Instructor Toolkit

Values and Responsibility in Interdisciplinary Environmental Science
A Dialogue-Based Framework for Ethics Education

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Dear Instructors,

Thank you for your interest in the Values and Responsibility in Interdisciplinary Environmental Science curriculum materials. We hope you find them useful! Below you will find a conceptual background for our project and suggestions for use that will describe how this curriculum might best be employed in an educational setting.

1. Conceptual Background

Interdisciplinary approaches to environmental issues, from water management to climate change vulnerability, are increasingly championed as the most effective way to address problems and impact change.\(^1\) Often these approaches include a range of biophysical and social sciences. For example, research on climate change vulnerability might integrate methods from climate modeling, economic analysis, historiography, and ethnography, among other disciplines. Because this interdisciplinary scientific wisdom might be implemented or adopted by non-scientists when addressing environmental problems, many scientists feel a sense of responsibility for the ways their research might impact or be interpreted by non-scientists. While this responsibility can apply to any number of issues related to the interface between scientific research and non-scientist communities, we have focused our curriculum on four common themes that are consistently relevant in interdisciplinary environmental science research contexts: risk and uncertainty, expertise, non-human impacts, and policy constraints.\(^2\) These themes provide a foundation for meaningful discussion about the roles of values and responsibility in an interdisciplinary environmental science context.

By values, we mean assumptions and beliefs about which actions are good or bad, right or wrong. By responsibility we mean the degree to which environmental scientists should be concerned about how their work impacts decision-makers and stakeholders. This is a different—but complementary—notion of responsibility than what is found in Responsible Conduct of Research (RCR) programs mandated by institutional review boards. RCR programs are typically oriented toward legal liability regarding the treatment of research subjects.\(^3\) The concept of responsibility used here instead evokes something more akin to moral accountability, whereby scientists seek to ensure their professional work reaches impacted communities in

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2 See the next Toolkit document—Four Ethical Themes Central to Interdisciplinary Science—for more detailed descriptions of these themes.
appropriate and beneficial ways.

**Risk**
In their capacity as experts in the public realm, scientists are often expected to communicate potential risks related to the adoption of their science in problem-solving or policy recommendations. Due to the nature of science and the complexity of environmental problems, potential risks are more often than not rooted in uncertainty, which complicates the task of formulating and appropriately communicating them to the public and opens the door for disagreements between scientists about risk priorities, levels, and urgency. In addition, as an assessment of states deemed desirable or less desirable, risk is inherently rooted in ethical decision-making. Scientists bear the responsibility of weighing the impacts of risks on multiple communities, considering the required efforts and resources to mitigate proposed risks, and, reciprocally, considering the role of public concerns on the risks and scientific issues they choose to study. Risks and uncertainty have tangible impacts on non-scientist groups. How scientists discuss, address, and account for risks in their work and in their communication with policy-makers, publics, and journalists is rooted in both disciplinary training and individual values.

**Expertise**
Generally we refer to non-scientist populations who are affected and involved in scientific research as “stakeholders,” because they have a stake in the issue at hand. Stakeholders include members of impacted communities as well as larger populations, or publics, whose health, access, economic situations, or interests are impacted by scientific research or expert advice on issues such as energy policy, air quality standards, and conservation regulations. Often these stakeholders are also research collaborators, not merely informants, data sources, or research subjects. For example, interdisciplinary climate science studies often work with Indigenous peoples in regions such as the Arctic, relying on their advice to help formulate research questions and analyze data. Scientists who have not been trained to work with non-scientists in this way may have differing views about how involved these groups should be in the research process, which can lead to disagreements, unjust decision-making, or stymied conservation progress.

**Non-human Impacts**
In many cases, stakeholders also include non-humans, e.g., animal populations and ecosystems, because non-humans often have a significant stake in the outcomes of scientific studies. While it might be strange to consider non-human nature a stakeholder, many people feel strongly that certain types of research may pose a negative threat to the well-being or “interests” of animals or the integrity of ecosystems, and therefore they believe these interests ought to be considered in decision-making processes. The work of deciding whose stake to consider, and how, in research decision-making includes ethical questions of equity, value, voice, and relationships.

**Policy Constraints**
Both human and non-human stakeholders are affected by interactions between environmental
scientists and decision-makers. Decision-makers include people in leadership positions, such as elected officials, law- and policy-makers, directors of private, non-profit, and governmental organizations, and informal community leaders. In one direction, environmental scientists provide decision-makers with sound information so they can make informed judgments about how to address problems that matter to the people they represent. On issues such as climate change vulnerability, for example, environmental scientists with the Intergovernmental Panel on Climate Change or the Climate Science Centers of the United States Geological Survey often advise decision-makers in ways that can improve the lives of people affected by the implemented decisions. In the other direction, decision-makers often make key decisions about what types of research receive federal, state, or other funding, such as support from corporations or charitable donors.

Scientists may have different views about the extent to which research priorities and methods should be influenced by decision-makers' agendas. Some scientists may feel that they are responsible for persuading decision-makers about what research to fund; others may feel their role is limited to simply applying for available funds. We refer to these issues about how decision-makers influence research as “policy constraints,” highlighting the idea that when decision-makers set policies about what research is supported, they place constraints on what scientists can and cannot do. Conversations about appropriate interactions between scientists and decision-makers will often unearth strongly held values and will demand dialogue about the responsibilities of scientists in the public sphere.

2. Suggestions for Use
Not all environmental scientists agree about the extent of these responsibilities, which is both a reflection of different disciplinary training as well as a function of individual values. For interdisciplinary teams to function effectively across disciplinary and values-based boundaries, they need to understand how their methodologies and expertise can impact non-scientists, and they need to practice productive dialogue that integrates different disciplinary languages and training. Environmental science graduate students are important participants in conversations about scientists’ responsibilities for their work and its impact on different audiences. In their development as scientists, and as interdisciplinary collaboration becomes imperative in addressing complex environmental problems, graduate students will need to consider their responsibilities to non-scientists, reflect on their own values, and cultivate effective interdisciplinary collaborative skills. Their ability to function effectively in interdisciplinary contexts will consequentially impact future environmental decision-making and problem-solving.

Institutions of higher education are designing and implementing Interdisciplinary Environmental Science Programs (IESPs) that facilitate students’ capacity to address environmental issues that matter to stakeholders and decision-makers. In IESPs, students and

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professors with diverse disciplinary training may have different values about appropriate interactions between scientists, stakeholders, and decision-makers. Our curriculum responds to the common perception among instructors in IESP's that students are underprepared for the ethical aspects of their future careers. As scientists, IESP graduates will face difficult ethical questions, such as: (a) Will they be public advocates as well as technical experts, (b) Will they treat non-scientist knowledge-holders, e.g., birdwatchers, as experts worthy of professional respect? (c) Will they value the interests of non-human animals, and if so, how might these interests be recognized in decision-making alongside other stakeholder interests? (d) Should they speak out against the scientific impacts of governmental funding priorities?, and (e) How should they best communicate potential risks related to the dissemination of their science to the public? Our curriculum does not presume to offer right or wrong answers to these, or other, ethical questions; rather, it is designed to facilitate thinking and dialogue around these kinds of values-driven questions, thereby preparing students to work with integrity alongside collaborators and with diverse audiences.

Our curriculum provides two teaching modules—a 6-hour/roughly 2-week lesson and an abbreviated 3-hour/roughly 1-week lesson—designed to be incorporated into existing IESP courses. The lessons, alongside the scientific curricula instructors are already teaching, are intended to prepare IESP graduate students for some of the ethical challenges they will face in their careers by emphasizing the importance of the accountability of researchers in professional sciences to both decision-makers and non-research communities.

Based on contemporary educational theory, our curriculum is committed to the idea that students best learn conceptually challenging ethical content through structured peer dialogue and guided self-reflection. Our approach derives its dialogue-based workshop model for interdisciplinary environmental education from the NSF-supported Toolbox framework, which works to enhance communication in interdisciplinary research.

**We suggest instructors review all documents included in the Instructor Toolkit before implementing the curriculum with students.** This initial preparation will save time and headaches in the classroom, and it will also create a more effective learning environment. Please note that both an Instructor Toolkit and a Student Toolkit have been provided, so be

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sure to direct students to the appropriate materials, which will include all of the readings and class-specific materials they will need to participate in the lessons. The Instructor Toolkit includes these same materials, as well as discussion, presentation, and class preparation materials.

We hope that this curriculum becomes an important part of your graduate teaching. We welcome feedback and stories about your experience with the curriculum in your classroom, which you are invited to provide at the curriculum website. Our intention is to adapt the curriculum over time to meet the needs of educators and students, and to provide meaningful learning experiences that offer useful ethics and collaborative training for interdisciplinary environmental science graduate students.

Sincerely,

Michael O’Rourke
Michigan State University

Troy E. Hall
Oregon State University

Principal Investigators

With curriculum co-developers:

Jan Boll, Washington State University
Barbara Cosens, University of Idaho
Thomas Dietz, Michigan State University
Jesse Engebretson, Oregon State University

Lissy Goralnik, Michigan State University
Zachary Piso, Michigan State University
Sean Valles, Michigan State University
Kyle Whyte, Michigan State University

9 The URL to the curriculum website is: http://eese.msu.edu/
Values and Responsibility in Interdisciplinary Environmental Science
A Dialogue-based Framework for Ethics Education

Four Ethical Themes Central to Interdisciplinary Environmental Science

This document supplies brief characterizations of the four ethical themes featured in the curriculum: risk, expertise, policy constraints, and non-human impacts. These “themes” are domains in which potential value differences may exist among scientists who work together in interdisciplinary contexts and whose research and advice have the potential to impact stakeholders and decision-makers. Of course, there are other themes that are also relevant to environmental science research and expertise; we have selected these specific themes because they are fairly common in interdisciplinary environmental science contexts and will provide a strong foundation for consideration of values and responsibility in interdisciplinary environmental science.

1. Risk

Interdisciplinary environmental science projects often have to assess and characterize risks that bear on stakeholders and decision-makers. Scientists in these projects may also be responsible for communicating these risks either to the public directly or to decision-makers, journalists, or other professional communicators who will take the science into the field. Reciprocally, scientists need to consider how public concerns shape the risks they choose to study. For example, should they investigate hazards that certain members of the public feel are more dangerous than scientists believe them to be (e.g., genetically modified crops), or focus their energy and resources elsewhere?

Scientists working in interdisciplinary environmental science may have the opportunity to communicate risks to decision-makers in ways that shape socially influential policies, yet they may disagree about how to do so. Consider the regulation of nanotechnology, which has emerged as an ongoing source of disputes about how to assess and respond to risks. Biochemists, pathologists, and related experts may emphasize the chemical and biological plausibility of health impacts.10 Academics interested in Ethical-Legal-Social Implications, such as sociologists and geographers, may focus on the culturally or socially informed perceptions of risk11 or on thought experiments, including implausible or speculative ones. Attention to these perceptions and thought experiments supports the development of scenarios that help illuminate important ethical features.12 An important study of a range of scientists concluded that “most upstream scientists,” which include engineers, chemists, physicists, and materials scientists, “do not think nanotechnologies pose new or substantial risks, while most downstream scientists,” which include toxicologists, epidemiologists, and other public health

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scientists, “are worried that they may pose new, unforeseen, and possibly substantial risks.”

Scientists routinely have to make hard choices about which aspects of risk to emphasize to decision-makers and stakeholders, who will then in turn make regulatory decisions based on their interpretation of that information.

2. **Expertise**

In the course of their professional lives, interdisciplinary environmental scientists must make a variety of judgments about expertise. Two types are especially prominent: (a) judgments about whose expertise matters to a project—their own, other scientists’, politicians’, regulators’, tribal representatives’, hunters’, etc., and (b) judgments about what their expertise puts them in a position to do, e.g., should they advocate certain actions to policy-makers or simply describe scientific results to them? Scientists should be concerned about the accountability of their judgments about expertise, since these will influence their relationships with decision-makers and the course of their research projects (e.g., will experts without academic credentials, like birdwatchers, hunters, or local knowledge-holders, be permitted to participate, and in what ways?).

Scientific disciplines are founded upon assumptions about the nature of credible knowledge and the qualifications of who counts as an expert, as well as social norms about what kinds of advice scientific experts should provide to scientists in other disciplines, stakeholders, and decision-makers. Across scientific disciplines, what makes knowledge credible is that it emerges from an empirical process sanctioned by the standards of a particular science. Experts qualify as such when they have met criteria that establish them as competent practitioners in an area of science. Experts are also positioned to offer advice to non-experts. Who counts as an expert, though, can be disputed. Climate scientists, for example, often value the knowledge of Indigenous peoples regarding climate insofar as it provides otherwise unavailable observational information, without giving it any further role in the design of their research questions, implementation of research methods, or interpretations of results. By contrast, cultural geographers, anthropologists, and other social scientists often see Indigenous knowledge as far more credible, taking it to be a source of knowledge that is equal to science in many respects. As for the kinds of advice experts should provide, some fields might be comfortable doing research that directly supports a particular policy option, whereas others might see their research as providing a range of options for decision-makers; still others might be uncomfortable with any connection to policy options at all.

3. **Non-human Impacts**

In addition to humans, interdisciplinary environmental science has an impact on non-human

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organisms and broader collectives such as ecosystems. Environmental scientists across the disciplines have different ways of conceiving how their research impacts the “interests” of non-human entities. Here “interests” refers to qualities such as the propensity to continue existing, the desire to reproduce, and the desire to ensure the safety of offspring. Should scientists take seriously the interests of non-human organisms and broader ecological collectives when designing their research? Scientists working in pollution abatement, for example, may see themselves as primarily responsible for protecting human health. Others disagree and insist that scientists should also be concerned with the impact of their research on animals and biodiversity aside from its connections to human interests, perhaps to protect things like ecosystem “integrity” or “well-being.” Scientists often feel responsible for making informed decisions about how to weigh the impacts of their research on these non-human entities. Some interdisciplinary environmental science programs address landscape-scale conservation issues and include in their curriculum coursework wildlife and plant biology, environmental management, and climate science. Integrating these diverse sciences requires negotiating a number of value differences concerning how impacts on non-humans should figure into research and management decision-making. Consider debates among scientists about the value of nature in relation to climate change. Global warming has shifted the habitable regions for many plants and animals and could lead to potential extinctions in the future. Some scientists argue that more research should address how to conserve species, habitats, and ecosystems that are threatened by climate change. Other scientists argue that we should study new human and natural systems and simply let go of certain species, habitats, and ecosystems.

For another example, consider the case of the Acoustic Thermometry of Ocean Climate experiment by oceanographers. Some biologists are opposed the research because it could interfere with the acoustic transmission of marine mammals that are already threatened by human activities. By contrast, the oceanographers are focused on the importance of their work for climate change research. Research goals often conflict, and situations can arise in which opposing goals are indeed mutually exclusive in that one path negates the other. These conflicts raise interesting questions for scientists to navigate as they explore their responsibilities to non-research communities and decision-makers.

4. Policy Constraints
Policy constraints are ways in which political realities—broadly construed to include the

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dynamics of professional scientific organizations, funders, and research institutions—and the needs of decision-makers influence what scientists study and how they do their research. For example, interdisciplinary environmental scientists may engage in research aimed to help particular communities adapt to climate change; however, it is often the case that scientists choose not to suggest certain solutions for adaptation because they would—for political or economic reasons—likely not be acceptable to decision-makers or other political groups involved in the decision-making process. In these situations, scientists are accountable for how they respond. Should they simply do whatever research is feasible within the aforementioned policy constraints, or should they openly oppose unacceptable policy constraints, e.g., constraints that they feel yield bad tradeoffs for the affected communities?

Individual environmental scientists must make decisions, whether explicit or implicit, about how they will interact with the policy constraints surrounding their work. Policy constraints include everything from the informal conventions of one’s discipline, such as statistical significance standards, to local and national regulations, such as The Endangered Species Act. Some environmental scientists argue for “more active participation by scientists in matters of policy,” while others claim that greater participation by scientists can only make matters more complicated.

Consider the case of interdisciplinary research on geoengineering approaches such as solar radiation management (SRM), i.e., releasing airborne particles to shade the earth’s surface. Robock (2008) points out that SRM research undermines current efforts to create greenhouse gas mitigation policies by giving the impression that climate change can be solved simply; furthermore, scientists might lack the “moral authority” necessary to pursue research that would intentionally reshape the global climate. Keith et al. (2010) argue that scientists must influence the processes that will lead to funding SRM research because the failure of international climate change mitigation negotiations means that we should be prepared in the future to deploy geoengineering. At the same time, some social scientists argue that scientists should not influence the specific research policy-makers fund.

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Conceptual Foundations: Eigenbrode et al. (2007)

This curriculum is rooted in the idea that structured dialogue about disciplinary perspectives on values and responsibility can prepare environmental scientists to communicate in an ethically sensitive way with a wide range of partners from academic disciplines and non-academic communities. This approach is an extension of the Toolbox dialogue approach, first presented in Eigenbrode et al. (2007). We recommend reading this article as an early step in understanding the conceptual foundations of the Values and Responsibility in Interdisciplinary Environmental Science curriculum.


Link: https://academic.oup.com/bioscience/article/57/1/55/224519
Values and Responsibility in Interdisciplinary Environmental Science
A Dialogue-based Framework for Ethics Education

Learning Objectives

By the end of the module, students will be able to:

Learning Objective 1
Describe the ethical challenges of risk, expertise, non-human impacts, and policy constraints in relation to their interdisciplinary environmental science field.

Learning Objective 2
Recognize risk, expertise, non-human impacts, and policy constraints in case studies related to their interdisciplinary environmental science area.

Learning Objective 3
Assess how risk, expertise, non-human impacts, and policy constraints should affect their own conduct as practitioners in the interdisciplinary environmental sciences.

Learning Objective 4
Identify and analyze differences and similarities among the perspectives of multiple environmental science disciplines on risk, expertise, non-human impacts, and policy constraints.

Learning Objective 5
Formulate dialogue prompts that apply the broad concepts related to values and responsibility in interdisciplinary environmental science, including risk, expertise, non-human impacts, and policy constraints, to each student’s particular research and practice specialty.

Learning Objective 6
Articulate and discuss their perspectives on risk, expertise, non-human impacts, and policy constraints in interdisciplinary environmental science with other members of the course.

Learning Objective 7
Produce a project that applies knowledge of the values and responsibility dimensions of interdisciplinary environmental science to a problem in one’s own research or practice domain.*

*The project assignment is an optional extension of the main curriculum
Frequently Asked Questions

**FAQs FROM INSTRUCTORS**

**What do you mean by values, ethics, and responsibility?**

By *values*, we mean assumptions and beliefs, held by scientists, about (1) what goals are important for scientists to achieve when designing research or providing recommendations to decision-makers, and (2) what boundaries are not worth crossing in order to protect empirical and professional integrity. The values we hold are at the heart of our judgments about which actions are right or wrong, that is, the *ethics* of our actions. Scientists in different fields may disagree about what interventions are ethically acceptable. In particular, they may disagree about the ways in which they are responsible to decision-makers and non-research communities. By *responsibility*, then, we mean the degree to which environmental scientists should be concerned about how their work impacts decision-makers and stakeholders.

**How are values related to the four curriculum themes?**

The four ethical themes that provide the foundation for our curriculum—risk, non-human impacts, expertise, and policy constraints—are domains in interdisciplinary contexts where values and perception differences commonly arise. Values, as well as disciplinary training, lie at the heart of potential disagreements that emerge around these issues. The four themes are also domains in which *not* taking a position is still a position—e.g., ignoring the relevance of policy constraints to one’s work is an ethical stance about the independence of science and politics, or communicating risk information in ways that only specialists would understand assumes that non-expert stakeholders do not need to be fully informed of certain risks. Exposure to and dialogue about these themes can help unearth one’s own particular value stances, stimulate reflection on the role of values in interdisciplinary environmental science contexts, and facilitate awareness of the value stances of others regarding scientific responsibility in the public sphere. While additional themes exist that are relevant to particular interdisciplinary environmental science areas, we selected these four because they are widely applicable to many interdisciplinary science areas.

**What type of courses would be good candidates for this curriculum?**

We have designed the curriculum with graduate environmental science courses in mind. The articles that drive the case studies (click here, on Case Studies in the Table of Contents, or on specific cases in the Case Study Guide) are drawn from environmental science, and the Generic Dialogue Instrument (below, or click here or in the Table of Contents) reflects environmental science problem solving. More fundamentally, two of the ethical themes on which we concentrate—non-human impacts and policy constraints—work well in the context of environmental research but may not be as relevant in other contexts. However, the curricular approach could be valuable for anyone teaching an interdisciplinary group of students who have a solid disciplinary grounding, including graduate students or advanced undergraduates,
and would benefit from some tools to develop interdisciplinary dialogue capacity and ethical problem-solving skills. Adopting our curriculum in a course context that does not involve environmental science would require reflection on the dominant ethical themes in that context to determine if the four themes we have identified are relevant; implementing the curriculum in new contexts would also require additional case study resources.

**Is this curriculum a stand-alone module, or should it be taught across the semester?**
The curriculum is designed to work as a stand-alone module, occupying 3 (minimum) to 6 (optimal) hours of class-time. It is also self-contained and could work at any time during a course. However, given the complexity of the themes addressed and their importance outside the domain of ethics, it is perfectly reasonable to time the implementation of the curriculum so that it connects the curricular content with other modules or elements of the course. The document *Instructions for Assessment Activities* (below, or click here or in the Table of Contents), outlines a number of projects that can be assigned to students. These could be modified to synthesize the curriculum with other sections of a course.

**What should I have my students read?**
Prior to the first session, we recommend students read (a) *Eigenbrode et al. 2007* (click here or in the Table of Contents) to introduce them to the structured dialogue approach we employ, and (b) *Four Ethical Themes Central to Interdisciplinary Science* (above, or click here or in the Table of Contents). These documents are both included in the Instructor and Student Toolkits. Additional readings should include texts that introduce your students to the themes and issues that will figure into your case studies work; specific examples of relevant case studies are included in the Instructor Toolkit (click here or on Case Studies in the Table of Contents). For background on the nature of dialogue prompts and workshops, students might find the *Looney et al. 2013* article useful (click here or in the Table of Contents).

**Do I have to use the provided case studies?**
No. In the document *Selecting Case Studies* in the Instructor Toolkit (click here or in the Table of Contents)—that describes the process of selecting your own case studies. This resource also includes a number of articles that contain case studies and supplementary documents with learning objectives, instructions on the use of case studies, and guidance on how to analyze case studies within the ethical framework of this curriculum. You are free to choose to use your own case studies, e.g., if you would prefer to use ones that are more directly connected to values and responsibility dimensions of your specific interdisciplinary environmental science context. Even if you decide not to use the provided case studies, it will be important to look at the supporting documents that describe how to use case studies within the curriculum. Some helpful resources for finding case studies for use in science coursework include:

- **National Center for Case Study Teaching in Science:**
  http://sciencecases.lib.buffalo.edu/cs/

- **ScienceCaseNet:** http://sciencecasenet.org/

- **National Socio-Environmental Synthesis Center (SESYNC) Case Study Collection:**
What is the purpose of the dialogue exercise?
The structured dialogue exercise is a chance for students to participate in an informed and informative discussion of the ethical dimensions of their specific interdisciplinary environmental science context, synthesizing what they learned about themselves and their classmates during the initial part of the curriculum. The exercise is structured by prompts designed by the students to reflect their own professional priorities and concerns. To support this opportunity and enhance their self- and mutual understanding, it helps to ensure that students are participating in an interdisciplinary dialogue group and, if possible, that they are using a set of dialogue prompts designed by another group in the class.

By providing scaffolding to support a sophisticated ethical discussion, the dialogue exercise enables students to achieve the 5th learning objective: “Articulate and discuss their perspectives on risk, expertise, non-human impacts, and policy constraints in interdisciplinary environmental science with other members of the course.” The exercise also provides an opportunity for students to discuss the relationship between the ethical themes and their practice, thereby satisfying the 3rd learning objective: “Assess how risk, expertise, non-human impacts, and policy constraints should affect their own conduct as practitioners in interdisciplinary environmental sciences.”

Should the students develop their own dialogue prompts or can we use the provided generic prompts?
The curricular materials are designed to help you and your students develop a set of dialogue prompts that are tailored to your specific environmental science context. The generic prompts included in the Generic Dialogue Instrument (below, or click here or in the Table of Contents) are meant to do two things: (a) provide further insight into important aspects of the four ethical themes we emphasize, and (b) serve as model prompts that can aid your class in developing their own. If you have three or more hours of class time available for the curriculum, we recommend working with your students to develop your own prompts. If you don’t have much class time to devote to the curriculum, the generic prompts can be very helpful but will lack specific applicability to your class, since they were developed without knowledge of specific context or content.

Are there instructions to guide the process of creating dialogue prompts with students?
Yes — see the document Instructions for Developing Dialogue Prompts (below, or click here or in the Table of Contents). The documents in this folder describe the steps involved in creating dialogue prompts. Please read these steps in order.

How should I facilitate the dialogue?
How you facilitate these dialogues depends on your specific objectives and how many distinct
dialogue groups you have in the class. See also the document Instructions for Conducting Dialogue Workshops (below, or click here or in the Table of Contents).

Objectives: The curriculum is inspired by the Toolbox approach to interdisciplinary dialogue, which involves light-handed facilitation designed to move the groups around the dialogue instrument without making the dialogue about the facilitator or the facilitator’s interests. The facilitator typically remains quiet and lets the participants engage in dialogue. If you have specific content objectives you seek to achieve, it may make more sense for the instructor/facilitator to play an active part in the dialogue.

Number of groups: If there is only one group, then the instructor/facilitator should guide discussion and address the prompts to best meet the course objectives. If there are several dialogue groups, the instructor/facilitator is likely most effective as a roaming observer. In this case, groups should be advised to be responsible for their own dialogues, while the instructor/facilitator observes, assists, and participates as needed. One effective technique is to request: one volunteer in each group to be responsible for moving the group through the dialogue instrument to make sure they address all of the prompts, and a second volunteer to be a timekeeper to assist the group’s movement through the prompts.

How can I evaluate student dialogue performance?

We have provided two Dialogue Evaluation Rubrics: one for form and one for content (below, or click here or in the Table of Contents). These can be used to guide an evaluation of student performance in the dialogue exercise. The student-developed prompts can be assessed from the perspective of your specific interdisciplinary environmental science context; this assessment can be aided by the following questions: (a) Do the prompts get at fundamental assumptions made by scientists and others working in this context? (b) Are the assumptions articulated by the prompts sources of disagreements that can frustrate progress in collaborative efforts? (c) Do the prompts articulate important sources of ethical concern? Affirmative answers to these questions indicate well-crafted prompts that will effectively serve the kind of probing dialogue our curriculum aims to create. Your experience and expertise in this context is key to proper evaluation of these prompts.

FAQs FROM STUDENTS

Why should I think about my role as an expert in relation to decision-makers?

People with credentials, especially graduate degrees in science fields, are often asked for their opinions on key issues by journalists and activists. Experts are also asked to serve on local, state, and federal government advisory committees that directly advise policy-makers. When people with credentials feel strongly about an issue, they may decide to advocate with respect to that issue and use their scientific credentials to validate their point of view. Others may decide to categorically avoid interactions with journalists, activists, and policy makers. But this avoidance is itself a stance with great ethical significance. For these reasons, acquiring a credential in

27 See Eigenbrode et al. (2007); Looney et al. (2013).
environmental science could put you in a position to advise policy-makers and other members of the non-science public. It is advisable to consider the implications such activity will have for your career, as well as consider your own values, commitments, and intentions, so that you are prepared for these situations before they arise.

**How are non-human impacts an ethical issue related to interdisciplinary environmental science?**

Non-human impacts influence decisions about what kind of research should be supported and pursued, marking some research as appropriate and other research as inappropriate for reasons that are grounded in the values of scientists. For example, some scientists believe it is important to conduct research about how best to shelter biodiversity from climate change; this kind of research relies on a belief that we should avoid contributing to certain extinctions or changes in habitat. By contrast, research on resilient landscapes that can adapt to climate change is driven by a belief that some plant and animal extinctions are acceptable. That is, some scientists see it as inherently bad when humans contribute to species extinctions, while others instead worry about the rippling impacts extinctions might have on systems. Different values about the non-human impacts of research can affect what research questions are regarded as significant and what scientific work is seen as fundable.

**How are policy constraints related to my future role as a scientist?**

Policy constraints describe the ways in which political realities and the needs of policy-makers influence what scientists study and how they conduct research. That is, as a scientist, your research is not entirely under your control. Funding decisions are in part determined by ideas about what kind of research is worthwhile. Many of these decisions are made by decision-makers and reflect the interests of voters, corporations, non-profit organizations, and charitable donors. Sometimes scientists will have to adapt their research to respond to policy or funding changes outside of their control. These are examples of policy constraints, or external constraints on scientific research. As a scientist, should you simply go with the flow? Or should you attempt to make your voice heard to the people and groups that affect how and what science is funded? These are important ethical questions about how scientists ought to behave professionally.

**I thought ‘risk’ was a measurable technical concept. How is risk also an ethical issue?**

Because risk involves the assessment of states of the world that have been judged desirable or undesirable, it is inseparable from ethics. Deciding how to weigh or balance risks, and ultimately how to proceed in light of risks, will necessarily involve ethical judgments. Risk is sometimes operationalized or mathematized in environmental science practice, but these risk calculations are just one way of pre-committing to particular ethical positions (e.g., that a potential harm to human health and a potential harm to the habitat of an endangered species can be directly compared). The impacts of these positions still merit careful attention.
Lesson Plan Overview

1. Below we detail two lesson plans for instructors: a 6-hour (roughly 2-week) plan and an abbreviated 3-hour (roughly 1-week) plan.

   - If the class meets fewer than three hours per week, the 6-hour curriculum can be spread out over more than two weeks, compressed in various places, or assigned in part to students for completion outside of class. Three hours is the minimum time allotment required to implement all of the main elements of the curriculum.

   - If more than 6 hours are available, various parts of the curriculum can be expanded, including consideration of case studies and the dialogue exercise.

   - If fewer than 3 hours are available, parts of the curriculum can be used as independent learning activities, e.g., the case studies with a focus on the four ethical themes, or a class dialogue structured by the Generic Dialogue Instrument (below, or click here or in the Table of Contents).

2. Instructors should take as much time as they can to adapt the lesson plans to their particular courses. It is important to review all of the materials in the Instructor Toolkit, especially those materials written specifically for the curriculum.

3. We make reference to document files in the lesson plans by indicating their location in the Instructor Toolkit.

4. The lesson plans make certain assumptions that need not apply for the curriculum to be useful: a) The classes are in-person and not online, b) The classes are led by at least one instructor who can take responsibility for preparing ahead of the first session and introducing the curriculum, c) There are six or more students in the class, and d) The four themes introduced in our curricular materials will serve as the primary ethical focus during the implementation. If these assumptions do not apply to a particular learning environment, modifications to the instructions below will be required.
# 6-Hour Lesson Plan

## Week 1

### Hour 1: Curriculum Introduction

**Assignment to be completed before class:**
- Read
  - *Four Ethical Themes Central to Interdisciplinary Environmental Science*
  - Conceptual foundations: *Eigenbrode et al. 2007*
  - Case studies article(s)

**Opening lecture (20-30 min):**
- Focus on values and responsibility in your specific interdisciplinary context
- Emphasize the four curricular themes that we have highlighted
- Draw on *Four Ethical Themes* and the *Introductory Presentation*.

**Discuss the role of the 4 curricular themes in the case studies (30-40 min):**
- Either: a) full group discussion of the case studies, b) small group discussion of different or the same case study, or c) role playing activity to explore case study actors, relationships, and situations
- For each case examined: have students develop arguments supporting their interpretation of the themes
- Record: a) observations about how the 4 curricular themes relate to the case studies, and b) student arguments about theme interpretation

### Hour 2: Isolating Focal Ethical Themes

**Assignment for class:**
- Review case studies article(s)
- Read *Instructions for Developing Dialogue Prompts*
- Optional: Read additional article(s) about values and responsibility in environmental science

**Discuss the case studies, continued: (20-30 min)**
- If different ethical themes are introduced, be sure to acknowledge and define them

**Summarize:**
- Use the *Instructions for Developing Dialogue Prompts* document to consolidate group ideas about ethical themes that arise in the case studies under a manageable number (4-8) of distinct, generic theme headings – these are the **focal themes**
  - The focal themes could simply be *risk, expertise, policy constraints, non-human impacts*, or they could be a set that aligns more closely with your specific context

**Analyze: (30-40 min)**
- With the help of the literature, analyze the focal themes into specific assumptions that represent positions on aspects of the themes
Either: a) groups work independently with instructor participation as needed, or b) the full class works together, guided by instructor

- Use the Instructions for Developing Dialogue Prompts document to guide this activity
- Use the Generic Dialogue Instrument to provide model prompts
- This work will carry into the next hour

**Hour 3: Group Discussion of the Focal Themes**

**Create Groups:** (can be done in Hour 2 ahead of the Analyze phase)
- Divide class into prompt development groups of no fewer than 3 students per group and no more than 8 students per group, creating as many groups as possible within these constraints
  - Identify groups in advance, being sure to introduce as much disciplinary diversity into each group as possible
  - If there is only one group, students should talk with one another about the prompt development process but should develop prompts on their own

**Select 4-6 specific assumptions from those identified in the Analyze phase that represent positions on each of the focal themes:**
- An online search of additional literature, as well as group discussion, can be useful here
- These assumptions will be articulated as dialogue prompts, i.e. statements that express a particular way of thinking about the identified assumption
- Use Instructions for Developing Dialogue Prompts document and the Generic Dialogue Instrument to guide this activity, as well as the literature students have read and the online resources they have accessed
- This activity can be assigned to students for completion outside of class

**Week 2**

**Hour 1: Instrument Completion and Review**

**Assignment to be completed before class:**
- Review
  - Instructions for Developing Dialogue Prompts
  - Instructions for Conducting Dialogue Workshops
- Read (optional): Looney et al. 2013; instructor should review the article prior to class
- Additional literature review: this might be necessary if groups struggle to locate specific dialogue prompts in Week 1, Hour 3
- Optional: Students meet with their group to develop dialogue prompts for the instrument

**Discuss of focal themes in the development groups, continued (if needed):**
- Focus on writing dialogue modules, i.e., sets of 4-6 dialogue prompts for each of the focal themes

**If access to a printer:**
- Class will divide into development groups, finalize their instrument language, and print off the number of copies indicated by their instructor
- Group will review their instrument, making sure they understand their own reactions to
If NO access to a printer or if class time is not available for printing:

- Come to class with appropriate number of instruments printed out
- Group will review their instrument, making sure they understand their own reactions to the prompts

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### Hour 2: In-class Dialogue Workshop

**Distribute group-made instruments to each discussion group:**

- Each group should receive an instrument created by a different group
- If there is only one group, then the dialogue will be an opportunity to collectively consider the prompts they developed individually

**Mark Likert scales associated with the dialogue prompts:**

- Students should indicate whether they agree, disagree, don't know, or regard the prompts as not applicable to them
- See *Generic Dialogue Instrument* for a model

**Discuss: (50-60 min)**

- In small groups, students should share their perspectives on the assumptions expressed in the prompts by comparing, contrasting, defending, and developing them
  - If the number of instructors is > the number of groups, an instructor can facilitate each group’s dialogue
  - If the number of groups > the number of instructors, the dialogues should be self-facilitated by the students (see the *Instructions for Conducting Dialogue Workshops* document)
  - One student per group should be responsible for taking notes while participating in the group dialogue

**Assess the pre-dialogue Likert data:**

- Notice changes in student attitudes and views as a result of the dialogue activity
- Consider having students fill out a second Likert instrument after the dialogue activity to capture any dialogue-driven attitude changes

---

### Hour 3: Debrief Discussion and Follow-up Assignment

**Report and Discuss:**

- Each group shares what they discussed the previous hour (5-10 min)
- General discussion about important themes and lessons learned
  - Could either be a full group discussion or small group conversations with a report-out and general discussion to follow
  - Possible questions for structuring the discussion
    - What are the differences among our attitudes toward the focal themes?
    - Do these differences reflect our disciplines or do they reflect some other aspect(s) of our identity?
      - If the latter, what aspects?
    - What might differences among our attitudes toward the focal themes imply for our ability to conduct research together?
- How might we negotiate our differences?
- How might the ethical landscapes of other environmental research contexts (or other research contexts in general) differ from our landscape?

**Assess:**
- Assign one of the assessment activities contained in the *Instructions for Assessment Activities* document
- This will allow the students to reflect further on the ethical dimensions of interdisciplinary environmental science revealed in developing and discussing the dialogue prompts
### 3-Hour Lesson Plan

#### Hour 1: Curriculum Introduction and Ethical Themes

**Assignment for class:**
- Read
  - *Four Ethical Themes Central to Interdisciplinary Environmental Science*
  - Conceptual foundations: Eigenbrode et al. 2007
  - Case studies article(s)

**Opening lecture (20-30 min):**
- Focus on values and responsibility in your specific interdisciplinary context
- Emphasize the four curricular themes that we have highlighted
- Draw on *Four Ethical Themes* and the Introductory Presentation

**Discuss the 4 curricular themes, locating them in the interdisciplinary context of the class:**
- Either: a) full group discussion of one or more of the case studies, or b) small group discussion of 1 theme or all of the themes and then report out to the full group
- Have the students develop arguments supporting their interpretation of the themes

**Record ways in which the themes relate to the interdisciplinary context of the class on the board**
(30-40 minutes)

#### Hour 2: Isolating Ethical Assumptions

**Assignment for class:**
- Review case studies article(s)
- Read Instructions for Developing Dialogue Prompts and the Generic Dialogue Instrument
- Optional: Read additional article(s) about values and responsibility in environmental science

**Discuss the case studies:**
- Evaluate the cases in terms of risk, expertise, non-human impacts, and policy constraints
- Either: (a) full group discussion of the case studies, or (b) small group discussion of either 1 case study each or all the case studies, with report outs by each group
- Examine the case studies through a role playing activity to explore case study actors, relationships, and situations (40 min)

**Discuss the next step:**
- Develop dialogue prompts similar to those in the Generic Dialogue Instrument that express fundamental assumptions people make in their disciplines about risk, expertise, non-human impacts, and policy constraints (20 min)

**Assign for Hour Three:**
- Develop one prompt for each of the four themes and send it to the instructor at least 2 days before the next class
• Use *Instructions for Developing Dialogue Prompts* and the *Generic Dialogue Instrument* to guide this activity.

<table>
<thead>
<tr>
<th><strong>Hour 3: Group Discussion of Themes and Debrief</strong></th>
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<tbody>
<tr>
<td><strong>Assignment for instructor:</strong></td>
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<tr>
<td>• Associate submitted prompts with a Likert scale; see <em>Generic Dialogue Instrument</em> for a model</td>
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<tr>
<td>• Combine prompts to eliminate redundancy</td>
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<tr>
<td>• Compile prompts into thematic modules with 4 to 6 prompts per module and an organizing “core question” to articulate the theme</td>
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<tr>
<td>• Produce an instrument containing one module of each type. You might want to generate several distinct instruments, depending on the number of prompts submitted</td>
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<tr>
<td>• Bring copies of the instrument(s) to class</td>
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<td><strong>Divide class into dialogue groups equal to the number of instruments:</strong></td>
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<tr>
<td>• Have each group use one instrument</td>
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<tr>
<td>• Distribute copies of the instruments and have the group members mark the Likert scales associated with the prompts</td>
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<tr>
<td><strong>Discuss in small groups:</strong></td>
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<tr>
<td>• Groups discuss their perspectives on the assumptions expressed in the prompts with the instructor circulating between groups (40 min)</td>
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<tr>
<td>• Ask students to attend to the differences and similarities that emerge in dialogue</td>
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<tr>
<td>• Consider having the students fill out a second Likert instrument after the session to detect dialogue-driven attitude changes</td>
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<tr>
<td><strong>Debrief:</strong></td>
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<tr>
<td>• Conduct a short, full class discussion (20 min)</td>
</tr>
<tr>
<td>• Possible questions for structuring the discussion</td>
</tr>
<tr>
<td>▪ What are the differences among our attitudes toward the ethical themes?</td>
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<tr>
<td>▪ Do these differences reflect our disciplines or do they reflect some other aspect of our identity?</td>
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</table>
Introductory Presentation

We have prepared an introductory PowerPoint presentation that provides details about the curriculum. It is designed to be modified by instructors, so we encourage you to adjust it as you see fit to situate the curricular elements and themes more snugly into your specific interdisciplinary environmental science context.

The introductory presentation is located here: <URL>.

An example of the introductory presentation, modified to fit into an interdisciplinary environmental science context that focuses on water resources, is located here: <URL>.
Suggested Assessment Activities

Below is a list of suggested activities that will enable students to build on what they learn in the curriculum. These activities should be assigned after the class has completed the curriculum. The following pages contain assignment sheets and assessment guidelines for each activity. We encourage you to adapt these to meet your own needs.

1. **Disciplinary Perspectives Project – Individual Essay [written]**

Throughout the curriculum, students explore various views on values and responsibility that can shape how interdisciplinary environmental science research influences decision-makers and stakeholders. This individual essay project tasks students with reflecting on how their research relates to the variety of disciplinary perspectives represented by other students in this class.

2. **Disciplinary Perspectives Project – Group Essay [written]**

This interdisciplinary writing assignment will produce a product similar in structure to the individual essay described above, but it will be a collaborative effort. In addition, individual students should write a one-page reflective evaluation of the experience that describes the insights and challenges of working with representatives from other disciplines.

3. **Scenario Project – Group performance [role play]**

This assignment will produce a group performance in which students play roles associated with a complex socio-environmental problem. For example, the scenario might center on a decision of the US Bureau of Land Management (BLM) to restrict recreation access to a stretch of river in order to protect a species newly listed as threatened under the Endangered Species Act. In this scenario, students could play the roles of an ecologist, a BLM manager, a local business person dependent on recreation for their livelihood, an environmental activist who has advocated for the species, and a rafter. The performance should highlight the ethical themes discussed in the curriculum. The scenario could be introduced with an article that presents a relevant case study, a news story, or perhaps a class visit from someone involved in a complex issue of this type.
Disciplinary Perspectives Project – Individual Essay

Assignment

So far in this class you have explored a variety of views on values and responsibility that can shape how interdisciplinary environmental science research influences decision-makers and stakeholders. In this project, you will be tasked with reflecting on how your own research relates to the various disciplinary perspectives represented by other students in this class. The project consists of an essay containing the following elements:

1. **Research problem** (1 paragraph): Select and describe a specific research problem that is closely related to your own research. If you have not begun to think about research or will not be conducting research for your program, please select a specific research problem related to your studies or work that interests you.

2. **Collaborative response** (1 paragraph): Describe how an interdisciplinary research team comprising representatives from the disciplines in this class might approach this problem. What would be an appropriate research objective for such a team? What methods might the team employ to address the problem?

3. **Ethical aspects of the research effort** (2 paragraphs – one for the problem and one for the response): Describe how risk, expertise, non-human impacts, and policy constraints are involved in the research problem and response. For example, with respect to risk, what risks are associated with the problem if it is left unaddressed? How does the response ameliorate those risks, and what new risks might it induce into the situation?

4. **Disciplinary perspectives** (1 paragraph per disciplinary perspective): Identify and describe perspectives on these ethical aspects that exist across the disciplines represented in the research team. How would a sociologist view the ethical issues in play? How would a hydrologist view them?

5. **Identification of potential difficulties** (1-2 paragraphs): Describe the differences that emerge from the perspectives identified in the previous paragraphs. Discuss these differences in relation to what you learned from the class readings and dialogue. How might these difficulties manifest as obstacles for the research team?

6. **Recommendation** (1 paragraph): Provide suggestions to identify and manage the differences that could exist within your research team. How can these differences be a source of insight into the complexity of the problem, rather than a source of unproductive disagreement and divisiveness?
Disciplinary Perspectives Project – Individual Essay
Assessment (for instructor use)

The Disciplinary Perspectives Project – Individual Essay assignment has 3 goals:

1. To have students write about what they learned from the dialogue work in relation to their own research
2. To articulate the ethical dimensions of their own research area, and
3. To evaluate how their thinking about the ethical aspects of their own scientific discipline has been influenced by what they have learned from their fellow students.

Student papers should be assessed in terms of the degree to which they accomplish these 3 goals. This can be achieved by evaluating the papers in terms of the quality of the six elements they should include, as spelled out in the assignment document. Is each element present, and does the student demonstrate an understanding of each element? Specifically:

a. Is the research problem well-formulated?
b. Is the response reasonable and achievable?
c. Does the student demonstrate an understanding of the four ethical themes?
d. Are the disciplinary perspectives correctly identified and described, based on class discussions?
e. Are the differences among the perspectives correctly identified?
f. Does the student demonstrate an appreciation for the difficulties these differences might produce?
g. Is the recommendation reasonable and will it address the difficulties identified in the previous section?
Disciplinary Perspectives Project: Group Essay

Assignment

So far in this class you have explored a variety of views on values and responsibility that can shape how interdisciplinary environmental science research influences decision-makers and stakeholders. In this project, you will write a collaborative paper with an interdisciplinary group of your peers that focuses on the values and responsibility aspects of your interdisciplinary environmental science context. Each member of your group will also write a one-page reflective evaluation of the group experience that describes the insights and challenges of working with representatives of other disciplines.

The collaborative paper should include the following elements:

1. **Research problem** (1 paragraph): Select and describe a specific research problem that is closely related to your own research. If you have not begun to think about research or will not be conducting research for your program, please select a specific research problem related to your studies or work that interests you.

2. **Collaborative response** (1 paragraph): Describe how an interdisciplinary research team comprising representatives from the disciplines in this class might approach this problem. What would be an appropriate research objective for such a team? What methods might the team employ to address the problem?

3. **Ethical aspects of the research effort** (2 paragraphs – one for the problem and one for the response): Describe how risk, expertise, non-human impacts, and policy constraints are involved in the research problem and response. For example, with respect to risk, what risks are associated with the problem if it is left unaddressed? How does the response ameliorate those risks, and what new risks might it induce into the situation?

4. **Disciplinary perspectives** (1 paragraph per disciplinary perspective): Identify and describe perspectives on these ethical aspects that exist across the disciplines represented in the research team. How would a sociologist view the ethical issues in play? How would a hydrologist view them?

5. **Identification of potential difficulties** (1-2 paragraphs): Describe the differences that emerge from the perspectives identified in the previous paragraphs. Discuss these differences in relation to what you learned from the class readings and dialogue. How might these difficulties manifest as obstacles for the research team?

6. **Recommendation** (1 paragraph): Provide suggestions to identify and manage the differences that could exist within your research team. How can these differences be a source of insight into the complexity of the problem, rather than a source of unproductive disagreement and divisiveness?
In writing this collaborative paper, your group should follow these steps:

a. Meet outside of class to formulate the elements of your paper. Each meeting should produce a set of minutes taken by different members of the team. These minutes will be submitted with your final papers.

b. Each member of your group will write one of the disciplinary perspectives paragraphs (i.e., #4 above), but not the paragraph associated with your own discipline. Your draft of this paragraph should be vetted with the group, and in particular with the disciplinary representative. Each of these paragraphs should be initialed by its author.

c. The group should determine an appropriate strategy for producing the final manuscript. For example, outside of the disciplinary perspectives paragraphs, the paper might be drafted by a single person and then sequentially edited, or it might be written in sections by individuals and then sequentially edited and single-voiced, or another approach your group agrees upon. You will then communicate that strategy in an endnote included in the paper that explains your group process and decision-making. This endnote should also describe how your group collaborated to identify the various elements of the paper.

d. Each individual should write a one-page, double-spaced reflective evaluation of the group experience, noting the insights and challenges that occurred as a result of the collaboration.

e. The final set of materials to be submitted includes: 1) the group paper (with the process endnote included); 2) minutes from each of the group meetings; and 3) individual reflection evaluations written by each group member.
Disciplinary Perspectives Project: Group Essay

Assessment (for instructor use)

The Disciplinary Perspectives Project: Group Essay assignment has 4 goals:

1. To have students write about what they learned from the dialogue work in relation to their own research
2. To articulate the ethical dimensions of their own research area
3. To evaluate how their thinking about the ethical aspects of their own scientific discipline has been influenced by what they have learned from their fellow students, and
4. To provide the students with a meaningful collaborative experience that results in the production of a written deliverable.

Student papers should be assessed in terms of the degree to which they accomplish the first 3 goals. This can be achieved by evaluating the papers in terms of the quality of the six elements they should include, as spelled out in the assignment document. Is each element present, and does the student demonstrate an understanding of each element? Specifically:

a. Is the research problem well formulated?

b. Is the response approach reasonable and achievable?

c. Does the group demonstrate an understanding of the four ethical themes?

d. Are the disciplinary perspectives correctly identified and described, based on class discussions?

e. Are the differences among the perspectives correctly identified?

f. Does the group demonstrate an appreciation for the difficulties these differences might produce?

g. Is the recommendation reasonable and will it address the difficulties identified in the previous section?

In addition, to address goal (4), students should receive points to reflect their participation in the group meetings and the completion of the reflective evaluation paper. For example, participation in the meetings could be worth 20%, submitting a reflective paper could be worth 10%, and the group paper – evaluated relative to the seven elements above – could then be worth the remaining 70% of the final grade.
Assignment Tips:

• The writing groups for this assignment should include representatives from several disciplines. While they can be the same groups that worked together to develop the dialogue prompts, there might be value in mixing them up to determine if their understanding can be extended to new people and (potentially) new disciplines.

• The assignment instructions indicate that the groups should meet outside of class to formulate the elements of their paper; however, the project could be pursued in class if there is class time available for it. This would afford you the opportunity to observe the various collaborative processes pursued by the groups, provide guidance and mentoring if needed, and comment on collaborative process in your evaluations of the projects.

• There is value in discussing your experiences in collaborative writing when this assignment is given.

• You should also offer to assist the groups in developing an effective group writing strategy during this stage of the assignment.
Scenario Project: Group Performance

Assignment

For this assignment you will produce a group performance based on a complex socio-environmental problem. Students will adopt the roles of stakeholders to explore the nuance and complexity of a particular scenario.

For example, you might choose a scenario that involves a US Bureau of Land Management (BLM) decision to restrict recreation access to a stretch of river in order to protect a species newly listed as threatened under the Endangered Species Act. In this scenario, members of your group might play the roles of an ecologist, a BLM manager, a local business person dependent on recreation for their livelihood, an environmental activist who has advocated for the species, and a rafter. The group performance should highlight the ethical themes discussed in the Values and Responsibility in Interdisciplinary Environmental Science curriculum.

The elements of the project include:

1. **Scenario development**: each group should identify a complex socio-environmental problem scenario that they will perform. This scenario should be described in a 1-page paper that will be used by the group as a foundation for the role map.

2. **Role map**: each group should produce a concept map of the problem, identifying the stakeholder roles represented by important participants in the problem case. This concept map should be a jointly produced document that could use a standard set of concept mapping conventions – e.g., Heemskerk, M., Wilson, K., Pavao-Zuckerman, M. 2003.Conceptual models as tools for communication across disciplines. *Conservation Ecology* 7: 8. 2 November 2006; www.consecol.org/vol7/iss3/art8/.

3. **Role profiles**: each of the identified roles should be assigned to a group member, and that group member should write a 1-page profile of their character that indicates what stake they have in the problem, what group(s) they represent, and what relevant values and beliefs they have.

4. **Script development**: the group should develop a script that details an interaction among the identified roles. This should be for a performance of 15 to 20 minutes in length (about 7-10 pages). The interaction should focus on the ethical dimensions of the problem, including risks involved, different types of expertise, impacts on non-human organisms and systems, and policy constraints on decision-making.

5. **Group performance**: the group should perform their script in front of the class.

6. **Performance reviews**: Each student could be assigned as a reviewer for one other group and then write a review of the that group’s performances, focusing on the degree to which the participants remained faithful to their roles, the degree to which the scripts got at key issues, and so forth. This should be no more than one page.
Scenario Project: Group Performance
Assessment (for instructor use)

The assessment of the group performance could involve assigning credit for each of the written documents produced, including the reviews by a particular group of other groups. For example, one grading scheme might be as follows:

1. **Scenario paper**: 10% group mark
2. **Concept map**: 20% group mark
3. **Role profile**: 20% individual mark
4. **Script**: 30% group mark
5. **Performance**: 10% individual or group mark
6. **Review of peer performance**: 10% individual mark

**Assignment Tips:**

- It might be helpful to provide students with an example or a rubric to use in their role as peer performance reviewer; this could simplify evaluation of this element by normalizing the reviews you receive.

- Additional option: Each student might also write a 1-page review of the collaborative creative process detailing their individual role(s) in the group work and identifying challenges and insights gained working with interdisciplinary collaborators on a creative project. This could be worth 10%, with adjustments made to the other suggested point breakdowns to accommodate it.
Selecting Case Studies

Case studies are important pedagogical resources, but it can be difficult to find good case studies that illustrate ethical issues in interdisciplinary science; further, there are few published case studies that focus on the specific ethical issues at the core of this curriculum in the context of interdisciplinary environmental science. For some science areas, such as environmental health science, there are published case studies with clear ethical emphases, while in other areas, instructors and students may have to tease the ethical issues out of existing case studies that take a different focus.

Here we provide six articles that discuss different cases with ethical emphases that are relevant to interdisciplinary environmental science. However, these articles may not align that well with your particular content focus. In that case, you may want to identify your own case studies using the resources listed in the Frequently Asked Questions (above, or click here). If so, we suggest picking cases that meet the following criteria, which will strengthen their compatibility with the Values and Responsibility in Interdisciplinary Environmental Science curriculum:

1. If possible, locate a single case study that exhibits the four ethical themes: risk, expertise, non-human impacts, and policy constraints. If no such case can be found, we recommend using several case studies, each of which exhibits at least one of the ethical themes.
2. Choose case studies that are directly relevant to the students’ future careers as environmental science professionals. Appropriate case studies will likely involve environmental scientists as central characters, as opposed to case studies in which there are only competing non-experts, such as a dispute between two politicians.
3. Cases should involve actors who are directly identified in the materials and whose views on one or more of the ethical areas can be extrapolated from facts or interpreted from actions or language. Actors include persons, organizations (e.g., governments and activist groups), and communities (from neighborhoods to ethnic groups to publics) who are impacted by the environmental concerns in the case.
4. Cases that focus on issues that are familiar to students or the instructor may be useful. In some cases, the instructors or students may supplement the case study with their own knowledge of actors who played a role in the case, including those who are not explicitly discussed in the case study materials.
5. Case study materials should support student discussion of tensions (i.e., disagreements) and compatibilities (i.e., areas of potential overlapping consensus) among different actors.
6. Case study materials should enable the students to think creatively about responses to the problem and perhaps explore possibilities that were not considered by the actors themselves.
Case Study Guide

This document is intended for instructors who choose to use one or more of the included case studies articles (numbered Cases 1-6). Here we link to .pdfs of these articles and indicate how they illustrate the ethical themes we emphasize in this curriculum: risk, expertise, non-human impacts, and policy constraints. We recommend that you consider using at least two articles, since no one individual article addresses all of the ethical themes.

For each reading, plan to prompt students with questions about the cases that bring into focus the four ethical themes, especially insofar as the readings present different views about those themes. Differences in view can be understood in two ways: (1) Some of the readings involve cases in which scientists disagree; and (2) the Arquette et al. and Oreskes readings (and to some extent the Sarewitz reading) are written by scientists in one field about scientists in another field. In (2), the views of the scientists writing the article are being contrasted with the views of the scientists they discuss.

For each article below, we highlight the text in the article that supplies the case study, indicate which of the ethical themes are emphasized in the case study, and offer sample questions that can be augmented as necessary to emphasize connections with your course.

<table>
<thead>
<tr>
<th>Case 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>See:</strong> pp. 259–261, from “Risk assessment...” to “into any assessment or risk-management scenario”</td>
</tr>
<tr>
<td><strong>Ethical emphases:</strong></td>
</tr>
<tr>
<td><strong>Relevant Questions:</strong></td>
</tr>
</tbody>
</table>
### Case 2


**See:** pp. 372–375, from “Rachel Carson and Silent Spring”
pp. 376–379, from “From DDT to global warming: the unfulfilled promise of ATOC”

<table>
<thead>
<tr>
<th>Ethical emphases:</th>
<th>Risk</th>
<th>Non-human Impacts</th>
<th>Policy Constraints</th>
</tr>
</thead>
</table>

**Relevant Questions:**

1. What does the Rachel Carson case study reveal about value-based trade-offs between *good science* and *good policy*?
2. What can we learn from the President’s Science Advisory Committee about evaluating scientific evidence in the context of conflicting values?
3. How do the non-human impacts of ATOC influence the debate between the different environmental scientists involved—specifically, the oceanographers who defend ATOC and the biologists who criticize it?

### Case 3


**See:** pp. 159–160, from “The occurrence of endocrine disruption”

<table>
<thead>
<tr>
<th>Ethical emphases:</th>
<th>Non-human Impacts</th>
<th>Policy Constraints</th>
</tr>
</thead>
</table>

**Relevant Questions:**

1. How do different agency definitions of ‘endocrine disruption’ reflect different views on the way that policies should manage chemicals with unknown biological effects?
2. In what way and to what extent should endocrine disruption in non-human organisms influence regulatory policy?

### Case 4


**See:** p. 390, from “For example, consider the controversy” to “biologists’ values were not,” and especially from “Oceanographers working on the experiment” to “the potential benefits of ATOC (Oreskes, 2004)”
### Ethical emphases:

- **Risk**
- **Non-human Impacts**
- **Policy Constraints**

### Relevant Questions:

1. How do different agency definitions of ‘endocrine disruption’ reflect different views on the way that policies should manage chemicals with unknown biological effects?

2. In what way and to what extent should endocrine disruption in non-human organisms influence regulatory policy?

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### Case 5


**See:** pp. 7–9, from “3. Expedited Risk Assessments” to “generate accurate results”

### Ethical emphases:

- **Risk**
- **Expertise**

### Relevant Questions:

1. How do the different approaches to chemical development, testing, and regulation in this case reflect differences in how risk is understood and managed?

2. How do the different approaches reflect different views on how scientists should advise policy-makers?

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### Case 6


**See:** full article, but especially the section “Bumping heads over the bumphead parrotfish”

### Ethical emphases:

- **Risk**
- **Non-human Impacts**

### Relevant Questions:

1. How does the intrinsic value of non-human organisms (i.e., the value of these organisms in and of themselves without regard for humans) figure into the debate between traditional conservationists and the New Conservationists?

2. According to the New Conservationists, what are the risks to non-human organisms if we do not decouple nature from the economy?
Instructions for Developing Dialogue Prompts

Overview

The primary goal of this curriculum is to help students learn about values and responsibility issues that are important in interdisciplinary environmental science. One key component is a class discussion about these issues, which will be structured by “prompts” (i.e., statements serving as discussion starters) the class will design. These prompts will express important standpoints that vary across scientists and stakeholders working on environmental problems in your specific interdisciplinary context. Dialogue about how much and why one agrees with these prompts will give participants an opportunity to articulate their own standpoints and discuss them. A successful dialogue is one in which the participants share their own disciplinary or professional worldview, learn about the worldviews of their collaborators, and come to see the research problem(s) they are addressing through each other’s eyes.

These instructions describe how the class will move from thinking broadly about values and responsibility issues, based on earlier general discussions and examination of case studies, to more focused, structured identification of specific issues that are especially important to the group. After general discussion of the nature and development of dialogue prompts, we describe a step-by-step process for groups to follow in developing their own prompts.

The Dialogue Instrument and Its Modules

The collection of prompts the class assembles is a dialogue instrument organized into a set of thematic modules, each of which concerns an important theme related to values and responsibility in interdisciplinary environmental science. The number of modules will vary, depending on the number of themes the group identifies. Many who use this curriculum concentrate on the four themes we have identified (namely, risk, expertise, non-human impacts, and policy constraints), developing one module for each of these themes; however, groups are also welcome to identify their own themes that relate to values and responsibility and build modules for them. For each of the modules developed, it is helpful to express the theme as a question—the core question. The module will then be filled out with specific dialogue prompts known as probing statements, each of which expresses a view on a particular aspect of the module theme.

For example, in our sample module “Risk”, our core question is, “How should risk be conveyed

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28 For related discussion of the issues in this document, see the Looney et al. (2013), which is described on p. 53 of the curriculum. The approach described in this document is known elsewhere as the “Toolbox approach” and is related to work done by the Toolbox Dialogue Initiative, http://tdi.msu.edu/.
to policy-makers?” This question is developed with four probing statements, each of which expresses a view about an aspect of risk, for example, “Risks identified by people directly affected by a policy should be the primary concern for policy-makers.” This is the kind of issue we use to structure the dialogue. We call issues like this *dialogue issues*.

**What Exactly Is a Dialogue Issue?**

Not all issues that divide collaborators are appropriate for use as dialogue issues. Dialogue issues should help identify challenges that can divide investigators along disciplinary lines. The goal is a focused and structured conversation about such challenges that will enable students representing multiple disciplines to be more thoughtful when they engage in interdisciplinary collaboration. This ability is a valuable professional skill. Four characteristics make issues appropriate for inclusion in the dialogue:

1. *They are important in many different disciplines.*

   Dialogue issues are *boundary objects*—they should be issues that members of your class all care about, even though their perspectives on them may differ. Given this, these issues should not be particular to just one discipline or be issues that are unfamiliar or perhaps unrecognizable to members of other disciplines. To locate them, the class will need to abstract away from the specific details of a particular disciplinary perspective by considering how fundamental elements of a particular discipline might intersect or share common foci with other disciplines. For example, instead of discussing how anthropologists incorporate traditional ecological knowledge in their studies, you could focus instead on how different forms of non-scientists’ knowledge can and should be used in research. And instead of talking about the specific ways in which hypotheses figure (or not) into your scientific practice, you could discuss whether or not scientific research must be hypothesis-driven.

2. *They are conceptual.*

   The issues should concern *conceptual* aspects of collaborative, interdisciplinary research. That is, they involve aspects of research that pertain to how researchers classify and organize phenomena of interest. When you examine a research problem, certain things will stand out for you that will not stand out for someone from another discipline. For example, consider the issue of removing a dam to restore lost salmon habitat: if you are an ecologist, you might examine the impacts on the fish, whereas if you are an economist, you might be concerned with the economic impacts of dam removal on the surrounding human populations. What stands out for you as a critical aspect of the problem will be a function of what you are trained to see, and what you are trained to see will include the considerations you deem relevant to your research. Differences among what are classified as relevant to understanding the problem can lead to disagreement (or worse) among collaborators, so learning about these differences in advance in a dialogue setting can help groups function more effectively by identifying potholes in the road before they hit them. This will require that you carefully reflect on the ideas underlying basic assumptions and priorities in your
scientific training. Concepts such as population, harm, testability, and stability are widely used concepts that are developed into assumptions such as “the only relevant harms are ones that can be expressed in economic terms.”

3. **They concern norms, standards, and core beliefs**

Dialogue issues typically highlight norms or standards that apply to research and practice across disciplines that contribute to environmental science. They could concern what you take to be fundamental features of good scientific practice in environmental science, such as addressing uncertainty or considering a variety of perspectives on a complex issue. They could also address important disciplinary standards, such as being objective or valuing the application of scientific results to real-world problems. In most cases, the issues won’t be purely factual, since factual issues can often be settled by accurate observation and in such a case will not typically serve to promote vigorous dialogue. Values and ethics dialogues are primarily about the way the world should be, not the way it is.

4. **There is no objectively right answer.**

Importantly, dialogue issues should not be issues for which there is a right answer—you are choosing questions that are difficult because judgments of the best answer will depend on one’s values and priorities. These questions should be open to conversations that involve a variety of perspectives and informed opinions. Discussions about values and responsibility address the questions that remain after we set aside true-or-false questions that have been settled with data or could be settled later with data.

Try to avoid designing prompts around narrow complaints about your own experiences. If expressed in the form of a probing statement, e.g., “My administration does not adequately recognize interdisciplinary scholarship” or “The first author on our papers should be the one who did the most work, whether they conceived of the paper idea or not,” the type of dialogue prompted might devolve into specific complaints about incentives and infrastructure, or worse, into a business meeting. Because they are concrete, these prompts are unlikely to reveal anything especially interesting about one’s research or professional worldview, given that they focus less on how one thinks about the research space and more on specific rules for acting in that space.

That said, if there are relatively concrete issues that strike your class as important enough to be represented in the dialogue, then feel free to include them and see how it goes! We encourage each class to customize the Values and Responsibility in Interdisciplinary Environmental Science curriculum to meet their own needs.
Constructing Dialogue Prompts

The main business of the dialogue prompts is to get people talking. A bad dialogue prompt is one that people ignore.

The core questions are open-ended questions that express important dialogue issues related to values and responsibility. We have included five such issues in the Generic Dialogue Instrument (below, or click here or in the Table of Contents) that correspond to our four ethical themes: risk, expertise, non-human impacts, and policy constraints. There are additional issues similar to these in interdisciplinary environmental science, and you are encouraged to identify issues that are especially important to the areas and interests represented in your class.

While the job of the core question is to get the participants thinking about the dialogue issue, the job of a probing statement is to provoke people to discuss the specific issue it expresses. Given this, it should not be wishy-washy or too easy to ignore. There are several heuristics to writing a good probing statement. These are:

1. **A probing statement should take a stand on a specific issue.**

   Remember that dialogue participants can agree with it or disagree with it, so whether it expresses your view or not is unimportant. What is important is that it expresses a particular position, so that respondents can position themselves with respect to this starting point. Since respondents need to read these statements and agree or disagree, statements must be written as clearly positive or negative assertions (“Interdisciplinary environmental scientists should be environmental advocates” or “Interdisciplinary environmental scientists should not be environmental advocates”), and cannot be wishy-washy or non-committal in a way that makes agreement or disagreement confusing for the respondent (“Interdisciplinary environmental scientists may or may not be environmental advocates”).

2. **Probing statements can include ambiguous or vague terms (e.g., ‘values’ or ‘risk’).**

   The idea here is that a vague (or imprecise) statement, or one that can be interpreted in various ways, can provoke conversation and encourage participants to sharpen its meaning. In doing this, other participants will chime in with their interpretations, resulting in the discovery of multiple different ways of thinking about the specific issue expressed. However, it is important that the vague or ambiguous term (e.g., ‘values’, ‘risk’) be a central one, that is, one that is useful and important. (For social scientists this will run against years of training to avoid ambiguous or vague terms in survey questions. But the primary purpose of the dialogue prompts in this case is to provoke people to critically reflect on and possibly change their views, not to simply report what they already believe.)

3. **Probing statements are effectively spiced up with extreme terms like ‘must’, ‘none’, ‘all’, etc.**

   As with vagueness and ambiguity, strong rhetoric will encourage the participants to react to the prompt. Be careful not to make the prompt so easy to agree or disagree with that
people move past it too quickly. An example of a good extreme prompt would be one where some of the participants react negatively to it as stated and then the discussion leads the group to scale back the force of the claim to the point where they would be inclined to change their opinion in a positive direction (i.e., shift from disagree to agree).

4. **Probing statements should be stated simply to avoid logical complexity.**

If you include terms that introduce logical complexity into the prompt (e.g., ‘and’, ‘or’, ‘if ... then’), it will be less clear what a person’s reaction to the prompt means. In this vein, each prompt should make only one claim, e.g., “Animal welfare is a key consideration when designing good environmental policies.” A prompt that has two parts, like a so-called “double-barreled question,” confuses respondents by making them give one response to a statement with multiple independent components, e.g., “Animal welfare and endangered species conservation are key considerations when designing good environmental policies.” A positive response to this statement would endorse both claims: animal welfare is a key consideration and endangered species conservation is a key consideration. If a respondent agrees with only one component, rather than both, then they will have to disagree with the entire statement. This makes constructive dialogue confusing.

5. **Include a Likert-type response scale.**

Each probing statement in the Generic Dialogue Instrument is associated with a Likert-like response scale that ranges from “strongly disagree” to “strongly agree,” with the opt-out choices “don’t know” and “not applicable.” It is useful to include these in your modules for two reasons: (a) they invite your participants to react to the prompts, engaging with them by marking a response on the scale, and (b) they can uncover disagreement, which can spur dialogue.

The Process in General: Analysis and Synthesis

By now, you have had the chance to think in general about the values and responsibility dimensions of your interdisciplinary context. It is important to spend time at the beginning of a dialogue development process getting oriented to these dimensions. Once you have done this, it is time to start thinking about writing dialogue prompts.

In general, the process is one of analysis followed by synthesis. The analysis stage is devoted to identifying candidate dialogue issues related to values and responsibility in your particular interdisciplinary context. As a class, you should analyze articles, experiences, case studies, and your own class discussions to identify the specific values and responsibility issues that matter to you. The synthesis stage concerns taking what the analysis stage gives you—which is often quite a lot—and combining and condensing it down into a more manageable and focused form. This synthesis stage should involve identifying module-level issues that can be articulated as core questions, along with more specific issues that can be expressed as probing statements. Together, these are the dialogue prompts that constitute the modules you’ll discuss in your dialogue.
In the end, you will want 2 to 4 modules, each of which should contain a core question and between 5 and 7 prompts. Keep in mind that module discussions tend to run about 30 minutes, as long as the group is interdisciplinary and talkative.

**The Process in Particular: Step-by-Step**

A key part of this curriculum is the transition between reading and talking in general about the values and responsibility dimensions of your interdisciplinary context to isolating and articulating specific standpoints on each dialogue issue in your particular context. The commitments you’re after are fundamental, framing the way in which people in your context think of values and responsibility. In this section, we provide step-by-step instructions for moving through this transition, organized into the *analysis stage* and the *synthesis stage*.

1. **Analysis Stage**: *These can be done individually and compiled later, or done collectively as a group.*
   - In reviewing the reading materials assigned by the instructor on the values and responsibility dimensions of your particular interdisciplinary context and in reflecting on class discussions, write down the concepts, ideas, and issues that were observed. For example, if you discussed the idea of *risk*, you might write down *uncertainty*, *trade-offs*, *negative consequences*, *trust*, *intellectual property*, etc.
   - Don’t filter at this point—aim to be as comprehensive as possible on your list.
   - Once you have compiled this list, phrase each of the items in the form of a statement, or perhaps several statements if there are different aspects of the concept or idea that are relevant. These become candidates for dialogue prompts.
   - Review the list to see if there are connections or extensions that appear when looking at the prompts as a group. These connections and extensions are also candidates for additional dialogue prompts (e.g., a new prompt that connects a prompt about uncertainty to another prompt about trust).

2. **Synthesis Stage**: *This stage begins after the analysis stage has yielded a long list of statements expressing values and responsibility issues*
   - Group all of the statements together according to topic.
   - Express the topic in the form of a general question: these will be candidate core questions.
   - Review each statement group to see if it contains any repetition. If so, eliminate the repetition.
   - Review each statement group to see if there are prompts that, while not repetitive,
cover more or less the same ground. If so, select one to keep and discard the others. The goal is not to address every issue, but rather to address important issues that are different enough from one another to cover a broad range of possible commitments in each module. Think here of a constellation—you want the group to be able to relate the probing statements in different ways, revealing different and potentially surprising connections.

- If two statements can be combined into one without introducing undue complexity, combine them.

- Reduce the number of prompts for each module idea to the 5 to 7 most promising ones.

- Name each module with its theme, and include the probing statements with their Likert-type response scales under the core question for the module.

There are several ways to choose the prompts that constitute a module. For example, the instructor could select from among the prompts you identify. Alternatively, the prompts could be selected using a more democratic process, with voting aimed to reduce the number to a manageable total. (This might be required even at the end of a synthesis stage, if the number of original prompts is too great.)

**Suggestion for the Instructor:** If the class is large enough (8 or more), we suggest the following to keep the dialogue prompts fresh

- Divide the class into two or more groups and have each group go through the module development process separately and develop their own set of modules.

- For the dialogue workshops, have groups exchange their results so that each dialogue group will be discussing modules that are new to them.

- In smaller classes where you can’t divide the students up, you should consider exerting more editorial control over the writing and selection of prompts.
Instructions for Conducting Dialogue Workshops

Before the workshop, make sure to have a photocopy of each set of dialogue modules for each participant. Determine the number of modules to be discussed by dividing the available number of minutes by 30—each module should receive about 30 minutes of discussion. (This can be reduced to 20 if there is a desire to cover more ground quickly or if there are only 2 or 3 prompts in a module.)

Put the dialogue group into a circle, perhaps around a table if one is available. The key to running a dialogue workshop is to make everyone feel as comfortable as possible, giving them the time and safe space to comfortably react to the prompts. Make sure to indicate that your role is to be the facilitator, and that you will not be participating in the dialogue.

Begin by distributing the dialogue modules and have each person read through their copy, scoring the Likert scales associated with each probing statement. (They can also be encouraged to respond to the core questions, but that will lengthen the amount of time necessary to get to the dialogue.) Once everyone has completed this step, invite the students to begin by discussing whatever prompt most interests them. You should facilitate this with a light touch, allowing them to do the talking—as the facilitator, you can respond to clarifying questions or questions about process, but you should resist the urge to participate in discussion of the issues even if the students direct questions or comments to you. The students may bounce around from module to module, in which case there will be no need to enforce time limits; however, if they stay locked on to each module, encourage them to move into a new one either after the conversation lags or 30 minutes has passed, whichever comes first. A useful rule of thumb is not to intervene until the silence has persisted for at least 20 seconds. Have someone in each group take notes so that you can review the issues discussed after the dialogue.

If you have more than one dialogue group and you don’t have other facilitators, consider conducting two workshops on the “fish bowl” model, where one group observes the other group dialogue about their modules. Alternatively, you can have the groups self-facilitate while you rotate through.

Be sure to build in time for the students to engage in a debrief conversation after the dialogue, perhaps up to a full hour if that much time is available. This will allow them to react to the modules, reflect on the experience, and draw connections between the topics discussed and broader values and responsibility dimensions related to their research, the course, and the university interdisciplinary environmental science program.

For more detail about facilitating the dialogue, please review the Looney et al. 2013 article (p. 53 of this document).
Generic Dialogue Instrument

Risk Module

Risk

Core Question: How should risk be conveyed to policy-makers?

1. Risk is an objective calculation of the probability of some uncertain state of affairs.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
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<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>I don’t know N/A</td>
</tr>
</tbody>
</table>

2. Policy-makers should always attend to the risks identified by scientific experts.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
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</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>I don’t know N/A</td>
</tr>
</tbody>
</table>

3. Risks identified by people directly affected by a policy should be the primary concern for policy-makers.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
</tr>
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<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>I don’t know N/A</td>
</tr>
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</table>

4. Policy-makers should focus on risks that matter to voting citizens, whether or not they are directly affected by a policy.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>I don’t know N/A</td>
</tr>
</tbody>
</table>
Expertise #1 Module

Expertise #1

Core Question: Who should participate in the research phase of interdisciplinary environmental science?

1. To have relevant knowledge for interdisciplinary environmental science, people must have formal academic credentials.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
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</table>

2. Experts who are not academics, such as indigenous elders, have knowledge that should impact interdisciplinary environmental science research.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
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<td>2</td>
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</tbody>
</table>
Expertise #2 Module

### Expertise #2

**Core Question:** How should interdisciplinary environmental scientists contribute to policy-making?

1. Interdisciplinary environmental scientists must keep their personal values out of their role in the policy process.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
</tr>
</thead>
</table>

2. Interdisciplinary environmental scientists should be environmental advocates.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
</tr>
</thead>
</table>

3. Interdisciplinary environmental scientists should only provide information to policy-makers based on their scientific expertise.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
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</thead>
</table>
Non-human Impacts Module

Non-human Impacts

Core Question: Should interdisciplinary environmental scientists be concerned with how their research impacts the interests of non-human organisms and collectives?

1. Non-human animals and plants should be protected for their own sake.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>4</td>
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</table>

2. Non-human collectives, such as landscapes, biomes, or ecosystems, should be protected for their own sake.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
</tr>
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<tbody>
<tr>
<td>1</td>
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<td>4</td>
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</table>

3. It is a scientist’s responsibility to protect anything non-human for its own sake.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
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<tbody>
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<td>4</td>
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</table>

4. Non-human interests need only be protected when they have an impact on human interests.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
<th>I don’t know</th>
<th>N/A</th>
</tr>
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<tbody>
<tr>
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<td>4</td>
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Policy Constraints Module

Policy Constraints

Core Question: How should interdisciplinary environmental scientists interact with the policies that constrain their research?

1. Interdisciplinary environmental scientists have an obligation to make their research policy-relevant.
   
   \[
   \begin{array}{ccccc}
   \text{Disagree} & 1 & 2 & 3 & 4 & 5 \\
   \text{Agree} & & & & & \\
   \text{I don’t know} & & & & & \\
   \text{N/A} & & & & & 
   \end{array}
   \]

2. Interdisciplinary environmental scientists should advocate against policies that limit scientific research they value.
   
   \[
   \begin{array}{ccccc}
   \text{Disagree} & 1 & 2 & 3 & 4 & 5 \\
   \text{Agree} & & & & & \\
   \text{I don’t know} & & & & & \\
   \text{N/A} & & & & & 
   \end{array}
   \]

3. Society has an obligation to fund interdisciplinary environmental research that scientists deem to have intellectual merit.
   
   \[
   \begin{array}{ccccc}
   \text{Disagree} & 1 & 2 & 3 & 4 & 5 \\
   \text{Agree} & & & & & \\
   \text{I don’t know} & & & & & \\
   \text{N/A} & & & & & 
   \end{array}
   \]

4. Elected officials should set funding priorities in interdisciplinary environmental science.
   
   \[
   \begin{array}{ccccc}
   \text{Disagree} & 1 & 2 & 3 & 4 & 5 \\
   \text{Agree} & & & & & \\
   \text{I don’t know} & & & & & \\
   \text{N/A} & & & & & 
   \end{array}
   \]
DIY Toolbox Workshops: Looney et al. (2013)

The process of delivering a Toolbox workshop is discussed in detail in Looney et al. (2013), a book chapter written to enable people to run their own Toolbox workshop.


Link: <URL>
Dialog Evaluation Rubrics

Introduction

The dialogue is the culmination of the curriculum. It is an opportunity for students to articulate their developing views on the values and responsibility dimensions of interdisciplinary environmental science, sharing and coordinating those views with those of their classmates. Such dialogue encourages collective reflexivity, enabling students to identify similarities and differences and enhancing their ability to work effectively in partnership with researchers from other disciplines. In a full implementation of the curriculum, the dialogue is structured by prompts that were developed by other students in the class, which supports the sharing of perspectives beyond just the students who constitute a particular dialogue group.

There are several points during the curriculum when an instructor might assess student performance. First, an instructor might wish to assess student understanding of the four ethical themes during the first class period via a short written assignment, perhaps focused on articulating and illustrating those themes in the context of the course. Second, an instructor might evaluate case study work, perhaps with the Scenario Project that is described in Suggested Assessment Activities (above, or click here or in the Table of Contents). Third, groups can be assessed on the basis of the quality of the work they do in devising dialogue prompts: Do the prompts relate to the themes? Collectively, do the prompts provide broad coverage of issues related to the module-level themes that arise in the context of the course? Fourth, the groups can be evaluated for the quality of the dialogue they generate.

This document is designed to help instructors evaluate dialogue quality. It contains two rubrics: one that relates to the form of the dialogue, or how the students interact with one another, and one that relates to the content of the dialogue, or how the students discuss the prompts that present the values and responsibility themes. These rubrics can be modified to suit an instructor’s specific interests – we offer them only as samples that highlight aspects of structured dialogue about these issues that we take to be important.

NOTE: These rubrics are designed for assessment of the class collectively, not individual students.

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Rubric: A sample rubric for evaluating the form of structured dialogue, focusing on the nature of the dialogic interactions among the students.

<table>
<thead>
<tr>
<th>Interpretations of the instrument introduced by the participant(s) on one another’s comments, work, and participant(s) work toward a resolution of that disagreement</th>
<th>Dialogue Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding of the concepts introduced by the participant(s) on one another’s comments, work, and participant(s) work toward a resolution of that disagreement</td>
<td>Categorize and participate work toward a resolution of that disagreement</td>
</tr>
<tr>
<td>Participants discuss disagreement</td>
<td>Declarative</td>
</tr>
<tr>
<td>Little or no discussion of differences</td>
<td>Differentiation</td>
</tr>
<tr>
<td>Recognition of differences but little or no discussion of differences</td>
<td>Differentiation</td>
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<tr>
<td>Recognition of differences but little or no discussion of differences</td>
<td>Differentiation</td>
</tr>
<tr>
<td>Participants with particular views have goals, perspectives, and explanations that are different ignoring each other’s views and will not accommodate others’ views, but participants feel free to explore the differences</td>
<td>Interaction</td>
</tr>
<tr>
<td>Some interaction among the participants with particular views, but goals, perspectives, and explanations are different</td>
<td>Interaction</td>
</tr>
<tr>
<td>Participants with particular views, with regular follow-up</td>
<td>Interaction</td>
</tr>
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</tbody>
</table>

**Level 3** (highest)

**Level 2**

**Level 1**
<table>
<thead>
<tr>
<th><strong>Dialogue Content</strong></th>
<th><strong>Human Impacts</strong></th>
<th><strong>Non-Human Impacts</strong></th>
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<tbody>
<tr>
<td><strong>Risk</strong></td>
<td></td>
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<tr>
<td>No direct discussion of risk</td>
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<tr>
<td>Participants explicitly develop the concept of risk in dialogue, that non-human impacts are part of their risk assessment</td>
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<tr>
<td><strong>Policy Constraints</strong></td>
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<tr>
<td>No direct discussion of policy</td>
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<tr>
<td>Participants explicitly discuss the concept of policy constraints in dialogue, that non-human impacts are part of their risk assessment</td>
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<tr>
<td><strong>Expertise</strong></td>
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<tr>
<td>No direct discussion of expertise</td>
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<tr>
<td>Participants explicitly develop the concept of expertise in dialogue, that non-human impacts are part of their risk assessment</td>
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<thead>
<tr>
<th><strong>Sub-Category</strong></th>
<th><strong>Category</strong></th>
<th><strong>Level 3</strong></th>
<th><strong>Level 2</strong></th>
<th><strong>Level 1</strong> (Highest)</th>
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