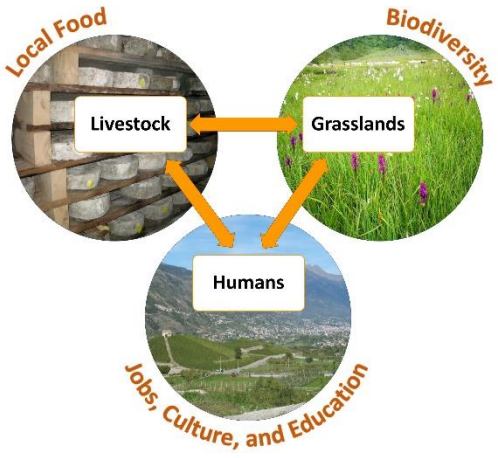
University of Arizona
School of Natural Resources and the Environment

A Special Topics, Study Abroad Course
RNR 395A - Sustaining Local Food, Biodiversity, and Livestock Grazing in the Alps

3 units, Summer Session 1
June 17 - June 30, 2019 (2 weeks)

Description of Course

The Italian and Swiss Alps provide a living, and easily accessible example of how a food and livelihood system can also support increased biodiversity in grasslands (see figure). Through field trips to farms, pastures, and mountain lodges (*rifugi*) we will assess how the decline of human populations in the Alps leads to the abandonment of grazing, followed by declines in the biodiversity of grassland plants, insects and birds, declines in the provision of local cheeses, and declines in the associated culture of alpine pastoralism. We will also explore how new initiatives are supporting the continued grazing of the grasslands, continued support of high biodiversity in the grasslands, continued provision of local cheeses and other foods, and continued opportunity for livelihood in the alpine region. In the end, we will explore how investments from local organizations and the European Union are being used to sustain this livelihood system in order to maintain biodiversity, local food, and the mountain culture for future generations.



Course Prerequisites

Completion of Freshmen year of college.

Required or Special Materials

Because this course has a significant amount of international travel required, students must obtain the necessary travel documents for travel and entry to Italy and Switzerland. The UA Study Abroad Office assists with these requirements: https://global.arizona.edu/study-abroad
Digital camera and laptop computer or tablet are required to complete assignments.
A 10x hand lens is strongly recommended.

Instructor and Contact Information

Course instruction will be completed by University of Arizona instructors with guest speakers and discussions with local practitioners facilitated by UA faculty:

Instructor	Assistant Instructor
Dr. Mitchel McClaran, Professor	**Dr. Alessandra Gorlier, Research Specialist Senior**
School of Natural Resources and the Environment, University of Arizona, Tucson, AZ Email: mcclaran@email.arizona.edu 520-390-9801 (c), 520-621-1673 (o) http://snre.arizona.edu/people/mitch-mcclaran Office Location: 112 Biological Sciences East	School of Natural Resources and the Environment, University of Arizona, Tucson, AZ Email: agorlier@email.arizona.edu 248-686-6623 (c) Office Location: 310 Biological Sciences East

Collaborating University, Research Centers, and Parks:

- University of Turin (Italy) – Dept. of Agricultural, Forest, and Food Sciences
- Alpi Cozie Natural Park (Italy)
- Agroscope Nyon (Switzerland) – Département fédéral de l'économie, de la formation et de la recherche, Domaine stratégique de recherche Systèmes de production animaux et santé animale
- Agridea Cadenazzo (Switzerland) – Antenna Svizzera Italiana, Développement rural

Course Format and Teaching Methods

The course begins with an on-line video to orient students to the travel requirement for reaching the Alps, guide to what to bring, and description of the places they will visit. The on-line orientation allows students to avoid returning to Tucson before traveling to the Alps.

Once in the Alps, the format is a combination of short presentations by the instructor and local experts and hands-on activities for students to understand and analyze concepts of grassland biodiversity, livestock grazing practices, cheese-making, and mechanisms that sustain their co-existence. We will visit 6 different areas, 4 in Italy and 2 in Switzerland to compare different approaches to sustain grazing, biodiversity, and local food; and analyze how the environment in each area dictates the need for a unique approach.

The hands-on assessments by students will be supported by structured worksheets that help focus the activities and provide a systematic record for each site. Those records will be vital for the students to complete their oral and written assignments that apply these findings to represent the relationship among biodiversity, grazing, local food and sustainability.

Course Objectives and Expected Learning Outcomes

Upon completion of this course ALL students in RNR xxx will be able to:

1. Understand the cultural history of human habitation and use in the Alps, including the recent out-migration from the Alps to cities
    a. Learn through readings and lectures
    b. Experience by visiting alpine villages and associated rural areas
2. Apply measures of grassland biodiversity to analyze how biodiversity changes with removal of grazing following human abandonment
    a. Understand through readings and lectures
    b. Apply and analyze through field-based activities of plant identification, and classification of plants into groups associated with low and high biodiversity
3. Analyze the process of managing livestock grazing in these grasslands to ensure the biodiversity goals and to sustain the livestock enterprise
    a. Understand through readings and lectures
    b. Apply and analyze through field-based visits with pastoralists to learn when, where, and how long they allow animals to graze areas, why they select specific breeds of animals, and what role local and European Union incentive programs influence their decisions and the sustainability of their enterprise
4. Analyze the process of cheese-making and cheese-marketing from milk produced by cows, goats, and sheep grazing in these grasslands
    a. Understand through readings and lectures
    b. Apply and analyze through field-based visits with cheese-makers to learn what distinguishes cheeses from different areas, why soft or hard cheeses are preferred, how practices have changed in recent decades, and how they market their cheeses
5. Demonstrate the ability to synthesize this information to apply concepts about sustainability of livelihood systems, relationships between land use and biodiversity,

and payment for ecosystems services that increase biodiversity, human culture and systems of human livelihood in rural areas

a. Participate in "end-of–the day" discussions to apply concepts, analyze patterns, and evaluate success of attaining management goals
b. Practice the application, analysis and evaluation processes through oral presentations at the end of week 1, and again at the end of week 2
c. Perform these processes by completing a written synthesis as a final course project

Assessment of Student Learning

Students are required to view and understand the pre-course orientation video to prepare for travel to the Italian and Swiss Alps; as well as all course activities in the Alps.

They will be expected to complete the relevant worksheets for each activity for each day, and maintain access to those worksheets in order to reference them for synthesis assignments. They will be expected to participate in the "end-of-the-day" synthesis discussions that will reinforce the relevance of the activities and address any needed modification of activities.

Students will be expected to make two 5-10 minute presentations during the course to show their ability to synthesize the information. One presentation will be at the end of week 1, and the other at the end of week 2. These presentations will help build class-wide agreement of what constitutes a synthesis of information. Also, these oral presentations will assist students in preparing their final written report (due 1 week after the completion of the course) which is expected to show their understanding of how livestock grazing, grassland biodiversity, and human livelihood can be sustained in the Alps.

Program Structure and Resources:

Preparation: Pre-course orientation video

Field Program:

17 June: Travel to Valle Chisone; accommodations at Rifugio Selleries, in Alpi Cozie Natural Park, Italy

18-19 June: Field orientation for landscape reading, plant, insect and bird identification, grazing management practices to increase biodiversity, dairy livestock orientation, cheese-making orientation and discovery, and payments for ecosystem services

20 June: Travel to Valle Troncea; accommodations at Rifugio Troncea, in Alpi Cozie Natural Park

21 June: Field practicals for landscape reading, plant, insect and bird identification, grazing management practices to increase biodiversity, dairy livestock practicals, cheese-making orientation and discovery, and payments for ecosystem services

22 June: Travel to Valle di Susa; accommodations at Certosa of Montebenedetto, in Alpi Cozie Natural Park; field practicals for ice-cream making; visit the Certosa and free time for exploring the surroundings

23 June: Travel to the Xerothermic Oases of Valle di Susa, in Alpi Cozie Natural Park; field practicals for landscape reading, plant, insect and bird identification in rare Mediterranean grasslands, grazing management practices to increase biodiversity, and payments for ecosystem services; accommodations at Certosa of Montebenedetto

24 June: Travel and accommodations to Valle d'Aosta for free day exploring cultural and natural wonders

25 June: Travel and accommodations to Nyon, Switzerland; introduction to the Agroscope Research Center

26 June: Field practicals for landscape reading, plant, insect and bird identification in grasslands, grazing management practices to increase biodiversity, dairy livestock

orientation, cheese-making orientation and discovery, and payments for ecosystem services

27 June: Travel and accommodations to Cadenazzo, Switzerland; introduction to the Agridea Research Center

28 June: Field practicals for landscape reading, plant, insect and bird identification in grasslands, grazing management practices to increase biodiversity, dairy livestock practical, cheese-making orientation and discovery, and payments for ecosystem services

29 June: Travel to Milano, Italy, for free day; accommodations near Malpensa Airport

30 June: morning summarize the course; afternoon deliver students to the Malpensa Airport

Mid-Course Assignments:

Participation in field activities and completion of the relevant worksheets that will be submitted digitally while in the field, and that explains the need to bring a digital camera, laptop computer, or capable tablet. A paper printer will be provided during the course as well.

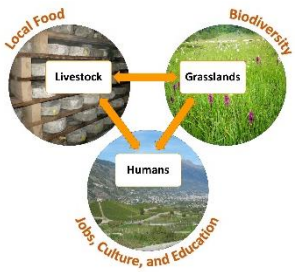
Participation in the "end-of-the-day" synthesis discussions.

Mid-class Oral Presentation: Small groups of 3-4 students will be expected to make a short presentation (5-10 minutes) that reflect on discussions and fieldwork activities carried out in Italy and help build class-wide agreement of what constitutes a synthesis of information. Students will be also asked individually to identify which topic among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture" that they will focus on for their final written assignment and briefly analyze that topic during the presentation.

Guidelines for Mid-Course Oral Presentations:

Small groups of students will be asked to:

a. Look at the picture on the right and point out an example and location for each of the arrows with reference to the measures and analysis performed at the places they visited during their first week in Italy.
b. Describe their biggest surprise in these relationships among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture".
c. Describe their biggest surprise (positive or negative) from the first week in Italy.



Students will be then asked to select a topic individually among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture" for their final written assignment, and analyze and evaluate:

d. What they understood and analyzed on this topic during the first week in Italy, also providing a comparison with relevant literature.
e. Using a synthesis of the information, address what is the most critical improvement needed to sustain that component of the system in Italy over the next 20 years.

Concluding Session Assignments:

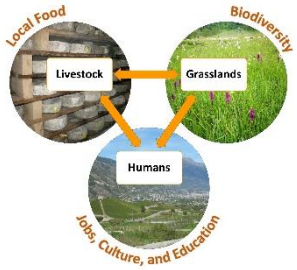
Final Oral Presentation: Small groups of 3-4 students will be expected to make a short presentation (5-10 minutes) that reflects on discussions and fieldwork activities and will help build class-wide agreement of what constitutes a synthesis of information. Students will be expected to discuss individually the topic selected among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture". More specifically, students will be asked to work on the same

points (from "a" to "e") discussed on their middle assignment (see Section 3) but with references to the experiences and the locations visited in Switzerland during the second week.

Guidelines for Final Oral Presentation

Small groups of 3-4 students will be expected to make a short presentation (5-10 minutes) that reflect on discussions and fieldwork activities carried out in Switzerland and help build class-wide agreement of what constitutes a synthesis of information. Students will be also asked to discuss the topic selected for the Mid-class assignment among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture", and briefly analyze that topic during the presentation. More specifically, small groups of students will be asked to:

a. Look at the picture on the right and point out an example and location for each of the arrows with reference to the measures and analysis performed at the places they visited during their week in Switzerland.
b. Describe their biggest surprise in these relationships among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture".
c. Describe their biggest surprise (positive or negative) from the second week in Switzerland.



Students will be individually asked to discuss the topic they selected for their final assignment, and analyze and evaluate:

d. What they understood and analyzed on this topic during the second week in Switzerland, also providing a comparison with relevant literature.
e. Using a synthesis of the information, address what is the most critical improvement needed to sustain that component of system in Switzerland over the next 20 years.

Guidelines for Final Written Assignment

Students will be expected to write a final report that reflect on discussions and fieldwork activities and constitute a synthesis of the information collected during the course. More particularly, they will be expected to focus on the topic selected among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture", analyze and evaluate what they experienced, and answer in their written assignment to the following points:

a. Look at the picture on the right and point out an example and location for each of the arrows with reference to the measures and analysis performed in the places they visited during our time in Italy and Switzerland.
b. Describe their biggest surprise in these relationships among "Grassland Biodiversity", "Livestock Grazing", and "Human Culture".

c. Describe their biggest surprise (positive or negative) from their visit to Italy and Switzerland.
d. Compare what they experienced with literature specific to the topic they selected for their final assignment.
e. Using a synthesis of the information, address what is the most critical improvement needed to sustain that component of system in Italy and Switzerland over the next 20 years.

Final Assignment Submission

Students will submit the final written assignment and the final post-course exam by 10 July 2019 through email and D2L dropbox.

Students will complete an 8-page paper that reviews significant, formative experiences in the course and permits the student to show their understanding of how livestock grazing, grassland biodiversity, and human livelihood can be sustained in the Alps. The format of the paper follows that of the Oral Presentations at the end of Weeks 1 and 2. More details are provided in Guidelines to Oral Presentations and Final Written Assignment.

Final Written Assignment and Final Reflective Essay

The final project and the post-test are due by 10 July 2019.

Final Exam Regulations can be found at https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information, and Final Exam Schedule, http://www.registrar.arizona.edu/schedules/finals.htm

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

Course Communications

Prior to departure for Europe, communication will be through email, the course D2L site, and the students will be required to view the orientation video.

Graded Assignments and Examinations:

Initial Pre-course test of knowledge delivered in the course	25 points
Participation in field activities and "end-of-the-day" synthesis discussions	
Participation in field activities and completion of the relevant worksheets that will be submitted digitally while in the field (15 worksheets x 20 points each)	300 points
Participation in the "end-of-the-day" synthesis discussions (10 days x 30 points each)	300 points
Mid-Class Assignments	
Mid-class Oral Presentation: Small group of students will be expected to make a short presentation that reflect on discussions and fieldwork activities and will help build class-wide agreement of what constitutes a synthesis of information	100 points

Final Assignments	
Final Oral Presentation: Small students groups will be expected to make short presentations that reflect on course activities and compare information between the sites visited	125 points
Final Individual Written Essay: Students will complete a 8-page paper that reviews significant, formative experiences in the course and permits the student to show their understanding of how livestock grazing, grassland biodiversity, and human livelihood can be sustained in the Alps	125 points
Final Post-course test of knowledge delivered in the course (same as pre-course test)	25 points
Total	**1000 points**

Grading Scale and Policies

A = (final percentage $\geq$ 90 of 1000 point total) Outstanding achievement that demonstrates superior mastery of the material and exemplary performance on both tests and written exercises. The distinction between A and B will depend on the student's ability to understand and articulate explicit and implicit concepts.
B =(total 80-89%) Achievement that significantly exceeds level necessary to meet course requirements.
C =(total 70-79%) Achievement that meets all course requirements at an average level.
D =(total 60-69%) Achievement worthy of credit, but which does not fully meet the course requirements.
E =(total<60%) Failure to complete the course requirements at a level worthy of credit.

Requests for Incomplete (I) or Withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.
Policy on Late Assignments Because of the nature of the course and the semester, no late assignments are permitted.
Dispute of Grade Policy Questions concerning grades should be submitted within 20 days of receiving the disputed grade.

Honors Credit

Students wishing to contract this course for Honors Credit should email me to set up an appointment to discuss the terms of the contact. Information on Honors Contracts can be found at http://www.honors.arizona.edu/faculty-and-advisors/contracts.

Scheduled Topics/Activities

Class Schedule

Anticipated 2019 Itinerary for Sustaining Local Food, Biodiversity and Livestock Grazing in the Alps
The start date allows students in NSC 455 Mediterranean Diet and Health (Verona, IT) to stay in country for this new course.

Day	Courses and Teaching Methods
June 17 **Monday** **4 h-Lecture**	**Travel to Valle Chisone (TO, ITALY)** • Accommodation at Rifugio Selleries – Alpe Selleries, in Alpi Cozie Natural Park **Overview of the course** • Introduction of the course and participating students • Syllabus • Safety in alpine environment and nearest facilities • Common Italian laws and rules • Code of conduct at the *rifugi* • Initial Pre-test of Knowledge **Introduction to the Alpi Cozie Natural Park and the alpine environment** **Required** Orientation video
June 18 **Tuesday** **2h-Lecture** **6h-Field/Lab**	**Field orientation, practicals, and hiking at the Alpe Selleries** **Changes with depopulation in the mountainous areas of the Italian Alps** • Understand the last century trends of: o Human Density o Livestock o Grasslands • Understand the concepts of land use intensification and abandonment and land ownership fragmentation in the Italian Alps • Practicals for landscape reading and biodiversity: apply concepts and analyze the effects of the above mentioned changes **(Worksheet #1)** o Landscape reading to assess past and current land use o Plant, insect, and bird identification to assess biodiversity levels in different environments (grassland, shrubland, forest) o Identification of plant species related to abandoned and grazed areas as indicators of biodiversity levels **Return to Sustainability** • Understand the current trends of: o Human density o Livestock o Grasslands • Understand and apply the concepts of Payments for Ecosystem services and products under the European Union: o The role of the Common Agricultural Policy (CAP) to support farmers' income and mountainous area development **End of the Day Discussion #1** **Required Reading** MacDONALD et al., 2000; TASSER & TAPPEINER, 2002.

June 19
Wednesday
 	
2h-Lecture
6h-Field/Lab
	Field orientation, practicals, and hiking at the Alpe Selleries
	
	Management Systems
	• Understand the current trends involving:
	  o Humans
	  o Livestock
	  o Grasslands
	• How are Humans, Livestock, and Grasslands related each other?
	  o Understand the effect of the seasons on animal feeding and management
	  ✓ Grazing systems and transhumances in the Alps
	  o Apply and analyze effects of biotic and abiotic factors on grassland composition:
	  ✓ Plant species identification and analysis of grassland types
	  ✓ Principles of plant succession under different types of management
	  o Apply and analyze effects of environmental conditions and grassland type on management decisions and farm productions
	  ✓ Animal species and breeds in the mountainous areas
	• Practicals for grazing management, monitoring, and planning in the Italian Alps **(Worksheet #2):**
	  o Introduction to Alpe Selleries farm manager: day-to-day life of a farmer in the Italian Alps
	  o Grazing management planning:
	  ✓ Analyze the effects of grazing management on Alpe Selleries grassland vegetation
	  ✓ Apply plant identification and grassland surveys for management purposes
	  ✓ Understand pastoral planning: goals, steps, and methods applied in the Italian Alps
	  ✓ Apply the Pastoral Value: an index to analyze grassland carrying capacity and stocking rates
	  ✓ Understand principles of livestock management to analyze selection of grazing system, animal species, breeds, equipment, practices, and tools
	  ✓ Analyze differences between dairy livestock and cow-calf management systems
	• Understand and apply livestock grazing policies and rules in the Italian Alps, including Protected Areas Conservation Measures
	  o Analyze how they affect management systems
	
	Outputs
	• Understand concept of Ecosystem Services and how it is applied to the grazing systems in mountainous areas
	• Practicals for cheese-making orientation at the Alpe Selleries **(Worksheet #3)**
	  o Understand the concepts of “biodiversity” of cheeses (Toma d’alpeggio, Plaisentif, Lait brusc, butter, yogurt, ricotta, and fresh milk) and apply that concept to analyze the role of livestock grazing practices in supporting that biodiversity
	  o Understand the concept of grass-fed dairy products and their nutritional value, apply that information to analyze how chemical composition, texture, and flavor of cheeses change depending on animal feeding and related factors
	• Understand how to measure and judge the sustainability of:
	  o Local food
	  o Biodiversity
	  o Job, Culture, and Education

	End of the Day Discussion #2 **Required Reading** BUCHIN et al., 1999; ROOK & TALLOWIN, 2003.
June 20 **Thursday** **2h-Lecture** **4h-Field/Lab**	**Travel to Valle Troncea (TO, ITALY)** • Accommodation at Rifugio Troncea – Alpe Troncea, in Alpi Cozie Natural Park **Meeting with University of Turin students and professors and introduction to participants** **Introduction to Valle Troncea** **End of the Day Discussion #3**
June 21 **Friday** **2h-Lecture** **4h-Field/Lab**	**Field practicals and hiking at the Alpe Troncea** **Changes with depopulation** • Practicals for landscape reading and biodiversity at the Alpe Troncea; apply the concepts of land abandonment and land ownership fragmentation to analyze their effects on biodiversity (**Worksheet #4**) o Landscape reading to assess past and current land use o Plant, insect, and bird identification to assess biodiversity levels in different environments (grassland, shrubland, forest) o Identification of plant species related to abandoned and grazed areas as indicators of biodiversity levels **Management Systems** • Practicals for grazing management reading, monitoring, and planning at the Alpe Troncea (activities in common with Italian students) (**Worksheet #5**): o Introduction to Alpe Troncea farm manager o Grazing management and planning: ✓ Analyze the effects of grazing on Alpe Troncea grassland vegetation ✓ Apply plant identification and examples of grassland surveys for management purposes ✓ Understand pastoral planning - goals, steps and methods applied to grazing management at the Alpe Troncea: The rotational grazing system vs continuous system ✓ Understand principles of livestock management to analyze selection of animal species, breeds, equipment, practices, and tools at Alpe Troncea ✓ Analyze differences between dairy livestock and cow-calf management systems • Key-studies at the Alpe Troncea to understand the role of grazing: o Special management practices to restore grasslands and increase biodiversity o The conservation of Black grouse, Rock ptarmigan, Rock partridge in Valle Troncea o Wild animal monitoring by Alpi Cozie Natural Park o Examples of payments for ecosystem services: the role of drinking troughs and enclosures for grassland conservation and restoration **Outputs** • Practicals for cheese-making orientation and discovery at the Alpe Troncea **(Worksheet #6)** o Understand the concepts of “biodiversity” of cheeses at the Alpe Troncea and apply that concept to analyze the role of livestock grazing practices in

	supporting that biodiversity ○ Understand the concept of grass-fed dairy products and their nutritional value: apply that information to analyze how chemical composition, texture, and flavor of cheeses change depending on animal feeding and related factors **End of the Day Discussion #4** **Required Reading** PEROTTI et al., 2018; PROBO et. al., 2013.
June 22 **Saturday** **2h-Lecture** **4h-Field/Lab**	**Travel to Valle di Susa (TO, ITALY)** • Accommodations at the Certosa of Montebenedetto, in Alpi Cozie Natural Park **Back in the XIII century: introduction and visit to the ancient monastery "Certosa of Montebenedetto"** **Introduction to Certosa farm manager (Worksheet #7)** • Grass-fed ice cream production and testing ○ Practicals for ice cream-making ○ Understand the concept of grass-fed dairy products and their nutritional value: apply that information to analyze how chemical composition, texture, and flavor of cheeses change depending on animal feeding and related factors **Discovering the surrounding of the Certosa** **End of the Day Discussion #5**
June 23 **Sunday** **2h-Lecture** **6h-Field/Lab**	**Travel to the Xerothermic Oases of Valle di Susa (TO, ITALY), in the Alpi Cozie Natural Park: Field practicals and hiking** **Introduction to the Xerothermic Oases and to the LIFE Xero-grazing European Project** • Understand the importance of abiotic factors in the Xerothermic Oases: apply that understanding to analyze the effects of climate, exposure, slope, and bedrock type on vegetation • Introduction to the rare and protected Mediterranean grasslands rich in orchids • Understand the origin of the ancient hand-made terraces built for cereal and vineyard cultivation, and hay-making • Apply the policies of the European Union to protect rare and threatened habitats for plant and animal species: examples of funds granted for biodiversity conservation and their effects on grazing systems **Changes with depopulation** • Practicals for landscape reading and biodiversity at the Xerothermic Oases : apply the concepts of land abandonment and land ownership fragmentation to analyze their effects on biodiversity **(Worksheet #8)** ○ Landscape reading to assess past and current land use ○ Plant, insect, and bird identification to assess biodiversity levels in different environments (grassland, shrubland, forest) ○ Identification of plant species related to abandoned and grazed areas as indicators of biodiversity levels ○ Apply the permanent grassland monitoring network of the LIFE Xero-grazing project to analyze vegetation surveys from experimental areas

	Management Systems
	• Introduction to the Oases sheep farm manager
	• Practicals for grazing management, monitoring, and planning at the Xerothermic Oases **(Worksheet #9)**
	  o Grazing management reading and planning
	  o Analyze the effects of grazing on Oasis grassland vegetation
	  o Apply plant identification and examples of grassland surveys for management purposes
	  o Understand pastoral planning: goals, steps and methods applied to grazing management at the Oases
	  o Understand principles of livestock management to analyze selection of animal species, breeds, equipment, practices, and tools applied at Oases
	
	Visit the Orrido di Foresto and travel back to the Certosa di Montebenedetto
	
	End of the Day Discussion #6
	
	Required reading
	PITTARELLO et al., 2017.

June 24 **Monday** **3h-Lecture** **3h-Field/Lab**	**Travel to Valle d'Aosta (AO, ITALY) for free day exploring cultural and natural wonders** **Accommodation and visit to the Institut Agricole Regional** **Mid-Class Oral Presentations**
25 June **Tuesday** **2h-Lecture** **3h-Field/Lab**	**Travel and accommodation to Nyon (SWITZERLAND)** **Introduction to the Suisse Romande and the Agroscope Research Center** **End of the Day Discussion #7**

26 June
Wednesday
 	
2h-Lecture
4h-Field/Lab
	Field orientation, practicals, and hiking at a Suisse Romande *alpage* to be described by Agroscope
	
	Changes with depopulation in the mountainous areas of the Swiss Alps
	• Understand the last century trends of:
	  o Human Density
	  o Livestock
	  o Grasslands
	• Understand the concepts of land use intensification and abandonment and land ownership management in Switzerland
	• Practicals for landscape reading and biodiversity: apply concepts and analyze the effects of the above mentioned changes (**Worksheet #10**)
	  o Landscape reading to assess past and current land use
	  o Plant, insect, and bird identification to assess biodiversity levels in different environments (grassland, shrubland, forest)
	  o Identification of plant species related to abandoned and grazed areas as indicators of biodiversity levels
	
	Return to Sustainability
	• Understand and apply the concept of Payments for Ecosystem services and products in Suisse Romande - Switzerland:
	  o Understand supports to farmers' income and mountainous area development
	  o Analyze differences between Switzerland and Italy

	Management Systems • Practicals for grazing management reading, monitoring, and planning in Switzerland (**Worksheet #11**): o Introduction to a Suisse Romande farm manager: day-to-day life of a farmer in Switzerland o Grazing management planning: ✓ Analyze the effects of grazing management on a Suisse Romande vegetation ✓ Understand pastoral planning: goals, steps, and methods applied by the Agroscope Research Center ✓ Apply plant identification and grassland surveys to evaluate grazing management practices ✓ Understand principles of livestock management to analyze selection of grazing system, animal species, breeds, equipment, practices, and tools ✓ Analyze differences between dairy livestock and cow-calf management systems • Understand and apply livestock grazing policies and rules in Switzerland, including Protected Areas Conservation Measures o Analyze how they affect management systems **Outputs** • Practicals for cheese-making orientation and discovery at a Suisse Romande (**Worksheet #12**) o Understand the concepts of "biodiversity" of cheeses in Suisse Romande and apply that concept to analyze the role of livestock grazing practices in supporting that biodiversity o Understand the concept of grass-fed dairy products and their nutritional value: apply that information to analyze how chemical composition, texture, and flavor of cheeses change depending on animal feeding and related factors **End of the Day Discussion #8** **Required Reading** GELLRICH et al., 2007; PETER et al., 2008.
27 June Thursday **1h-Lecture** **2h-Field/Lab**	**Travel and accommodation to Cadenazzo (SWITZERLAND)** **Introduction to the Ticino and the Agridea Research Center** **Free time to discover the surroundings of Cadenazzo**
28 June Friday **2h-Lecture** **4h-Field/Lab**	**Field orientation, practicals, and hiking at a Ticino *alpage* to be described by Agridea** **Changes with depopulation** • Practicals for landscape reading and biodiversity reading at a Ticino (**Worksheet #13**) o Landscape reading to assess past and current land use o Plant, insect, and bird identification to assess biodiversity levels in different environments (grassland, shrubland, forest) o Identification of plant species related to abandoned and grazed areas as indicators of biodiversity levels o Analyze differences between Suisse Romande and Ticino landscape and biodiversity

	Return to Sustainability
	• Understand and apply the concept of Payments for Ecosystem services and products in Ticino - Switzerland:
	  o Understand supports to farmers' income and mountainous area development
	  o Analyze differences between Suisse Romande and Ticino
	
	Management Systems
	• Practicals for grazing management reading, monitoring, and planning at a Ticino alpage (**Worksheet #14**):
	  o Introduction to a Ticino farm manager: day-to-day life of a farmer in Switzerland
	  o Grazing management and planning:
	  ✓ Analyze the effects of grazing management on a Ticino *alpage* vegetation
	  ✓ Understand pastoral planning: goals, steps, and methods applied by the Agridea Research Center
	  ✓ Apply plant identification and grassland surveys to evaluate grazing management
	  ✓ Understand principles of livestock management to analyze grazing system, animal species, breeds, equipment, practices, and tools
	  ✓ Analyze differences between dairy livestock and cow-calf management systems
	Outputs
	• Practicals for cheese-making orientation and discovery at a Ticino **(Worksheet #15)**
	  o Understand the concepts of "biodiversity" of cheeses in Ticino and apply that concept to analyze the role of livestock grazing practices in supporting that biodiverity
	  o Understand the concept of grass-fed dairy products and their nutritional value: apply that information to analyze how chemical composition, texture, and flavor of cheeses change depending on animal feeding and related factors
	
	End of the Day Discussion #9
	
	Required Reading
	COLLOMB et al., 2002; MAURER et al., 2006.

29 June Saturday	**Travel to Milano (MI, ITALY) for free day and accommodations near Malpensa Airport**
30 June Sunday **4h-Lecture**	**Morning session to summarize the course** • Final group presentations • Overview and comparison of subjects and policies between Italy and Switzerland • Comparison with US context and issues **End of the Day Discussion #10** **Afternoon deliver students to the Malpensa Airport for return to US**
30 June-1 July Sunday-Monday	**Return to Tucson**
10 July Wednesday	**Complete Final Written Assignment and Reflective Essay and Final Post-test of knowledge**

Required Texts or Readings

1. BUCHIN S., MARTIN B., DUPONT D., BORNARD A. & ACHILLEOS C., 1999. Influence of the composition of Alpine highland pasture on the chemical, rheological and sensory properties of cheese. Journal of Dairy Research 66, 579-588.
2. COLLOMB M., BUTIKOFER U., SIEBER R., JEANGROS B. & BOSSET J.O., 2002. Correlation between fatty acids in cows' milk fat produced in the Lowlands, Mountains and Highlands of Switzerland and botanical composition of the fodder. International Dairy Journal 12, 661-666.
3. GELLRICH M., BAUR P., KOCH B. & ZIMMERMANN N.E., 2007. Agricultural land abandonment and natural forest re-growth in the Swiss mountains: A spatially explicit economic analysis. Agriculture, Ecosystems and Environment 118, 93-108.
4. MACDONALD, D., CRABTREE, J.R., WIESINGER, G., DAX, T., STAMOU, N., FLEURY, P., LAZPITA J.G. & GIBON A., 2000. Agricultural abandonment in mountain areas of Europe: environmental consequences and policy response. Journal of Environmental Management 59, 47-69.
5. MAURER K., WEYAND A., FISCHER M. & STÖCKLIN J., 2006. Old cultural traditions, in addition to land use and topography, are shaping plant diversity of grasslands in the Alps. Biological conservation 130, 438-446.
6. PEROTTI E., PROBO M., PITTARELLO M., LONATI M. & LOMBARDI G., 2018. A 5-year rotational grazing changes the botanical composition of sub-alpine and alpine grasslands. Applied Vegetation Science 00, 1-11.
7. PETER M., EDWARDS P.J., JEANNERET P., KAMPMANN D. & LÜSCHER A., 2008. Changes over three decades in the floristic composition of fertile permanent grasslands in the Swiss Alps. Agriculture, Ecosystems and Environment 125, 204-212.
8. PITTARELLO M., GORLIER A., LOMBARDI G. & LONATI M., 2017. Plant species selection by sheep in semi-natural dry grasslands extensively grazed in the south-western Italian Alps, The Rangeland Journal 39, 2, 123-131.
9. PROBO M., MASSOLO A., LONATI M., BAILEY D. W., GORLIER A., MAURINO L. & LOMBARDI G., 2013. Use of mineral mix supplements to modify the grazing patterns by cattle for the restoration of sub- alpine and al-pine shrub- encroached grasslands. The Rangeland Journal 35, 85-93.
10. ROOK A.J. & TALLOWIN J.R.B., 2003. Grazing and pasture management for biodiversity benefit. Animal Research 52, 181-189.
11. TASSER E. & TAPPEINER U., 2002. Impact of land use changes on mountain vegetation, Applied Vegetation Science 5, 173-184.

Optional Readings

1. DE NONI I. & BATTELLI G., 2008. Terpenes and fatty acid profiles of milk fat and ''Bitto" cheese as affected by transhumance of cows on different mountain pastures. Food Chemistry 109, 299-309.
2. FISCHER M., RUDMANN-MAURER K., WEYAND A. & STÖCKLIN J., 2008. Agricultural Land Use and Biodiversity in the Alps. Mountain Research and Development 28, No 2, 148–155.
3. LEIBER F., KREUZER M., NIGG D., WETTSTEIN H.R. & SCHEEDER M.R.L., 2005. A study on the causes for the elevated n-3 fatty acids in cows' milk of alpine origin. Lipids 40, 191-201.
4. NIEDRIST G., TASSER E., LÜTH C., DALLA VIA J. & TAPPEINER U., 2009. Plant diversity declines with recent land use changes in European Alps Plant Ecology 202, 2, 195-210.
5. PROBO, M., LONATI M., PITTARELLO M., BAILEY D. W., GARBARINO M., GORLIER A. & LOMBARDI G., 2014. Implementation of a rotational grazing system with large paddocks changes the distribution of grazing cattle in the south- western Italian Alps. The Rangeland Journal 36, 445-458.
6. PROBO M., PITTARELLO M., LONATI M. & LOMBARDI G., 2016. Targeted grazing for the restoration of sub- alpine shrub- encroached grasslands. Italian Journal of Agronomy, 11, 268-272.
7. RAVETTO ENRI S., PROBO M., FARRUGGIA A., LANORE L., BLANCHETETE A. & DUMONT B., 2017. A biodiversity- friendly rotational grazing system enhancing flower- visiting insect

assemblages while maintaining animal and grassland productivity. Agriculture, Ecosystems and Environment 241, 1-10.
8. TALLOWIN J.R.B., ROOK A.J. & RUTTER S.M., 2005. Impact of grazing management on biodiversity of grasslands. Animal Science 81, 193-198.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.). Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit **http://drc.arizona.edu**.
If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.
Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.
The University Libraries have some excellent tips for avoiding plagiarism, available at http://www.library.arizona.edu/help/tutorials/plagiarism/index.html.
Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or

buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy
Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students
UA Academic policies and procedures are available at
http://catalog.arizona.edu/policies
Student Assistance and Advocacy information is available at
http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

Confidentiality of Student Records
http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa

Subject to Change Statement
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

University of Arizona
School of Natural Resources and the Environment

A Special Topics, Study Abroad Course

RNR XXXX - Sustaining Local Food, Biodiversity, and Livestock Grazing in the Alps

3 units, Summer Session 1
June 17 - June 30, 2019 (2 weeks)

Calculation of Contact Hours

We outline the expected contact hours for each day or week as appropriate. We assume that each in class hour equates to a single contact hour; 3 hours of field and travel experiences equates to a single contact hour. Fifteen contact hours are required for each unit of credit and thus 45 contact hours are required for this 3 credit course. Our estimate of university contact hours during the 2-week course is 45 contact hours. The remaining hours of time outside of official course will occur as part of the immersive nature of this experiential learning course when students will not be working a job or taking other courses. Students will work on their required final project written assignment and post-course exam after the field portion of the course.

Date	Lecture Hours	Field/Lab Hours	Field/Lab Worksheets	End of the Day Discussions
17 June	4	-	-	-
18 June	2	6	1	1
19 June	2	6	2	1
20 June	2	4	-	1
21 June	2	4	3	1
22 June	2	4	1	1
23 June	2	6	2	1
24 June	3	3	-	-
25 June	2	3	-	1
26 June	2	4	3	1
27 June	1	2	-	-
28 June	2	4	3	1
29 June	-	-	-	-
30 June	4	-	-	1
Total Hours	**30**	**46**	**15**	**10**