Systems Thinking for the Future of Agriculture

SFS 3083

Syllabus
4 credits

The School for Field Studies (SFS)
Center for Sustainable Food Systems
Greve in Chianti, Italy

This syllabus may develop or change over time based on local conditions, learning opportunities, and faculty expertise. Course content may vary from semester to semester.

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COURSE CONTENT SUBJECT TO CHANGE

Please note that this is a copy of a recent syllabus. A final syllabus will be provided to students on the first day of academic programming.

SFS programs are different from other travel or study abroad programs. Each iteration of a program is unique and often cannot be implemented exactly as planned for a variety of reasons. There are factors which, although monitored closely, are beyond our control. For example:

- Changes in access to or expiration or change in terms of permits to the highly regulated and sensitive environments in which we work;
- Changes in social/political conditions or tenuous weather situations/natural disasters may require changes to sites or plans, often with little notice;
- Some aspects of programs depend on the current faculty team as well as the goodwill and generosity of individuals, communities, and institutions which lend support.

Please be advised that these or other variables may require changes before or during the program. Part of the SFS experience is adapting to changing conditions and overcoming the obstacles that may present. In other words, elephants are not always where we want them to be, so be flexible!

Course Overview

The necessity and urgency of halting and reversing the loss of biodiversity has been repeatedly called for by international organizations such as the UN, FAO, IPBES, EU, national governments and NGOs. More specifically, official strategies and reports such as the UN's Millennium Ecosystem Assessment (2005), the UN' s Agenda 2030 (2015), the IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019), the FAO's Strategy on Mainstreaming Biodiversity across Agricultural Sectors (2020), the EU's Biodiversity Strategy (2020), and the UN's Kunming-Montreal Global Biodiversity Framework (2022), are defining goals, targets and actions in order to reverse the loss of biodiversity.

However, when it comes to implementing these strategies and action plans on the ground, there is the need to understand what the problems and opportunities of nature restoration at the local level are. This is particularly true for food systems in densely populated Europe, where almost no pristine natural area exists below 2000 meters of altitude. Instead of addressing the lessening/mitigating of food systems' impacts on the environment to halt the loss of biodiversity, this program is adopting a change of perspective by focusing on the understanding, analysis, and assessment of making "nature's return" sustainable for food systems. By looking at what is happening in Tuscany, students will explore the ecological, economic, and sociocultural complexities of sustainably managing natural restoration in ecosystems historically used by food systems

This interdisciplinary course explores the complex dynamics of how traditional agriculture can teach us to rethink the future of food production and agri-environmental policies. The historical background of Tuscany, with its hilly landscape, and a millenial practice of farming, from the Apennine Mountain range, Chianti hilly landscape and Maremma flat coastal areas, the students will learn how to read the landscape with a historical perspective.

The connection between traditional and contemporary agriculture and its policies will be defined using a systems thinking approach to learning, research and group work.

The future of a different vision of food production is based on the application of systems thinking.

Learning Objectives

Students will be able to:

- **Explain** traditional community-based agricultural practices and their impact on the landscape and environment,
- **Identify** the use of resources creating a connection between traditional and contemporary water use in agriculture
- **Assess** the viability of different restoration strategies, considering their impacts on ecosystem services and on farmers, shepherds, fishers, foresters, and local communities.
- **Design** potential management proposals and strategies for sustainable agricultural landscapes, applying a systems thinking approach using permaculture design.

Assessment

The evaluation breakdown for the course is as follows:

Assessment Item	Value (%)
Participation	10
Field Exercise 1	20
Field Exercise 2	20
Permaculture Assignment	15
Systems thinking quiz	10
Exam part I	10
Exam part II	15
TOTAL	100

Participation (10%)

Everybody should be prepared for each academic session. This implies reading the materials for each session with enough detail to be able to ask relevant questions, and to participate in analytical discussions about the key issues. Active participation during classes, discussions, assignments, and hikes is expected. Participation will be evaluated by looking at student's attention during classes, appropriate and timely questions and comments, contribution to teamwork and educate and respectful behavior.

Permaculture Assignment (15%)

The students will read Patrick Whitefiled's book: Permaculture in a Nutshell, divided in smaller groups and then share the concepts they found in the section they were assigned to as a group. This assignment introduces the systems thinking approach of permaculture design to the course

Field Exercise 1 (20%) Applying a systems thinking perspective to a farm

This FEX will allow students to apply the permaculture design systems thinking perspective to a case study project on a farm near Greve. The cohort will have to design an orchard on a terraced landscape. Using the systems thinking permaculture approach, practically applying different design tools (sector analysis, zoning, SWOC, etc.), the students will finalize the design and present their proposal. The FEX will be divided into various visits to the site for data collection and analysis. This FEX will give a hands-on experience in systems thinking design applied to an actual agricultural farm.

Field Exercise 2 (20%) water management as a driver for evaluating farm sustainability - assessing water resources on a farm and how to evaluate its use

This FEX will allow students to experience in the field what they have learned during the water cycle workshop. The FEX requires the evaluation of the water sources a farm has and if they are completely valued or not. The students using a questionnaire will identify the different water sources that are present on the farm and consider the necessity of water in the different phases of production and processing. The students will evaluate the farm's sustainability by applying water management theory and practice. The students will individually submit a brief written essay suggestions for improvement.

Systems thinking quiz (10%)

A short quiz will be given based on pre-course reading. The quiz will be multiple choice and short-answer during week 2

Exam part I (15%)

The exam will focus on the importance of connecting traditional resource and landscape design with contemporary sustainable agriculture. Students will have to work on the data collected on field trips done in the program and share, with an essay, their perspective on how we can think about sustainability learning and valuing the traditional ecological knowledge. For the essay the students will have to search for an orginal article not used in the course readings quote it corectly and use it to support their point of view.

Exam part II (15%)

This exam will focus on the connection between sustainable agriculture and conservation and agro-environmental policies. The students will have to work on the data gathered on the visits to farms and evaluate if farmers are aware of the policies, how they apply them or not, and if the policies meet the needs of the farmers. With a written essay the students will share their results and thoughts on policies, and suggest an adjustment to come closer to farmers needs or to help value conservation policies.

Grading Scheme

A	95.00 - 100.00%	B+	86.00 - 89.99%	C+	76.00 - 79.99%	D	60.00 - 69.99%
A-	90.00 - 94.99%	B	83.00 - 85.99%	C	73.00 - 75.99%	F	0.00 - 59.99%
		B-	80.00 - 82.99%	C-	70.00 - 72.99%		

General Reminders

Honor Code/Plagiarism – SFS places high expectations on their students and we hold students accountable for their behaviors. SFS students are held to the honor code below. SFS has a zero-tolerance policy towards student cheating, plagiarism, data falsification, and any other form of dishonest academic and/or research practice or behavior. Using the ideas or material of others without giving due credit is cheating and will not be tolerated. Any SFS student found to have engaged in or facilitated academic and/or research dishonesty will receive no credit (0%) for that activity.

> *"SFS does not tolerate cheating or plagiarism in any form. While participating in an SFS program, students are expected to refrain from cheating, plagiarism and any other behavior which would result in a student receiving credit for work which they did not accomplish on their own. Students are expected to report any instance of cheating or plagiarism by others."*

Deadlines – Deadlines for written and oral assignments are instated to promote equity among students and to allow faculty ample time to review and return assignments before others are due. As such, deadlines are firm; extensions will only be considered under extreme circumstances. Late assignments will incur a penalty of 10% of your grade for each day you are late. After two days past the deadline, assignments will no longer be accepted. Assignments will be handed back to students after a one-week grading period. Grade corrections for any assessment item should be requested in writing at least 24 hours after assignments are returned. No corrections will be considered afterwards.

Content Statement – Every student comes to SFS with unique life experiences, which contribute to the way various information is processed. Some of the content in this course may be intellectually or emotionally challenging but has been intentionally selected to achieve certain learning goals and/or showcase the complexity of many modern issues. If you anticipate a challenge engaging with a certain topic or find that you are struggling with certain discussions, we encourage you to talk about it with faculty, friends, family, the HWM, or access available mental health resources.

Participation – Since we offer a program that is likely more intensive than you might be used to at your home institution, missing even one lecture can have a proportionally greater effect on your final grade simply because there is little room to make up for lost time. Participation in all components of the course is mandatory, it is important that you are prompt for all activities, bring the necessary equipment for field exercises and class activities, and simply get involved.

AI Usage in Assignments – SFS acknowledges the growing role of artificial intelligence (AI) tools in education and professional settings. While AI can be a valuable resource for learning and productivity, its use must align with the learning goals and integrity of each assignment. For this reason, students are encouraged to discuss the acceptable uses of AI for each assignment with the instructor. If you wish to use AI for any part of an assignment, consult with the instructor beforehand to ensure that its use adheres to the academic expectations of the course. Let's work together to navigate this evolving landscape responsibly!

Course Content

Type: O: Orientation, **D**: Discussion, **L**: Lecture, **FL:** Field Lecture, **FEX:** Field Exercise

*Readings in **Bold** are required.

No	*Title and outline*	*Type*	*Time (hrs)*	*Required Readings*
	Pre-departure reading			**Arnold and Wade (2015)** **Parra (2024)** **Bawden (1991)**
1	**Introduction to the course** Content, and structure, objectives	O	1.0	
2	**Climate change and agriculture** Feeding our communities; Challenges agriculture is facing from today to 2050	L	2.0	Di Bernardo, A. (2022)
3	**A history of agriculture in Italy** From Etruscan to Roman agriculture – Cetamura	FL	2.0	
4	**Traditional agricultural practices** The sharecropping system in Italy, with a focus on Tuscany and the socio-economic model; visit to Museo Mezzadria Buonconvento	FL	2.0	**Fisher et al. (2012)**
5	**The sharecropping system** How the socio-economic system designed the landscape (La Scoscesa)	FL	2.0	Oglethorpe, S., (2014)
6	**The sharecropping system, from a landscape perspective** Farming practices, soil, water and resource management, learning from the work of Pietro Cuppari (La Scoscesa)	FL	2.0	
7	**Definition of sustainability** What is sustainable today?	D	1.0	**Purvis et al. (2019).** **Meyfroidt et al., (2022)** Willet, W. et al. (2019)
8	**A systems thinking approach to sustainability** Applying the permaculture design system to agriculture (La Scoscesa)	FL	1.0	**Plate and Monroe (2014)** **Schiere, Rob & Vlug (2004)**
9	**Workshop, part 1** Permaculture design applied to the agroenvironment	W	2.0	**Ferguson and Lovell (2014)**
10	**Workshop, part 2** Permaculture design applied to the agroenvironment	W	2.0	
11	**Water Cycle Workshop, part 1**	W	2.0	

12	**Water Cycle Workshop, part 2**	W	2.0	
13	**Water management as a driver for evaluating farm sustainability** Assessing water resources on a farm and how to evaluate its use	FL; FEX	3.0	**Wang W., Straffelini E., Pijl A., Tarolli P. (2022)**
14	**Comparing farm practices** How can we assess the value of different approaches?	D	2.0	
15	**The sustainability of a small artisanal fishery** Visit to fishing cooperative in Orbetello's lagoon	GL	2.0	Penca et al. (2021)
16	**Intensive Agriculture** The environmental impacts of intensive agriculture on biodiversity conservation in the Orbetello's lagoon in Maremma; visit to WWF	GL	2.0	
17	**Diversifying production** Innovation impact in farm production	GL	1.0	
18	**In-situ and ex-situ agro-biodiversity conservation in the Regional Park of Maremma.** Visit the regional bank of germplasm and meet with the Tuscany Region officer in charge. Introduction to breeds of Maremmana cow and horse and other work happening in the park.	GL	2.0	Barthel, S., C. L. Crumley, and U. Svedin. (2013)
19	**The multifunctional character of agriculture** Agri-environmental goods and services, joint production of private and public goods	L	2.0	**Renting et al. (2009).** Morgan et al. (2010). OECD (2001). Pinto-Correia et al. (2019)
20	**Ecosystem Services** Identifying and valuing ecosystem services at farm and agroecosystem levels	FEX	2.0	Soy-Massoni et al. (2018)
21	**The influence of conventional and alternative theories on shaping the EU CAP**	L	2.0	Simoncini et al. (2019). Pe'er et al. (2014). European Commission (2020). Hodge et al. (2015). European Commission (2011). IEEP (2002).
22	**The EU's Common Agricultural Policy today**	GL; D	2.0	Simoncini et al. (2019). Pe'er et al. (2014). European Commission (2020).
23	**EU/US** A comparison of EU's CAP and US agricultural policy - how are policies	L; D	2.0	**Blanford, D., Matthews A., (2019)** **Blanford(2019)**

	thought about, implemented, and their impact			**Smith (2019)** **Lichtenberg (2019)**
24	**Sicily Field Trip** A history of farming and fishing in mediterranean islands	GL	2.0	
25	**The impact of EU policies on small fisheries and island ecosystems**	GL; FL	2.0	Lloret et al. (2018).
26	**The future of agriculture** Agroecology or innovative technology	L; D	2.0	
27	**Exam review**	D	1.0	
28	**Course wrap up and student led discussion**	L	1.0	
	Total		**50**	
	UMN Instructional Hours*		**60**	

**UMN defines an instructional hour as a 50-minute block. SFS syllabi are written in full 60-minute hours for programming purposes. Therefore 50 full hours = 60 UMN instructional hours (for four credit courses) and 25 full hours = 30 UMN instructional hours (for two credit courses).*

Reading List

*Readings in **Bold** are required

1. **Ross D. Arnold, Jon P. Wade**, **(2015),** A Definition of Systems Thinking: A Systems Approach, Procedia Computer Science, Volume 44, 2015, Pages 669-678,

2. Barthel, S., C. L. Crumley, and U. Svedin. (2013). Biocultural refugia: combating the erosion of diversity in landscapes of food production. Ecology and Society 18(4): 71. http://dx.doi.org/10.5751/ES-06207180471

3. **Bawden, Richard, (1991)**, Systems thinking and practice in agriculture, Journal of dairy science, 1991

4. **Blanford, D., Matthews A., (2019). EU and US Agricultural Policies: Commonalities and Contrasts**, EuroChoices, Volume18, Issue1, April 2019. https://doi.org/10.1111/1746-692X.12217

5. **Blandford D., (2019)**, Agricultural Policy Expenditures in the European Union and the United States, EuroChoices, Volume18, Issue1, April 2019

6. **Cuadros-Casanova, I., Cristiano, A., Biancolini, D., Cimatti, M., Sessa, A. A., Mendez Angarita, V. Y., Dragonetti, C., Pacifici, M., Rondinini, C., & Di Marco, M. (2023).** Opportunities and challenges for Common Agricultural Policy reform to support the European Green Deal. Conservation Biology, 37, e14052. https://doi.org/10.1111/cobi.14052

7. Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., … Zlatanova, D. (2015). The IPBES Conceptual Framework — connecting nature and people. Current Opinion in Environmental Sustainability, 14, 1–16. http://doi.org/10.1016/j.cosust.2014.11.002

8. Di Bernardo, A. (2022), Climate Change and Food Insecurity: Unleashing the Promise and Potential of Agroecology in the Mediterranean, https://www.iai.it/en/pubblicazioni/c05/climate-change-and-food-insecurity

9. European Commission (2020). A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 20.5.2020, COM (2020). 381

10. European Commission (2011). Investing in Natura 2000: for nature and people

11. **Ferguson Sass Rafter, Lovell Sarah Taylor (2014)**, Permaculture for agroecology: design, movement, practice, and worldview. A review, Agronomy for sustainable development, vol 34, issue 2, pag 251-274

12. **Fischer Joern, Hartel Tibor, & Kuemmerle Tobias, (2012).** Conservation policy in traditional farming landscapes, Conservation Letters 5 (2012) 167–175, doi: 10.1111/j.1755-263X.2012.00227.x

13. **Hodge et al., (2015).** The alignment of agricultural and nature conservation policies in the European Union, Conservation Biology, Volume 29, No. 4, 996–1005, DOI: 10.1111/cobi.12531

14. IEEP (2002). Background Report for European Conference on 'Promoting the Socio-Economic Benefits of Natura 2000', Brussels, 28–29 November 2002, Report by Patrick ten Brink, Claire Monkhouse, and Saskia Richartz, Institute for European Environmental Policy (IEEP).

15. **Jepsen, M. R. et al. (2015).** Transitions in European land-management regimes between 1800 and 2010. Land Use Policy.

16. **Jacobs, S., et al., (2016).** A new valuation school: Integrating diverse values of nature in resource and land use decisions, Ecosystem Services 22 (2016) 213–220

17. **Kumar P., Brondizio E., Gatzweiler F., Gowdy J., de Groot D., Pascual U., Reyers B. and Sukhdev P., (2013).** The economics of ecosystem services: from local analysis to national policies, Current Opinion in Environmental Sustainability (2013), Volume 5, Issue 1, March 2013, Pages 78-86 http://dx.doi.org/10.1016/j.cosust.2013.02.001

18. **Lichtenberg (2019**), Conservation and the Environment in US Farm Legislation, EuroChoices, Volume18, Issue1, April 2019

19. **Lloret et al. (2018).** Small-scale coastal fisheries in European Seas are not what they were: Ecological, social and economic changes. Marine Policy, Volume 98, December 2018, Pages 176-186

20. **Meyfroidt et al., (2022).** Ten facts about land systems for sustainability, PNAS 2022 Vol. 119 No. 7 e2109217118, https://doi.org/10.1073/pnas.2109217118

21. Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Synthesis. Island Press, Washington DC. pp. 1-24.

22. Morgan, S. L., Marsden, T., Miele, M., & Morley, A. (2010). Agricultural multifunctionality and farmers' entrepreneurial skills: A study of Tuscan and Welsh farmers. Journal of Rural Studies, 26, 2, 116-129.

23. OECD (2001). Multifunctionality – towards an analytical framework, OECD, Paris, pp. 9-26.

24. Oglethorpe, S., (2014), The End of Sharecropping in Central Italy after 1945: The Role of Mechanisation in the Changing Relationship between Peasant Families and Land, Rural History, Volume 25, Issue 2, https://doi.org/10.1017/S0956793314000089

25. **Parra, Clara Garcia, (2024**), Agroecology and systems thinking, The Canopy Lab, https://share.google/KkMvzXO5IPc96TAk8

26. Pe'er, G., Dicks L.V., Visconti, P., Arlettaz, R., Báldi, A., Benton, T. G., … Scott, A. V. (2014). EU agricultural reform fails on biodiversity. Science, 344(6188), 22–46. http://doi.org/10.1126/science.1252254

27. **Penca, J., Said, A., Cavallé, M., Pita, C., Libralato, S., (2021).** Sustainable small-scale fisheries markets in the Mediterranean: weaknesses and opportunities. Maritime Studies, Springer.

28. Pinto-Correia, T., Muñoz-Rojas, J., Hvarregaard Thorsøe, M. and Bjørnshave Noe, E., (2019). Governance Discourses Reflecting Tensions in a Multifunctional Land Use System in Decay; Tradition Versus Modernity in the Portuguese Montado, Sustainability 2019, 11, 3363

29. **Plate R. and Monroe M. (2014),** A Structure for Assessing Systems Thinking, THe creative learning Exchange, VOLUME 23 • NUMBER 1 • WINTER 2014

30. Pretty, J., (2018)**.** Intensification for redesigned and sustainable agricultural systems, Science 362, eaav0294

31. Primmer, E., et al., Governance of Ecosystem Services: A framework for empirical analysis. Ecosystem Services (2015). http://dx.doi.org/10.1016/j.ecoser.2015.05.002i

32. **Purvis Ben, Miao Yong, Robinson Darren, (2019).** Three pillars of sustainability: in search of conceptual origins, Sustainability Science (2019) 14:681–695, https://doi.org/10.1007/s11625-018-0627-5

33. **Renting, H., Rossing, W.A.H., Groot, J.C.J., Van der Ploeg, J.D., Laurent, C., Perraud, D., Stobbelaar, D.J., Van Ittersum, M.K. (2009**). Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. Journal of Environmental Management, Elsevier.

34. **Ross D. Arnold, Jon P. Wade (2015).** A Definition of Systems Thinking: A Systems Approach. Procedia Computer Science, Volume 44, 2015, Pages 669-678.

35. **Schiere, J. & G., Rob & Vlug, A. & K.,. (2004)**. System thinking in agriculture: An overview. Emerging challenges for farming systems: lessons from Australian and Dutch agriculture.

36. **Simoncini, R. (2015).** Introducing territorial and historical contexts and critical thresholds in the analysis of conservation of agro-biodiversity by alternative food networks, in Tuscany, Italy. Land Use Policy, 42, 355366.

37. Simoncini, R., Ring, I., Sandstrom, C., Albert, C., Kasymov, U., Arlettazf, R. (2019). Constraints and opportunities for mainstreaming biodiversity and ecosystem services in the EU's Common Agricultural Policy: Insights from the IPBES assessment for Europe and Central Asia. Land Use Policy 88 (2019) 104099, Elsevier.

38. **Smith, (2019)**, The future if US farm policy, EuroChoices, Volume18, Issue1, April 2019

39. **Soy-Massoni E., Monllor N., Nuss S., Markuszewska I., and Tanskanen M., (2018).** Landscape Eaters: supporting rural development and ecosystem services delivery by eating, Agriculture & Food, Volume 6.

40. The Economics of Ecosystems and Biodiversity (TEEB) for Agriculture & Food (February 2014). Concept Note, 27 February 2014.

41. Willet, W. et al. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, The Lancet Commissions Report, Published Online January 16, 2019 http://dx.doi.org/10.1016/S0140-6736(18)31788-4

42. **Wang W., Straffelini E., Pijl A., Tarolli P. (2022)**, Sustainable water resource management in steep-slope agriculture, Geography and Sustainability, Volume 3, Issue 3, 2022, Pages 214-219,

43. **Whitefield, P. (1996), Permaculture in a nutshell, Permanent publications, 1996**