Introduction

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Our dominant influence on Earth's climate and environment has prompted the current geological era to be named the Anthropocene, or Age of Humans. These ecological impacts have been mostly negative for species biodiversity, through human changes to natural habitats that threaten the well-being of other species and increase their extinction rates. Is it our responsibility to be better caretakers of the planet, to ensure Earth's biodiversity is preserved for future generations? Or, should we exploit Earth at all costs to feed and provide energy for the growing human population? This seminar examined the many ways that humans impact biodiversity, and whether we have an obligation as caretakers who preserve other species even for purely aesthetic reasons, versus exploiters that ruthlessly modify Earth on our 'evolutionary path' as a species. We considered climate change and global warming, and how these ecosystem effects alter the biogeography and behavior of species – including humans. Mosquito and tick populations are expanding their geography along with vector-transmitted pathogens; plants are changing their flowering times and marine creatures are migrating, impacting agriculture and fisheries; and desertification and reduced access to clean water are already affecting human demography and agriculture. Pollution from fossil fuels and e-waste can threaten the health of wildlife, as well as humans. The ease of land, ocean and air travel can promote movement of animals, plants and microbes, allowing them to invade and displace resident species. Our landfills and built environments can actually improve survival of some species, such as bears, seagulls, mice, weedy plants and bedbugs – but this can threaten human safety and increase the risk of infectious diseases. If species go extinct, so do their natural products that might be harnessed by humans to discover new medicines, and to solve energy problems. We discussed book chapters and magazine articles on the seminar topic, and how it was portrayed in popular culture. The seminar led to curriculum units appropriate for K-12 classrooms, especially for instructors in biology and the environmental sciences. In addition, the seminar produced units valuable for K-12 teachers in math and statistics.

The overarching goal of the seminar was to empower teachers in their knowledge of human effects on earth's biodiversity, with the expectation that this understanding would enrich the classroom experiences of their students. The resulting units are diverse, reflecting the varied interests and backgrounds of the Fellows. Jesse Baker develops a unit for high school Geometry students concerning human impacts on ecosystems and particularly declines in pollinator species of bees, where students learn about the importance of hexagon shapes in biology and gain practice in evaluating data on the impact of disappearing species. The focus of Chelsea Best's unit for 5th-grade science students is the role of human activities in disease spread, especially for chytrid fungus that threatens amphibian species around the world, as well as for the global pandemic caused by SARS CoV-2 virus. Kendra Butler's unit for 3rd-grade science students examines the role of parks in fostering biodiversity and educating young learners about natural ecosystems, while reminding that human activities nearby parks can promote problems caused by invasive species. Sara Conway's unit for 1st through

3rd grade Montessori students looks at the success of indigenous cultures that live alongside biodiverse communities without threatening species with extinction, especially in biomes on the continent of Africa. Jenn Frasher's unit for elementary school students concerns native versus invasive species, and emphasizes how outdoor instruction can aid student appreciation for biodiversity and that humans can be better caretakers of natural ecosystems. Tara McCrone's 5th-grade unit instructs students on the main ways in which humans are negatively impacting biodiversity to hasten extinction of species, as well as the unfortunate effects of these activities on human communities and health. The 5th-grade unit by Jolene Smith explores strip-mining of coal and how this practice has devastated animal and plant species, and has negatively impacted the health of Native Americans in locations such as Black Mesa, Arizona. Vanessa Vitug develops a unit for high schoolers that concerns changes in land-use practices, and how these human activities cause species extinctions and also may contribute to the ongoing threat of emerging disease pathogens capable of spurring epidemics and pandemics in humans. Jason Ward's unit for 1st graders examines the role of bats in ecosystems, and how human activities have factored in the threat caused by White Nose Syndrome, a fungal disease that can completely eradicate bat colonies. Lawrence Yee develops a unit for high schoolers in math and Advanced Placement Statistics courses, on human activities that promote growth of toxic algae, which can threaten other marine organisms and contaminate seafood consumed by humans.