

Master of Science in Sustainability Management

Reversing the Biodiversity Crisis (PS4236)

Mondays 6:10-8:00pm

3 Credits

Instructor: Dr. Amy Karpati, ask2197@columbia.edu
Office Hours: Mondays 5:30-6:00pm and 8:00-8:30pm, or by appointment
Response Policy: Students can generally expect a response to emails within 24 hours, seven days a week.

Facilitator/Teaching Assistant: TBD

Office Hours: TBD

Response Policy: TBD

Course Overview

Often described as “twin crises,” climate change and biodiversity loss are among the most urgent sustainability challenges to be addressed in our modern era. While much focus has rightfully been placed on climate change mitigation actions at local, regional, and global scales, biodiversity loss is less often addressed by governments, institutions, industries, and individuals as a critical piece of the sustainability puzzle. In 2021, COP 15, the fifteenth meeting of the Conference of the Parties to the UN Convention on Biological Diversity, received far less media attention than COP 26, the Conference of the Parties to the UN Convention on Climate Change. Yet climate change and biodiversity loss are inextricably linked, and without biodiversity and the associated ecosystem services and biospheric resilience upon which human society relies, a sustainable world is not possible. Moreover, certain climate change mitigation actions can actually be to the detriment of biological diversity.

Unlike a traditional conservation biology course geared towards ecologists and biologists, this course will be taught through the lens of sustainability management, equipping sustainability managers with the knowledge and direction needed to begin integrating biodiversity conservation and restoration into their professions. This course will illuminate the critical importance of biodiversity to sustainability and human well-being, the science and politics behind the current biodiversity crisis, and proposals, policies, and actions for bending the curve of biodiversity loss to create more sustainable and equitable outcomes for both humans and the non-humans with which we share our planet.

Students who seek to deepen their understanding of ecological sustainability and address the biodiversity crisis through the lens of sustainability management are encouraged to take this course. This course is an on-campus elective offered during the Fall semester and fulfills 3 credits within the Physical Dimensions of Sustainability Management curriculum area in the Master of Science in Sustainability Management program. Cross-registration is available to students outside of the Master of Science in Sustainability Management program, space permitting.

Learning Objectives

Upon successful completion of this course, students should be able to:

- L1 - Define biodiversity and identify how it is measured.
- L2 - Explain the role of biodiversity in human sustainability.
- L3 - Analyze past and projected patterns of biodiversity loss.
- L4 - Evaluate the impacts of land use, industry, and policy on local, regional, and global biodiversity.
- L5 - Identify and assess goals, opportunities, and actions for biodiversity conservation and restoration across individual, business, and government sectors.
- L6 - Incorporate biodiversity goals and actions into climate change mitigation/sustainability plans.
- L7 - Design and apply biodiversity-related policies and actions to one’s own profession.

Readings

All readings are available through the course Canvas website.

Texts:

There are no required “texts” for this course, however, we will often reference the following two reports, which you might decide to explore further. You are not required to read these reports in their entirety.

Secretariat of the Convention on Biological Diversity. (2020). *Global biodiversity outlook 5*.
<http://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>

IPBES-IPCC. (2021). *Biodiversity and climate change: Scientific outcome*.
http://www.ipbes.net/sites/default/files/2021-06/2021_IPCC-IPBES_scientific_outcome_20210612.pdf

Required Readings:

Beyond Risk and Return: The role of finance in preserving and fostering biodiversity. (2022). Triodos Bank.

Biodiversity Strategy: Bending the curve on biodiversity loss. (2020). Kering.

Blicharska, M., Smithers, R.J., Mikusiński, G., Rönnbäck, P., Harrison, P.A., Nilsson, M., & Sutherland, W.J. (2019). Biodiversity’s contributions to sustainable development. *Nature Sustainability*, 2(12), 1083–1093.
<http://doi-org.ezproxy.cul.columbia.edu/10.1038/s41893-019-0417-9>

Boyer, A.E., Granat, M., Skinner, A., Demerritt, P., Deering, K., Margoluis, C., & Skinner, T. (2021). Gender inequality, biodiversity loss, and environmental degradation. CARE-WWF Alliance.

Cardinale, B.J., Duffy, J.E., Gonzalez, A., Hooper, D.U., Perrings, C., Venail, P., Narwani, A., Mace, G.M., Tilman, D., Wardle, D.A., Kinzig, A.P., Daily, G.C., Loreau, M., Grace, J.B., Larigauderie, A., Srivastava, D.S., & Naeem, S. (2012). Biodiversity loss and its impact on humanity. *Nature*, 486, 59-67.
<http://dx.doi.org.ezproxy.cul.columbia.edu/10.1038/nature11148>

Ceballos, G., Ehrlich, P.R., & Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proceedings of the National Academy of Sciences*, 114(30), E6089-6096. <http://doi.org/10.1073/pnas.1704949114>

Convention on Biological Diversity. (2021). First draft of the Post-2020 Global Biodiversity Framework.

Delabre, I., Rodriguez, L.O, Smallwood, J.M., Scharlemann, J.P.W, Alcamo, J., Antonarakis, A.S., Rowhani, P., Hazell, R.J., Aksnes, D.G., Balvanera, P., Lundquist, C.J., Gresham, C., Alexander, A.E., & Stenseth, N.C. (2021). Actions on sustainable food production and consumption for the post-2020 global biodiversity framework. *Science Advances*, 7, eabc8259. <http://doi.org/10.1126/sciadv.abc8259>

Díaz, S., Settele, J., Brondízio, E.S., Ngo, H.T., Agard, J., Arneith, A., Balvanera, P., Brauman, K.A., Butchart, S.H.M., Chan, K.M.A., Garibaldi, L.A., Ichii, K., Liu, J., Subramanian, S.M., Midgley, G.F., Miloslavich, P., Molnár, Z., Obura, D., Pfaff, A., Polasky, S., Purvis, A., Razzaque, J., Reyers, B., Chowdhury, R.R., Shin, Y., Visseren-Hamaker, I., Willis, K.J., & Zayas, C.N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science*, 366(6471), 1327. <http://dx.doi.org/10.1126/science.aax3100>

Dinerstein, E., Joshi, A.R., Vynne, C., Lee, A.T.L., Pharand-Deschenes, F., Franca, M., Fernando, S., Birch, T.,

- Burkart, K., Asner, G.P., & Olson, D. (2020). A “Global Safety Net” to reverse biodiversity loss and stabilize Earth’s climate. *Science Advances*, 6, eabb2824.
- Dirzo, R., Young, H.S., Galetti, M., Ceballos, G., Isaac, N.J., & Collen, B. (2014). Defaunation in the anthropocene. *Science*, 345(6195), 401-406. <http://www.jstor.org/stable/24745121>.
- Einhorn, C. (2021, June 10). Our response to climate change is missing something big, scientists say. *The New York Times*. <http://www.nytimes.com/2021/06/10/climate/biodiversity-collapse-climate-change.html>
- Einhorn, C. (2021, October 14). The most important global meeting you’ve probably never heard of is now. *The New York Times*. <http://www.nytimes.com/2021/10/14/climate/un-biodiversity-conference-climate-change.html>
- Einhorn, C., & Popovich, N. (2022, March 3). This map shows where biodiversity is most at risk in America. *The New York Times*. <http://www.nytimes.com/interactive/2022/03/03/climate/biodiversity-map.html>
- Fisher, B. & Christopher, T. (2007). Poverty and biodiversity: Measuring the overlap of human poverty and the biodiversity hotspots. *Ecological Economics*, 62(1), 93-101. <http://doi.org/10.1016/j.ecolecon.2006.05.020>
- Hooper, D.U., Adair, E.C., Cardinale, B.J., Byrnes, J.E., Hungate, B.A., Matulich, K.L., Gonzalez, A., Duffy, J.E., Gamfeldt, L., & O’Connor, M.I. (2012). A global synthesis reveals biodiversity loss as a major driver of ecosystem change. *Nature*, 486(7401), 105–108. <http://doi.org/10.1038/nature11118>
- IPBES. (2018). Summary for policymakers of the assessment report on land degradation and restoration of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services.
- IPBES. (2022). Summary for policymakers of the methodological assessment regarding the diverse conceptualization of multiples values of nature and its benefits, including biodiversity and ecosystem functions and services (assessment of the diverse values and valuation of nature). Bonn, Germany.
- Lanham, J.D. (2021). What do we do about John James Audubon? *Audubon Magazine*. <http://www.audubon.org/magazine/spring-2021/what-do-we-do-about-john-james-audubon>
- Leclère, D., Obersteiner, M., Barrett, M., Butchart, S.H.M., Chaudhary, A., De Palma, A., DeClerck, F.A.J., Di Marco, M., Doelman, J.C., Dürauer, M., Freeman, R., Harfoot, M., Hasegawa, T., Hellweg, S., Hilbers, J.P., Hill, S.L.L., Humpenöder, F., Jennings, N., Krisztin, T., Young, L. (2020). Bending the curve of terrestrial biodiversity needs an integrated strategy. *Nature*, 585, 551-556. <http://doi.org/10.1038/s41586-020-2705-y>
- Legagneaux, P., Casajus, N., Cazelles, K., Chevallier, C., Chevris, M., Guéry, L., Jacquet, C., Jaffré, M., Naud, M., Noisette, F., Ropars, P., Vissault, S., Archambault, P., Bêty, J., Berteaux, D., & Gravel, D. (2018). Our house is burning: Discrepancy in climate change vs. biodiversity coverage in the media as compared to scientific literature. *Frontiers in Ecology and Evolution*, 5(175).
- Lepczyk, C.A., Aronson, M.F., Evans, K.L., Goddard, M.A., Lerman, S.B., & MacIvor, J.S. (2017). Biodiversity in the city: Fundamental questions for understanding the ecology of urban green spaces for biodiversity conservation. *BioScience*, 67(9), 799–807. <http://doi.org/10.1093/biosci/bix079>
- Nilon, C.H., Aronson, M.F.J., Ciliers, S.S., Dobbs, C., Frazee, L.J., Goddard, M.A., O’Neill, K., Roberts, D., Stander, E.K., Werner, P., Winter, M., & Yocom, K.P. (2017). Planning for the future of urban biodiversity: A global review of city-scale initiatives. *BioScience*, 67(9), 332-342.
- Norris, K. (2008). Agriculture and biodiversity conservation: Opportunity knocks. *Conservation Letters*, 1, 2-11.

- Perring, M.P., Erickson, T.E., & Brancalion, P.H.S. (2018). Rocketing restoration: Enabling the upscaling of ecological restoration in the Anthropocene. *Restoration Ecology*, (26)6, 1017-1023.
- Pettorelli, N., Graham, N.A.J., Seddon, N., da Cunha Bustamante, M.M., Lowton, M.J., Sutherland, W.J., Koldewey, H.J., Prentice, H.C., Barlow, J. (2021). Time to integrate global climate change and biodiversity science-policy agendas. *Journal of Applied Ecology*, 58, 2384-2393.
- Reed, G., Brunet, N.D., McGregor, D., Scurr, C., Sadik, T., Lavigne, J., & Longboat, S. (2021). Toward Indigenous visions of nature-based solutions: An exploration into Canadian federal climate policy. *Climate Policy*, 22(4), 514-533. <http://doi.org/10.1080/14693062.2022.2047585>
- Rowland-Shea, J., Doshi, S., Edberg, S., & Fanger, R. (2020, July 21). *The nature gap: Confronting racial and economic disparities in the destruction and protection of nature in America*. Center for American Progress. <http://www.americanprogress.org/article/the-nature-gap/>
- Science Task Force for the UN Decade on Ecosystem Restoration. (2021). Science-based ecosystem restoration for the 2020s and beyond. Gland, Switzerland: IUCN.
- Secretariat of the Convention on Biological Diversity. (2020). *Global biodiversity outlook 5*. <http://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>
- Secretariat of the Convention on Biological Diversity. (2020). *Global biodiversity outlook 5: GBO-5 agriculture highlights*. <http://www.cbd.int/agriculture/doc/gbo5-agri-en.pdf>
- Simkin, R.D., Seto, K.C., McDonald, R.I., & Jetz, W.. (2021). Biodiversity impacts and conservation implications of urban land expansion projected to 2050. *PNAS*, 119(12) e2117297119.
- Staudinger, M.D., Carter, S.L., Cross, M.S., Dubois, N.S., Duffy, J.E., Enquist, C., Griffiths, R., Hellmann, J.J., Lawler, J.J., O'Leary, J., Morrison, S.A., Sneddon, L., Stein, B.A., Thompson, L.M., & Turner, W. (2013). Biodiversity in a changing climate: A synthesis of current and projected trends in the US. *Frontiers in Ecology and the Environment*, 11(9), 465-473. <http://doi.org/10.1890/120272>
- Society for Ecological Restoration International Science & Policy Working Group. (2004). *The SER Primer on Ecological Restoration*. http://www.ser.org/resource/resmgr/custompages/publications/ser_publications/ser_primer.pdf
- Stephenson, P.J. & Carbone, G. (2021). *Guidelines for planning and monitoring corporate biodiversity performance*. IUCN, Global Business and Biodiversity Programme. <http://doi.org/10.2305/IUCN.CH.2021.05.en>
- Summerhayes, G. & Waterford, L. (2021, July 3). Biodiversity loss is a risk to the global financial system. *The Guardian*. <http://www.theguardian.com/commentisfree/2021/jul/04/biodiversity-loss-could-wreck-the-global-financial-system-and-its-only-a-matter-of-time>
- Te Mana o Te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020. (2020). Department of Conservation, New Zealand.
- Te Man o Te Taiao – Aotearoa New Zealand Biodiversity Strategy Implementation Plan. (2022). Department of Conservation, New Zealand.
- The Economics of Biodiversity: The Dasgupta Review. (2021). Headline Messages.

Tilman, D. & Williams, D.R. (n.d.). *Preserving global biodiversity requires rapid agricultural improvements*. The Royal Society. <http://royalsociety.org/topics-policy/projects/biodiversity/preserving-global-biodiversity-agricultural-improvements/>

UN Environment Programme. (n.d.) *Decade on Ecosystem Restoration*. <https://www.decadeonrestoration.org/>

Recommended Readings:

Alexander, S., Aronson, J., Whaley, O., & Lamb, D. (2016). The relationship between ecological restoration and the ecosystem services concept. *Ecology and Society*, 21(1), 34. <http://dx.doi.org/10.5751/ES-08288-210134>

Bayulken, B., Huisingsh, D., & Fisher, P.M.J. (2021). How are nature based solutions helping in the greening of cities in the context of crises such as climate change and pandemics? A comprehensive review. *Journal of Cleaner Production*, 288, 125569. <http://doi.org/10.1016/j.jclepro.2020.125569>

Conservation tools. (n.d.). IUCN. <http://www.iucn.org/resources/conservation-tools>

Driscoll, D.A., Bland, L.M., Bryan, B.A., Newsome, T.M., Nicholson, E., Ritchie, E.G., & Doherty, T.S. (2018). A biodiversity-crisis hierarchy to evaluate and refine conservation indicators. *Nature Ecology & Evolution*, 2(5), 775-781. <http://doi.org/10.1038/s41559-018-0504-8>

Farber, D.A. (2015). Separated at birth? Addressing the twin crises of biodiversity and climate change. *Ecology Law Quarterly*, 42, 841-888. <http://www.jstor.org/stable/43920966>.

Fernández, N., Navarro, L.M., & Pereira, H.M. (2017). Rewilding: A call for boosting ecological complexity in conservation. *Conservation Letters*, 10(3), 276-278. <http://doi.org/10.1111/conl.12374>

Gavin, M.C., McCarter, J., Berkes, F., Mead, A.T.P., Sterling, E.J., Tang, R., and Turner, N.J. (2018). Effective biodiversity conservation requires dynamic, pluralistic, partnership-based approaches. *Sustainability*, 10(6), 1846. <http://doi.org/10.3390/su10061846>

Ingram, J.C., Wilkie, D., Clements, T., McNab, R.B., Nelson, F., Baur, E.H., Sachedina, H.T., Peterson, D.D., & Foley, C.A.H. (2014). Evidence of payments for ecosystem services as a mechanism for supporting biodiversity conservation and rural livelihoods. *Ecosystem Services*, 7, 10-21. <http://doi.org/10.1016/j.ecoser.2013.12.003>

Maes, J. & Jacobs, S. (2017). Nature-based solutions for Europe's sustainable development. *Conservation Letters*, 10(1), 121-124. <http://doi.org/10.1111/conl.12216>

Martay, B., Brewer, M.J., Elston, D.A., Bell, J.R., Harrington, R., Brereton, T.M., Barlow, K.E., Botham, M.S., & Pearce-Higgins, J.W. (2017). Impacts of climate change on national biodiversity population trends. *Ecography*, 40, 1139-1151. <http://doi.org/10.1111/ecog.02411>

Montoya, D., Rogers, L., & Memmott, J. (2012). Emerging perspectives in the restoration of biodiversity-based ecosystem services. *Trends in Ecology and Evolution*, (27), 12, 666-672.

Oliver, T.H., Isaac, N.J.B., August, T.A., Woodcock, B.A., Roy, D.B., & Bullock, J.M. (2015). Declining resilience of ecosystem functions under biodiversity loss. *Nature Communications*, 6, 10122. <http://doi.org/10.1038/ncomms10122>

- Pereira, H.M., Rosa, I.M.D., Martins, I.S., Kim, H., Leadley, P., Popp, A., van Vuuren, D.P., Hurtt, G., Anthoni, P., Arneth, A., Baisero, D., Chaploin-Kramer, R., Chini, L., Di Fulvio, F., Di Marco, M., Ferrier, S., Fujimori, S., Guerra, C.A., Harfoot, M.,... Alkemade, R. (2020). Global trends in biodiversity and ecosystem services from 1900 to 2050. *bioRxiv*. <http://doi.org/10.1101/2020.04.14.031716>
- Purdy, J. (2015, August 13). Environmentalism's racist history. *The New Yorker*. <http://www.newyorker.com/news/news-desk/environmentalisms-racist-history>
- Reversing biodiversity loss – the case for urgent action*. (2021, March 31). The Royal Society. <http://royalsociety.org/-/media/about-us/international/g-science-statements/G7-reversing-biodiversity-loss-31-03-2021.pdf>
- Seddon, N., Daniels, E., Davis, R., Chausson, A., Harris, R., Hou-Jones, Z., Huq, S., Kapos, V., Mace, G.M., Rizvi, A.R., Reid, H., Roe, D., Turner, B., & Wicander, S. (2020.) Global recognition of the importance of nature-based solutions to the impacts of climate change. *Global Sustainability*, 3, 1-12. <http://doi.org/10.1017/sus.2020.8>
- Segan, D.B., Murray, K.A., & Watson, J.E.M. (2016). A global assessment of current and future biodiversity vulnerability to habitat loss–climate change interactions. *Global Ecology and Conservation*, 5, 12–21. <http://doi.org/10.1016/j.gecco.2015.11.002>
- Shin, Y.J., Midgley, G.F., Archer, E.R., Arneth, A., Barnes, D.K., Chan, L., Hashimoto, S., Hoegh-Guldberg, O., Insarov, G., Leadley, P., Levin, L.A., Ngo, H.T., Pandit, R., Pires, A. P., Pörtner, H.O., Rogers, A.D., Scholes, R.J., Settele, J., & Smith, P. (2022). Actions to halt biodiversity loss generally benefit the climate. *Global Change Biology*, 28(9), 2846–2874. <http://doi.org/10.1111/gcb.16109>
- Taft, D. (2015, July 3). Wild in the streets: A 24-hour field guide to New York City. *The New York Times*. <http://www.nytimes.com/interactive/2015/07/03/nyregion/A-24-Hour-Field-Guide-to-New-York-City.html>
- Tandon, U., Parasaran, M., & S. Luthra, S. (Eds.). (2018). *Biodiversity: Law, policy and governance*. Routledge/Taylor & Francis Group.
- The Economics of Biodiversity: The Dasgupta Review. (2021). Abridged Version.
- Verma, A.K., Rout, P.R., Lee, E., Bhunia, P., Bae, J., Surampalli, R.Y., Zhang, T.C., Tyagi, R.D., Lin, P., & Chen, Y. (2020). Biodiversity and Sustainability. In R. Surampalli, T. Zhang, M.K. Goyal, S. Brar, & R. Tyagi (Eds.), *Sustainability: Fundamentals and applications* (pp. 255-275). John Wiley & Sons, Ltd.

Additional Useful Websites:

Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES): <https://www.ipbes.net/>

UN Convention on Biological Diversity: <https://www.cbd.int/>

US Endangered Species Act: <https://www.fws.gov/law/endangered-species-act>

Assignments and Assessments

Details for all assignments and assessments can be found on the course Canvas site.

Attendance and Class Participation/Discussion (15%) (L1-L7)

Attendance is expected for each class session. If you have to miss class for any reason, please notify me by email before the start of the class session. Each unexcused absence can negatively impact your overall grade in the class. Participation in and contribution to topical class discussion is an important component of learning success in this course.

Introduction Video and Biodiversity Response (5%) (L1, L2)

The goal for this assignment is both to introduce yourself to our class and to try to encapsulate your initial thinking about biodiversity at the beginning of this course.

For this video assignment, you will (1) do a brief introduction of yourself – where you are from, your pronouns if you choose, your academic/professional background, what you hope to learn in this course, etc., and (2) verbalize your answer to the question: “What vision would you present as the ideal scenario for biodiversity and human sustainability?” In other words, what would you consider the successful “end point” to look like, at which we have achieved a sustainable relationship with nature/biodiversity? What do you envision as an alternative future to the biodiversity crisis? What worldview/paradigm would dominate our relationship with biodiversity? You are not expected to be an expert; this will simply help me see your starting point. Please try to keep your video to 3 minutes or less. This assignment will be worth 45 points (full points awarded for giving a personal introduction and a thoughtful answer to the question), with an additional 5 points awarded for responding to two classmates’ videos the following week. Please see our Canvas site for technical details on creating and submitting this assignment.

At the end of the semester, you will create another Biodiversity Response video without consulting your original video, to help you see how your thinking has (or hasn’t!) changed through this course. After recording your new response video, write up a short paragraph comparing your original Biodiversity Response from the beginning of the course to your new, final one. The final Biodiversity Response will be worth 50 points, with full points awarded for a video uploaded to Canvas in which you explain your newest vision for the ideal scenario for biodiversity and human sustainability, and a brief but thoughtful written response comparing your initial and final responses.

Discussion Board Responses (30%) (L1-L5)

Each week, students are expected to read all of the week’s assigned readings before coming to class. For most weeks’ readings, there will be an associated question posted on the Canvas Discussion Board. Please post your response to this question each week before the start of the class, and note that your response will be visible to other students. The writing prompts will ask you to draw on information you learned in the readings, but will allow for flexibility in your responses. The goal here is to try to stimulate your thinking and conduct formative assessment of your learning to date. There are no absolutely right answers, but I will be looking for evidence that you read the readings and also that you spent at least a little time thinking about the question. No need to write a full-length essay; a brief paragraph or two is perfectly sufficient.

We will often discuss your responses in class. Please view your classmates’ responses, and come to class prepared to provide insightful feedback, refute a point, provide further relevant information, or otherwise expand your classmates’ thinking. This is meant to facilitate collaboration, promote sharing of ideas, and stimulate discussion.

Each Discussion Board Question will be graded out of 15 points as follows: Relevance to Topic (5 points), in which your understanding is demonstrated through a direct reply to the prompt and further exploration relevant to the discussion topic; Quality of Effort (5 points), which is made apparent through clear writing and well-developed ideas; and Reference to the Readings (5 points), in which you cite information from the week’s readings to support your response. The detailed grading rubric can be found on Canvas.

Midterm Assignment: Biodiversity Observation Narrative (20%) (L1-L5)

The Midterm Assignment will encourage you to become more aware of the biodiversity around you and its function in your landscape. For this assignment, you will explore/sit outside in any place of your choosing. It can be an urban environment, a forested landscape, a coastal environment, etc. While acclimating to your environment, begin

observing the biotic and abiotic components of your landscape. You will be asked to make observations, specifically about the characteristics of the ecosystem you've chosen and the species you observe (exact species IDs for all observed species are not required – high-level taxonomic classifications will suffice). You will also analyze the likely functional roles of observed plants and animals in the ecosystem, their interactions with each other, and predict what might happen if a number of these species, or particular species, were lost. Using what you've learned about current trends and projected biodiversity loss, how do you predict biodiversity might change at this location under a “business as usual” scenario? What are the biggest threats to biodiversity here? What species might be most vulnerable? What kinds of species do you think might have already been lost here? How would the loss of species change the function of the ecosystem, and how might these functional changes in turn affect human sustainability in the area? How can we protect and/or enhance biodiversity at this location?

If your observation location is within NYC, you might use the VisionMaker 2409 program to discover what species and ecosystems were likely present in your exact location prior to urbanization. Compare this to the species you observed now. What species do you think should/could be brought back, if any? You might consider how the ecological functioning of this landscape has changed over time due to changes in biodiversity, as indicated by VisionMaker.

The Midterm Assignment will be a written document using a template provided on the Canvas site (the template includes a list of the above questions/considerations in this assignment description). The paper will be evaluated and graded out of 100 points as follows: 30 points awarded for a narrative of site characteristics, species observations, functional roles, and interactions in the observed ecosystem; 30 points for predicting how the ecosystem would change with the loss of species, supported by information on trends in biodiversity loss; 40 points for discussion of proposed actions to protect/enhance biodiversity in the observed ecosystem, supported by cited research/professional guidance. The detailed grading rubric can be found on Canvas.

Final Project (30%) (L5-L7)

There are three options to choose from for your Final Project, with flexibility afforded to how you envision applying this course to your current or future profession. You might decide to work individually on your Final Project, or with a team of students with similar interests. The Final Project will culminate in both an in-class presentation as well as an independently-written project brief, each worth 50 points, for a total of 100 points.

The options for the Final Project are as follows:

- a.) *Biodiversity Strategy Analysis.* Analyze one of the biodiversity conservation/restoration strategies as discussed in class, or found through your own research. What biodiversity goals does this strategy address? Under what circumstances should it be applied? How effective has this approach been in reversing biodiversity loss to date? In what specific cases has it been applied, and what were the outcomes? How has it affected indigenous and/or marginalized communities? How can it be improved? A case study involving your chosen strategy would be especially relevant here.

This final project option will be graded out of 100 points as follows, with each category split between the in-class presentation and the written project brief: 20 points awarded for describing the selected biodiversity conservation/restoration strategy, its goals, and the circumstances under which it is appropriately applied; 40 points for an analysis of the strategy's effectiveness and outcomes for target species and human communities from cited research/case studies; 40 points for a discussion of ways to improve the biodiversity strategy and enhance its successful application towards reversing the biodiversity crisis.

- b.) *Create Biodiversity Actions for an Existing Climate Action/Sustainability Plan.* Find an existing climate change action plan or sustainability plan (or choose from provided ones). This can be a plan drafted and/or implemented for a city, a country, a specific community, a business industry/corporation, an agricultural

operation, a transportation industry, etc. Your task will be to analyze the plan for inclusion of biodiversity goals and biodiversity conservation/restoration actions, and to add your own elements of biodiversity conservation/restoration, which complement the proposed climate mitigation and/or other sustainability actions. Are there areas of conflict between climate mitigation actions and biodiversity actions? How would such actions impact affected human communities? How can we ensure that biodiversity protection/restoration elements are not ignored in climate change mitigation / sustainability plans?

This final project option will be graded out of 100 points as follows, with each category split between the in-class presentation and the written project brief: 20 points awarded for a thorough description of biodiversity-related goals and actions and/or other goals and actions currently included in the selected plan; 40 points for recommending additional biodiversity elements to be included in the plan, the rationale behind these recommendations, and a prediction of their impacts on and potential conflicts with multiple stakeholders; 40 points for a discussion of how biodiversity-related goals and actions can be consistently included in climate mitigation / sustainability plans.

- c.) *Propose a Biodiversity Intervention to Your Profession.* Apply biodiversity conservation/restoration goals and strategies to the field/profession/industry/business in which you work by proposing a biodiversity-related intervention. What biodiversity goals could be applied to your profession? At what levels of your profession's operations/structure can biodiversity actions be incorporated? How would you propose to implement such actions, and to convince others of the importance of reversing biodiversity loss in your profession? What outcomes might you expect from such actions? What metrics would you use to measure progress and/or success?

This final project option will be graded out of 100 points as follows, with each category split between the in-class presentation and the written project brief: 20 points awarded for a description of your profession, your specific role, and your profession's relationship to biodiversity; 40 points for recommending a biodiversity intervention in your profession that includes biodiversity targets, goals, and actions grounded in the theories and practices learned in class; 40 points for a discussion of predicted outcomes, metrics, anticipated challenges, and ideas for convincing others in the profession of the importance of reversing biodiversity loss and implementing biodiversity-related actions into their professional practice.

Full details on these Final Project options and specific grading rubrics can be found on Canvas.

Grading

The final grade will be calculated as described below:

FINAL GRADING SCALE

Grade	Percentage
A+	98–100 %
A	93–97.9 %
A-	90–92.9 %
B+	87–89.9 %
B	83–86.9 %
B-	80–82.9 %
C+	77–79.9 %
C	73–76.9 %
C-	70–72.9 %

D	60–69.9 %
F	59.9% and below

Assignment/Assessment	% Weight	Individual or Group/Team Grade
Class Participation / Discussion	15%	Individual
Introduction Video and Biodiversity Response	5%	Individual
Weekly Discussion Board Posts	30%	Individual
Midterm Assignment	20%	Individual
Final Project	30%	Individual / Team

Course Schedule/Course Calendar

Date	Topic	Readings (due on this date)	Assignments (due on this date)
9/12	Introduction to Biodiversity	None	None
9/19	Biodiversity and Sustainability	<p>Required:</p> <p>Blicharska, M. et al. (2019). Biodiversity’s contributions to sustainable development. <i>Nature Sustainability</i>, 2(12), 1083–1093.</p> <p>Cardinale, B.J. et al. (2012). Biodiversity loss and its impact on humanity. <i>Nature</i>, 486, 59-67.</p> <p>Hooper, D.U. et al. (2012). A global synthesis reveals biodiversity loss as a major driver of ecosystem change. <i>Nature</i>, 486(7401), 105–108.</p> <p>Recommended:</p> <p>Verma, A.K. et al. (2020). Biodiversity and Sustainability. In R. Surampalli, T. Zhang, M.K. Goyal, S. Brar, & R. Tyagi (Eds.), <i>Sustainability: Fundamentals and applications</i> (pp. 255-275). John Wiley & Sons, Ltd.</p>	Online Introduction Video and Biodiversity Response

9/26	The Past, The Present, The [Projected] Future	<p>Required:</p> <p>Ceballos, G., Ehrlich, P.R., & Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. <i>Proceedings of the National Academy of Sciences</i>, 114(30), E6089-6096.</p> <p>Díaz, S., et al. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. <i>Science</i>, 366(6471), 1327.</p> <p>Dirzo, R. et al. (2014). Defaunation in the anthropocene. <i>Science</i>, 345(6195), 401-406.</p> <p>Einhorn, C., & Popovich, N. (2022, March 3). This map shows where biodiversity is most at risk in America. <i>The New York Times</i>. http://www.nytimes.com/interactive/2022/03/03/climate/biodiversity-map.html</p> <p>Recommended:</p> <p>Oliver, T.H. et al. (2015). Declining resilience of ecosystem functions under biodiversity loss. <i>Nature Communications</i>, 6, 10122.</p> <p>Pereira, H.M. et al. (2020). Global trends in biodiversity and ecosystem services from 1900 to 2050. <i>bioRxiv</i>.</p> <p><i>Reversing biodiversity loss – the case for urgent action</i>. (2021, March 31). The Royal Society. http://royalsociety.org/-/media/about-us/international/g-science-statements/G7-reversing-biodiversity-loss-31-03-2021.pdf</p> <p>Segan, D.B., Murray, K.A., & Watson, J.E.M. (2016). A global assessment of current and future biodiversity vulnerability to habitat loss–climate change interactions. <i>Global Ecology and Conservation</i>, 5, 12–21.</p>	Response to Classmates' Online Introduction Videos
10/3	Biodiversity and the Climate Crisis: A Case for Unification	<p>Required:</p> <p>Einhorn, C. (2021, June 10). Our response to climate change is missing something big, scientists say. <i>The New York Times</i>. http://www.nytimes.com/2021/06/10/climate/biodiversity-collapse-climate-change.html</p> <p>Einhorn, C. (2021, October 14). The most important global meeting you've probably never heard of is now. <i>The New York Times</i>. http://www.nytimes.com/2021/10/14/climate/un-biodiversity-conference-climate-change.html</p>	Week 4 Discussion Board Post

		<p>Legagneaux, P. et al. (2018). Our house is burning: Discrepancy in climate change vs. biodiversity coverage in the media as compared to scientific literature. <i>Frontiers in Ecology and Evolution</i>, 5(175).</p> <p>Staudinger, M.D. et al. (2013). Biodiversity in a changing climate: A synthesis of current and projected trends in the US. <i>Frontiers in Ecology and the Environment</i>, 11(9), 465-473.</p> <p>Recommended:</p> <p>Farber, D.A. (2015). Separated at birth? Addressing the twin crises of biodiversity and climate change. <i>Ecology Law Quarterly</i>, 42, 841-888.</p> <p>Martay, B. et al. (2017). Impacts of climate change on national biodiversity population trends. <i>Ecography</i>, 40, 1139-1151.</p>	
10/10	Conservation Inequities: Racism, Sexism, Classism	<p>Required:</p> <p>Boyer, A.E. et al. (2021). Gender inequality, biodiversity loss, and environmental degradation. CARE-WWF Alliance. [Please read the Executive Summary, and skim the rest of the report for anything that specifically interests you.]</p> <p>Fisher, B. & Christopher, T. (2007). Poverty and biodiversity: Measuring the overlap of human poverty and the biodiversity hotspots. <i>Ecological Economics</i>, 62(1), 93-101.</p> <p>Lanham, J.D. (2021). What do we do about John James Audubon? <i>Audubon Magazine</i>. http://www.audubon.org/magazine/spring-2021/what-do-we-do-about-john-james-audubon</p> <p>Rowland-Shea, J. et al. (2020, July 21). <i>The nature gap: Confronting racial and economic disparities in the destruction and protection of nature in America</i>. Center for American Progress. http://www.americanprogress.org/article/the-nature-gap/</p> <p>Recommended:</p> <p>Purdy, J. (2015, August 13). Environmentalism’s racist history. <i>The New Yorker</i>. http://www.newyorker.com/news/news-desk/environmentalisms-racist-history</p>	Week 5 Discussion Board Post

10/17	Biodiversity in the Built Environment	<p>Required:</p> <p>Lepczyk, C.A. et al. (2017). Biodiversity in the city: Fundamental questions for understanding the ecology of urban green spaces for biodiversity conservation. <i>BioScience</i>, 67(9), 799-807.</p> <p>Nilon, C. et al. (2017). Planning for the future of urban biodiversity: A global review of city-scale initiatives. <i>BioScience</i>, 67(9), 332-342.</p> <p>Simkin, R.D. et al. (2021). Biodiversity impacts and conservation implications of urban land expansion projected to 2050. <i>PNAS</i>, 119(12) e2117297119.</p> <p>Recommended:</p> <p>Taft, D. (2015, July 3). Wild in the streets: A 24-hour field guide to New York City. <i>The New York Times</i>. http://www.nytimes.com/interactive/2015/07/03/nyregion/A-24-Hour-Field-Guide-to-New-York-City.html</p>	Week 6 Discussion Board Post
10/24	Rural Biodiversity and Food Systems	<p>Required:</p> <p>Delabre, I. et al. (2021). Actions on sustainable food production and consumption for the post-2020 global biodiversity framework. <i>Science Advances</i>, 7, eabc8259.</p> <p>Norris, K. (2008). Agriculture and biodiversity conservation: Opportunity knocks. <i>Conservation Letters</i>, 1, 2-11.</p> <p>Tilman, D. & Williams, D.R. (n.d.). <i>Preserving global biodiversity requires rapid agricultural improvements</i>. The Royal Society. http://royalsociety.org/topics-policy/projects/biodiversity/preserving-global-biodiversity-agricultural-improvements/</p> <p>Browse:</p> <p>Secretariat of the Convention on Biological Diversity. (2020). <i>Global biodiversity outlook 5: GBO-5 agriculture highlights</i>. http://www.cbd.int/agriculture/doc/gbo5-agri-en.pdf</p> <p>Recommended:</p> <p>Ingram, J.C. et al. (2014). Evidence of payments for ecosystem services as a mechanism for supporting biodiversity conservation and rural livelihoods. <i>Ecosystem Services</i>, 7, 10-21.</p>	Week 7 Discussion Board Post
10/31	Ecological Restoration	<p>Required:</p>	Midterm Assignment: Biodiversity

		<p>Perring, M.P. et al. (2018). Rocketing restoration: Enabling the upscaling of ecological restoration in the Anthropocene. <i>Restoration Ecology</i>, (26)6, 1017-1023.</p> <p>Society for Ecological Restoration International Science & Policy Working Group. (2004). <i>The SER Primer on Ecological Restoration</i>.</p> <p>Browse:</p> <p>IPBES. (2018). Summary for policymakers of the assessment report on land degradation and restoration of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services.</p> <p>Science Task Force for the UN Decade on Ecosystem Restoration. (2021). Science-based ecosystem restoration for the 2020s and beyond. Gland, Switzerland: IUCN.</p> <p>UN Environment Programme. (n.d.) <i>Decade on Ecosystem Restoration</i>. https://www.decadeonrestoration.org/</p> <p>Recommended:</p> <p>Alexander, S. et al. (2016). The relationship between ecological restoration and the ecosystem services concept. <i>Ecology and Society</i>, (21),1, 34-42.</p> <p>Montoya, D. et al. (2012). Emerging perspectives in the restoration of biodiversity-based ecosystem services. <i>Trends in Ecology and Evolution</i>, (27),12, 666-672.</p>	Observation Narrative
11/7	Academic Holiday – No Class	None	None
11/14	Business and Economics of Biodiversity	<p>Required:</p> <p>IPBES. (2022). Summary for policymakers of the methodological assessment regarding the diverse conceptualization of multiples values of nature and its benefits, including biodiversity and ecosystem functions and services (assessment of the diverse values and valuation of nature). Bonn, Germany.</p> <p>Summerhayes, G. & Waterford, L. (2021, July 3). Biodiversity loss is a risk to the global financial system. <i>The Guardian</i>. http://www.theguardian.com/commentisfree/2021/jul/04/biodiversity-loss-could-wreck-the-global-financial-system-and-its-only-a-matter-of-time</p>	Week 10 Discussion Board Post

		<p>The Economics of Biodiversity: The Dasgupta Review. (2021). Headline Messages.</p> <p>Browse:</p> <p>Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES). https://www.ipbes.net/</p> <p>UN Convention on Biological Diversity. https://www.cbd.int/</p> <p>Recommended:</p> <p>Tandon, U., Parasaran, M., & S. Luthra, S. (Eds.). (2018). <i>Biodiversity: Law, policy and governance</i>. Routledge/Taylor & Francis Group.</p> <p>The Economics of Biodiversity: The Dasgupta Review. (2021). Abridged Version.</p>	
11/21	Bending the Curve I: Proposals and Nature-Based Solutions	<p>Required:</p> <p>Convention on Biological Diversity. (2021). First draft of the Post-2020 Global Biodiversity Framework.</p> <p>Dinerstein, E., et al. (2020). A “Global Safety Net” to reverse biodiversity loss and stabilize Earth’s climate. <i>Science Advances</i>, 6, eabb2824.</p> <p>Leclère, D. et al. (2020). Bending the curve of terrestrial biodiversity needs an integrated strategy. <i>Nature</i>, 585, 551-556.</p> <p>Pettorelli, N., et al. (2021). Time to integrate global climate change and biodiversity science-policy agendas. <i>Journal of Applied Ecology</i>, 58, 2384-2393.</p> <p>Reed, G. et al. (2021). Toward Indigenous visions of nature-based solutions: An exploration into Canadian federal climate policy. <i>Climate Policy</i>, 22(4), 514-533.</p> <p>Recommended:</p> <p>Bayulken, B., Huisingsh, D., & Fisher, P.M.J. (2021). How are nature based solutions helping in the greening of cities in the context of crises such as climate change and pandemics? A comprehensive review. <i>Journal of Cleaner Production</i>, 288, 125569.</p> <p>Maes, J. & Jacobs, S. (2017). Nature-based solutions for Europe’s sustainable development. <i>Conservation Letters</i>, 10(1), 121-124.</p>	Week 11 Discussion Board Post

		Seddon, N. et al. (2020.) Global recognition of the importance of nature-based solutions to the impacts of climate change. <i>Global Sustainability</i> , 3, 1-12.	
11/28	Bending the Curve II: More Tools and Best Practices	<p>Required:</p> <p>Beyond Risk and Return: The role of finance in preserving and fostering biodiversity. (2022). Triodos Bank.</p> <p>Biodiversity Strategy: Bending the curve on biodiversity loss. (2020). Kering.</p> <p>Te Mana o Te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020. (2020). Department of Conservation, New Zealand. [CBD Biodiversity Strategy and Action Plan – New Zealand]</p> <p>Te Man o Te Taiao – Aotearoa New Zealand Biodiversity Strategy Implementation Plan. (2022). Department of Conservation, New Zealand. [CBD Biodiversity Strategy Implementation Plan]</p> <p>Browse:</p> <p>Stephenson, P.J. & Carbone, G. (2021). <i>Guidelines for planning and monitoring corporate biodiversity performance</i>. IUCN, Global Business and Biodiversity Programme. http://doi.org/10.2305/IUCN.CH.2021.05.en</p> <p>Recommended:</p> <p><i>Conservation tools</i>. (n.d.). IUCN. http://www.iucn.org/resources/conservation-tools</p> <p>Driscoll, D.A. et al. (2018). A biodiversity-crisis hierarchy to evaluate and refine conservation indicators. <i>Nature Ecology & Evolution</i>, 2(5), 775-781.</p> <p>Fernández, N., Navarro, L.M., & Pereira, H.M. (2017). Rewilding: A call for boosting ecological complexity in conservation. <i>Conservation Letters</i>, 10(3), 276-278.</p> <p>Gavin, M.C. et al. (2018). Effective biodiversity conservation requires dynamic, pluralistic, partnership-based approaches. <i>Sustainability</i>, 10(6), 1846.</p> <p>Shin, Y.J. et al. (2022). Actions to halt biodiversity loss generally benefit the climate. <i>Global Change Biology</i>, 28(9), 2846–2874.</p>	Week 12 Discussion Board Post

12/5	Final Project Presentations I	None	None – Work on presentations!
12/12	Final Project Presentations II	None	Final Project Presentations and Written Briefs Final Biodiversity Response Video

Course Policies

Our classroom is a shared learning community and one where diverse experiences and opinions are highly valued. Please remember to be respectful at all times and to share ideas and thoughts in a non-judgmental, respectful, and empathetic manner. I cannot stress enough that we are all life-long learners, and we should take every opportunity to learn from each other in this course, which could mean considering new perspectives, challenging prevailing assumptions, working through difficult conversations, and embracing the discomfort and mis-steps that can accompany the process of personal and professional growth.

Participation and Attendance

You are expected to complete all assigned readings, attend all class sessions, and engage with others in discussions. I expect you to come to class on time and thoroughly prepared. I will keep track of attendance and look forward to an interesting, lively and confidential discussion. If you miss an experience in class, you miss an important learning moment and the class misses your contribution. Please make every effort to communicate planned absences ahead of time.

Late work

Assignments are due at the start of the class session on the dates/times identified. Points will be deducted from any assignment submitted after the due date/time, as specific in the grading rubrics on Canvas. Assignments not received by the time final grades must be submitted will receive zero points for the assignment. Extensions may be granted in especially warranted situations as per the instructor's discretion.

Citation & Submission

All written assignments must use standard citation format (e.g., MLA, APA, Chicago), cite sources, and be submitted to the course website (not via email).

School and University Policies and Resources

Copyright Policy

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times. SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <https://sps.columbia.edu/students/student-support/academic-integrity-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Diversity Statement

It is our intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <https://health.columbia.edu/content/disability-services>.

Class Recordings

All or portions of the class may be recorded at the discretion of the instructor to support your learning. At any point, the instructor has the right to discontinue the recording if it is deemed to be obstructive to the learning process.

If the recording is posted, it is confidential and it is prohibited to share the recording outside of the class.

SPS Academic Resources

The Division of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: <https://sps.columbia.edu/students/student-support/student-support-resources>.

Columbia University Information Technology

[Columbia University Information Technology](#) (CUIT) provides Columbia University students, faculty and staff with central computing and communications services. Students, faculty and staff may access [University-provided and discounted software downloads](#).

Columbia University Library

[Columbia's extensive library system](#) ranks in the top five academic libraries in the nation, with many of its services and resources available online.

The Writing Center

The Writing Center provides writing support to undergraduate and graduate students through one-on-one consultations and workshops. They provide support at every stage of your writing, from brainstorming to final drafts. If you would like writing support, please visit the following site to learn about services offered and steps for scheduling an appointment. This resource is open to Columbia graduate students at no additional charge. Visit <http://www.college.columbia.edu/core/uwp/writing-center>.

Career Design Lab

The Career Design Lab supports current students and alumni with individualized career coaching including career assessment, resume & cover letter writing, agile internship job search strategy, personal branding, interview skills, career transitions, salary negotiations, and much more. Wherever you are in your career journey, the Career Design Lab team is here to support you. Link to <https://careerdesignlab.sps.columbia.edu/>

Netiquette

Online/Hy-Flex sessions in this course will be offered through Zoom, accessible through Canvas. A reliable Internet connection and functioning webcam and microphone are required. It is your responsibility to resolve any known technical issues prior to class. Your webcam should remain turned on for the duration of each class, and you should expect to be present the entire time. Avoid distractions and maintain professional etiquette.

Please note: Instructors may use Canvas or Zoom analytics in evaluating your online participation.

More guidance can be found at: https://jolt.merlot.org/vol6no1/mintu-wimsatt_0310.htm

Netiquette is a way of defining professionalism for collaborations and communication that take place in online environments. Here are some Student Guidelines for this class:

- Avoid using offensive language or language that is not appropriate for a professional setting.
- Do not criticize or mock someone's abilities or skills.
- Communicate in a way that is clear, accurate and easy for others to understand.
- Balance collegiality with academic honesty.
- Keep an open-mind and be willing to express your opinion.
- Reflect on your statements and how they might impact others.
- Do not hesitate to ask for feedback.
- When in doubt, always check with your instructor for clarification.