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# Technology-Driven Solutions for Mediterranean Ecosystems

ENVI-3250 (3 credits)

## Italy: Island Ecosystems in the Mediterranean

*This syllabus is representative of a typical semester. Because courses develop and change over time to take advantage of unique learning opportunities, actual course content varies from semester to semester.*

### Course Description

This course explores innovative strategies that take on the pressing challenges facing Mediterranean island ecosystems. Centered around immersive fieldwork in Sicily and Sardinia, students engage directly with issues such as water scarcity, soil degradation, biodiversity loss, and the impacts of climate change. Throughout the course, technology is envisaged as the thoughtful application of knowledge and awareness to enhance the wellbeing of all life on Earth. Through this multi-faceted lens, the course material is enriched by diverse scholarly positions. Emphasizing data-driven decision-making and the use of emerging technologies in engendering ecosystem health, students learn from researchers and conservation professionals to understand and experience firsthand the challenges and successes of creating and applying appropriate, science-based solutions.

### Learning Outcomes

Upon completion of the course, students will be able to:

- Explain the role of technology, and its limitations, in achieving conservation goals, sustainability, and improving community well-being
- Compare the effectiveness and flaws of a series of technologies that are commonly applied to distinct ecological problems
- Debate the role of policy and the use of technology as a remedy to environmental problems and discuss relevant examples from the Mediterranean region
- Assess the capacity of technologies to buffer and ameliorate the impacts of climate change in Mediterranean island ecosystems

### Language of Instruction

This course is taught in English, and where Italian is used, translation to English will be provided.

### Instructional Methods

SIT's teaching and learning philosophy is grounded in the experiential learning theory developed by Kolb (1984; 2015) and informed by various scholars, such as Dewey, Piaget,

Lewin, among others. Experiential learning theory recognizes that learning is an active process that is not confined to the formal curriculum; “knowledge is created through the transformation of experience” (Kolb, 2015, p. 49). Learning involves both content and process. Learning is holistic and happens through various life experiences upon which students draw to generate new ways of knowing and being. Learning involves a community and is a lifelong endeavor. Learning is transformational. The suggested four step-cycle of a *concrete experience*, *reflective observation*, *abstract conceptualization*, and *active experimentation* embedded in the experiential learning model is not linear and might not always happen in that specific order, as any learning is highly context dependent. These stages of taking part in a shared experience; reflecting on that experience by describing and interpreting it; challenging their own assumptions and beliefs to generate new knowledge; and ultimately applying new knowledge, awareness, skills, and attitudes in a variety of situations and contexts are important for students to engage in to become empowered lifelong learners.

**Required Texts**
See the course schedule for a full list of reading assignments.

Attendance and Participation
Due to the nature of SIT Study Abroad programs, and the importance of student and instructor contributions in each and every class session, attendance at all classes and for all program excursions is required. Criteria for evaluation of student performance include attendance and participation in program activities. Students must fully participate in all program components and courses. Students may not voluntarily opt out of required program activities. Valid reasons for absence – such as illness – must be discussed with the academic director or other designated staff person. Absences impact academic performance, may impact grades, and could result in dismissal from the program.

Late Assignments
SIT Study Abroad programs integrate traditional classroom lectures and discussion with field-based experiences, site visits and debriefs. The curriculum is designed to build on itself and progress to the culmination (projects, ISP, case studies, internship, etc.). It is critical that students complete assignments in a timely manner to continue to benefit from the sequences in assignments, reflections and experiences throughout the program.
Example: Students may request a justified extension for one paper/assignment during the semester. Requests must be made in writing and at least 12 hours before the posted due date and time. If the reason for the request is accepted, an extension of up to one week may be granted at that time. Any further requests for extensions will not be granted. Students who fail to submit the assignment within the extension period will receive an ‘F’ for the assignment.

**Assignments and Evaluation**

Assignment Descriptions and Grading Criteria

**Participation (10%)**

Active participation is essential for learning in this course. Students are expected to engage meaningfully in field activities, contribute to group discussions, and demonstrate professional conduct when working with local communities. The participation grade reflects both the quantity and quality of student engagement throughout the course.

**Case Study Analysis – Water and Soil Conservation (25%)**

You will select and analyze a real-world project aimed at alleviating water scarcity or soil degradation on a Mediterranean island. Your task is to explore the technologies used, discuss their effectiveness, and explain the challenges involved. A 5–7-page written report will detail your analysis, with a specific focus on the impact of local conditions and community involvement. Post your paper to the Canvas discussion board for your peers to review. Each student will report on a different project.

**Photo Essay (30%)**

Photo essays have been described as a form of visual storytelling. This assignment is an opportunity for you to tell the story, according to your interpretation, of the natural places you encounter during the semester. During this course, you will visit diverse ecosystems and habitats that, in some cases, are thriving, growing, regenerating, and, in other cases, degraded and endangered. You will create a photo essay that documents these unique systems and conveys their contexts. Through the images you capture, articulate the ecological and social importance of each ecosystem and habitat. Each photo should be accompanied by a narrative explanation of the image's subject and its context.

**Climate Resilience Strategy Report and Presentation (35%)**

In your final assignment, you will evaluate the climate resilience of a specific Mediterranean island ecosystem. You will research the region's climate vulnerabilities and propose scientifically supported adaptation strategies that account for both ecological and community needs. Submit a 5-7-page report outlining your strategies, followed by a class presentation of your recommendations.

Grading Scale

| | |
|---|---|
| 94-100% | A |
| 90-93% | A- |
| 87-89% | B+ |
| 84-86% | B |
| 80-83% | B- |
| 77-79% | C+ |
| 74-76% | C |
| 70-73% | C- |
| 67-69% | D+ |
| 64-66% | D |
| below 64 | F |

## Program Expectations

- **Show up prepared.** For an interactive course to succeed, you must be present, on time, and have your readings completed and points in mind for discussion or clarification. Being prepared with these elements raises the level of class discussion for everyone. Moreover, the content of this course is learned collaboratively, meaning that when a student isn't here, they take away from everyone's opportunity to learn. The only way to maximize our collective learning potential is if we are all here contributing. Valid reasons for absence – such as illness – must be discussed with the academic director or other designated staff person. Absences impact academic performance, may impact grades, and could result in dismissal from the program
- **Submit assignments on time:** SIT Study Abroad programs integrate traditional classroom lectures and discussion with field-based experiences, site visits and debriefs. The curriculum is designed to build on itself and progress to the culmination (projects, ISP, case studies, internship, etc.). It is critical that students complete assignments in a timely manner to continue to benefit from the sequences in assignments, reflections and experiences throughout the program.
- **Bring your curiosity:** Ask questions in class**.** Engage the guest lecturers, as these are often very busy professionals who are doing us an honor by coming to speak. Remember, there are no foolish questions, and your inquiries might help others in class who have similar ideas/thoughts. By actively participating and showing curiosity, you demonstrate respect for our guests and contribute to creating a dynamic learning environment for everyone.
- **Maintain academic Integrity:** As members of a learning community, we all want to submit work that reflects our own ideas and efforts. Even if it is unintentional, plagiarism can have serious consequences. Before you submit each assignment, ask yourself these questions:

  - Did I reference ideas, quotes, phrases, or facts I read about in a book, article, or website, without citing the author and year of the source where I read about them?
  - Did I paraphrase by changing only a word or two or moving the words around?
  - Did you answer "yes" to any of the above questions? If so, you are committing plagiarism and need to give credit to appropriate sources before you submit your assignment.

- **Principled Disagreement**: Learning often involves discomfort. Some discomfort can facilitate personal and collective growth. You, your peers, guest lecturers, instructors, and local constituents, have diverse experiences, values, beliefs, affiliations, and identities. Reflecting on these differences can be emotionally challenging, even when it deepens self-awareness and mutual understanding. In this course, we aim to encourage brave spaces where principled disagreement is encouraged rather than avoiding difficult conversations. *This is challenging work, and we will inevitably make mistakes.* Our goal is to thoughtfully critique ideas rather than attacking individuals. We aim to embrace productive discomfort and minimize unproductive discomfort, striving for principled disagreement.

- **Content Considerations**: Some texts and activities you will encounter in this course delve into sensitive topics that may be emotionally and intellectually challenging. Our classroom is a brave space where we can engage with challenging ideas, question assumptions, and navigate difficult topics with respect and maturity. As possible, I will flag content and activities that are especially graphic or intense, so we are prepared to address them soberly and sensitively. If you are struggling to keep up with the work or participate in the course because of the nature of the content and activities, you should speak with me and/or seek help from counseling services.
- **Our social identities** – Our social identities - race/ethnicity, class, gender, sexual identity, religion, mental and physical ability, size, national origin, citizenship status, and more – shape how we are perceived, represented, and treated. They also influence what knowledge and learning is deemed valuable and legitimate. To challenge hegemonic paradigms and perspectives, this course intentionally includes readings, topics, videos, and assignments from authors and perspectives of diverse backgrounds. However, there may be gaps we have overlooked. Your constructive feedback is always welcome on how to make this course more inclusive and transformative.

- **Storing Your Work**: Keep several copies of your work as back up and keep one copy accessible to you through an online forum, such as an attachment in your email, the course learning management system, or cloud-based storage. This way your work will always be available despite technical issues. Lost files, deleted drives, or computer crashes are not excuses for late, missing work.
- **Personal Technology Use:** Cell phones and other personal electronics can be used for taking notes and other class activities. Off-task usage is not acceptable. You may be marked as absent for habitually using them for something other than classroom activities.
- **Course Communication**: Although the course calendar provides a broad overview and the general sequence of work and assignments for the course, what we accomplish in class will vary, and revisions to the calendar will be posted at the course site. You will need to check the course site regularly. You are responsible for letting me know about any network-related problems that prevent you from accessing or submitting assignments.
- **Classroom recording policy:** To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

**SIT Policies and Resources**

Please refer to the SIT Study Abroad Handbook and the Policies section of the SIT website for all academic and student affairs policies. Students are accountable for complying with all published policies. Of particular relevance to this course are the policies regarding: academic integrity, Family Educational Rights and Privacy Act (FERPA), research and ethics in field study and internships, late assignments, academic status, academic appeals, diversity and disability, sexual harassment and misconduct, and the student code of conduct.

Please refer to the SIT Study Abroad Handbook and SIT website for information on important resources and services provided through our central administration in Vermont, such as Library resources and research support, Accessibility Services, Counseling Services, Title IX information, and Equity, Diversity, and Inclusion resources.

## Course Schedule

**Please be aware that topics and excursions may vary to take advantage of any emerging events, to accommodate changes in our lecturers' availability, and to respect any changes that would affect student safety. Students will be notified if this occurs.*

### Module 1: Introduction to Climate Change and Energy Technologies in Island Ecosystems

This foundational module introduces students to applied technologies that address the unique characteristics of Mediterranean island ecosystems and the critical challenges they face. Through lectures, readings, field visits, and meetings with specialists, students develop an understanding of the role that technology plays in the creation of comprehensive solutions for environmental conservation.

Possible sessions may include:

- The role of technology in the creation of sustainable environmental solutions
- Climate change impacts on Mediterranean island environments
- Sicily's oil refineries and the technologies that reduce their impact
- EU policies on energy and Adaptation to Climate Change (ACC) strategies
- Agrivoltaics: a multi-purpose and multi-production energy technology

### Required Readings

Cuevas-Wizner, R., Ledda, A., Martín, B., Ortega, E., Calia, G., & De Montis, A. (2024). Mainstreaming adaptation to climate changes: A comparison between Sardinia, Italy and Valencia, Spain. *Sustainability*, *16*(16), 7099.

Herce, C., Martini, C., Salvio, M., & Toro, C. (2022). Energy performance of Italian oil refineries based on mandatory energy audits. *Energies*, *15*(2), 532.

Pagliaro, M., & Meneguzzo, F. (2020). Oil refining in Sicily: A critical perspective looking to the future. *Energy Science & Engineering*, *8*(3), 566-573.

Pasquali, D., Bruschi, A., Lisi, I., & Risio, M. D. (2023). Wave forcing assessment at a regional scale in a climate change scenario: the Sardinia case study. *Journal of Marine Science and Engineering*, *11*(9), 1786.

Ulanov, V. L., & Skorobogatko, O. N. (2018). Transformation of refinery loading as a result of stricter environmental regulations and development of alternative fuels. *International Journal of Energy, Environment and Economics*, *26*(4), 285-301.

Vogiatzakis, I. N., Pungetti, G., & Mannion, A. M. (Eds.). (2007). Mediterranean Island Landscapes: Natural and Cultural Approaches. Chapters 7 and 8.

**Module 2: Agroecological Innovation, Soil Loss, and Regenerative Technologies**

In Sardinia's olive groves and Sicily's vineyards, students explore new agroecological practices and technologies geared toward confronting the deleterious impacts of climate change, including drought, soil carbon loss, and increased temperatures. Students meet with growers and climate scientists to learn about technological innovations and the risks and advantages of their implementation in diverse agricultural and ecological environments.

Sessions may include:

- Sustainable food production and climate change
- Agroforestry and multi-story agroecological systems
- Regenerative soil management
- EU Sustainable Agriculture and Food Security policy: The Common Agricultural Policy (CAP)

**Required Readings**

Cistrone, L., Augusto, A. M., Fichera, G., Rebelo, H., & Russo, D. (2024). Agriculture and water availability show contrasting effects on bats on a Mediterranean island of outstanding chiropteran biogeographical value. *Ecology and Evolution*, *14*(12), e70717.

Conte, L., Prakofjewa, J., Floridia, T., Stocco, A., Comar, V., Gonella, F., & Lo Cascio, M. (2024). Learning from farmers on potentials and limits for an agroecological transition: participatory action research in Western Sicily. *Frontiers in Environmental Science*, *12*, 1347915.

La Mantia, T., Russo, M., Quatrini, P., & Da Silveira Bueno, R. (2021). The transformation of agricultural systems into agroforestry systems as a system of adaptation to climate and economic changes: some Sicilian case studies. In *The transformation of agricultural systems into agro-forestry systems as a system of adaptation to climate and economic changes: some Sicilian case studies*.

Lo Papa, G., Dazzi, C., Némethy, S., Corti, G., & Cocco, S. (2020). Land set-up systems in Italy: A long tradition of soil and water conservation sewed up to a variety of pedo-climatic environments. Italian Journal of Agronomy, 15(1760), 281-292.

 

Miccichè, D., Puccio, S., Di Lorenzo, R., Turano, L., Di Carlo, F., & Pisciotta, A. (2025). Adapting viticulture to climate change: Impact of shading in Sicily. *Horticulturae*, *11*(2).

**Module 3: Technological Responses to Water Scarcity and Coastal Wetland Health**

Through visits to impacted wetlands and key watersheds, in this module students will grapple with the impacts of climate change, tourism and human use on water availability and healthy water systems in the western Mediterranean. Students will also learn about the vital role wetlands play in mitigating flooding and, simultaneously, providing coastal protection from sea level rise. Technologies such as water catchments, rainwater harvesting, and desalination will be studied.

Sessions may include:

- Wetlands and the key roles they play in coastal protection and flood mitigation
- Desalination technology and its relevance in Sicily
- Water conservation techniques and their current use in diverse Mediterranean contexts
- Impacted watersheds of Sicily and Sardinia
- Tourism development regulation: a tool for wetland conservation

**Required Readings**

Ferrarini, A., Gustin, M., & Celada, C. (2021). Twenty-three years of land-use changes induced considerable threats to the main wetlands of Sardinia and Sicily (Italy) along the Mediterranean bird flyways. *Diversity*, *13*(6), 240.

Licata, M., Ruggeri, R., Iacuzzi, N., Virga, G., Farruggia, D., Rossini, F., & Tuttolomondo, T. (2021). Treatment of combined dairy and domestic wastewater with constructed wetland system in Sicily (Italy). Pollutant removal efficiency and effect of vegetation. *Water*, *13*(8), 1086.

Martorana, P., Guercio, A., De Luca, A., & Curto, D. (2024, September). Monitoring water reservoirs in southern Italy and fighting water scarcity. In *OCEANS 2024-Halifax* (pp. 1-5). IEEE.

Parada, M. P., Randazzo, S., Gamboa, G., Ktori, R., Bouchaut, B., Cipolina, A., ... & Xevgenos, D. (2023). Resource recovery from desalination, the case of small islands. *Resources, Conservation and Recycling*, *199*, 107287.

Ponce-Reyes, R., & Castro-Prieto, J. (2023). Climate change in the Mediterranean Basin (Part II): A review of challenges and uncertainties in climate change modeling and impact analyses. Water Resources Management, 37, 2307-2323.

 

Sannitu, S. (2022). The integrated water cycle in the context of water management systems: The Sardinian experience. In Food and Agriculture Organization (Ed.), Watershed management: Water resources for the future (pp. 153-162). FAO Conservation Guide.

**Module 4: Island biodiversity conservation and multi-ecosystem habitat restoration**

This module focuses on scientific approaches to biodiversity conservation and forest, coastal, and marine habitat restoration. Students learn about practices and strategies currently in place in Sicily and Sardinia that have successfully conserved local biodiversity. Students may participate in habitat restoration activities that are currently underway to regenerate burned land and polluted waterways.

Sessions may include:

- Natura 2000 – the EU protected areas initiative
- Italy's National Recovery and Resilience Plan: Marine Restoration Project Sicily
- Biodiversity conservation challenges on Mediterranean islands
- Nature-based solutions and the impacts of fire and invasive fauna on native forests in Sardinia
- Ancient cork forests and their conservation – in the face of climate change
- Wetland reclamation and the pressures of tourism development along island coasts

**Required Readings**

Boudouresque, C. F., Blanfuné, A., Pergent, G., & Thibaut, T. (2021). Restoration of seagrass meadows in the Mediterranean Sea: A critical review of effectiveness and ethical issues. *Water*, *13*(8), 1034.

Consoli, P., Altobelli, C., Perzia, P., Bo, M., Rosso, A., Alongi, G., Serio, D., Canese, S., Romeo, T. and Andaloro, F. (2021). Species and habitats of conservation interest in the ecologically and biologically significant area of the Strait of Sicily: A contribution towards the creation of specially protected areas of Mediterranean importance. *Mediterranean Marine Science*, 22(2), pp.297-316.

Ferrarini, A., Celada, C., & Gustin, M. (2024). Spatiotemporal dynamics in bird species assembly in the coastal wetlands of Sicily (Italy): A multilevel analytical approach to promote more satisfactory conservation planning. *Land*, *13*(8), 1333.

Grace, M., Balzan, M., Collier, M., Geneletti, D., Tomaskinova, J., Abela, R., Borg, D., Buhagiar, G., Camilleri, L., Cardona, M., Cassar, N., Cassar, R., Cattafi, I., Cauchi, D., Galea, C., La Rosa, D., Malekkidou, E., Masini, M., Portelli, P., Dicks, L. V. (2021). Priority knowledge needs for implementing nature-based solutions in the Mediterranean islands. *Environmental Science & Policy*, 116, 56-68.

Médail, F. (2017). The specific vulnerability of plant biodiversity and vegetation on Mediterranean islands in the face of global change. *Regional Environmental Change*, 17(6), 1775-1790.

Musumeci, R. E., Marino, M., Cavallaro, L., & Foti, E. (2022). Does coastal wetland restoration work as a climate change adaptation strategy? The case of the SE Sicily coast. *Coastal Engineering Proceedings*, (37), 66-66.

Signorello, G., Prato, C., Marzo, A., Ientile, R., Cucuzza, G., Sciandrello, S., ... & Villa, F. (2018). Are protected areas covering important biodiversity sites? An assessment of the nature protection network in Sicily (Italy). *Land Use Policy*, *78*, 593-602.

Vogiatzakis, I. N., Mannion, A. M., & Sarris, D. (2016). Mediterranean island biodiversity and climate change: The last 10,000 years and the future. *Biodiversity & Conservation, 25*(13), 2597-2627.

**Module 5: Technology and the Role of Policy**

Through the analysis of past and contemporary policies, including policy successes and failures, in this module students will examine the role of regional, national, and local policy in the pursuit of sustainable solutions to environmental challenges. Grounded in the understanding that contemporary environmental challenges are the result of human behavior and decision making, the module's material will lead students to explore and question the role of technology in the greater sustainability context.

Sessions may include:

- Introduction to the role of policy in environmental problem solving
- EU environmental policy and the politics of technology
- Is technology the answer?
- Public policy, regulation, and innovation
- Appropriate technology and technology adoption

**Required Readings**

Cairney, P. (2023). The politics of policy analysis: theoretical insights on real world problems. *Journal of European Public Policy*, *30*(9), 1820-1838.

Edler, J., Blind, K., Kroll, H., & Schubert, T. (2023). Technology sovereignty as an emerging frame for innovation policy. Defining rationales, ends and means. *Research Policy*, *52*(6), 104765.

Masi, M., De Rosa, M., Vecchio, Y., Bartoli, L., & Adinolfi, F. (2022). The long way to innovation adoption: Insights from precision agriculture. *Agricultural and Food Economics*, *10*(1), 27.

 

Timpanaro, G., Foti, V. T., Cascone, G., Trovato, M., Grasso, A., & Vindigni, G. (2024). Living lab for the diffusion of enabling technologies in agriculture: The case of Sicily in the Mediterranean context. *Agriculture*, *14*(12), 1-24.

Van Woensel, L. (2024). Foresight in EU policymaking: Purpose, mindsets and methods. *European Law Journal*, *30*(3), 361-381.

 