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Lesson

Debating Conservation: Developing Critical Thinking Skills in Introductory Biology Classes

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Abstract

Role-playing activities in the classroom promote students' critical thinking, research, and communication skills. We present an activity where students debate a current controversy in conservation. In our case study, students debate the topic of wolf reintroduction in California. Each student is assigned a stakeholder role (*e.g.*, rancher, environmental scientist, hunter, or politician) and a position (either pro or con). First, the whole class participates in a vote on the debate topic so as to register pre-debate sentiment. Then, in the first part of the activity (75 minutes or as homework), students prepare arguments with others representing their stakeholder group by reading the primary and secondary literature and answering guided questions. In the second part of the activity (75 minutes), students participate in a live debate divided into three sections: introductory arguments, questions from the jury, and concluding arguments. The whole class then votes again to decide the winner of the debate, leading to a discussion about which factors do and do not lead to changes in understanding and opinion. The interdisciplinary nature of this activity reinforces student knowledge on ecological networks, keystone species, and natural history, as well as introduces the importance of non-scientific stakeholders in conservation. While this case study focuses on the reintroduction of wolves in California, the activity can be adapted to the reintroduction of controversial species in other regions, or used as a framework for any debatable topic in conservation biology.

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Learning Goals

Students will:

◊ integrate complex social and ecological issues through consideration of a realworld issue in wildlife conservation.

◊ recognize roles and perspectives of different stakeholder groups.

◊ strengthen science literacy skills.

◊ formulate arguments based on literature and popular media.

◊ From the Ecology Learning Framework:
- » How can you explain the change of biodiversity over short and long (geological) timescales?
- » How do species interact with their habitat?
- » How are living systems interconnected and interacting?
- » What impacts do humans have on ecosystems?
- » What can or do humans do to mitigate negative impacts they have on ecosystems?
- » How do humans depend on ecosystems for their health and well-being?

Learning Objectives

Students will be able to:

◊ demonstrate ability to research a topic in conservation science.

◊ demonstrate ability to think critically about research findings.

◊ compare and contrast different stakeholder perspectives.

◊ present arguments for or against a conservation action.

INTRODUCTION

As humans grapple with global conservation crises, it is critical that undergraduate students in biology and environmental science courses learn to consider the variety of nuanced perspectives that are relevant to effective conservation policy. Many students may favor strict conservation policies, such as containing species in nature preserves or outlawing hunting. However, better long-term conservation outcomes often result from policies that incorporate benefits to multiple stakeholder groups (1, 2). In this lesson plan, we present a multi-day activity where undergraduate students research and prepare for an oral debate on a current controversy in conservation biology, adopting different stakeholder roles. Our lesson is easily adapted to many topics in conservation or environmental science. We chose to center the lesson on questions surrounding the potential reintroduction of the gray wolf (*Canis lupus*) to California. Our lesson aims to prepare undergraduate participants to become more thoughtful conservation practitioners and advocates.

The debate surrounding the reintroduction of wolves into territories where they have been displaced by humans is a classic example of an ongoing and contentious conservation issue. As illustrated in art and folklore throughout the northern hemisphere, many Native American, Asian and Middle Eastern cultures regard the wolf positively, but many European cultures and European immigrants to North America have historically feared wolves (3). The reasons for this animosity are not fully understood, but include perceptions of wolves killing livestock and game, as well as complex emotional responses based on fear, disgust, and surprise (4). These negative feelings are, however, often intertwined with a sense of admiration and fascination. Wolves occupy collective imaginations and many origin stories across cultures: symbolizing bravery, fierceness, and idealized wilderness (3, 5, 6). While other educational studies have aimed to increase knowledge of wolf biology in support of conservation (*e.g.,* 7), our activity encourages consideration of both positive and negative perspectives. Indeed, the mixed emotions surrounding wolves have turned their reintroduction into an ongoing and often heated debate among stakeholder groups with different motivations (*e.g.,* 8, 9). In the implementation described below, we selected four stakeholder groups (ranchers, environmental scientists, hunters, and politicians). We recognize, however, that additional groups are impacted by the issue (*e.g.,* indigenous groups, environmental activists, business and industry) and recommend that instructors decide how many and which perspectives they would like their students to explore. Note that each stakeholder group should comprise voices both in favor of and against wolf reintroduction.

To incorporate this activity into a biology, ecology, or conservation class, it is helpful for students to understand the concept of ecological networks and the role of apex predators and keystone species in their ecosystems. The wolf's ecological role as a keystone species directly regulates prey species and indirectly affects interactions among species in a way that impacts the physical structure of the environment (*sensu* 10, 11). A famous example illustrating this is the reintroduction of wolves into Yellowstone National Park, U.S. in 1995 following their local extinction 70 years prior (12). The absence of wolves as the primary apex predator in this ecosystem had led to overpopulation of ungulate grazers such as elk and deer which severely reduced tree growth, leading to substantial erosion of river systems, changing stream flow and ecology. When wolves were reintroduced, they re-assumed their role as predators of ungulate populations. The increased regulation of ungulate populations facilitated the regrowth of willow and aspen trees, which in turn provided novel habitats and resources for beavers to build dams. These environmental modifications prevented erosion of the riverbank and returned streams to a marshy state. This trophic cascade of ecological changes increased both the abundance and diversity of other species including insects, amphibians, and birds (12).

The importance of wolves to their ecosystems is vital to consider for ecosystem function and restoration worldwide. A highly adaptable and wide-ranging apex predator, the gray wolf's historic range encompasses nearly the entire northern hemisphere, inhabiting a large diversity of habitats (13). Deliberate eradication and habitat loss has restricted their current contiguous range mainly to northern North America, Greenland, Eastern Europe, Russia, and China, with small remnant populations persisting in Mexico, Western Europe, India, and the Arabian Peninsula (13–15). As wolves re-expand their range and deliberate reintroductions take place alongside expanding human populations, the potential for human-wildlife conflict is high, and engagement of many stakeholders is necessary. In the U.S., wolf populations are slowly rebounding in areas where wolves have not been seen since the 1800's (16), and many states are beginning to engage residents on this issue. For example, in November 2020, a referendum outcome in Colorado showed 50.91% of voters in favor of reintroducing and managing gray wolves on designated lands by the end of 2023 (17). In California, where the authors teach this lesson, managers documented multiple breeding wolf packs in 2017 (18), which has been a cause for both excitement and conflict among the public. Popular media has documented individual wolves' journeys throughout the state, as well as recent wolf deaths attributed to traffic accidents and poaching (19). Wolves are currently protected under the California Endangered Species Act (2014). The historic distribution in California is likely limited to the northern and eastern-most areas of the state, with little known of the history of interaction with either indigenous or immigrant human populations, or of their ecological effects on different ecosystems (20–22). As wolves begin to establish packs in the state with increased possibility for human conflict, and the potential for significant ecological changes, this complex situation provides rich fodder for debate from many stakeholder perspectives.

The lesson we present here helps students develop essential skills for STEM subjects by reinforcing important ecological concepts, developing critical thinking and research skills, and practicing oral communication skills through a classroom debate activity. Additionally, the group discussions and student-led interactions push students to engage with opinions they may not initially share and to exchange a diverse array of ideas, thereby activating their moral sensitivity (23). Role-playing has been shown to increase student understanding of content and to help them connect better to the learning experience (24–28). By assuming perspectives which they may not have otherwise considered, students go beyond a purely theoretical vision of a conservation issue and experience more

closely and in a more practical way what actual scientists must consider when making conservation decisions (29). Such role-playing should result in an increased appreciation of why policies aiming to protect and conserve biodiversity, and put in place by scientists, governments, and/or non-governmental organizations (NGOs), may not be effective if they do not account for the multiplicity of perspectives associated with the issue. To assure the full potential of this role-playing activity, time for reflection should be set aside after the debate to compare pre- and post-debate voting outcomes and to discuss why students may have cast their votes differently following this activity.

Intended Audience

This lesson was designed for an introductory undergraduate biology course, but can be implemented in a variety of courses such as introductory ecology, bioethics, conservation biology, or environmental science. We tested this lesson in a course offered concurrently at the University of California, Los Angeles (UCLA) and the University of California, Santa Cruz (UCSC). Students in this course ranged in undergraduate education level from first-year to senior class standing from various majors, including non-science majors. The lesson has been taught twice with in-person attendance and twice remotely.

Required Learning Time

This lesson is designed to be taught over two 75-minute class periods (including 50 minutes that could be assigned as homework rather than taught during class). Instructors may choose to assign relevant videos and readings for students to complete outside of class in preparation for the class activities. See Table 1 for recommended timing of the various class components.

Prerequisite Student Knowledge

Students should have an understanding of basic ecological concepts such as ecosystems, community, population, species, species range, human impact on species range, and predation. It is helpful if students already have some background knowledge about ecosystem networks, keystone species and trophic cascades so that the videos we suggest reinforce students' background knowledge, rather than introduce new topics. Additionally, students should feel comfortable speaking in front of their peers. We achieved this by 1) creating a space where students felt safe and respected by establishing learning community rules at the start of the term as a group, and 2) having frequent opportunities throughout the term where students would share out to the bigger group. Rocca (30) provides excellent resources for instructors that are struggling to get students to participate in class.

Prerequisite Teacher Knowledge

We recommend that the instructor read about community ecology topics (*i.e.,* keystone species, predation, ecosystem engineer, direct and indirect interactions, disturbance, ecosystem function and services) at a level that is appropriate for introductory biology courses/textbooks.

In addition, we suggest that the instructor research the context for the topic of debate—in our case, the history of wolf extinction and conservation, current local legislation surrounding wolf reintroductions, as well as any recent scientific findings or cultural events.

Finally, the instructor should be comfortable with the technology that will be used to poll students (*e.g.,* PollEverywhere, Mentimeter, Zoom, clickers, etc.). If technology is not a feasible option to poll students, the instructor can use other polling techniques such as index cards or a show of hands.

SCIENTIFIC TEACHING THEMES

Active Learning

Active learning strategies (31) used in this lesson include group discussion, role-playing, data research and exploration, collaborative work in small groups, and student self-reflection.

Assessment

In this lesson we focused on formative rather than summative assessment techniques; however, summative assessments could easily be incorporated as well. We suggest that instructors interested in linking formative and summative assessments reference the 2018 work by Dolin *et al.* (32).

Before lesson: Students watch the assigned videos and read an article on the topic to be debated. Students are then asked to complete a short online pre-class quiz (S1. Debating Conservation – Pre-class quiz). This quiz is composed of multiple-choice and open-ended questions meant to 1) ensure students have the basic knowledge needed to engage in thoughtful dialogue with their peers, and 2) have students reflect on their personal perspective about the issue at hand. We recommend that the students receive a small number of points for completing the quiz (no more than 5% of their assignment grade).

Day 1: Students complete and submit a worksheet as the first part of this activity (S2. Debating Conservation – Preparation worksheet). The worksheet is a guide for students to research questions and issues relevant to their stakeholder's perspective. Students work in groups to complete the worksheet and prepare the arguments to be used during the debate. This worksheet is used as a formative assessment for learning objectives 1–3 (demonstrating research and critical thinking skills, comparing and contrasting stakeholder perspectives). We graded the worksheet based on completion. Participation by all members of the teams was ensured by assigning specific roles within the teams and by having members of the instructional staff circulate to confirm participation by all students. We recommend that instructors wishing to use the worksheet as summative assessment communicate the expected outcomes via a rubric (not provided).

Day 2: Students participate in the live debate. Each group is allowed to decide how to distribute speaking time (some teams might have only one reporter, while others divide it equally between all members) such that each student can participate in the debate in the way they are most comfortable/capable. The debate and final vote are used as a formative assessment for learning objective 3 (argue for or against conservation actions

for wolves in California). Instructors seeking to assign grades to the live debate should communicate their expectations via a rubric that is available to students prior to the debate (not provided). We suggest that the worksheet and live debate be weighed equally in the overall breakdown of this activity (for example, 45% each).

At the end of the activity, we asked students to complete an "Individual and Group Assessment" worksheet (S3. Debating Conservation – Individual and group assessment). This worksheet allows students to assess their team members' participation as well as to reflect on their own contributions towards this activity. Instructors can then choose, at their own discretion, to remove points from students who did not participate as much as others. To incentivize students to complete this assessment, we recommend that they receive a small number of points for completing it (no more than 5% of their assignment grade). Asynchronous students do not complete the "Individual and Group assessment" worksheet and are only graded on the other components of this activity.

Inclusive Teaching

This lesson was designed to highlight diverse perspectives in an engaging way. Because each group represents a different set of stakeholders, students are confronted with opinions on a scientific topic from the perspectives of both scientists and non-scientists. Students are randomly assigned into groups to ensure that no bias occurs in the assignment of roles. The structured activities encourage students to research how the values and goals might differ between stakeholders, and reflect on how those perspectives impact their own view of the problem. We envision that, after this lesson, some students will identify as community members that are empowered to contribute to decisions made about environmental problems.

This lesson incorporates various active learning strategies and is designed to provide ample ways in which students can participate (*e.g.,* doing the research, preparing the arguments, acting as devil's advocate, speaking on behalf of the group during the debate). Within their groups, we allowed students to decide how to divide the various tasks such that everyone felt comfortable with their role and the way in which they would contribute. We had been doing this throughout the course and felt that students responded well to this form of role assignment when the activities were appropriately complex and thus required multiple individuals to contribute for completion (also see 33). Other instructors might wish to assign roles to avoid dominant individuals from taking over. Members of the instructional staff can help ensure that all students are participating by circulating among the groups.

This lesson is easily adaptable to remote or hybrid courses, or those in which some students can only participate asynchronously. If teaching this lesson remotely, students can utilize online breakout rooms to conduct group work, and the debate is performed synchronously online. Students unable to participate synchronously can contribute asynchronously by completing the first part of the activity on their own and then performing a reporter role in the lesson by watching a recording of the debate and writing a short news article on the outcome of the debate (S7. Debating Conservation – Asynchronous assignment). Finally, the diversity of student socioeconomic status was considered in the development of this lesson. All the materials required for this lesson are available to students at no cost (no textbooks or other supplemental materials need to be purchased).

LESSON PLAN

Overview

The goal of this lesson is to engage students in a debate on a current topic in conservation so as to develop research, communication, and critical thinking skills. The lesson is completed within two class sessions: 1) Preparation Day, during which instructors provide a brief lecture describing the issue, followed by a free-form research period during which students prepare for their stakeholder roles, and 2) Debate Day, the in-class live debate. During the first class, an instructor presents a short introductory lecture on the topic of interest and assigns each student a stakeholder role (~20 minutes). Students then prepare for their roles during the rest of the class (~50 minutes; this preparation work could also be done as homework between the two classes). Students return for the second class ready to participate in the debate. The second class lasts ~75 minutes, although this time can be adjusted depending on the number of students and/or time allotted for the class period. Students that attend synchronously are assessed for both their research (S2. Debating Conservation – Preparation worksheet) and live debate. Students unable to participate synchronously may follow this lesson asynchronously; we provide the details for this option at the end of this lesson plan.

Lecture and student vote

In preparation for this lesson, we suggest assigning pre-class readings and/or videos to contextualize the issue prior to Preparation Day. Students take a short quiz (S1. Debating Conversation – Pre-class quiz) to assess their understanding of the pre-class assignments. Instructors begin Preparation Day with a brief lecture describing the issue (S4. Debating Conservation – Lecture slides for Preparation Day). As we taught our lesson in California, our introductory materials primarily focus on wolf conservation issues in North America. However, other instructors may wish to modify this material to match a different debate topic and/or to more closely align with instructor expertise, local issues, or different stakeholder perspectives. Prior to attending class on Preparation Day, students read the Ripple *et al.* manuscript (34) that discusses large carnivores and watch several lecture videos introducing ecological concepts related to the lesson including ecosystem services, ecosystem processes, wolf reintroduction, and trophic cascades impacted by wolves. In class, on Preparation Day, instructors give a short lecture that includes information about wolf biology and some history of wolf extinction and conservation in North America, as well as traditional approaches to monitoring wolves. At the end of the lecture, students vote individually about whether they support the topic of the debate. In our example the question was "Should wolves be reintroduced in California? Yes or No". Votes can be counted either by asking students to raise their hands or using polling functions or clickers. Note that this vote is to assess their personal, pre-research opinion about the topic. Instructors record the votes and announce them to the class.

Stakeholder role assignment and student preparation

Following the first lecture, students are randomly assigned a stakeholder role. In our example, these roles include ranchers,

environmental scientists, hunters, and politicians. Students are also assigned a side in the debate (pro or con) for their specific stakeholder. We recommend 2–4 students per stakeholder per side. For example, in a class with 24 students, there would be 12 students for and 12 students against the motion. If one chose to have 4 different stakeholder groups, there would be 4 groups of 3 students for each side of the debate. In sum, there would be 8 groups of 3 students (4 groups representing each stakeholder, each of these represented twice for each side of the debate).

Once roles have been assigned, student groups are given a worksheet to guide them through their argument preparation (S2. Debating Conservation – Preparation worksheet, for remote classes also see S5. Debating Conservation – Breakout room assignments). Students prepare to argue in support of their role by performing independent research using primary and secondary literature, media sources, and popular literature (preparation can be assigned as homework, completed in class or both). The worksheet guides students as they outline the major arguments for their perspective, helps them predict what potential points the opposing view might bring, and prompts them to find evidence that supports both conflicting perspectives. Although some roles might seem counterintuitive (*e.g.,* ranchers arguing in favor of wolf reintroduction), we have found that with this structure, students of all stakeholder groups are empowered to make creative and convincing arguments in support of their assigned position (*e.g.,* ranchers seeing potential for ecotourism). The worksheet also includes a list of questions that the jury might ask each stakeholder group (S2. Debating Conservation – Preparation worksheet). These questions prompt students to reflect on real problems and policies related to the topic of the debate (*e.g.,* a hunter's concern that wolves would negatively affect the abundance and presence of deer in hunting grounds and their request for information and/or policies to address those concerns, or a scientist's concern about how genetic diversity could be maintained and monitored), and help students further prepare for the live debate. Students decide within their own team who will speak in the live debate, and make sure that preparation for debate and live debate tasks are shared evenly. Both synchronous and asynchronous students submit their worksheet preparation prior to the upcoming live debate.

In-class debate

During the live Debate Day, students participate in a timed debate facilitated by their instructors. The instructor can begin with a few slides explaining the format of the debate (S6. Debating Conservation – Lecture slides for Debate Day). Although instructors may choose to vary the format of the debate, we recommend dividing the debate into three sections: 1) introductory arguments, 2) jury questions, 3) concluding arguments/rebuttal. Students must come to class prepared to refute the opposition's arguments and respond to jury questions listed on the worksheet (Supporting Files S2, S6). The jury, which is formed by the instructional staff, may choose to ask these exact questions or new questions during the debate. Instructors decide which stakeholder group and side will perform first (*e.g.,* with a coin flip), and call on each group in turn. Instructors are recommended to use a timer that is visible to students during the debate and to monitor it strictly to guarantee that arguments are concise and that the debate is fair and kept to schedule. If one chose to have 4 different stakeholder groups, the 60 minutes of the debate could be broken down as follows: 3 minute presentation by each group, one side followed by the next (*e.g.,* pro then con); 2 minutes to answer the jury's question per group, one side followed by the next; 2 minutes to rebut the opposite's side arguments per group, one side followed by the next (S6. Debating Conservation – Lecture slides for Debate Day). At the end of the debate, students vote again to assess whether their research and/or the arguments presented in the debate have changed their minds. Once again, votes should be recorded and results announced by the instructor. Votes can then be compared to the first round of voting and the results discussed. Students participating in group work also submit their "Individual and Group Assessment" worksheet at this stage, to reflect on both their own and their peers' contributions towards this activity (S3. Debating Conservation – Individual and group assessment).

Asynchronous option

Students participating asynchronously take on the role of a media reporter. They watch a recording of the debate and are assessed on the write-up of an article summarizing the arguments and outcome of the debate (S7. Debating Conservation – Asynchronous assignment).

TEACHING DISCUSSION

Our objective is to teach students biological and ecological concepts beyond the facts: we want students to develop their critical thinking on a pressing, real-world conservation issue. As our world becomes increasingly polarized, with social media promoting one-sided views (8), opportunities to engage with views that are different from one's own are increasingly rare. Here, we present a lesson that allows students to remove their own preconceptions as well as those of their instructors from the decision-making process, while also developing collaboration and communication skills and better understanding of the nuances of the challenges of developing and implementing conservation policy.

The team of co-authors have taught this lesson four times: twice in person and twice remotely. Each time, we were impressed by the students' engagement and enthusiasm during this activity. Students appreciated the opportunity to think from a different perspective as well as to bring their personal experiences and opinions into the debate. The results of our pre- and post-debate votes reflected the evolution of the students' thinking following this activity. Each year, the "yes" vote to wolf reintroduction in California was above 80% before the activity but the outcome of the vote tended to change substantially after the debate. A whole-class discussion after the conclusion of the live debate was helpful in understanding nuances in student perspectives and how the activity may have changed or reinforced students' personal opinions in either direction.

The first part of the lesson, which involves an introductory lecture and the completion of a worksheet, was essential in preparing the students for the debate. The worksheet required students to think through their role thoroughly, to research information in the primary and secondary literature, and to write down their main arguments as well as predict the opposing team's counter-arguments. The richest contributions to the live debate occurred when students were well prepared, referring to their argument notes on their completed worksheets to clearly and cohesively present their ideas. Some

students assumed their role more passionately than others, with some even choosing to dress up for their role during the debate. While some students may feel less comfortable talking in public, even those students will have been exposed to the others' presentations and have participated in forming arguments in their small groups. Thus, regardless of the student's participation in the live debate, the whole lesson achieves its objectives to familiarize students with different perspectives on a controversial topic.

The lesson can also easily be adapted to classrooms of different sizes. Smaller classrooms could form smaller debate teams or a smaller number of stakeholder groups, while larger classes could add additional stakeholder groups (see S4. Debating Conservation – Lecture slides for Preparation Day, slide 20 for examples). Larger classes may also find that splitting the class in two to have parallel debates with the same stakeholder groups may be more manageable for instructors. Finally, this lesson can be taught remotely. We found that students organized themselves well to meet and communicate outside of class using private discussion boards and breakout rooms to research and formulate arguments and rehearse the debate.

A major strength of this lesson is that it can easily be adapted to another "hot topic" in conservation or even in another field. Instructors can choose topics more relevant to their location or subject area of expertise. Examples of other topics of debate in conservation are the conservation strategies of the northern spotted owl in the Pacific North-West of North America (35) or, more globally, whether to "share or spare" our habitats with nature for agriculture and urban development (36). We believe our lesson provides a valuable framework for developing students' critical thinking and oral presentation skills regardless of the topic of debate.

SUPPORTING MATERIALS

- S1. Debating Conservation – Pre-class quiz. List of pre-class videos and reading along with an example homework quiz.
- S2. Debating Conservation – Preparation worksheet. A preparation worksheet used for students participating either synchronously or asynchronously, which includes debate instructions, possible jury questions, and instructions for the different stakeholder groups.
- S3. Debating Conservation – Individual and group assessment. A worksheet for students participating in a live debate to assess their team members' participation as well as to reflect on their own contributions towards this activity.
- S4. Debating Conservation – Lecture slides for Preparation Day. Lecture slides for the Preparation Day are available for faculty to prepare and deliver the lesson. A script for each slide is provided at the end of the slide deck to help instructors with teaching.
- S5. Debating Conservation – Breakout room assignments. An example of a breakout room assignments sheet that can be used to structure the debate groups both when teaching in-person or remotely.
- S6. Debating Conservation – Lecture slides for Debate Day. Lecture slides for the Debate Day are available for faculty to explain the format of the debate to the students.
- S7. Debating Conservation – Asynchronous assignment. Instructions on the assignment for asynchronous students.

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Table 1. Teaching timeline table. The lesson spans two class sessions as well as outside of class time for pre-class and additional debate preparation.

Activity	Description	Estimated Time	Notes
Preparation for Class			
Pre-class materials	Students watch four videos and read one article, which provide context for the in-class debate.	40 minutes to watch all the videos 40 minutes to read the article	Ripple *et al.* (2014) paper (34) Ecosystem Services video Ecosystem Processes video Reintroduction of Wolves video How Wolves Change Rivers video
Quiz	Students complete a short online pre-class quiz.	10 minutes	See S1. Debating Conservation – Pre-class quiz.
Class Session 1 - Preparation Day			
Introductory lecture	Lecture contextualizing the topic of debate (here, "The Return of the Wolf").	20 minutes	Lecture slides with notes are in S4. Debating Conservation – Lecture slides for Preparation Day.
Pre-debate vote	Students vote for or against the motion proposed.	5 minutes	Votes are recorded and displayed.
Student debate preparation	Students are randomly assigned into their stakeholder groups and prepare for the debate.	50 minutes	Synchronous and asynchronous students fill in a worksheet in preparation for the debate, see Supporting Files S2 and S3. If the class is happening remotely, refer to S5. Debating Conservation – Breakout room assignments.
Class Session 2 - Debate Day			
Introductory lecture	Lecture reviewing format of debate.	10 minutes	Lecture slides with notes are in S6. Debating Conservation – Lecture slides for Debate Day.
Live debate	Students debate live with each other.	60 minutes	If the class is happening remotely, refer to S5. Debating Conservation – Breakout room assignments. For asynchronous students, the debate is recorded for them to watch. They then complete S7. Debating Conservation – Asynchronous assignment.
Post-debate vote	Students vote for or against the motion proposed.	5 minutes	Votes are recorded and displayed.