letter of support from your advisor should include:
- Description of how the student can succeed in the NRT program from the three core concepts listed above, specifically addressing the potential to develop both strong quantitative skills and deep understanding of the natural and social sciences, management, and policy approaches. (Please visit the “Research” and “Training” pages on the NRT website for additional information on the NRT program).
- Description of how the student fits in to the research project.
- Examples of how the student will/has succeed (ed) in collaborative, cross-disciplinary team settings.
- Evidence of a viable plan for funding for the student for his/her entire degree program.
- Describe your plans for working with the student and other NRT faculty in the training aspects of the program. Specifically, address how you will:
  o Follow student’s progress to finalization of degree.
  o Participate in NRT activities when requested.
  o Engage with other NRT faculty who are collaborating with your student.
B. **NRT Program Elements and Timeline:**

The NRT program includes the following elements: interdisciplinary training (See Table 2), development of a collaborative research project, professional training and the completion of two final products. Each of these is described in detail in the following sections.

<table>
<thead>
<tr>
<th>Year in graduate school</th>
<th>Course work and internship</th>
<th>NRT Program Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 early fall</td>
<td>NRT IFC (intensive field course)</td>
<td>Student gets familiar with the NRT Program and team disciplinary expertise</td>
</tr>
<tr>
<td>Year 2 fall</td>
<td>Minor course work and MRM 525 professional training</td>
<td>Develop goals of ID chapter and TD report</td>
</tr>
<tr>
<td>Year 2 winter</td>
<td>Minor course work and MRM 525 professional training</td>
<td>Develop outline of ID chapter and TD report</td>
</tr>
<tr>
<td>Year 2 spring</td>
<td>Minor course work and MRM 525 professional training</td>
<td>Write introduction of ID chapter and TD report. Become familiar with how to talk about this work with stakeholders.</td>
</tr>
<tr>
<td>Year 2 summer</td>
<td>Internship</td>
<td>Completion TD and ID (if applicable)</td>
</tr>
</tbody>
</table>

1. **Interdisciplinary Training**
   
a. **Intensive Field Course (IFC):**
   
   Students are REQUIRED to enroll in GEO 508: Intensive Field Course (IFC): Introduction to NRT core concepts (3 credits). The course is usually held the week before the fall term begins, at the Hatfield Marine Science Center in Newport, OR. During this time, students are exposed to the core concepts of the program via lectures and fieldtrips; and they have the opportunity to meet prior NRT program participants. The evolution of their progress is documented with Concepts Maps and videotaping of initial project presentations. Students will begin working on their (IDP) Individual Development Plan and meet with their research clusters.

   b. **Learning Objectives of MRM 525 Professional Training Model:**
   
   Students are required to enroll in a 6 credit, professional development course series that includes the following:
   
   i. **Fall Term:** MRM 525 Special Topics, part 1: Marine and Earth Systems Sciences - Conceptual Foundations of Risk and Uncertainty (2 credits).
   
   ii. **Winter Term:** MRM 525 Special Topics part 2: Marine and Earth Systems Sciences - Collaborative Working Structure and Functions (2 credits).
   
   iii. **Spring Term:** MRM 525 Special Topics, part 3: Marine and Earth Systems Sciences - Communication of Risk and Uncertainty (2 credits).
Table 2: Learning Objectives of IFC and MRM 525 Professional Training Model

<table>
<thead>
<tr>
<th>Professional training elements</th>
<th>IFC Introduction of the NRT core concepts</th>
<th>MRM 525 Conceptual Foundations Knowledge and Comprehension</th>
<th>MRM 525 Collaboration Apply and analyze</th>
<th>MRM 525 Communication Synthesize and Evaluate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts:</td>
<td>Students will recognize myriad perceptions of the concepts, describe them, and relate them to groups and disciplines</td>
<td>Students will describe and explain the concept from multiple disciplinary perspectives (e.g., natural science, social science, statistics and mathematics) and they will distinguish, compare, and contrast those perspectives</td>
<td>Students will demonstrate how alternative perspectives on the concept affect group formation and dynamics including challenges and rewards of collaborative working structures, and practice the application of those alternative perspectives to produce a collaborative research proposal</td>
<td>Students will identify target audiences, assess their perception of the concept, and design and compose communication/engagement strategies (a communication plan) about the concept. Students will initiate the implementation of the communication plan, evaluate the effectiveness of the communication plan, and re-assess and re-construct as needed.</td>
</tr>
<tr>
<td>Risk and Uncertainty</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big data</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>CNH systems</td>
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</tbody>
</table>

c. **NRT Minor:**
Students are expected to enroll in a [graduate minor in Risk and Uncertainty Quantification in Marine Science](#). This interdisciplinary minor will provide graduate students with knowledge and skills to quantify and communicate risk and uncertainty derived from the analyses of large data sets in earth system science. The minor is focused on marine science and resource management, yet will be relevant to students from a variety of fields. Students will extend their ability to perceive and solve problems in a transdisciplinary context related to statistical inference, uncertainty quantification, risk analyses, earth system science, and social systems. Students will also acquire professional skills in communication and collaboration. The minor is open to all graduate students. The Minor requires 18 credits for Ph.D. students and 15 credits for M.S. There are four focal areas in the Minor, including: 1. Earth Systems, 2. Social Systems, 3.
Risk and Uncertainty Analysis, and 4. Big Data Analytics. Ph.D. students are required to take at least one course from each of the focal areas, while M.S. students are only expected to take courses from three of the focal areas (they can choose to leave out focal area 3 or 4). The MRM 525 professional development series is also part of the minor, and required for both Ph.D. and M.S. students.

i. **Four areas of the minor:**
   
   **EARTH SYSTEMS**
   
   Students will develop an integrated understanding of the Earth System, including biological, physical and geological mechanisms that affect earth climate, species dynamics and interactions, elemental cycles and ecosystem services. The emphasis will be on understanding the linkages between physics, biology, geology, and chemistry from a system theory perspective, and on how these linkages affect earth’s biogeochemical processes. Disciplinary components of the Earth System module include biological, chemical and physical oceanography, biogeochemistry, geology, climate and atmospheric sciences, and ecology.

   **SOCIAL SYSTEMS**
   
   The “social or human system” component is one of the key elements of a coupled natural human system. Specifically, it encompasses the social, cultural, economic, management, and policy aspects of the system, and how they interact with each other and with their environment. Disciplinary approaches to the human system include Anthropology, Sociology, Policy, Economics, etc. The goal of the “social systems” training component of the graduate RU minor is to learn about social science methods, theory and/or applications as they relate to a marine, coupled natural human system. We expect RU minor students to complete the requirements by taking at least one course in this area. The course must allow students to: (1) Recognize the perspective of the particular discipline or area of study, (2) Understand and respect the various methodological approaches used in the social sciences (qualitative and/or quantitative), their possibilities and limitations, and how these may be best integrated to the earth systems, big data or R&U component of the minor, (3) Explain and extract the scalar nature of the course material, whether it is related to cultural, social, institutional, management, or policy aspects of a system, and (4) Critically assess gaps or opportunities for inclusion of social, cultural, or economic elements of a natural system, and vice versa. NRT (National Research Traineeship) students with STEM backgrounds will be expected to understand and become literate and conversant in the qualitative aspects of risk and uncertainty.

   **RISK AND UNCERTAINTY ANALYSIS**
   
   The goal of the risk and uncertainty quantification training component of the graduate RU minor is to understand and acquire mastery of some of
the fundamental mathematical/computational and statistical methods for quantifying uncertainty and analyzing risk for decision making. NRT students seeking the graduate minor are expected to acquire mathematical, computational, and statistical tools that can be used to describe and assess risk and uncertainty in problems related to the marine, coupled natural human system. Students have options to choose from a variety of courses dealing with the mathematical foundations of risk and uncertainty involving mathematical techniques in (i) decision making under uncertainty (ii) ruin probabilities (iii) measures of variability (iv) probabilities of rare events and large deviations (v) Monte Carlo simulation (vi) optimization and dynamic programming and (vii) stochastic models in biology pertaining to spread of disease and related phenomena. Students are expected to acquire experience in a combination of computational, simulation and/or theoretical approaches. NRT (National Research Traineeship) students with a social science or human dimension component will be expected to understand and become literate and conversant in the quantitative aspects of risk and uncertainty quantification.

BIG DATA ANALYTICS
Issues surrounding massive data sets (“big” data) are intertwined with data-enabled science and engineering. The goals of the big data training component are for students (1) to acquire computational and data-management skills necessary for handling and processing large data sets, and (2) to assess the value of information obtained from big data with respect to such issues as observation bias, signal versus noise, spurious relationships, and incidental endogeneity. Much of the training in big data management and processes is acquired through hands-on experiences. Specific components of the big data module include handling and processing massive datasets; being able to identify and articulate the limitations of big data sets; implementing classification, clustering and/or network analyses.

ii. Credit hours:
Minor Credit Hours: The OSU Graduate School's base rule on credit for minor: Some can be concurrent with graduate program. (i.e. “double-dipping” is allowed in some cases). A class can rarely be used for two minors or a minor and a concentration/certification concurrently. Some departments have different rules over and above the base rule, e.g. for MS, 15 credits for the minor is required above the base 45 credits required for the M.S. Program of Study, where for a Ph.D., the minor can be from within the required 108 credits. Please check specifics in your home college/program and degree-level.

iii. Class substitutions: In some cases, a student may petition for a class(es) which is/are not listed as part of the minor, on a case-by-case basis. The
prospective class must be representative of one of the 4 areas: Risk Analysis, Uncertainty Quantification, Social Systems, or Earth Systems. The substitution form (Please see Appendix D) must be submitted to Katherine Hoffman. Students are required to send in the proposed substitute course syllabus along with the substitution form. Forms must be turned in no later than the end of the second week of classes. If approved, the substitute class will ultimately need to be signed off by the student’s minor professors on the student’s program of study.

iv. Student minor professor: Expectations and list of minor professors
Students must identify a minor professor from see list below. It is encouraged that it be a professor whom the student has taken a class from. This person must not be from the student's same college or major, and must not be the GCR on their committee. Please be advised that some professors may decline requests based on workload, etc. If another faculty member is desired, we can nominate him/her. Please contact Katherine Hoffman for more information. Expectations of a minor professor include the following: Must provide guidance to the student research and coursework in professor’s area of expertise; Must be familiar with the learning outcome (page 9) of the Minor in R&U (Risk and Uncertainty), and ultimately approve/disapprove the course list and proposed substitutions; and Must sign off on student's minor with designated classes making sure classes and credit hours are met (http://gradschool.oregonstate.edu/forms#program).

1. F. Conway-MRM
2. A. Spalding- SCHOOL OF PUBLIC POLICY
3. L. Cianelli-CEAOS
4. J. Restrepo-MATH
5. E. Cortilla-Sanchez-COMPUTER SCIENCE
6. S. Todorovich-COMPUTER SCIENCE
7. J. Jones-CEOAS/GEORAPY
8. A. Gitelman-STATISTICS
9. R. Kennedy-CEOAS
10. C. Fuentes-STATISTICS
11. H. Yeh-CIVIL AND CONSTRUCTION ENGINEERING
12. B. Dupont-M.E.
13. N. Gibson-MATH
14. T. Ozkan-Haller-C.E/CEOAS
15. D. Koslicki, MATH
16. L. Torres-FISHERIES AND WILDLIFE
17. R. Vega-Thurber-MICROBIOLOGY
18. K. McLaughlin-STATISTICS
19. J. Miller-FISHERIES AND WILDLIFE
2. Collaborative Research Project

a. General Research Cluster Guidelines:

An NRT Research Cluster is composed of all students in a research team, their respective faculty, and one NRT core faculty representative. Below we describe the role of each group in the Research Cluster.

Who/Role:

**Students:** Each NRT student involved in the NRT-supported project team is also part of the Research Cluster, and as such is expected to participate fully in all cluster meetings. Each student brings their disciplinary knowledge to the meeting, yet they are also expected to be open to considering other viewpoints and be willing to become comfortable stepping out of their “comfort” zones. The goal of this is to work together to define a truly transdisciplinary problem/project that the student team can focus on over the course of their NRT fellowship.

Specific guidelines to achieving this goal are illustrated in the “Projects form” guidelines listed on the NRT website. [http://marinerisk.ceoas.oregonstate.edu/for-students/](http://marinerisk.ceoas.oregonstate.edu/for-students/)

Students are expected to:

- Design the Research Cluster meeting agenda, provide it to the Research Cluster in a timely manner, and to facilitate the meeting
- Appoint a secretary from their team to take notes during each meeting
- Use these meetings as an opportunity to solicit feedback

**Faculty mentors:** Each faculty advisor for their respective student is part of the Research Cluster. Advisors should be aware that the mentoring they provide applies to their student and to other students and faculty members in their respective clusters; the goal of which is “cross-pollination.”

Faculty mentors are expected to:

- Fully participate in each cluster meeting as per the NRT student/advisor agreement form
- Provide constructive feedback on progress and address questions during meeting
- Support the student project team as they uniquely define the research question that their team will address
- Promote a shared understanding of the NRT products across the Research Cluster and the student team: the interdisciplinary chapter (*see guidelines) and the Transdisciplinary Report (*see guidelines)
- Be an active participant in grading the Transdisciplinary Report.

*NRT Core Faculty Representative:* This person helps facilitate these steps by providing additional information on the NRT core concepts and supporting the understanding and
practice of communication among participants as the team converges on a doable research project question. The NRT representative also reports back to others in the NRT Core group so that any feedback from the Research Cluster can be incorporated in the guidelines of the NRT program. He/She could also be involved at any step of the team-based research project, but at the very least should be present during each Research Cluster meeting. The NRT representative could also be a source of support as the students make their progression through the NRT fellowship.

**TD Research Question Guidelines**

By the end of the Fall term we ask that each team writes a six pages essay containing the following information about the TD research question:

1. *Problem definition:* What is the nature of the problem that you are addressing and its relationship to the 3 NRT core concepts?
2. *Determining the researchable question:* What is your agreed overarching TD question? Describe the process for how it has evolved over the term. What are potential source of data/assets/methodologies available to address the TD question? Describe the process for how you have further refined these over the term your choice of data/assets/methodologies.
3. *Integration:* What are the opportunities for each member to contribute to the question and what is the potential for integration across the team contributions?
4. *What is the potential for societal and academic relevance* of the TD question?

The intent of these guidelines is that of facilitating the development of the team transdisciplinary research question by unpacking its complexity in the four components listed above. Further, by completing this essay your team will have text that can be directly integrated in the TD report. The faculty mentors, through the cluster meetings, should be involved in the process of developing and writing this essay. The essay may also contain supporting figures, tables, and reference list, but everything should be limited to the aforementioned six pages. Turn in the essay to Katherine Hoffman by **Friday November 30**th. One NRT faculty and students from the other NRT teams will be asked to provide feedback on it.

NRT Representatives 2017-2018:

Keystone Species- Lorenzo Ciannelli
Impact of Changing Ocean Conditions of Dungeness Crab- Flaxen Conway
Emerging Technologies in Fisheries Science (Ground fish)- Alix Gitelman

**Frequency of cluster meetings:** 1-2/quarter

**3. Professional Training**

a. *Individual Development Plan (IDP)*

Students must complete their IDPs with their advisor(s), and turn it in no later than the end of the second week of fall classes. (Please See Appendix C).

Document can also be found: [http://marinerisk.ceoas.oregonstate.edu/for-students/](http://marinerisk.ceoas.oregonstate.edu/for-students/)
b. **Student Internship**
Trainees are expected to complete an internship. Students can arrange for this on their own, or select from the NRT program’s list or partners, or have their advisors assist them. Students generally take the internship in summer term and sign up for 3 hours of thesis credits or 3 hours of internship credits. If you wish to sign up for internship credits, please contact your home department for the logistics of this. Conference costs are not an allowable expense for internships. (Please see Appendix E.) The form can also be found can be found:
http://marinerisk.ceoas.oregonstate.edu/for-students/

Upon completion, students will be expected to write a two-page essay on their experience and how their goals were met.

4. **Final Products** (Please see Appendix B).
   a. **Interdisciplinary Thesis Chapter (ID)**
   Each student will complete an *interdisciplinary chapter* for their M.S. thesis or Ph.D. dissertation, based on their NRT Team Project. The distinguishing element of the interdisciplinary chapter is that of being based on a topic or research question that has been collectively defined by your group before addressing it. This topic or questions must include elements of big data, risk and/or uncertainty quantification, and coupled natural-human marine system science. However, each individual interdisciplinary chapter does not need to contain all three of these elements. It is up to the student to decide which of these three elements is covered in the interdisciplinary chapter.

   The formatting of the interdisciplinary chapter should reflect that of a typical thesis chapter: introduction / background, method, results and discussion, and conclusion. NRT Team members *may share similar (even identical) introduction / background, and conclusions* in their interdisciplinary chapters. It will be the *methods, results and discussion -- based on their disciplinary expertise and research challenges* – that will be unique. Note that these chapters may refer readers to (aka cite) the other Team member’s chapters. If the chapter is published, each student should consider including other student team members and/or advisors as co-authors, depending on their level of engagement in developing the question and carrying out the study to a peer-reviewed level of quality.

   b. **Team Transdisciplinary Report (TD)**
   The students in each NRT Team must collaboratively complete a *transdisciplinary report*. This might be a figurative combination of their interdisciplinary chapters, and as such it should involve no or minimal use of additional data. However, in the *transdisciplinary report*, the disciplinary expertise of each student is no longer “traceable” as it should be written in “one voice.” In other words, all contributions are merged to address the NRT Team Project’s topic / research question and the collaborative effort. While publication might be a desired outcome, publication is NOT a requirement. However, we
recommend depositing the report in a publically accessible repository, such as OSU Scholars Archives.

The transdisciplinary report can take multiple forms, depending on how you intend to merge your disciplinary perspectives and experience working together.

Some examples might be:

- An integrated literary *synthesis* addressing common research goal(s) from multiple disciplinary perspectives. Example: a review of large pelagic management practices around the world, and identification of knowledge gaps from human and biological perspectives.
- A *mathematical* or *statistical model* that includes qualitative or quantitative insight from all team members. Example: a bioeconomic model of fleet and resource dynamics that includes environmental- and human-driven uncertainties.
- A *policy analyses* that includes knowledge (qualitative and quantitative) from all team members. Example: a management strategy evaluation, such as an assessment of marine spatial planning policies under human and biophysical constraints.
- A *visualization tool* that captures the skills of all team members. Example: the display of uncertainties in model forecast.
- A *conceptual model* to quantify and implement a new management strategy. Example: a strategy to examine the placement, typology, and size of marine reserves in a well-defined geographic region.
- A *vulnerability assessment* of a system. Example: an assessment of the exposure, sensitivity, and adaptive capacity of XX groups to phenomenon YY.

c. **When and How to Write the Interdisciplinary Chapters and Transdisciplinary Reports**

The first step is that of collectively identifying the NRT Team Project: the topic or research question that will be collectively addressed by your Team. Defining a question before addressing it sounds the obvious thing to do, but when it comes to implementation of inter or transdisciplinary research, this seemingly logical course of action is not always followed (for example, agencies technical reports). Ideally, you will do that by the end of Fall term in your first NRT year.

Once this has been accomplished, Team members should start working on the outline of their interdisciplinary chapters and transdisciplinary report. An outline is a roadmap for the completion of the chapter and report. It is 2-3 pages long, containing NRT Project Topic/research question, background and rationale/justification, approach/methods, anticipated results, and significance. Outline should be completed by the end of Winter term in your first NRT year. Recall that the introduction section of an interdisciplinary chapter is a product of your collaborative thinking and is shared among Team members. So, preparing an outline for your chapters also requires a collaborative effort. For the rest of the
NRT year (spring and summer), students complete their interdisciplinary chapters, and the transdisciplinary repo
<table>
<thead>
<tr>
<th></th>
<th><strong>Interdisciplinary chapter</strong></th>
<th><strong>Transdisciplinary report</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who are authors?</strong></td>
<td>Individual student</td>
<td>All students in an NRT team</td>
</tr>
<tr>
<td><strong>Where does it appear?</strong></td>
<td>In the thesis</td>
<td>As a separate document from thesis</td>
</tr>
<tr>
<td><strong>How are the reports related to each other?</strong></td>
<td>Information in the chapter is each student's contribution to the transdisciplinary report</td>
<td>Transdisciplinary report is based on the research conducted in the chapters. Has similar introduction of the chapters, but the methods, results and discussions are new, and directly address ALL aspects of the NRT Team Project goals</td>
</tr>
</tbody>
</table>
| **What is the topic?**             | One aspect of the NRT Team Project that best relates to the student’s individual research topic  
May involve new data collection if it was part of the student’s individual research topic, but new data is not required specifically around the Team topic  
Contains at least one of the NRT Core Concepts: big data, risk and/or uncertainty quantification, and coupled natural-human marine system science.  | Topic of the NRT Team's Project  
Minimal or no acquisition of new data in the form of interviews, experiments, or field collections  
Contains all three of the NRT Core Concepts: big data, risk and/or uncertainty quantification, and coupled natural-human marine system science. |
| **What is the format?**            | A typical thesis chapter: introduction / background, method, results and discussion, and conclusion  
NRT Team members may share similar (even identical) introduction / background, and conclusions | Several options:  
1. An integrated literary synthesis  
2. a mathematical or statistical model  
3. a policy analysis  
4. a visualization tool  
5. a conceptual model  
6. a vulnerability assessment  
  Has a clear description of each student’s contribution to the report  
  Has a team reflection of the TD process (e.g., frequency of meetings, delegation vs team work, etc.) |
| **When is it written?**            | By the end of Fall term of NRT year: define NRT Team Project topic / question  
By the end of Winter term of NRT year: complete outline  
By the end of spring and summer of NRT year: complete the main text (introduction, methods, results, discussion) | By the end of summer term during your NRT fellowship year. For this year the due date for this is Aug. 30th, 2018. One or more of your team will be asked to present your Project and this report at the IFC field course for the incoming NRT cohort. |
d. NRT Faculty Grading Rubric
   (Please see Appendix G) for a grading rubric for the transdisciplinary report

C. General Program Policies

1. Stipend and Tuition Information
   All students should expect to receive and sign the Stipend Offer Letter and the Graduate Tuition Relief forms from the Graduate School in a timely manner. Please check your e-mail frequently in the summer for these forms and other important matters. Failure to do so may result in not being granted a fellowship. You must be signed up for 12 credits for the F, W, Sp terms and 3 credits only in the summer in order to receive your stipend. Although the Tuition Remission does not mention summer term coverage, you will still have your tuition and fees paid for by the grant. In most cases, the stipend period will commence Sept. 16th, 20XX and end Sept. 15th, 20XX for incoming students. In other words, you will be paid on Sept. 16th 20XX for ½ a month and then full stipends beginning in Oct. Your first and last stipend check will be ½ a regular stipend payment on Sept. 1st the following year. By definition, a stipend payment is granted at the first of the month to defray the cost of living expenses for that month as opposed to an employee who is paid at the end of the month for work provided for that month.

2. Taxes in Relation to a Fellowship
   Trainees on fellowships are not considered bona fide employees. There are no taxes taken out of fellowship stipends. Guidance on how to file taxes for this particular situation is below: http://gradschool.oregonstate.edu/finance/fellowships-and-scholarships/policies - tax

"Tax Liability: OSU does not withhold taxes from fellowship stipend payments made to US citizens and resident aliens and does not currently report stipend payments on an annual IRS Form 1099 (Miscellaneous Income) for these individuals. However,
graduate fellows who are US citizens and resident aliens are responsible for paying all income taxes that may become due as a consequence of receiving graduate fellowship stipend payments. [see linked page for information about end-of-year 1099 forms showing health insurance subsidy and administrative fee assistance, but not showing stipend] Oregon State University staff members are not tax professionals and cannot provide tax guidance to students. There are a number of IRS forms and publications that may be helpful for determining tax liability, including the following:

- IRS Publication 970, Tax Benefits for Education
- IRS Form 8863, Education Credits (Hope & Lifetime Learning Credits) *** LLC especially useful
- IRS Form 1042, Annual Withholding Tax Return for US Source Income of Foreign Persons

For more information, students are encouraged to contact IRS 1-800-829-1040 and/or consult a tax professional."

3. **Health Insurance**

Health insurance is mandatory for Graduate Fellows. All Graduate Fellows are required to submit documentation to enroll in or waive out of the insurance plan offered by the University. Graduate Fellows are only eligible for summer coverage if they had an appointment the prior contract year and signed up for the coverage by May 1st prior to summer term, OR if they have a Graduate Fellow appointment during summer term. If students are starting funding for the first time in Oct., then they are not eligible for coverage prior to October 1. You must submit the necessary paperwork within the first 30 days of the start of your Graduate Fellowship appointment. If you choose to waive the coverage offered by the University, you must have medical, dental and vision coverage that is deemed comparable by the University. You authorize the University to post a monthly charge to your student business office account for the health insurance premium for the level of coverage for which you have enrolled.

For additional information visit [http://studenthealth.oregonstate.edu/insurance/](http://studenthealth.oregonstate.edu/insurance/) or send an email to [osustudent.insurance@oregonstate.edu](mailto:osustudent.insurance@oregonstate.edu)

4. **Student Research Funds**

Students may apply for limited research funds for conference costs and equipment. (Please see Appendix F.) Also, the form can be found: [http://marinerisk.ceoas.oregonstate.edu/for-students/](http://marinerisk.ceoas.oregonstate.edu/for-students/)

5. **NRT Graduate Student Representative**

An NRT student will be nominated by his/her peers to serve as a Student Representative who will attend the monthly NRT Meetings and be the voice of the cohort. This student will bring feedback to the NRT Core Faculty and also relay information back to the group. Serving as a student representative is a great opportunity for a student to develop skills which could be highlighted on their CVs
APPENDIX A
STUDENT/ADVISOR CHECK-OFF SHEET

I, ____________________, understand that as an agreement for receiving an NSF NRT one year fellowship, that I am required to engage in the following activities as a student. Please review with your advisor and check off each box indicating that you understand, sign along with your advisor, and return to Katherine Hoffman, mailbox in CEOAS Administration Building or e-mail Katherine.Hoffman@oregonstate.edu. Please keep a COPY for yourself for reference.

☐ Student takes the IFC (Intensive Field Course in late summer _____ at HMSC).
☐ Student receives the minor including taking the MRM 525 series professional courses: http://marinerisk.ceoas.oregonstate.edu/minor/.

15 hours M.S., 18 hours Ph.D. Students are strongly advised to complete minor in year of receiving fellowship. Please see additional requirement above on link.

☐ Student actively participates in project’s group meetings.
☐ Student works and completes interdisciplinary chapter as a chapter of thesis and contributes to completion of team transdisciplinary report. Please see http://marinerisk.ceoas.oregonstate.edu/for-students/ to review material.

☐ Student makes arrangements for internship and fulfills it.
☐ Student seeks approved minor professor who is NOT part of their college (please ask Katherine Hoffman for a list).

☐ Student understands the Graduate School’s policies and knowledge of filling out a program of study or petition to change form adding the minor.

☐ Student understands stipends are sent to current address and the option of having them directly deposited.

☐ Student must be signed up for 12 credit hours during F, W, Sp terms.

☐ Student must be signed up for 3 credits only during the summer in order to receive an NRT stipend.

☐ It is student’s responsibility to explore the tax rules concerning receiving a stipend.

☐ My Advisor understands the expectations of her/him below:

• Attend and participate in one day of the IFC (Intensive Field Course) at the Hatfield Marine Science Center in Newport, OR. Course date: __________________________
• Engage in other training activities, as needed, through MRM professional series.
• Actively participate and engage with ALL students on team in mentoring activities of NRT group project, including cluster and faculty meetings, etc.
• Understand that the interdisciplinary chapter is an important and significant part of the student’s thesis.
• Develop and follow an IDP (individual Development Plan) with the primary student.

______________________________                    __________________
Student’s signature                       Date

______________________________                    __________________
Advisor’s signature                       Date
APPENDIX B

STUDENT INTERDISCIPLINARY CHAPTER/TRANSDISCIPLINARY REPORT GUIDELINES

NSF Research Traineeship Guidelines for Students for Interdisciplinary Chapter and Transdisciplinary reports

September 8, 2018

Outcome of collaborative work
Each student engaged in the OSU-NRT program will work on a NRT Team Project. The NRT Team Project is a collaborative effort to address a topic / question that all members of the team collectively define and determine. The NRT Team Project must contain elements of the NRT Core Concepts: big data, risk and/or uncertainty quantification, and coupled natural-human marine system science.

There are **two products** resulting from the students’ collaborative work on the NRT Team Project (Table 1).

**Product 1:** Each student will complete an *interdisciplinary chapter* for their MS thesis or PhD dissertation, based on their NRT Team Project. The distinguishing element of the interdisciplinary chapter is that of being **based on a topic or research question that has been collectively defined by your group before addressing it** (see the ‘Project’ form for strategies to help you formulate a common research topic or question). This topic or questions must include elements of data (which are big), risk and/or uncertainty quantification, and coupled natural-human marine system science. **However, each individual interdisciplinary chapter does not need to contain all three of these elements.** It is up to the student to decide which of these three elements is covered in the interdisciplinary chapter.

The formatting of the interdisciplinary chapter should reflect that of a typical thesis chapter: introduction / background, method, results and discussion, and conclusion. NRT Team members **may share similar (even identical) introduction / background, and conclusions in their interdisciplinary chapters.** It will be **the methods, results and discussion -- based on their disciplinary expertise and research challenges -- that will be unique.** Note that these chapters may refer readers to (aka cite) the other Team member’s chapters. If the chapter is published, each student should consider including other student team members and/or advisors as co-authors, depending on their level of engagement in developing the question and carrying out the study to a peer-reviewed level of quality (Table 1). We ask that you clearly identify the ID chapter within the thesis, with a sentence: ‘*This chapter was competed in partial fulfillment of the OSU-NRT program in Risk and Uncertainty quantification in marine science and policy.*’
Examples of completed ID chapter from previous NRT students are available through the OSU Scholar Archives portal. Please inquire with us if you want to see past ID chapters.

**Product 2:**
The students in each NRT Team must also collaboratively complete a transdisciplinary report. This might be a figurative mixture of their interdisciplinary chapters, and as such it should involve no or minimal use of additional data. However, in the transdisciplinary report, the disciplinary expertise of each student is no longer “traceable” as it’s written in “one voice.” In other words, all contributions are merged to address the NRT Team Project’s topic / research question and the collaborative effort. While publication might be a desired outcome, publication is NOT a requirement. However, we recommend depositing the report in a publically accessible repository, such as OSU Scholars Archives.

The transdisciplinary report can take multiple forms, depending on how you intend to merge your disciplinary perspectives and experience working together. Some examples might be:

1. An integrated literary synthesis addressing common research goal(s) from multiple disciplinary perspectives. Example: a review of large pelagic management practices around the world, and identification of knowledge gaps from human and biological perspectives.

2. A mathematical or statistical model that includes qualitative or quantitative insight from all team members. Example: a bioeconomic model of fleet and resource dynamics that includes environmental- and human-driven uncertainties.

3. A policy analysis that includes knowledge (qualitative and quantitative) from all team members. Example: a management strategy evaluation, such as an assessment of marine spatial planning policies under human and biophysical constraints.

4. A visualization tool that captures the skills of all team members. Example: the display of uncertainties in model forecast.

5. A conceptual model to quantify and implement a new management strategy. Example: a strategy to examine the placement, typology, and size of marine reserves in a well-defined geographic region.

6. A vulnerability assessment of a system. Example: an assessment of the exposure, sensitivity, and adaptive capacity of XX groups to phenomenon YY.

While the content and form of the transdisciplinary report may vary from team to team, we ask that all reports include 1. clear description of each student’s contribution and 2. a team description and reflection of the TD process (e.g., frequency of meetings, delegation vs team work, challenges and opportunities encountered during the process of developing TD research, etc.). We also ask that the transdisciplinary report does not exceed 40 pages including title, main text, individual contributions and team reflections, refs, figures, and tables. Additional text, figures, tables (e.g., detailed methodologies), can be included as an Appendix. Any deviations from these guidelines should be requested and justified at least one month in advance of the report submission.

**When and how to write the interdisciplinary chapters and transdisciplinary reports**
The first step is that of collectively identifying the NRT Team Project: the **topic or research question that will be collectively addressed by your Team.** Defining a question before addressing it sounds the obvious thing to do, but when it comes to implementation of inter- or transdisciplinary research, this seemingly logical course of action is not always followed (for example, agencies technical reports). Ideally, you will do that by the end of Fall term in your first NRT year.

Once this has been accomplished, Team members should start working on the outline of their interdisciplinary chapters and transdisciplinary report. An outline is a roadmap for the completion of the chapter and report. It is 2-3 pages long, containing NRT Project Topic/research question, background and rationale/justification, approach/methods, anticipated results, and significance. Outline should be completed by the end of Winter term in your first NRT year. Recall that the introduction section of an interdisciplinary chapter is a product of your collaborative thinking, and is shared among Team members. So, preparing an outline for your chapters also requires a collaborative effort. For the rest of the NRT year (spring and summer), students complete their interdisciplinary chapters, and the transdisciplinary report.
APPENDIX C
INDIVIDUAL DEVELOPMENT PLAN

Name of NRT Trainee: ________________________________

Name of the faculty mentor: __________________________

Department/College: ________________________________

Start date of traineeship: _____________________________

Name of the NRT faculty mentoring the cluster: __________

Signed by:

______________________________________  __________________________
NRT Trainee                                    date

________________________________________
Mentor (name in print)

________________________________________
Mentor (sign)                                    date

________________________________________
Mentor (if more than one)                       date

Please return to Katherine Hoffman by September 28th, 2018
What is an IDP?
The IDP (Individual Development Plan) is a planning and communication tool used by the student, his/her advisors, and the NRT faculty to:

1) self assess students’ skills, interests, and values,
2) identify career options that best match students’ skills, interests, and values,
3) set individual short- and long-term career and professional training goals,
4) monitor progress toward the implementation of short- and long-term career and professional training goals
5) assess the effectiveness of NRT training elements in helping trainees achieve professional and career goals

How should I use it?
Upon entering the NRT program, trainees will be first asked to complete the AAAS Individual Development Plan IDP (a.k.a., MyIDP), following the template shown here: [http://myidp.sciencecareers.org/](http://myidp.sciencecareers.org/). After completing MyIDP, students will be asked to also complete the IDP template shown below in this document. We refer to the template below as the NRT-IDP. The NRT-IDP was adapted from the OSU post-doctoral scholar IDP. You can find more information about the OSU post-doc IDP here: [http://gradschool.oregonstate.edu/postdocs/individual-development-plan](http://gradschool.oregonstate.edu/postdocs/individual-development-plan).

Why do I need to work on two IDPs templates?
Both the NRT IDP and MyIDP refer to the six competency skills for a scientist that were assembled by the National Post-doctoral Association ([http://www.nationalpostdoc.org/?CoreCompetencies](http://www.nationalpostdoc.org/?CoreCompetencies)) to assess students’ skills, interests, and values. Additionally, the NRT-IDP includes competency skills related to professional goals of our program, namely cross-disciplinary knowledge and communication of NRT core concepts, development of collaborative trans-disciplinary research skills, and proficiency with concepts and practices of Diversity, Equity and Inclusion.

While the MyIDP template has a user-friendly portal to easily navigate through the questionnaire, store responses, and evaluate them, we think that it falls short of monitoring progress toward the accomplishment of your short- and long-term career and professional goals.

---

1 By cross-disciplinary we refer to some unspecified level of merging across disciplines. Multidisciplinary is the simplest level of merging, without clear linkages across disciplines. Interdisciplinary is an intermediate level of merging, often involving two-way interactions across disciplines (e.g., from math to biology and from biology to math). Trans-disciplinary is the highest level of disciplinary merging, where boundaries across disciplines are no longer recognizable (e.g., mathematical biology), often applied to an applied problem.
training goals via the NRT Program. Also, the AAAS MyIDP is focused on academics. In contrast, the NRT-IDP template highlights resource planning and monitoring your progress throughout graduate school here at OSU. Additionally, it helps to set up communication and expectations with your mentor and focus on professional skills that are germane, and of interest to a broader group of students and professionals (i.e., not only academics). This is why we ask you to fill both templates.

Where can I get help to work with the IDP?
Your faculty mentor should be the primary resource in helping you through the IDP. In addition, we have assigned a NRT faculty member\(^2\) to each research cluster (students + faculty mentor). The NRT faculty will:

1. help you walk through the NRT IDP and MyIDP templates
2. provide insight on the disciplinary and professional training available through the NRT program
3. in collaboration with the NRT external evaluator, use the IDP as an assessment tool of the NRT program activities

We also have a 1.5 hour IDP primer during the IFC, and we require that your faculty mentor attend that session to work on the NRT IDP with you.

When should I start working on the IDP?
The sooner, the better. Ideally, individual trainees and their mentor(s) will work through MyIDP before attending the GEO 508 Intensive Field Course (IFC). During the first day of the IFC, trainees will receive additional background information about IDPs, and will have an opportunity to start filling in the NRT-IDP. Bear in mind that the IDP is an evolving document. We ask you to return a copy of your IDP two weeks after the end of the IFC. That will be your first attempt at this. Later in the year, during the Winter Benchmark meeting\(^3\), we will ask you and your faculty mentor to check progress on the NRT-IDP so that you can update it with new knowledge acquired during the academic year.

\(^2\) Assignment is TBD
\(^3\) These are meetings between the faculty mentor, the student and one or two NRT representative meant to check student progress in the NRT program
NRT-IDP template
Before answering these questions we require that each student goes through the steps of the AAAS Individual Development Plan (MyIDP, http://myidp.sciencecareers.org/) and becomes familiar with the six competency skills based on the National Post-Doctoral Association (http://www.nationalpostdoc.org/?CoreCompetencies). If you would like, you can print out your answers from the MyIDP portal for your own use.

A. Career Goals (to be filled out by the NRT trainee).

- What are your short-term career goals? Describe your time line for achieving them.
- What are your long-term career goals? Describe your time line for achieving them.
- When will you begin a job search? If you do not know, estimate. If you have already begun a search, briefly describe.

B. Research Project(s) (to be filled out by the NRT trainee and validated by the mentor(s))

- Briefly describe the aims and experimental approaches of your current research project(s), including the NRT interdisciplinary chapter and other chapters done in fulfillment of your graduate degree at OSU. At the beginning of the NRT program you may not yet have a clear idea of what your interdisciplinary project will look like. That is OK, you will be able to refine the project idea later in the program.

C. Expectations for Contribution to Research Project(s) (to be filled out by the mentor(s) and validated by the trainee)

- Please provide a detailed list. Examples: supervise 1 undergraduate student on independent research project that will produce a poster; complete experiment xx described on pages yy-zz of the student’s proposal; complete data analyses for experiments xx and xx and submit summary to mentor; etc.

D. Professional Development Plan (to be filled out by the trainee and mentor(s) in collaboration). See Tables below.
For more information and links to resources, download the complete Core Competencies document.

Table 1. Competency skills of a scientist (in your discipline)

<table>
<thead>
<tr>
<th>Competency</th>
<th>Goals from your own discipline</th>
<th>Expected activities/efforts of trainee</th>
<th>Responsibilities of faculty mentor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(What do you, the trainee, expect as outcomes?)</td>
<td>(For each goal, think about how you will achieve it. By which mechanism(s)?)</td>
<td>(For each goal, think about how you will support your student to achieve it. By which mechanism(s)?)</td>
</tr>
</tbody>
</table>

(1) Discipline specific conceptual knowledge (gain understanding of a new theory or concept, develop fluency with respect to a methodology/method of analysis, learn how to use a new computational tool)

(2) Research skill development (includes experimental design, new measurement or analysis technique, data analysis, peer review process)

(3) Communication skills (includes writing publications and grants, CV, teaching portfolio, job interview skill, poster and oral presentations, teaching, networking, with diverse audiences)

(4) Professionalism (can include interpersonal relationships, multicultural competency, institutional obligations, service to institution and society, diversity, equity and inclusion training)
(5) Leadership and management skills  
(can include staff and project management; time management; budget preparation and management; strategic planning, serving as mentor and role model; running meetings; delegating responsibilities)  

(6) Responsible conduct of research  
(can include data sharing and ownership; authorship criteria; human subjects, animal research and IRB; scientific misconduct – identifying and reporting; conflicts of interest)
<table>
<thead>
<tr>
<th>Competency</th>
<th>Goals (what do you, the trainee, expect as outcomes?)</th>
<th>Expected Activities/Efforts of trainee (for each goal, think about how you will achieve it. By which mechanism(s)?)</th>
<th>Responsibilities of NRT mentors(s) (For each goal, think about how you will support your student to achieve it. By which mechanism(s)?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Cross-disciplinary conceptual knowledge of the OSU NRT core concepts (includes a) Coupled Natural Human systems - CNH b) Risk and Uncertainty Quantification and Communication – R&amp;U c) Analyses of Data as Evidence- DE)</td>
<td>Examples: Geo 508, MRM series, classes which constitute the minor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Development of collaborative research skills (can include learning about challenges and rewards of collaborative working structures; how alternative disciplinary perspectives on a concept affect group formation; and applying those alternative perspectives to produce collaborative research)</td>
<td>Examples: - Complete MRM professional series - Engage in internship with .....</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Cross-disciplinary communication (can include writing publications, posters and oral)</td>
<td>- Attend professional training on communication provided by OSU Graduate School</td>
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</tbody>
</table>
presentations; networking, etc. regarding the three core concepts and the complexity of cross-disciplinary issues to diverse audiences)

<table>
<thead>
<tr>
<th>(4) Diversity, equity and inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(includes achieving competency in communication in groups composed of multicultural and multidisciplinary disciplinary experts; exploring implicit biases; developing cultural sensitivity and awareness)</td>
</tr>
</tbody>
</table>

Description:
- Engage in internship with .....  
- Actively participate in guided self-reflection activities during IFC  
- Attend and engage with all diversity, equity, and inclusion elements of the MRM professional series  
- Demonstrate respect within NRT groups (students, faculty, administrators, etc.)

Example:
- Establish an environment of trust and openness within student groups and across student-mentor  
- Co-create clear guidelines for meeting (process, interpersonal relationships, mediation, conflict resolution, etc.)
APPENDIX D
NRT STUDENT CLASS SUBSTITUTION

Dear Students,

If you are wanting to substitute a class with a course which can be substituted with another one from the 4 areas of a minor (please see link below), please out this form and return with the syllabus.

We do not generally accept slashed courses (4XX/5XX) if the course can be taken for undergraduate credits as well.

http://catalog.oregonstate.edu/MinorDetail.aspx?Minor=5050&college=24

Name____________________________

New class_____________________

Which class you would like to substitute for:______________________

Justification for class (please provide syllabus):

Which area of the minor does the class fall into: Big Data and Uncertainty Quantification, Risk Analysis, Earth Systems, Social Systems:

Lastly, if there is a graduate class from another university, you wish to consider, your major professor must contact the Graduate School.
If you are thinking this may apply to you either with a class you have taken or a class you are planning on taking, please provide the following information along with the syllabus of the class you are wanting to substitute for and e-mail back to Katherine.Hoffman@oregonstate.edu
APPENDIX E
NRT STUDENT INTERNSHIP APPLICATION

NRT Internship Application/Report Guidelines:

You must complete and turn in this form no later than 1 month prior to the start of your internship. In addition, no later than one month after the end of the internship you must complete a two-page essay with reflections on how the internship has provided a) experiential learning, b) engagement and other professional development opportunities (e.g., communication, project coordination, etc.), c) career opportunities-get professional training, in line with your career expectations (from IDP). Please fill in ALL categories including a budget justification.

Name: ______________________________

Proposed Internship Site: ___________________________

Proposed Mentor(s): ___________________________

Specific Dates: ___________________________

Term: ___________________________

Goals of an internship
Internships should provide an opportunity to a) engage with stakeholders, b) have experiential learning opportunities on topics relevant to the OSU NRT, and c) Please clearly explain below how your internship will meet these goals:

Financing your internship
Students are allowed to receive up to $2,000 maximum combined funds for internship and research cost requests. For example, if you were awarded $1,100 in internship costs, you could apply for $900 in research funds. Please note, all requests will still need to go through the approval process. And the stipulations for the each fund solicitation still apply.

The NRT can provide support for travel up to $1,500 to and from internship sites but not for living expenses such as per diem.
  • Lodging costs for up to $600 may be considered if the student has a compelling reason as to why the stipend would not over lodging costs.
  • Rent for Corvallis while the student is away is not an allowable expense. Internship funds must be used for internship-related travel only.
• Attending or presenting research at a conference does not fulfill the internship requirements, and therefore funding requests for attending conferences will not be considered.
• It might be advantageous to take the internship in the summer as you will still receive your stipend and will only need to be signed up for 3 credit hours.

Budget:

You MUST check with your Research Group to make sure you will still be engaged with them during your absence.

How to register for internship

If you are planning on taking your internship in the summer, please sign up for no more than 3 credit hours. You may take these as thesis or internship credits. If you decide to take them as internship credits, please check with your home department on the specifics of this.

Please send completed form to: Katherine.Hoffman@oregonstate.edu
APPENDIX F
NRT STUDENT RESEARCH FUNDS APPLICATION

Students are allowed to receive up to $2,000 maximum combined funds for internship and research cost requests. For example, if you were awarded $1,100 in internship costs, you could apply for $900 in research funds. Please note, all requests will still need to go through the approval process. And the stipulations for the each fund solicitation still apply.

Name___________________________________

In about one page, please address the following points

1. Brief description of the research/travel to be conducted

2. Timeline for conducting such research/travel

3. How does the research/travel address the student's a) interdisciplinary chapter, and/or the team's b) transdisciplinary report?

4. Budget and justification for the research or travel. $150-200 is available to each student for research or towards a conference.

Please turn into to Katherine Hoffman, 104 Burt Hall Katherine.Hoffman@Oregonstate.edu
APPENDIX G
NRT FACULTY RUBRIC FOR GRADING TRANSDISCIPLINARY REPORT

The goal of this rubric is to list criteria for assessing and providing constructive feedback to the student transdisciplinary reports. Please provide a brief narrative for each of the five criteria listed in the table below and for the two general questions:

Is this report ready to be shared with stakeholders and/or published in peer-reviewed journals?

What are your final recommendations for improving the report?
<table>
<thead>
<tr>
<th>Weight</th>
<th>Where</th>
<th>Non-satisfactory</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>Introduction</td>
<td>TD report is strictly based on academic research with unclear or unrealistic links to societal implications Or Is strictly based on societal implications with unclear links to scientific discovery</td>
<td>TD report is relevant to academia and societies, but has very limited applicability to one of the two spheres</td>
<td>TD report is relevant to academia and societies and has clear applicability to both spheres</td>
<td>TD report is an exemplary integration of research for academic discoveries and for societal relevance. Should be used as an example of societally and academically relevant research and synthesis for agencies, industry, and NRT students.</td>
</tr>
<tr>
<td>20%</td>
<td>Entire text</td>
<td>TD report is mostly focused on one NRT concept with superficial treatment of other core concepts</td>
<td>TD report is mostly focused on two OSU-NRT core concepts with superficial treatment of the other core concept</td>
<td>TD report has an in-depth treatment of all three OSU-NRT core concepts</td>
<td>TD report has an in-depth treatment of all three OSU-NRT core concepts and has relevance to other disciplines as well</td>
</tr>
<tr>
<td>20%</td>
<td>Entire text</td>
<td>Core concepts are not integrated, and the report reads as a multi-disciplinary endeavor</td>
<td>Core concepts are integrated, but there are clear and recognizable disciplinary boundaries</td>
<td>Core concepts are integrated, and the report reads as a single voice with no clear separation of disciplinary expertise</td>
<td>TD report is an exemplary demonstration of integrated NRT core concepts. The report leads to new principles broadly applicable to multiple systems for studying and integrating NRT core concepts. Should be used as a reference for future NRT cohorts</td>
</tr>
<tr>
<td>20%</td>
<td>Individual contributions and team reflections.</td>
<td>TD report was lead by subset of team members. Conflicts within the team were not addressed</td>
<td>All team members contributed to the TD report. Conflicts were addressed but not resolved</td>
<td>All team members contributed to the TD report. Team encountered significant challenges, but through communication and team building practices, were able to overcome them.</td>
<td>All team members contributed to the TD report. Team approach conflict in such a way that significant challenges were avoided through the active use of communication and team building practices.</td>
</tr>
<tr>
<td>20%</td>
<td>Entire text</td>
<td>TD report lacks clarity. No attention has been paid to editing, grammar, and overall flow of information</td>
<td>TD report is clearly written, but there are grammar and editing issues, such as inaccurate figures and table legends, missing references, etc. Only experts can read and understand it.</td>
<td>TD report is clearly written and edited, but some concepts are only understandable by specialized readers.</td>
<td>TD report is an exemplary essay for future NRT students. It is clearly written and very carefully edited. Report has the clarity of a published article and is understandable to experts in each of the NRT core disciplines.</td>
</tr>
</tbody>
</table>