

Degree	Type	Year	Semester
4313784 Interdisciplinary Studies in Environmental, Economic and Social Sustainability	OB	0	A

Contact

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Teachers

Jordina Belmonte Soler

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Mario Giampietro

María Antonia Casellas Puigdemasa

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Use of languages

Principal working language: english (eng)

External teachers

François Diaz Maurin

Tarik Serrano

Violeta Cabello

Zora Kovacic

Prerequisites

no prerequisites

Objectives and Contextualisation

This module aims to ensure the interdisciplinarity of environmental studies. Every environmental issue must be tackled considering natural as well as economic and social aspects in order to guarantee a sustainable solution for future generations.

This is why a review of the essential concepts related to the three itineraries of this Master's program is conducted. Altogether, new concepts related to ongoing research conducted at ICTA and partner Departments are introduced. Lastly, topics related to communication and academic diffusion are also to be studied.

This is a module divided between the first and second semester. Nevertheless, as this is an introductory module, most part of the lectures is set in the first semester.

In the first semester the core concepts related to each of the three itineraries are discussed, and lecturers from each of the specialties will take part in the presentations. In this semester a three day fieldwork excursion to Alinyà will be also conducted. This implies that this module contains a considerable workload. Lectures in the second semester are devoted to topics related to communication and academic diffusion, also related to the Master's Thesis. This is why students are trained in a practical exercise with this specific objective.

Skills

- Analyse how the Earth functions on a global scale in order to understand and interpret environmental changes on the global and local scales.
- Analyse, summarise, organise and plan projects related to the environmental improvement of product, processes and services
- Apply knowledge of environmental and ecological economics to the analysis and interpretation of environmental problem areas.
- Apply knowledge of environmental engineering to purification and decontamination in different environments
- Apply the acquired knowledge and methodologies of environmental, economic and social sustainability to the planning and control of environmental management policies and projects.
- Communicate orally and in writing in English.
- Seek out information in the scientific literature using appropriate channels, and use this information to formulate and contextualise research in environmental sciences.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Learning outcomes

1. Apply a multi-criteria analysis to a system.
2. Communicate orally and in writing in English.
3. Compare and make an objective selection from among the different possible techniques in an industrial process, applying criteria of environmental sustainability.
4. Distinguish the Earth's subsystems and know its interactions.
5. Know the different options for waste treatment.
6. Know the economic tools that can be applied to problems of environmental policy.
7. Know the main systems for purifying water and gases.
8. Know the processes of prevention, re-use, recycling and valorisation of waste.
9. Know the two fundamental tools for evaluation problems: Cost-benefit analysis and multi-criteria analysis.
10. Seek out information in the scientific literature using appropriate channels, and use this information to formulate and contextualise research in environmental sciences.
11. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Content

FIRST SEMESTER

FIRST PART: THE METABOLIC PATTERN OF SOCIAL-ECOLOGICAL SYSTEMS: THE NEXUS BETWEEN ENERGY, WATER, AND FOOD (WEEK 1)

Prof: Mario Giampietro (mario.giampietro@uab.cat)

Lecturers: Violeta Cabello, Zora Kovacic, Tarik Serrano, Alevgul Sorman

Assignment: The assignment will be provided and explained during the first class.

1. How to deal with the current impasse in sustainability science: The metabolic pattern of social-ecological systems (Monday, 26 September 2016, 15:00-17:00)

We introduce the concept of metabolic pattern of social-ecological systems with the aim to show that the current, politically-correct narrative of perpetual economic growth fails to deal with the ongoing crisis. We show that it does not make much sense to use monetary evaluation in a world run by Ponzi scheme economics. Instead, the discussion on sustainability should address the implications of biophysical limits to perpetual growth. Do we have effective tools to investigate the implications of biophysical limits to growth? A series of conventional indicators commonly used in sustainability science are examined to illustrate a systemic epistemological error found in quantitative analysis, that of ignoring the complex nature of adaptive, self-organizing systems such as social-ecological systems. We identify and discuss the epistemological challenges that complicate quantitative characterizations in sustainability science.

2. Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM). (Tuesday, 27 September 2016, 15:00-17:00)

In this lecture we introduce the MuSIASEM approach to analyze the metabolic pattern of complex social-ecological systems. We use MuSIASEM to explore the nexus between water, food, energy, land use and population. The analysis of the metabolic pattern of social-ecological systems establishes a relation between the internal and external view of metabolic processes and across different hierarchical levels of analysis. We show how to check the feasibility (compatibility with external biophysical constraints), viability (compatibility with internal socio-economic constraints), and desirability (compatibility with normative values and institutions) of the metabolic pattern. Several case studies are presented to illustrate the approach, including sugar cane production in Mauritius; the fragility of the grain basket of India; integrated urban waste management in Naples, Italy.

3. Energy accounting: theoretical concepts and practical applications. (Wednesday, 28 September 2016, 15:00-17:00)

Introduction of the basic notions of energy accounting:

- Not all joules are equal: thermal energy vs mechanical energy, primary energy sources vs energy carriers, end-uses (energy services);
- The aggregate production function of energy transformations (inputs of energy carriers, power capacity, and human labour);
- Contextualization of energy transformations within economic processes;
- Assessment of the level of openness of the metabolism of energy;
- Practical examples, including an analysis of the shortcomings of the EROI index (Energy Return On the Investment) and the fiasco of biofuels.

Presentation of the concept of energy grammar -a set of semantic relations used to structure the crunching of numbers, and illustration of its application with numerical examples. Newly introduced concepts such as end-use matrix, environmental impact matrix, and externalization matrix are illustrated, and energy data sources are discussed.

4. Water accounting: theoretical concepts and practical applications (Thursday, 29 September 2016, 15:00 - 17:00)

Introduction of the basic notions of water accounting, including

- Taxonomy for water accounting: ecological water funds, water flows, water uses;
- Contextualization of water uses and water flows in relation to water funds;
- The aggregate production function of water-related processes (water flows, power capacity, human activity);
- Contextualization of water-related processes within the economic process;
- Assessment of the level of openness of the metabolism of water.

Presentation of the water grammar -a set of semantic relations used to structure the crunching of numbers- and an illustration of its application with numerical examples, including a discussion of data sources.

5. Putting the pieces together: analysis of the metabolic pattern of a rural community (Friday, 30 September 2016, 15:00 - 17:00)

Presentation of the other elements (land use, demographic and socio-economic characteristics) required for a meaningful assessment of the metabolic pattern of social-ecological systems:

- Spatial analysis of the metabolic pattern of socio-ecological systems.
- Scaling the metabolic pattern of land uses;
- The importance of demographic variables (dependency ratio, population size);
- The importance of social variables (labor requirement in the service sector);
- The importance of economic variables (economic job productivity and the strength of the economic hypercycle);

Synthesis of all the material presented through the analysis of the metabolic pattern of the rural village of Mokolodi in Botswana.

SECOND PART: URBAN PROCESSES

Prof. Louis Lemkow (louis.lemkow@uab.cat)

1. Origin and development of cities. (Monday 3 October 2016. 10.00-13.00)

- The role of food production and agriculture in urbanization
- Patterns of urbanization
- Is there an "urban culture"

2. Ecological theories of the city. (Tuesday 4 October 2016. 10.00-13.00)

- Human Ecology and the Chicago School
- The spatial Distribution of inequalities in the city. Visual indicators of urban inequalities (class exercise)

3. Sustainability and intergenerational solidarity. (Wednesday 5 October. 10.00-13.00)

- Challenges of sustainability: environmental degradation, resource depletion and climate change.
- Are sustainable cities possible?

THIRD PART: VISIT TO THE ALINYÀ CAMPUS (6/7/8 October. 2016)

Prof: Jordina Belmonte & Marti Boada (jordina.belmonte@uab.cat; marti.boada@uab.cat)

Departure from UAB Campus ("eje central" close to the SAF) by bus at 08:00 h

A map will be provided and arrival at Alinyà (Llobera) at 10:30 h.

Activities developed (Staff to be precised)

- The Sustainable Use of the Local Environment
- Livestock in the Alinyà valley and the management of pastures
- Talk-debate invigorating the economy of Alinyà Valley. Main speakers: Martí Boada (ICTA), Sílvia Garrigós (FCLP). Visit to the "Rectoria" and the function of the "Agrobotiga" (organic food store) and the making of a more dynamic economy in Alinyà Valley.
- Life Project for CO₂ fixation and other experimental projects. Staff: Xavier Escuté (FCLP) Site visit of the EU project LIFE operation CO₂ : Apple plantation combined with other species to increase fixation in the framework of the LIFE project.
- Talk-debate on the sustainable use of the local environment and practical interpretation of the landscape from a socioecological perspective. ICTA staff.
- Protected species Staff: FCLP. Excursion on foot from Alinyà to the "Ermita de Sant Ponç". Project on the reintroduction of the black vulture. The work done at the supplementary feeding site.

FOURTH PART: INTEGRATIVE EVALUATION APPROACHES & SOCIAL MULTI-CRITERIA EVALUATION

Prof: Neus Martí Sanz Neus.marti.sanz@gmail.com

Evaluation becomes a crucial exercise when public informed-based decision making processes are promoted. The nature of problems related to environmental sustainability requires an appropriated evaluation approach consistent with their characteristics. Social multi-criteria evaluation (SMCE) is proposed as a tool to integrate different scientific languages in a public choice framework, where the whole "civil society" and ethical concerns on future generations have to be considered along with policy-makers and market conditions. The main topics tackled in this course are:

1. Evaluation for an informed-based decision-making (Monday, 10 October 2016 15.00-18.00)

- Dealing with a Complex World: Multiple Dimensions, Values and Scales
- The evaluation purpose
- Public informed-based decision-making processes
- Appropriated evaluation approaches
- Examples of appropriated evaluation approaches

2. Social-multi-criteria evaluation approach (Tuesday 11 October 2016 15.00-18.00)

- What is Multi-Criteria Evaluation?
- Social Multi-Criteria Evaluation and Sustainability Issues
- Technical and social incommensurability

3. Basic operational concepts (Thursday, 13 October 2016, 15:00 - 17:00)

- Preference Modelling in SMCE
- Measurement scales
- Uncertainty in the criterion scores
- Compensability and the Meaning of Weights
- The Total Comparability Axiom: Multi-Attribute Value Functions
- The Partial Comparability Axiom: Outranking Methods
- The Issue of Consistency: Lessons Learned from Social Choice Literature
- Examples of software applications

4. Designing smce processes (Friday, 14 October 2016, 15:00 - 17:00)

- The evaluability issue
- Structuring a SMCE process
- The quality of the SMCE process: outputs & process
- Examples of real-world SMCE
- Material to study: Papers in the virtual campus.

SECOND SEMESTER

COMMUNICATION AND ACADEMIC DIFFUSION, ALSO RELATED TO THE MASTER'S THESIS.

Prof. Antònia Casellas antonia.casellas@uab.cat

- Sessions Second Group: February 1/8/15/22 and March 1/7/14/21 from 15:00h to 18:00h
- Sessions First Group: February 3/10/17/24 and March 3/7/14/21 from 10:00h to 13:00h

Description:

In these 8 sessions students engage in the techniques of academic writing. We will specifically work on academic practice of summary-critique, literature review-synthesis and design research. Topics covered include discussion of Critical/Academic Writing, Papers Structure, Abstracts, Introductions/Conclusions, Evidence, Citation Style, and Plagiarism, Academic Sources, and Library Resources. We will also address strategies for presenting information.

The **assignment requirements** of the sessions include:

1. Readings: We will do readings of journal articles selected by professor and students. The readings will be discussed in class.
2. Short Writings: Throughout the classes students will complete several short writing assignments in class. These pieces will be exercises in employing concepts learned in class/reading, and will be incorporated into the short essays.
3. Short Essays: Students will write two individual short essays:
 - (a) The first essay is a Summary-Critique Essay: Students find a lengthy scholarly article from their fields of study and write a summary and critique of that article.
 - (b) The second essay is a Synthesis Essay: Students write a Literature Review for a topic they are working on in their fields of study related to a research question.
- 4) Class presentation: During the last sessions students will present their Research Question and the Synthesis Essay under the directions of the professor and will receive feedback from the class.

Note: students with limited English skills will be able to do their essays in Catalan or Spanish

Methodology

1. Lectures, problem solving and case studies
2. Case-based learning
3. Presentation and oral exposition of developed research
4. Participation in complementary activities
5. Field trips

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Complementary activities	26	1.04	11
Field trips	80	3.2	3, 2, 8, 4, 11
Final work	65	2.6	10, 2, 6, 11
Lessons	84	3.36	3, 2, 6, 11
Type: Supervised			
Reading papers	40	1.6	10, 11
Reading teaching materials	45	1.8	

Evaluation

FIRST SEMESTER

FIRST PART: THE METABOLIC PATTERN OF SOCIAL-ECOLOGICAL SYSTEMS: THE NEXUS BETWEEN ENERGY, WATER, AND FOOD Prof: Mario Giampietro

Assignment: The assignment will be provided and explained during the first class

SECOND PART: URBAN PROCESSES Prof. Louis Lemkow

Assignment: The assignment will be provided and explained during the first class

THIRD PART: VISIT TO THE ALINYÀ CAMPUS Prof: Jordina Belmonte & Marti Boada

Students will follow an evaluation consisting in answering the questions and field exercises that the teachers will provide them. The matter subject of the written proofs will deal on the teachings received during the Alinyà trip and can include personal opinions on how to run the management of an environment. Students will have an accorded period of time for preparing and submitting the answers. They will be evaluated from 0 to 10 and the final mark will be the mean of the two (or more) exercises proposed.

FOURTH PART: INTEGRATIVE EVALUATION APPROACHES & SOCIAL MULTI-CRITERIA EVALUATION Prof: Neus Martí Sanz

Assignment: The assignment will be provided and explained during the first class

SECOND SEMESTER

COMMUNICATION AND ACADEMIC DIFFUSION, ALSO RELATED TO THE MASTER'S THESIS Prof. Antònia Casellas

Final Grade of the 8 Sessions: Essay Assignments (70%), Class Presentation (20%), Attendance & class participation (10%)

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Assistance activities and complementary field work	10	20	0.8	10, 3, 2, 7, 8, 5, 9, 6, 11
Attendance and active participation in class	10	5	0.2	1, 2, 8, 5, 9, 6, 4, 11
Defense course assignments	20	10	0.4	2, 11

Bibliography

FIRST SEMESTER

FIRST PART: THE METABOLIC PATTERN OF SOCIAL-ECOLOGICAL SYSTEMS: THE NEXUS BETWEEN ENERGY, WATER, AND FOOD Prof: Mario Giampietro

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2. Madrid C., Cabello V. and Giampietro M. 2013. Water-use sustainability in socio-ecological systems: A multi-scale integrated approach. BioScience 63 (1): 14-24.
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3. Serrano-Tovar T. and Giampietro M. 2014. Multi-scale integrated analysis of rural Laos: Studying metabolic patterns of land uses across different levels and scales. Land Use Policy 36: 155-17
<http://www.sciencedirect.com/science/article/pii/S0264837713001506>
4. Kovacic Z. and Giampietro M. 2015. Beyond "beyond GDP indicators:"The need for reflexivity in science for

governance. *Ecological Complexity* 21: 53-61.

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5. Aragao A. & Giampietro M. 2016. An integrated multi-scale approach to assess the performance of energy systems illustrated with data from the Brazilian oil and natural gas sector. *Energy*, in press.

<http://www.sciencedirect.com/science/article/pii/S0360544216308325>

SECOND PART: URBAN PROCESSES Prof. Louis Lemkow

-Beck U., (1992) *Risk Society: Towards a New Modernity*, Sage, London

-Harvey D., (2010) *Social Justice and the City*, Revised Edition, UGA University Press, Atlanta

-Johnston R. J., (2007), *City and Society: An Outline for Urban Geography*, Routledge, London

-Lemkow L., (2012), "Intergenerational Solidarity, Sustainability and Climate", in *QUERIES 4.2*, FEPS, Brussels

THIRD PART: VISIT TO THE ALINYÀ CAMPUS Prof: Jordina Belmonte & Marti Boada

-AVV. Els sistemes naturals de la Vall d'Alinyà. Institució Catalana d'Història Natural i Fundació Territori i Paisatge. http://ichn.iec.cat/Alinya_Articles.htm

FOURTH PART: INTEGRATIVE EVALUATION APPROACHES & SOCIAL MULTI-CRITERIA EVALUATION Prof: Neus Martí Sanz

Textbook for further readings: Munda G. - *Social multi-criteria evaluation for a sustainable economy*, Operation Research and Decision Theory Series, Springer, Heidelberg, New York, 2008

SECOND SEMESTER

COMMUNICATION AND ACADEMIC DIFFUSION, ALSO RELATED TO THE MASTER'S THESIS. Prof. Antònia Casellas

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-Holliday A. (2007). *Doing and Writing Qualitative Research*. London: Sage.

-Swales J. & Feak C. (2012). *Academic Writing for Graduate Students: Essential Tasks and Skill*. 3rd edition. University of Michigan Press.

-Waller, V., Farquharson, K, & Dempsey D. Eds (2016). *Qualitative social research: contemporary methods for the digital age*. Los Angeles, Calif: Sage.