

## **01:460:203 Building and Maintaining a Habitable Planet**

Rutgers University-New Brunswick, Spring 2021

Canvas: <https://rutgers.instructure.com/courses/105678>

Mondays/Thursdays 10:20-11:40am via Zoom

### **Professor Robert Kopp**

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When you email me, please prefix the phrase “HABITABLE PLANET:” to the email subject.

Office hours are available during those class slots not used for synchronous sessions. If you would like to schedule office hours, please email me at least a day in advance (e.g., by 10am Wednesday if the available slot is on Thursday.) I will not hold office hours if no one requests them.

**Course Description:** Humanity has become a geological force, reshaping Earth’s land, atmosphere, oceans and climate. Developing the capacity to manage these planetary changes in a wise, deliberate, and democratic manner is one of the most critical tasks of this century. This course will prepare you to be an informed global citizen, able to interpret the environmental changes humanity is effecting today in the context of our planet’s 4.6-billion year history and to make informed decisions about policies to manage these changes. We will focus particularly on: how the climates of rocky planets like Earth, Mars, and Venus function, evolve, and shape planetary habitability; how humans are reshaping Earth’s climate; and how choices made today may affect the future habitability of the planet for our own civilization.

**Learning goals:** The fundamental goal of this class is to equip you to interpret the environmental changes humanity is effecting today in the context of the long-term evolution of the planet’s climate. In this course, you will fulfill the **Natural Sciences (NS)** core curriculum requirement by applying the concepts of system feedbacks, energy, entropy, and carbon cycling to the Earth system in the planet’s past and in the current Anthropocene epoch. In this course, you will also fulfill the **Our Common Future (CCO)** core curriculum requirement by analyzing the relationship science & technology have to a contemporary social issue (namely, the human reshaping of the global environment).



**Texts:** The two required texts for the course are:

Charles Langmuir & Wally Broecker (2012), *How to build a habitable planet* (ISBN 0691140065; available online via Rutgers Library)

Adam Frank (2018), *Light of the Stars: Alien Worlds and the Fate of the Earth* (ISBN 0393609014)

Additional articles, podcasts, and videos will be posted on Canvas and assigned during the course of the term. (See bibliography at the end of the syllabus.)

### Course Schedule

Unit	Day	Date	Topic	Pre-Class Readings and Media
1	Th	1/21/21	Introduction	Syllabus
2	Th	1/28/21	How does Science Work?	Sagan (1996) ch. 2 and 12; Chamberlin (1890); Oreskes (2019); Frank (2018) Intro, ch.1
3	M	2/1/21	The Earth as a System	Morton 2.1; L&B ch. 1; Kirkwood ch. 1; Frank ch. 3
4	M	2/8/21	The Greenhouse Effect	Benestad (2010); L&B ch. 9.4-9.5
5	M	2/15/21	Climate feedbacks	L & B ch. 9.6
6	M	2/22/21	Special discussion of planetary exploration (Guest: Prof. Lujun Ojha)	Frank ch. 2 Videos: <i>Venus: Death of a Planet</i> , <i>Voyage of Curiosity</i> , <i>Perseverance</i> videos
6	Th	2/25/21	Venus and Mars	
7	M	3/1/21	Planetary Habitable Zone	Frank ch. 4 Video: <i>Are There Other Earths? The Odds of Life Around Nearby Stars</i>
8	M	3/8/21	Natural climate variability	L&B 14.2, 14.5, 6.1, 6.2, ch 18; Brannen (2021)
	M	3/15/21	SPRING BREAK	
	Th	3/18/21	SPRING BREAK	
9	M	3/22/21	Human Energy System	L&B ch. 19, Mackay (at least ch. 1 and 2), President's Task Force (2020), Wilson and Nielsen (2020)
10	M	3/29/21	Kaya Identity	LB ch. 20, Steffen et al. (2011); Video: Rockstrom TED talk
11	M	4/5/21	Current climate change	Hsiang and Kopp (2018), NAS (2020), Schneider (2020)
12	M	4/12/21	Future Climate Change	Houser et al. (2015), Preface and ch. 1-4, Kopp (2020) Podcast: Ezra Klein with Kate Marvel
13	M	4/19/21	Climate change mitigation	Roberts (2020) Video: Vox – How American can leave fossil fuels behind
14	M	4/26/21	Climate communications, policy, and politics	Economist (2021) Podcast: Ezra Klein with Leah Stokes Video: Katharine Hayhoe (2019)

				Morrow and Shwom interviews
15	M	5/3/21	Envisioning a sustainable future	
		5/10/21	EXAM PERIOD - Final project and all assessment revisions due	

**Pandemic Operations:** This is a challenging and unusual time for all of us. The course you are getting is not exactly what you would be getting were we meeting in person, but I hope to work with you to achieve the learning goals of the course as best as possible under the circumstances.

In my mind, the value of synchronous lecture sessions over Zoom is limited, so after the first couple class sessions, we will migrate to a mode in which the class sessions serve primarily as weekly discussion sections. In the discussion sections, we will clarify topics that are confusing to you. You should do your first pass through the asynchronous unit materials beforehand to get the most out of these sections. These sections will also provide an opportunity for us to get to know each other, and to have free-ranging discussions of topics related to the course material.

**Assessment and Grading:** Each module of the course ends with a test covering that module's materials, and building upon past modules. You may take each test up to four times, provided the times you take them are at least 24 hours apart. (The questions may differ each time you take the test.) The last grade you get on the test will count toward your course grade. While taking the tests, you may not collaborate with other students or reference materials other than a single sheet of paper with your notes. You are free to discuss with your fellow students while not taking the tests. These tests will constitute 90% of your grade.

10% of your grade will be determined by a final creative product due during the exam period.

In addition, there will be a series of exercises over the course of the semester that are intended to help you understand core concepts but will not count toward your grade. You are free to collaborate on these exercises.

All assignments will be submitted online via Canvas.

**Attendance:** The synchronous sections are an important part of the course, and you are expected to attend your assigned sessions. That said, I understand the challenges of the pandemic, and if for some reason you cannot attend, I ask that you use the University absence reporting website (<https://sims.rutgers.edu/ssra>) to let me know the date and reason for your absence. An email will be sent to me automatically.

### **What I Expect From You**

1. You have read the syllabus and keep a copy of it for your referral.

2. You will be respectful and compassionate towards your professors and your fellow students. Any behavior that disrupts the class and other students' learning will not be tolerated.
3. On average, you should spend 2-3 hours per credit hour (i.e., 6-9 hours per week) on your own work on activities related to the course (reading, studying, making notes, working on assignments, etc.), not including time watching lectures or in discussion sections. Overall work load should be about 9-12 hours/week.
4. You will share your personality, knowledge, skills, and special expertise with the rest of us throughout this class.

### ***What You Should Expect From Me***

1. I will give you the same respect and compassion that I ask you to give me and other members of this class.
2. I will encourage you and be receptive to constructive comments about my teaching.
3. I will do my best to help you, but I cannot learn the material for you.

***Cameras in Zoom:*** I encourage you to have cameras on while we are having discussion sections, but understand this may not always be feasible. So that we can, at least, see pictures of each others' faces, please set your profile to an classroom-appropriate selfie if you plan on regularly having your camera off.

***Academic Integrity:*** All students are responsible for upholding the highest standards of student behavior, as specified under the University Code of Student Conduct (<http://studentconduct.rutgers.edu/>), including but not limited to strict adherence to the terms of the University's Academic Integrity Policy (<http://academicintegrity.rutgers.edu/>). Plagiarism is not acceptable on any assignment and on first occurrence will lead to a failing grade on the assignment. On collaborative assignments, all group members should be clearly identified and all are responsible for ensuring the integrity of all group products.

***Accommodations for disabilities:*** Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>

***Safe Learning Environment: Discrimination and Harassment:*** Rutgers faculty are committed to helping create a safe learning environment for all students and for the university as a whole. If you have experienced any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, know that help and support are available. Rutgers has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more. The University strongly encourages all students to report any such incidents to the University. Please be aware that all Rutgers employees (other than those designated as confidential resources such as advocates, counselors, clergy and healthcare providers as listed in Appendix A to Policy 10.3.12) are required to report information about

such discrimination and harassment to the University. This means that if you tell a faculty member about a situation of sexual harassment or sexual violence, or other related misconduct, the faculty member must share that information with the University's Title IX Coordinator. If you wish to speak to a confidential employee who does not have this reporting responsibility, you can find a list of resources in Appendix A to University Policy 10.3.12. For more information about your options at Rutgers, please visit [endsexualviolence.rutgers.edu](http://endsexualviolence.rutgers.edu)

**Active Citizenship:** Part of the goal of this course, and of your Rutgers education as a whole, is to facilitate your activities as an active global citizen. In a democracy, voting in elections is the most basic level of being a citizen. For those of you who are NJ residents, I strongly encourage you to make sure you are registered to vote, and to vote in the primary election on Tuesday, June 8. To check your registration in New Jersey, or to determine your polling location, visit <http://www.njelections.org/voting-information.html>. For more information, visit: <http://cypp.rutgers.edu/ru-voting/>

**Your Rights:** We are all human and instructors and students both make mistakes. If you feel that you have been treated unfairly and have an issue you do not wish to raise with me, contact the department chair, Dr. Gregory Mountain ([gmtn@eps.rutgers.edu](mailto:gmtn@eps.rutgers.edu)).

**Pandemic Resources:** As mentioned, this is a challenging time. Rutgers has a variety of resources to help you.

The Rutgers Student Food pantry is open to all RU-NB students with no questions asked. It remains open (with some modifications) during COVID-19. <http://ruoffcampus.rutgers.edu/food/>

The Dean of Students office can connect students to food and housing resources. <http://deanofstudents.rutgers.edu/>

Counseling is available via CAPS, Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services <http://health.rutgers.edu/medical-counseling-services/counseling/>

Rutgers HOPE (Health Outreach, Promotion, and Education) offer a wide range to peer services, workshops and training, and crisis prevention. <http://health.rutgers.edu/education/hope/>

## Bibliography

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- Excerpts from T. Houser et al. (2015), *Economic Risks of Climate Change: An American Prospectus*.
- [Hsiang, S. M. and R. E. Kopp \(2018\). An economist's guide to climate change science. \*Journal of Economic Perspectives\* 32\(4\), 3-32. doi:10.1257/jep.32.4.3.](#)

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<http://www.planetary.org/blogs/emily-lakdawalla/2013/12051108-mars-chemical-history.html>
- Excerpts from J. Lovelock (1988), *The Ages of Gaia* (ISBN 0393312399)
- D. Mackay (2008). *Sustainable Energy Without the Hot Air*. <https://withouthotair.com/>
- Excerpts from O. Morton (2009), *Eating the Sun* (ISBN 0007163657)
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<https://www.nap.edu/catalog/25733/climate-change-evidence-and-causes-update-2020>
- Excerpts from N. Oreskes (2019), *Why Trust Science?* (ISBN 9780691179001)
- M. Paul, A. Fremstad and J. W. Mason (2019). Decarbonizing the US Economy: Pathways toward a Green New Deal. Roosevelt Institute. <https://rooseveltinstitute.org/decarbonizing-the-us-economy/>
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- David Robers (2020). How to Drive Fossil Fuels out of the US Economy, Quickly.  
<https://www.vox.com/energy-and-environment/21349200/climate-change-fossil-fuels-rewiring-america-electrify>
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- Elizabeth J. Wilson and Elias Grove Nielsen (2020). Energy. In: *Earth 2020: An insider’s guide to a rapidly changing planet*. P. D. Tourelle, ed. Open Book Publishers.

## Videos

- Venus: Death of a Planet* <https://youtu.be/HTGxCxNVn9g>
- Voyage of Curiosity* <https://youtu.be/qaUhLXolGal>
- Are There Other Earths: The Odds of Life Around Nearby Stars* <https://youtu.be/snHcrLxHXbA>
- K. Hayhoe (2019). Talking Climate: When facts are not enough. <https://youtu.be/zdCw3RUcRro>
- J. Rockstrom (2010). *Let The Environment Guide Our Development*.  
[https://www.ted.com/talks/johan\\_rockstrom\\_let\\_the\\_environment\\_guide\\_our\\_development/transcript](https://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development/transcript)
- Vox (2020). How America can leave fossil fuels behind, in one chart. <https://youtu.be/QfAXbGlnwno>

## Podcasts

- Ezra Klein Show (Oct. 6, 2020). Leah Stokes: How a climate bill becomes a reality.  
<https://www.vox.com/21504369/climate-change-green-new-deal-biden-2020-the-ezra-klein-show>

Ezra Klein Show (Oct. 28, 2019). Kate Marvel: We live in the Good Place. And we're screwing it up.  
<https://podcasts.apple.com/us/podcast/we-live-in-the-good-place-and-were-screwing-it-up/id1081584611?i=1000455242142>