ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

COURSE INFORMATION

Course Title	Course Code Number	Days and Time	Credit Value
Casual Inference in the Economics of Natural Resource Conservation.	FRE 474	MWF 2-2:50 PM	3

DESCRIPTION

In this course we will learn how researchers use data to examine the economics of natural resource use. You will learn how one can 'infer' (in the statistical sense) the human (economic) 'cause' of natural resource use.

I will introduce empirical methods necessary to evaluate the causal impact of economic development and environmental policies on conservation outcomes, and subsequently illustrate the use of these techniques through in-class exercises, and academic articles in the field of conservation.

We will focus on issues related to forests and wildlife. We will consider questions like: What are the drivers of species loss, and which environmental policies have been successful in halting it? Is there a trade-off between poverty alleviation and the conservation of charismatic species, coral reefs, and/or tropical rainforests? Does endangered species legislation impact species conservation, and employment?

PREREQUISITES

One of LFS 252, STAT 300, BIOL 300, ECON 326, COMM 291

ECON 101 or 310, or permission of the instructor.

Students from a diversity of backgrounds are welcome, but knowledge of 1) statistics/econometrics, specifically regression analysis and 2) the theory of environmental economics is important for your success.

CONTACTS

Course Instructor	Contact Details	Office Location	Office Hours
Sumeet Gulati	+1 (604) 822-2144, sumeet.gulati@ubc.ca.	MCML 341	Wednesdays, 11:30 AM or by appointment.

COURSE INSTRUCTOR BIOGRAPHICAL STATEMENT

I am a Professor in Environmental and Resource Economics at the University of British Columbia. Among other things, I study the cost of conflict with wildlife to farmers living in proximity of wildlife reserves in India. This includes direct damages from conflict: lost crops and livestock, human injury and death. My projects in the economics of conservation are listed at the Wildlife and Conservation Economics Laboratory.

OTHER INSTRUCTIONAL STAFF

You will also interact with your TA, Erin Litzow, who will help you with course material, with coding, and data issues, and especially for quizzes, assignments, and grading.

Teaching Assistant	Contact Details	Office Location	Office Hours
Erin Litzow	erinlitz@mail.ubc.ca	MCML 318D	As needed prior to assignment due dates

COURSE STRUCTURE

This is a course that requires you to read, and interpret an academic literature evaluating the impact of human activity and policy on forest and wildlife conservation. You will learn through course lectures, assignments/reports, quizzes/exams, and your empirical project. All assignments and exams, play an important part in the learning of the topics presented. All students will submit a final project, where they will employ either STATA or R to implement one of the causal techniques they learn in class using a pre-compiled dataset provided to them.

SCHEDULE OF TOPICS

Wherever possible I provide a stable link to the paper. While some of these links will work anywhere, many of them are digitally protected requiring a subscription. You can access this material by logging in through your account at the UBC library, or on any computer connected via Ethernet on the UBC network. For some articles I do not provide a link, in that case, please search for the article (if you search via the UBC library you will find access to its electronic version).

Section 1: Introduction.

1. Economics and Conservation.
    a. Metrick, A., & Weitzman, M. L. (1998). Conflicts and choices in biodiversity preservation. *Journal of Economic Perspectives*, *12*(3), 21-34.
2. The Economics of Species at Risk Legislation in Canada and The USA.
    a. Adamowicz, W. L. (2016). Economic analysis and species at risk: Lessons learned and future challenges. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, *64*(1), 21-32.
    b. Ando, Amy W, and Christian Langpap. (2018). "The Economics of Species Conservation." Annual Review of Resource Economics.
    c. Langpap, C., Kerkvliet, J., & Shogren, J. F. (2018). The economics of the US Endangered Species Act: A review of recent developments. *Review of Environmental Economics and Policy*, *12*(1), 69-91.
3. Counterfactual Thinking. Ferraro, P. J. (2009). Counterfactual thinking and impact evaluation in environmental policy. *New directions for evaluation*, *2009*(122), 75-84.

Section 2: Forests, Species and their interaction with International Trade, and Economic Development.

1. The Economics of Forest Conservation.
    a. Foster, A.D. and Rosenzweig, M.R., 2003. Economic growth and the rise of forests. The Quarterly Journal of Economics, 118(2), pp.601-637.

   b. Baland, J.M., Libois, F. and Mookherjee, D., 2018. Forest Degradation and Economic Growth in Nepal, 2003–2010. Journal of the Association of Environmental and Resource Economists, 5(2), pp.401-439
   c. Assunção, J., Lipscomb, M., Mobarak, A.M. and Szerman, D., 2017. Agricultural Productivity and Deforestation in Brazil. Working Paper
   d. Abman and Lundberg 2019 Does Free Trade Increase Deforestation? The Effects of Regional Trade Agreements. Working Paper.
2. Economic Development and Trade and its impact on Species Loss and Extraction.
   a. Naidoo, R., & Adamowicz, W. L. (2001). Effects of economic prosperity on numbers of threatened species. *Conservation Biology*, *15*(4), 1021-1029.
   b. Eisenbarth, S. (2022). Do exports of renewable resources lead to resource depletion? Evidence from fisheries. *Journal of Environmental Economics and Management*, *112*, 102603.

Section 3: Conservation Policy, and the Value of Species Preservation.

1. Overview.
   a. Miteva, Daniela A, Subhrendu K Pattanayak, and Paul J Ferraro. 2012. "Evaluation of biodiversity policy instruments: what works and what doesn't?" Oxford Review of Economic Policy 28 (1): 69–92.
2. Evaluating Endangered Species Legislations.
   a. Ferraro, P. J., McIntosh, C., & Ospina, M. (2007). The effectiveness of the US endangered species act: An econometric analysis using matching methods. *Journal of Environmental Economics and Management*, *54*(3), 245-261.
   b. Bošković, Branko, and Linda Nøstbakken. 2017. "The cost of endangered species protection: Evidence from auctions for natural resources." Journal of environmental economics and management 81:174–192.
   c. Frank, E., (2020), The Impact of the Northern Spotted Owl Conservation Plan on Local Labor Markets, working paper.
3. Valuing a Species.
   a. Manning, D. T., & Ando, A. (2022). Ecosystem Services and Land Rental Markets: Producer Costs of Bat Population Crashes. *Journal of the Association of Environmental and Resource Economists*, *9*(6), 1235-1277.
   b. Li, L., & Ando, A. W. (2022). The impact of bison reintroduction on local economies. *Agricultural and Resource Economics Review*, *51*(3), 455-472.
4. Economic Development and Protected Areas.
   a. Andam, Kwaw S, Paul J Ferraro, Katharine R E Sims, Andrew Healy, and Margaret B Holland. 2010. "Protected areas reduced poverty in Costa Rica and Thailand." Proceedings of the National Academy of Sciences of the United States of America 107 (22): 9996–10001.
   b. Burgess, R., Costa, F. J., & Olken, B. A. (2018). Wilderness Conservation and the Reach of the State: Evidence from National Borders in the Amazon (No. w24861). National Bureau of Economic Research
5. International Issues.
   a. Noack, F., Larsen, A., Kamp, J., & Levers, C. (2021). A bird's eye view of farm size and biodiversity: The ecological legacy of the iron curtain. *American Journal of Agricultural Economics*.

   b. Hsiang, S., & Sekar, N. (2016). Does legalization reduce black market activity? Evidence from a global ivory experiment and elephant poaching data (No. w22314). National Bureau of Economic Research.

6. Property Rights.
   a. Isaksen, E.T. and Richter, A., 2019. Tragedy, property rights, and the commons: investigating the causal relationship from institutions to ecosystem collapse. Journal of the Association of Environmental and Resource Economists.
   b. Costello, C., Gaines, S. D., & Lynham, J. (2008). Can catch shares prevent fisheries collapse?. *Science*, *321*(5896), 1678-1681.

Section T: The econometrics section follows this book:

Angrist, J.D. and Pischke, J.S., 2014. Mastering 'metrics: The path from cause to effect. Princeton University Press.

Before each Topic Section above, I will cover the relevant econometric technique from the above book. We will cover chapters 1—5 in the textbook.

LEARNING OUTCOMES

At the end of this course you will have a better understanding of what makes a careful causal analysis, and what might be spurious correlation.

Specifically, I will help you,

- Understand 5 main econometric tools commonly used to determine cause and effect in data analysis. These are:
  - Random Assignment.
  - Regression Analysis.
  - Instrumental Variables.
  - Difference in Difference.
  - Regression Discontinuity.
- Recognize the economic factors underlying common conservation issues.

LEARNING ACTIVITIES

In class lectures.

Active participation in class through the means available.

Assignments, data analysis.

LEARNING MATERIALS

Required Book: Angrist, J.D. and Pischke, J.S., (2014). *Mastering'metrics: The path from cause to effect*. Princeton University Press. Available at the UBC Bookstore, and online.

Other books:

1) Huntington-Klein, N. (2021). *The effect: An introduction to research design and causality*. Chapman and Hall/CRC, available online at: https://theeffectbook.net/.
2) Cunningham, S. (2021). Causal inference. In *Causal Inference*. Yale University Press, available online at: https://mixtape.scunning.com/

Required Instructor provided resources are available at Canvas: http://www.canvas.ubc.ca. You are required to regularly login to your course page for FRE 474. Your syllabus, course-lecture slides, additional material, announcements, assignments, and grades will be available there.

Other resources on UBC Github.

ASSESSMENTS OF LEARNING

Your performance in the class will be graded as follows:

- Class reflection submissions: 10%
- 4 out of 5 take-home assignments: 40%
- 2 out of 3 in-class assignments/quizzes: 20%
- A referee report: 10%
- Final project 20%

There will be 5 assignments for you to do, and your four highest grades in those assignments will count towards your grade. There will be 3 in-class assignments/quizzes that will do either online, or in person as the term progresses. Your two highest grades on that will count towards your grade.

Participation Grade- You will have to come prepared to the class, and you will be expected to discuss the assigned material in class.

Every two weeks you will submit on canvas a short reflection of the what you learnt in class in the previous fortnight. While writing this reflection you are required to relate something you learnt in class to the world around you. You can relate a topic from class something you read in the news, or something you experienced in life. The possibilities are up to you. The reflection cannot exceed 400 words, but can be shorter. If the reflection makes sense, it will be assigned a 2 participation points, if submitted but hard to understand, it will get 1 participation point, and if not submitted will earn 0. There will be a recurring assignment on canvas for you submit this reflection.

A Referee Report: Students will choose a paper from the syllabus and will write a two page report in which they: a) summarize the paper (half a page), b) highlight what the paper does well (half a page), and c) suggest improvements to their analysis of data in answering the question posed (one page). Academic papers outside those in the syllabus can be chosen with permission.

Final project More detail will be provided in the first two weeks of class (this part of the syllabus will be updated subsequently).

The assignments will be online and based on material from the lectures and readings. In-class assignments/quizzes will cover material in lectures and readings.

UNIVERSITY POLICIES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on **the UBC Senate website.**

Academic Accommodation for Students

The University accommodates students with disabilities who have registered with the Disability Resource Centre. The University also accommodates students whose religious obligations conflict with attendance or scheduled tests or exams. Other absences for varsity athletics, family obligations or other similar commitments are not part of University policy and students should not assume that they would be accommodated. Academic accommodations help students with a disability or ongoing medical condition overcome challenges that may affect their academic success. Students requiring academic accommodations must register with Access & Diversity. A&D will determine that student's eligibility for accommodations in accordance with Policy 73: Academic Accommodation for Students with Disabilities. Your instructors do not determine academic accommodations, however, your instructor may consult with Access and Diversity should the accommodations affect the essential learning outcomes of a course. If you have a pressing issue those conflicts with an exam, you should discuss this with your instructor as soon as possible. Refer to the UBC Calendar for details of 'academic concession'.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity.

At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work.

Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

For International Students - Issue of controversial topics in online learning

During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to the laws of your local jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,33,86,0 for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom).

Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find

substitute courses. For further information and support, please visit:
http://academic.ubc.ca/supportresources/freedom-expression

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Classification of papers & methods.

Author	Title	Methods
Section 1: Introduction. **1. Economics and Conservation**		
Metrick, A., & Weitzman, M. L. (1998)	Conflicts and choices in biodiversity preservation	Theory. OLS
2. The Economics of Species at Risk Legislation in Canada and The USA.		
Adamowicz, W. L. (2016)	Economic analysis and species at risk: Lessons learned and future challenges	Theory. Descriptive. Policy
Ando, Amy W, and Christian Langpap. (2018)	The Economics of Species Conservation	Theory. Descriptive. Policy
Langpap, C., Kerkvliet, J., & Shogren, J. F. (2018)	The economics of the US Endangered Species Act: A review of recent developments	Theory. Descriptive. Policy
3. Counterfactual Thinking.		
Ferraro, P. J. (2009)	Counterfactual thinking and impact evaluation in environmental policy	Theory. Overview of methods of evaluation design.
Section 2: Forests, Species and their interaction with International Trade, and Economic Development. **1. The Economics of Forest Conservation**		
Foster, A.D. and Rosenzweig, M.R., 2003	Economic growth and the rise of forests	**OLS** to estimate land prices. **OLS & FE** (village) to estimate High Yielding Variety (HYV). **OLS, FE & IV** to estimate effect of Ag. Productivity, Population and presence of rural infrastructure Land prices, Wages and Income.
Baland, J.M., Libois, F. and Mookherjee, D., 2018	Forest Degradation and Economic Growth in Nepal, 2003–2010	**FE** to estimate biomass levels (village and year FE).

		FE to estimate Engel curve for annual wood collection, annual consumption expenditure and fuel expenditure.
Abman and Lundberg 2019	Does Free Trade Increase Deforestation? The Effects of Regional Trade Agreements	**FE. Event Study** (year, county FE) to estimate effect of enactment of Regional Trade Agreements (RTA) on deforestation (and others).
Assunção, J., Lipscomb, M., Mobarak, A.M. and Szerman, D., 2017	Agricultural Productivity and Deforestation in Brazil	**IV** to estimate effect of electrification on rural productivity. Instrument for electrification: predicted electrification based on geographic cost variables.
2. Economic Development and Trade and its impact on Species Loss and Extraction.		
Eisenbarth, S. 2019	Do exports of renewable resources lead to resource depletion? Evidence from fisheries	**OLS & IV** to estimate the effect of exports on collapsed fisheries. Instrument of exports: Collapse of Japan's fisheries. Regression includes year, country species FE.
Naidoo, R., & Adamowicz, W. L. (2001)	Effects of economic prosperity on numbers of threatened species	**Negative-binomial regression model** to estimate the effect of GNP on threatened species.
Section 3: Conservation Policy, and the Value of Species Preservation. **1. Overview**		
Miteva, Daniela A, Subhrendu K Pattanayak, and Paul J Ferraro. 2012	Evaluation of biodiversity policy instruments: what works and what doesn't?	Survey of evaluation of biodiversity methods.
2. Evaluating Endangered Species Legislations.		
Frank, E., (2020)	The Impact of the Northern Spotted Owl Conservation Plan on Local Labor Markets	**DID, Triple-Differences (DDD), Synthetic Controls (SCM**). **DID** to estimate the causal effect of the listing on the conservation on labor market outcome. **DDD** adding as another treatment the "Lumber and Wood" sector (compared to all other industries), Thus the treatment is

		a combination between Listing on conservation and the sector.
Bošković, Branko, and Linda Nøstbakken. 2017	The cost of endangered species protection: Evidence from auctions for natural resources	**RDD (sharp)** to evaluate how prices differ along regulation boundaries that constrain resource development.
Ferraro, P. J., McIntosh, C., & Ospina, M. (2007)	The effectiveness of the US endangered species act: An econometric analysis using matching methods	**Matching** to estimate the average treatment effect of the treated (ATT), ie: what a listed species' change in status would have been had it not been listed.
3. Valuing a Species.		
Manning, D. T., & Ando, A. (2022)	Ecosystem Services and Land Rental Markets: Producer Costs of Bat Population Crashes.	**OLS and FE,** estimating the impact of bat population crashes on rental value of agricultural land.
Li, L., & Ando, A. W. (2022).	The impact of bison reintroduction on local economies.	**Staggered Diff in Diff** with zero effects.
4. Economic Dvelopment and Protected Areas		
Burgess, R., Costa, F. J., & Olken, B. A. (2018)	Wilderness Conservation and the Reach of the State: Evidence from National Borders in the Amazon	**RDD**, to estimate the effect of the distance to the Brazilian border to changes in forest cover (or forest loss)
Andam, Kwaw S, Paul J Ferraro, Katharine R E Sims, Andrew Healy, and Margaret B Holland. 2010	Protected areas reduced poverty in Costa Rica and Thailand.	**Matching methods** to estimate the effect of protected areas on poverty in communities near protected areas: The Average Treatment Effect on the Treated (ATT)
5. International Issues		
Noack, F., Larsen, A., Kamp, J., & Levers, C.	A bird's eye view of farm size and biodiversity:	**RDD** to estimate the impact of changing administrative borders on bird biodiversity in Germany.

	The ecological legacy of the iron curtain.	
Hsiang, S., & Sekar, N. (2016)	Does legalization reduce black market activity? Evidence from a global ivory experiment and elephant poaching data	**OLS and FE** to estimate the effect of a one-time legal sale of ivory in the Proportion Illegally Killed Elephants (PIKE). Use site FE and different trends as controls.
6. Property Rights		
Isaksen, E.T. and Richter, A., 2019	Tragedy, property rights, and the commons: investigating the causal relationship from institutions to ecosystem collapse	**DID and IV**. To estimate the effect of the introduction of Private property Rights (PPR) on ecological outcomes. Treatment: fisheries who have implemented PPR. IV instrument for PPR: implementation of tradable quota systems in other environmental domains, like water, forest, land, hunting, and pollution
Costello, C., Gaines, S. D., & Lynham, J. (2008)	Can catch shares prevent fisheries collapse?	**OLS, FE** and **matching methods** to estimate the effect of adopting ITQ on the percent of collapsed fisheries.