ACCESS PhD Course Plan

1. General information

Course title:	**Ecological principles for sustainable weed management**
Course co-conveners Chile: Sweden:	 Rodrigo Figueroa, Pontificia Universidad Católica De Chile Alexander Menegat, Swedish University of Agricultural Sciences
Course credits (ECTS):	5
Course length (full time weeks):	3
Course period:	November 2022
Language of instruction:	English
Level:	Open to PhD students of ACCESS universities.
Entry requirements:	Admitted to PhD studies at one of the ACCESS universities. The course is open to all PhD students interested in sustainable management of unwanted vegetation. **We are aiming for an interdisciplinary teaching and learning environment**, encouraging students from a wide range of scientific disciplines to apply for the course. This is including, ecology, agronomy, forestry, horticulture, viticulture, biology, environmental sciences or any adjacent scientific areas that are interested in deepening their knowledge about ecological principles for sustainable management of unwanted vegetation. The students are required to write a short abstract about their research interests when applying.
Course on-line and teaching management platform:	The course will be held online. Zoom will be used for online meetings and Canvas as interaction and communication platform.

Course abstract / introduction (max 200 words).	Simplified agricultural production systems with excessive use of fertilizers and pesticides has led to a cascade of complex problems in todays' agroecosystems. This is including the rapid spread of herbicide resistant weed populations, pesticide contamination of the environment and food chain, health risks to pesticide users and consumers as well as a tremendous loss of biodiversity. Todays weed communities are dominated by a few highly adapted species that are difficult to manage with strategies that are solely based on direct means for weed control. This course offers a synthesis of key traits of agricultural and environmental harmful plants as well as it will provide a comprehensive understanding of ecological principles that can be utilised for supporting sustainable weed management practices. Factors and processes affecting the environmental, economic and social sustainability of weed management strategies are discussed across scales. Economic, political and social constraints of weed management are integrated, providing a detailed comparative overview on the current and future regulatory framework in Sweden and Chile. The course presents a review of the relevant theoretical basis in ecological weed management and a set of specific examples for annual and perennial production systems.
Suggested deadline for course registration:	May 31, 2022

2. Course description

Course aims:	The course will synthesise knowledge from biology, ecology, chemistry as well as from environmental and social sciences. The aim is to provide a holistic overview on ecological principles that can be utilised for sustainable weed management as well as their environmental, economic and social implications. We are aiming for an interdisciplinary learning experience, connecting students from various scientific disciplines. The course is further intending to support the intercultural competences as well as the ability to work interdisciplinary. Furthermore, the course is aiming to provide next generation researchers and advisors with relevant knowledge for assessing and optimising the management of weeds in agricultural and semi-natural ecosystems. The course contend is aiming to address several of the SDGs but in particular SDG 15, Life on Land, with targets 15.5 (halt biodiversity loss) and 15.8 (prevent the impact of invasive alien species) as well as SDG 3, Good Health and Well-Being, with target 3.9 (reduce exposure to hazardous chemicals).

Learning outcomes: On completion of the course, participants shall be able to:	On completion of the course, participants shall be able to: i. Describe key physiological traits of weeds and to summarise and compare their ecosystem services and disservices. ii. Understand the principle of functional traits and to link them with ecosystem services and disservices. iii. Describe the principles of interspecific and intraspecific plant competition. iv. Evaluate weed species importance in different agroecosystems. v. Understand and analyse the interplay of ecological and biological mechanisms in agroecosystems. vi. Evaluate the effect of agronomic practice on the sustainability of plant production, utilising knowledge about indicator for sustainability assessment. *vii.* Planning and evaluation of measures for optimisation of agronomic practice towards improvement of social, economic and environmental sustainability.
Course content:	The course is divided into three main topics. In the first two topics a number of interconnected themes will be explored, building the basis for the case study at the end of the course. **1) The biology and ecology of weeds (1 week):** ▪ Key morphological, physiological and phenological traits of weeds, seeking to answer the question what makes a plant inherently weedy. ▪ Linking weed species functional traits with ecosystem services and disservices including an overview of the worlds most harmful weeds. ▪ The principles of interspecific plant competition are explored and discussed for different ecosystems. **2) Utilising ecological principles for weed management (1 week)** ▪ An overview of ecological principles and strategies will be provided, including adjustments and modifications to the ecosystem that contribute to the regulation of weed populations and the reduction of negative impacts of weeds on crop production. ▪ Soil health promoting measures and their implications on crop-weed competition. ▪ Cropping system diversification including multi-species cropping systems. ▪ Nutrient management. ▪ Mechanical weed management. **3) Case study (1 week)** ▪ Introduction in indicators for assessing the ecological, social and environmental sustainability of agricultural practice. ▪ Cropping system sustainability assessment and optimisation case study.

Course format and pedagogy:	The course will be a mixture of online lectures and seminars, pre-lecture reading assignments as well as a post-lecture assignment in the form of a problem-oriented case study. Pre-course reading assignments will be complemented by “meet the author” sessions, where course participants will engage in an online Q&A sessions with the authors of their reading assignments. Lectures and seminars will be used for providing knowledge on the fundamentals of weed biology and ecology. Lectures will have a maximum length of 1 hour and will alternate with seminars and meet-the-author sessions. Video diaries will be produced during 2021 and 2022, documenting three farms in Chile and Sweden and their production practices for major staple crops. The video diaries will document the major environmental context and constraints of the respective production regions, building the required knowledge basis for the case study. The students will be divided in groups with equal number of students from Sweden and Chile, working together on scenarios for improving the sustainability of the described production practices. Emphasis will be put on the reduction or avoidance of chemical weed control options by utilisation of ecological principles for weed control. The groups will present their results at the end of the course in a final seminar.
Assessment	It is intended that the students take an active role in the course in order to allow a mutual learning experience among students and teachers. Therefore, the assessment will be based on students active participation during all course moments.
Grading scale:	Pass and Fail. To pass the course participants will have to: ✓ Fully attend all course moments ✓ Actively participate during the lectures, seminars and especially during the “meet the author” sessions. ✓ To write a summary of the problem-oriented group studies.