

ENVS 80.18: The Control of Nature

Spring Quarter 2024

Course Time: Tuesdays & Thursdays 10:10am-12:00pm

X-hour used occasionally as needed: Fridays from 3:30pm-4:20pm

Professor: Dr. Shersingh Joseph Tumber-Dávila

Office Hours: Tuesdays from 12:30-1:30 or by appointment

Office Location: Steele 110

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Course Description:

Embark on a journey that explores the convergence of speculative fiction and cutting-edge scientific advancements. This course delves into the realm of geoengineering technologies, designer genes, carbon removal technologies, renewable energy, and various transformational technologies that shape our understanding of society, the environment, and the climate. Contrary to its portrayal in cinematic works such as *Dune*, *Jurassic World*, and *Snowpiercer*, controlling the earth's climate is not mere science fiction.

With a focus on ethical considerations and governance, this discussion-based course critically examines the potential consequences, both positive and negative, of manipulating the environment. Content is presented through a dual lens, initially addressing issues briefly through popular media and subsequently delving into comprehensive analysis via scientific papers and research. Through rigorous discourse, gain insights into the ethical principles governing these transformative decisions. This course serves as a platform for fostering a nuanced understanding of the dynamic interplay between emerging technologies, societal implications, and ethical considerations.

Distributive: TAS

Prerequisites: ENVS 2 or 3, or permission of the instructor

Learning Outcomes:

- Develop an understanding of transformational technologies in earth, biological, and engineering sciences, integrating knowledge from diverse disciplines.
- Cultivate the ability to make informed decisions, considering the long-term societal implications of transformative technologies.
- Apply ethical frameworks to assess the moral dimensions of deploying emerging technologies, fostering an awareness of ethical considerations in decision-making.
- Investigate governance structures influencing technological decisions, discerning the roles of decision-makers, and considering societal justice principles.
- Enhance critical thinking skills to systematically evaluate the potential consequences, both positive and negative, associated with transformative technologies.

- Develop effective communication skills and engage in collaborative discussions, facilitating the exchange of diverse perspectives on the societal, ethical, and environmental implications of emerging technologies.

Course Format:

This dynamic course is designed to cultivate an inclusive and participatory learning environment, placing a significant emphasis on collaborative engagement and insightful discussions. The course begins with a focus on community building, as students actively contribute to the creation of community norms that will govern the ways we engage and discourse throughout the term. At the outset of the course, students collectively develop a series of community norms, fostering an inclusive space where diverse perspectives are welcomed and respected. This foundational step aims to create a supportive atmosphere that encourages open dialogue and hopefully facilitates the active involvement of all participants.

Throughout the course, a variety of pedagogical techniques are employed to facilitate a broad range of class participation. Online discussion posts provide asynchronous opportunities for reflection and sharing, while think-pair-share activities and small group breakout sessions encourage collaborative problem-solving and in-depth discussions. Regular class check-ins and exit tickets enable brief moments of individual reflection and feedback.

Case studies, in-class activities, and open whole-class discussions further enhance the learning experience, allowing students to apply theoretical concepts and collectively analyze and debate course topics. By integrating these pedagogical strategies and prioritizing the establishment of inclusive community norms, the course fosters a collaborative and supportive learning environment where all students can actively contribute to the exploration of transformative technologies and their societal implications.

Course Expectations & Evaluation:

Class Participation (25%): This course is centered around facilitating open discussions and dialogue during class. Participation is therefore critical for success in the course, and will be evaluated through a diversity of opportunities. This includes participation in course check-ins and exit tickets, engaging in small group and whole class discussions/activities, and sharing with the class examples of relevant literature and media pertaining to course topics. Additionally, class participation requires adherence to the agreed upon community norms developed and discussed during the first class.

Discussion Board Posts and Feedback (15%): In lieu of weekly writing assignments, students will submit responses to weekly discussion board posts via Canvas. Students are also expected to respond to two discussion posts from fellow classmates weekly. The discussion board posts are 10% of the total grade whereas the responses account for 5% of the total grade.

Topic-based quizzes & Assignments (30%): Each course topic will be accompanied by either quizzes or assignments comprised of mostly short-answer and multiple-choice questions. The material of the quizzes and assignments will be based on the lectures, class activities, and assigned course materials (readings, media, and other materials posted on canvas).

Final Project (30%): The final project will consist of a written report or presentation where students will take either a “pro” or “con” position of one of the topics described in class. Each student is expected to independently write their report, whereas presentations will be with groups of no more than four students. The final project topics and groups will be assembled mid-way through the quarter, with presentations occurring on the last days of class, and the essays are due by the start-time of our last class.

The paper should only briefly describe the approach—in no more than a very short paragraph or two. (We will cover the technology basics in class.) Instead, focus on 1) the biggest technical challenges and opportunities or risks (depending on your position); 2) a governance structure for implementing the technology regionally or globally; and 3) an ethical framework you would apply to its use, pro or con.

The group presentations will be ten minutes per topic-group. Provide a brief one-slide introduction of the technology, a slide or two on technological challenges and opportunities or risks, then focus most of your presentation on ethics and governance issues for your position. You may use PowerPoint, but feel free to use any medium you desire. If in doubt, ask us ahead of time.

Course Schedule & Topics:

The course schedule is subject to change from week to week based on student input, in addition to the emergence of media coverage of pertinent course topics. Required readings, assignments, and discussion prompts will be posted on canvas prior to each class session (readings for Tuesday classes will be posted by end of day the previous Thursday, and Thursday class readings will be posted by Tuesday at the latest). *The readings posted below are an example of what may be assigned, but as stated previously, all required course materials will be posted on Canvas prior to each class session.*

Week	Dates	Topic & Sample Readings
1	March 25-29	Course introduction, community norms, ethics, historical introduction to human attempts to control nature <ul style="list-style-type: none"> ○ <i>Velasquez et al. A Framework for Ethical Decision Making. Markkula Center for Applied Ethics at Santa Clara University. (2021)</i>
2	April 1-5	Geoengineering- human attempts to alter earth’s climate <ul style="list-style-type: none"> ○ <i>Svoboda, Toby. "The ethics of geoengineering: moral considerability and the convergence hypothesis." Journal of Applied Philosophy 29.3 (2012)</i> ○ <i>UNESCO. Report of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) on the ethics of climate engineering. (2023)</i>
3	April 8-12	Climate change scenarios and negative emissions technologies <ul style="list-style-type: none"> ○ <i>NASEM - National Academies of Sciences, Engineering, and Medicine. Negative Emissions Technologies and Reliable Sequestration: A Research Agenda. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/25259 (2019)</i> ○ <i>IPCC. 2014. Climate Change 2014: Mitigation of Climate Change: Contribution of Working Group III to the Fifth Assessment Report to the</i>

		<i>Intergovernmental Panel on Climate Change [final draft], http://www.ipcc.ch/report/ar5/wg3/.</i>
4	April 15-19	Nature based & emerging climate solutions <ul style="list-style-type: none"> ○ <i>Novick et al. The science needed for robust, scalable, and credible nature-based climate solutions in the United States: Summary Report. DOI: https://doi.org/10.5967/8rgp-tc11. (2022)</i>
5	April 22-26	Case study: Net Zero by 2050? Sustainable energy and land-use futures <ul style="list-style-type: none"> ○ <i>MA EEA. MA 2050 Decarbonization Roadmap (Abridged). Commonwealth of Massachusetts Report. (2023)</i> ○ <i>Thompson et al. Land Sector Report- A Technical Report of the Massachusetts 2050 Decarbonization Roadmap Study. Commonwealth of Massachusetts Report. (2020)</i>
6	April 29-May 3	Carbon markets & terraforming <ul style="list-style-type: none"> ○ <i>Badgley et al. Systematic over-crediting in California's forest carbon offsets program. Global Change Biology, 28, 1433–1445. https://doi.org/10.1111/gcb.15943. (2022)</i> ○ <i>Levchenko, Igor, et al. "Mars colonization: beyond getting there." Terraforming Mars (2021)</i> ○ <i>Bostrom, Nick. "The vulnerable world hypothesis." Global Policy 10.4 (2019)</i>
7	May 6-10	Genetic Engineering: GMOs and Designer Genes <ul style="list-style-type: none"> ○ <i>Kofler, Natalie, et al. "Editing nature: Local roots of global governance." Science 362.6414 (2018)</i> ○ <i>Coller, Barry S. "Ethics of human genome editing." Annual Review of Medicine 70 (2019)</i> ○ <i>National Academies of Sciences, Engineering, and Medicine. Human genome editing: science, ethics, and governance. National Academies Press. (2017)</i>
8	May 13-17	Species resurrection, de-extinction, & reintroduction <ul style="list-style-type: none"> ○ <i>Sherkow, Jacob S., and Henry T. Greely. "What if extinction is not forever?." Science 340.6128 (2013)</i> ○ <i>Shapiro, Beth. "Pathways to de-extinction: how close can we get to resurrection of an extinct species?." Functional Ecology 31.5 (2017)</i> ○ <i>Popkin, Gabriel. "Can a transgenic chestnut restore a forest icon?." (2018)</i>
9	May 20-24	Emerging technologies and AI & begin final project presentations <ul style="list-style-type: none"> ○ <i>Kaack, L.H., Donti, P.L., Strubell, E. et al. Aligning artificial intelligence with climate change mitigation. Nat. Clim. Chang. 12, 518–527 (2022). https://doi.org/10.1038/s41558-022-01377-7</i>
10	May 28	Final project presentations & course summary/feedback

Academic Honor:

The faculty, administration, and students of Dartmouth College acknowledge the responsibility to maintain and perpetuate the principle of academic honor, and recognize that any instance of academic dishonesty is considered a violation of the [Academic Honor Principle](#).

In the context of this course, students may discuss homework assignments with each other provided that the work they submit for credit is their own. This means that you should understand each step involved in the solution and be able to reproduce it independently.

Religious Observances:

Dartmouth has a deep commitment to support students' religious observances and diverse faith practices. Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me as soon as possible—before the end of the second week of the term at the latest—to discuss appropriate course adjustments.

Student Accessibility and Accommodations:

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; [Apply for Services webpage](#); student.accessibility.services@dartmouth.edu; 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, students should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its [Testing Center](#) may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Mental Health and Wellness

The academic environment is challenging, our terms are intensive, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including: the [Counseling Center](#) which allows you to book triage appointments online, the [Student Wellness Center](#) which offers wellness check-ins, and your [undergraduate dean](#). The student-led [Dartmouth Student Mental Health Union](#) and their peer support program may be helpful if you would like to speak to a trained fellow student support listener. If you need immediate assistance, please contact the counselor on-call at (603) 646-9442 at any time. Please make me aware of anything that will hinder your success in this course.

Title IX

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all community members have equal access to Dartmouth's educational and employment opportunities. We strive to promote an environment of sexual respect, safety, and well-being. Through the Sexual and Gender-Based Misconduct Policy (SMP), Dartmouth demonstrates that sex and gender-based discrimination, sex and gender-based harassment, sexual assault, dating violence, domestic violence, stalking, etc., are not tolerated in our community.

For more information regarding Title IX and to access helpful resources, visit Title IX's website (sexual-respect.dartmouth.edu). As a faculty member, I am required to share disclosures of sexual or gender-based misconduct with the Title IX office.

If you have any questions or want to explore support and assistance, please contact the Title IX office at 603-646-0922 or TitleIX@dartmouth.edu. Speaking to Title IX does not automatically initiate a college resolution. Instead, much of their work is around providing supportive measures to ensure you can continue to engage in Dartmouth's programs and activities.

Socioeconomic Differences and Financial Difficulty

Our community is composed of students from a variety of financial backgrounds. Socioeconomic diversity can be invisible, and you may be experiencing financial difficulties related to the cost of textbooks, materials, or other necessities for our class of which I am not aware.

If you encounter financial challenges related to this class, there may be sources of support for you. If you feel comfortable sharing your experience with me, you may. You may also consider meeting with a financial aid officer to discuss options, reaching out to the First-Generation Office if you are a first-generation student, browsing the [Funding Resources](#) page, or, for unexpected expenses, applying to the Barrier Removal Fund through the Financial Aid tile in [DarthHub](#).