Ecosystem Management and Policies

Course title – Intitulé du cours	Ecosystem Management and Policies
Level / Semester – Niveau /semestre	M2 / S2
School – Composante	Ecole d'Economie de Toulouse
Teacher – Enseignant responsable	MISSIRIAN Anouch
Lecture Hours – Volume Horaire CM	30
TA Hours – Volume horaire TD	0
TP Hours – Volume horaire TP	0
Course Language – Langue du cours	English
TA and/or TP Language – Langue des TD et/ou TP	English

Teaching staff contacts:

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Course Objectives:

The sustainable management of the ecosystems within which we live, feed, take shelter, create, necessitates combining ecological knowledge with social sciences. The former ensures scientifically sound policies or management plans, the latter that it will be aided (and not defeated) by human behaviour. This course aims at exploring this intersection and focuses on two topics where the collision is salient: ocean management and biodiversity. The course aims at getting the students acquainted with the frontier of research in these domains and will cover both theoretical and empirical aspects as published in academic papers. Besides this topical focus, a second goal of the course is to get the students acquainted with the statistical software R to address quantitatively the problems posed by modern ecosystem management and policies.

After having taken the course, the students will be familiar with the current frontier in oceans and biodiversity policy and management research and practice. They will be able to critically engage with research in that domain, and produce quantitative analysis of their own using R.

Prerequisites:

Please download R and RStudio on the laptop you will use in class before the first session of the semester (NB: macOS users may need to install XQuartz, follow download instructions on CRAN), and read **sections 1 through 3.1** of *R for Beginners*. A useful (though somewhat redundant) complement is "Getting Started with Data in R" as it also covers some notions specific to RStudio. Students will be expected to know the different object types available in R, how to assign objects, install and load packages.

Practical information about the sessions:

Students are expected to come to class prepared (having done the readings and/or the homework). Attendance is mandatory, enthusiastic participation strongly recommended. Laptops and tablets are accepted during lectures, necessary during hands-on sessions.

Grading system:

The grade for this course will have three components:

- **Weekly homework (50%).** Each week an exercise in R will be posted (due before class on the first session of the week). While the main objective of the exercise is to practice and expand skills in R, critical interpretation of the results is no less important.
- **Final (40%).** A final exam (*not* take-home) mobilising the R routines seen throughout the problem sets, and material from the lectures. Option to work on a final project instead; if chosen, *please talk with me after the break* (or sooner) to confirm that the scope of the project is reasonable (topic and workload). The final project should be on a course-related topic and consist in analysing a (combining and analysing) data set(s) in R. Unless your project idea is explicitly approved, the default is the exam.
- **Class participation (10%).** Students are expected to attend all lectures, having done the required readings, and participate in the class discussion of the assigned readings. Small weekly précis (short subjective summary) of flagged papers are warmly recommended but not mandatory.

Late submissions will get penalties and shall not be accepted after a week. Collaboration is encouraged but homework is individual – said otherwise, while it's okay to think about problems together, the coding, writeup, etc. are your own work. Plagiarism is proscribed.

Bibliography/references:

There is no required textbook for this class. Lecture notes and papers will be posted on Moodle. References covered will include:

Ay, J.-S., Chakir, R., Doyen, L., Jiguet, F., & Leadley, P. W. (2014). Integrated models, scenarios and dynamics of climate, land use and common birds. *Climatic Change*, *126*, 13–30. https://doi.org/10.1007/s10584-014-1202-4 .

Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P. A., 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*(7401), 59–67. https://doi.org/10.1038/nature11148

Costello, C., Gaines, S. D., & Gerber, L. R. (2012). A market approach to saving the whales. *Nature*, *481*(7380), 139–140. https://doi.org/10.1038/481139a

Englander, G. (2021). Information and Spillovers from Targeting Policy in Peru's Anchoveta Fishery. Working paper.

Finnoff, D., & Tschirhart, J. (2003). Harvesting in an eight-species ecosystem. *Journal of Environmental Economics and Management*, *45*(3), 589–611. https://doi.org/10.1016/S0095-0696(02)00025-6

Gregr, E. J., Christensen, V., Nichol, L., Martone, R. G., Markel, R. W., Watson, J. C., Harley, C. D. G., Pakhomov, E. A., Shurin, J. B., & Chan, K. M. A. (2020). Cascading social-ecological costs and benefits triggered by a recovering keystone predator. *Science*, *368*(6496), 1243–1247. https://doi.org/10.1126/science.aay5342

Isbell, F., Gonzalez, A., Loreau, M., Cowles, J., Díaz, S., Hector, A., MacE, G. M., Wardle, D. A., O'Connor, M. I., Duffy, J. E., Turnbull, L. A., Thompson, P. L., & Larigauderie, A. (2017). Linking the influence and dependence of people on biodiversity across scales. *Nature*, *546*(7656), 65–72. https://doi.org/10.1038/nature22899

Loreau, M., Downing, A. L., Emmerson, M., Gonzalez, A., Hughes, J., Inchausti, P., Joshi, J., Norberg, J., & Sala, O. E. (2002). A new look at the relationship between diversity and stability. In M. Loreau, S. Naeem, & P. Inchausti (Eds.), *Biodiversity and Ecosystem Functioning. Synthesis and Perspectives* (pp. 79–91). Oxford University Press.

Oremus, K. L. (2019). Climate variability reduces employment in New England fisheries. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(52), 26444–26449. https://doi.org/10.1073/pnas.1820154116

Scott, J. C. (1998). Taming Nature: An Agriculture of Legibility and Simplicity. In *Seeing Like a State. How Certain Schemes to Improve the Human Condition Have Failed* (pp. 262–306). Yale University Press.

Taylor, M. S. (2011). Buffalo Hunt: International Trade and the Virtual Extinction of the North American Bison. *American Economic Review*, *101*(7), 3162–3195. https://doi.org/10.1257/aer.101.7.3162

Weitzman, M. L. (2000). Economic profitability versus ecological entropy. *Quarterly Journal of Economics*, *115*(1), 237–263. https://doi.org/10.1162/003355300554728

Yachi, S., & Loreau, M. (1999). Biodiversity and ecosystem productivity in a fluctuating environment: the insurance hypothesis. *Proceedings of the National Academy of Sciences of the United States of America*, *96*(February), 1463–1468.

Session planning:

The course will consist in two weekly 1.5-hour lectures taking place over 10 weeks. The first lecture of the week will tend to be topic-oriented, the second R-oriented. The outline below is subject to change, in particular to accommodate students' interests, refer to the course webpage for the up-to-date schedule.

1. Oceans - Introduction; Ocean bioeconomics facts & figures — HW#1 posted
2. Oceans - Bioeconomic model of fisheries (1)
3. Oceans - Bioeconomic model of fisheries (2) — HW#1 due (HW #2 posted)
4. Oceans - Fisheries management: quotas
5. Oceans - Fisheries management: bans — HW #2 due (etc.)
6. Oceans - Fisheries management: demand
7. Oceans - Fisheries management: other demand-side factors — HW #3 due
8. Oceans - Information and fisheries
9. Oceans - Management in the presence of environmental fluctuations — HW #4 due
10. Oceans - Multi-species models and lingering issues in ocean policy and management
11. Biodiversity - Economics of biodiversity: introduction, and a simple case — HW #5 due
12. Biodiversity - Economics of biodiversity: IPBES overview
13. Biodiversity - Economics of biodiversity: small trophic networks — HW #6 due
14. Biodiversity - Beyond charismatic megafauna
15. Biodiversity - Insurance and stability — HW #7 due
16. Biodiversity - In space: thinking trade-offs and landscape diversity

17. Biodiversity - Compounding issues: climate change
18. Biodiversity - Policy solutions
19. Biodiversity - Solutions from the private sector
20. Biodiversity - Lingering issues Final project due

Distance learning :

Interactive virtual classrooms when face-to-face is not allowed.