



Output 2

Overview discipline approach report 2 – Ecosystem Services, Geoethics and Biodiversity

Erasmus Plus Project

Reference 2015-1-PL01-KA203-016621

Final version

Submission date: 31st January, 2017.

Main authors: Clara Vasconcelos, Joana Faria, Luís Calafate

Contributors: Cristina Calheiros, Isilda Rodrigues, Joana Torres, Jan Činčera, Katarzyna Iwińska, Alexandra Smyrniotopoulou

Table of Contents

1. Introduction	2
2. Ecosystem Services, Geoethics and Biodiversity	3
2.1. Ecosystem Services – The case of Green Roofs	3
2.2. Geoethics	7
2.3. Biodiversity	10
3. The Objectives for Education for Sustainable Development	12
3.1. Education and Sustainable Development	13
4. The educational methodology	15
4.1. Case-based methodology	15
4.2. The Portuguese case: Sustain a Sustainable decision - remodelling an antique farm	17
4.3. The Greek Case: Organic Farming and Public Finance	20
5. Synthesis and guidelines for future work	23
6. References	24
Appendix list	26
Appendix I – Conceptual Modelling exercise	27
Appendix II – Template of the Portuguese Case	29
Appendix III – Contributions of partner teams	35
Appendix IV – Template of the Greek Case	41

1. Introduction

This report explores fundamental linkages between ecosystem services, geoethics' concerns and biodiversity. In accordance to that, the Portuguese WISE workshop aims were:

- To get acquaintance with Portuguese case studies in biodiversity and green-roof/walls.
- To introduce the renovated area of Geoethics.
- To present some negative environmental impacts in Portugal that intercept Geoethics concerns.
- To do a field trip to a solar in an antique farm: a case study of sustainable tourism with a series of good practices related to the environmental performance.
- To exchange knowledge and good practices regarding the presented study cases.

The learning outcomes of this second WISE report intended to:

- Comment Portuguese study cases regarding biodiversity and ecosystem services and establish links with other country similar studies.
- Define Geoethics and its alignment with Sustainability.
- Evaluate a Portuguese study case of sustainable tourism.
- Discuss good practices in the fields of biodiversity, ecosystem services and geoethics in a Sustainable Education Perspective.
- Discuss the development of educational resources in the explored thematic to be used in Education for Sustainability in Higher Education courses.

As a whole, this report addresses Ecosystem Services, Geoethics and Biodiversity as a growing, essential and, first and foremost, an intelligent approach to sustainable development. Undoubtedly, Education has a pivotal role in the attainment of this ultimate goal.

Ecosystem Services, Geoethics and Biodiversity have become increasingly relevant scientific concerns since they are fundamental to sustainability and development, thus its strong connection with environmental quality, social wellbeing and economic development and growth. It is intended to show an interdisciplinary approach to sustainable development by revealing linkages between biology and geology and discussing themes such as functional Biodiversity, Geoethics and Ecosystem Services, both theoretically and empirically. These axis are intertwined under the concept of sustainable development, and its environmental, economic and social pillars.

Meeting the needs of contemporary societies without compromising the ability of future generations to meet their own needs, is no easy task. But it is an absolutely crucial one and asks for huge effort in terms of Geoethics and Geoeducation. We are striving this path and combining the benefits from an international collaboration while doing it. The articulation of knowledge and good practices in the fields of biodiversity and ecosystems services, and linked social, psychological, cultural, environmental, economic and legal issues offered suggestions of educational resources that can be used in Education for Sustainability in Higher Education courses.

2. Ecosystem Services, Geoethics and Biodiversity

The broad concept of Sustainability began to be demarcated and defined at the United Nations Conference on the Human Environment in 1972. However, even today it is still difficult to establish a consensual definition. Nevertheless, a sustainable development aims to ensure that man finds equal opportunities for both genders, peace and security, and social, economic and environmental conditions required to have a good quality of life on Earth. Despite several conferences, meetings and summits led by the United Nations over the years, many goals and targets are yet to be achieved.

In September 2015, the United Nations presented the new Agenda for 2030 with 17 goals and 169 targets. Given the relevance of the citizens' awareness to achieve the targets of Agenda 2030, more attention should be given to its goals in higher education context, thus connecting the learning process with a necessary growing comprehensive and familiarity of sustainable development by students.

As mentioned above, this report will explore three themes that establish a close link with the Agenda 2030 for Sustainable Development: ecosystem services, geoethics and biodiversity.

2.1. Ecosystem Services – The case of Green Roofs



The concept of ecosystem service provision can be broadly defined as the benefits people obtain from ecosystems. Such services can be divided into four main categories (Millennium Ecosystem Assessment, 2005): (i) supporting services (e.g. soil formation, photosynthesis, primary production, nutrient cycling, water cycling); (ii) regulating services (e.g. air quality regulation, climate regulation, water regulation, erosion regulation, water purification and waste treatment, disease regulation, pest regulation, pollination, natural hazard regulation); (iii) provisioning services (e.g. food, fibre, genetic resources, biochemicals, natural medicines, pharmaceuticals, fresh water); and (iv) cultural services (e.g. cultural diversity, spiritual and religious values,

knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, recreation and ecotourism).

The particular case of green roofs stand out for their capacity of supporting a whole range of ecosystem services including water retention, energy savings, wildlife habitat, sustainable use of building materials, and diminishing air pollution and urban heat effects. As so, they can improve cities, making them more safe and sustainable.

In applying a biophilic urban design in dense environments it becomes essential to see the many leftover spaces as opportunities for green, for nature creep in and occupy and grow into the urban fabric. In densely populated cities there will always be many surfaced spaces where this can happen, but there will also have to be greening and growing in the more vertical and elevated environments. These spaces include rooftops and building façades, balconies and window openings, terraces and fire escapes, among many others (Figure 1).



Figure 1. Green roofs are examples of a ‘win-win’ scenario because they meet human aesthetic, recreational and other needs while also promoting biodiversity conservation goals.

Urban environments across a wide range of latitudes and climatic regimes commonly experience ‘heat island’ effects, in which air temperatures are elevated compared with surrounding landscapes. Urban heat island effects are exacerbated by a number of different factors, but principally tend to increase with proportional coverage by impervious surfaces. Conversely, they will decrease relative to the proportion of unsealed surface, and more particularly green space. This vegetation can be effective in a wide diversity of forms, including green roofs and green walls. In regions where urban temperatures become uncomfortably warm, the demand for air-conditioning in buildings is likely to rise. The planting of vegetation can therefore also contribute to reductions of fossil fuel consumption and resultant carbon dioxide (CO₂) emissions.

Green roofs and green walls reduce heat gain in summer and they also insulate buildings from cold in winter.

In northern regions, with colder and humid climates, green roofs have a low maintenance without resorting irrigation. However, in the Mediterranean or regions of similar latitudes, characterized by

a hot climate with dry summers, the use of classical green roofs requires irrigation because most vascular plants cannot withstand the summer period without watering both due to survival reasons and/or aesthetic ones (Figure 2).



Figure 2. MedMossRoofs: In extreme cases, where there is no water available for irrigation, the choice of the group of organisms is crucial.

Biocrusts thrive in dry areas and are composed of a complex mosaic of cyanobacteria, green algae, lichens, mosses, microfungi and other bacteria (Figure 2). These communities are able to photosynthesize when water is available, but in drought conditions, they cease the entire metabolism.

Green roofs offer habitats and can mitigate some biodiversity loss in cities, especially in inner city areas where vegetation is limited.

Apart from biodiversity, green roofs also offer ecosystem services, such as thermal regulation, stormwater management, and aesthetic and amenity value (Figure 3).

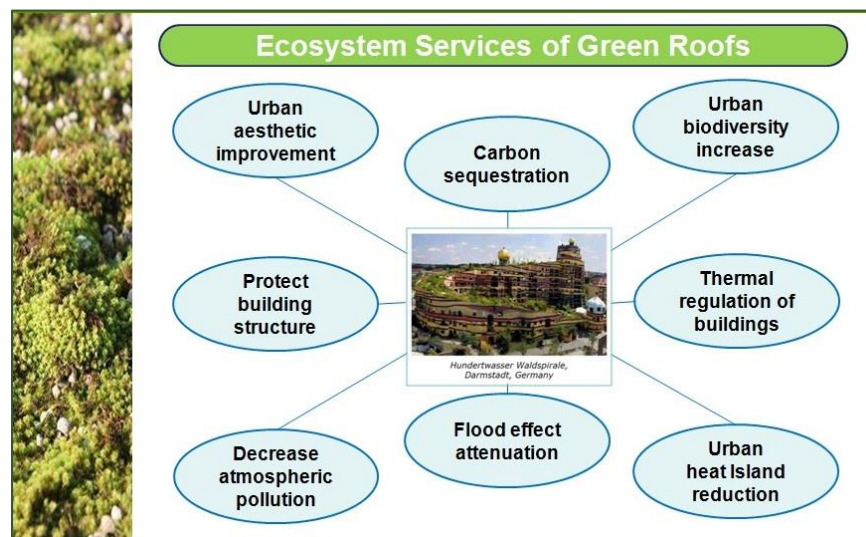


Figure 3. Green roofs provide several important benefits, such increasing biodiversity in urban areas, enhancing insulation of buildings, contributing to storm water management, reducing the heat island effect, increase carbon sequestration improving air quality and providing more green spaces in cities.

The distribution of green space is crucial in explaining variation in water regulation across the urban landscape (Figure 4). Concerning stormwater management, green roofs are a key tool. The distribution of green space is crucial in explaining variation in water regulation across the urban landscape.



Figure 4. Increasing the extent of vegetated areas enhances water regulation and improves water loss through evapotranspiration.

Green roofs can provide suitable habitat for animal and plant species that are able to adapt to and develop survival strategies for extreme local conditions and are also mobile enough to reach habitats on roofs.

In order to minimize irrigation costs in green roofs, under Mediterranean climates, low water use plants, such native plants (Figure 5) can be a smart choice.

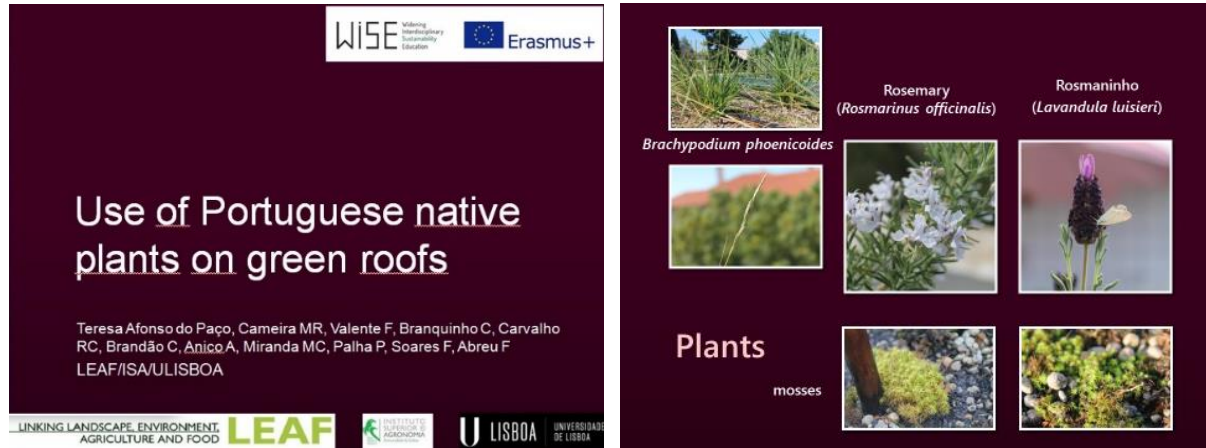
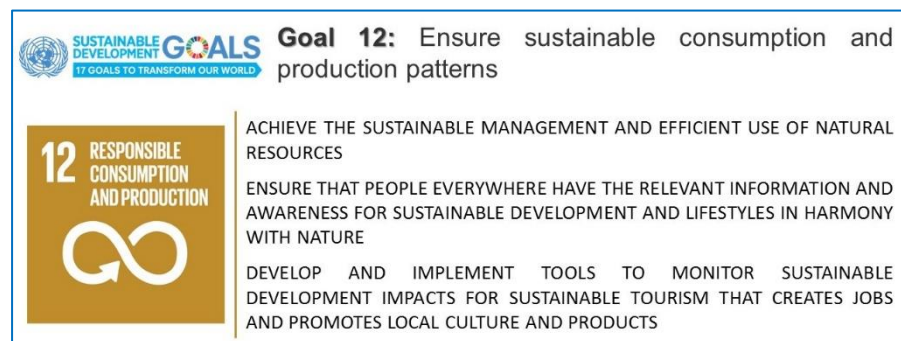


Figure 5. Plants in green roofs are greatly exposed to solar radiation and wind, while thriving in a shallow substrate. The conditions become harsher under Mediterranean climates, with dry and hot summers.

Sustainability it's an entirely new way of thinking about how we design, construct, and operate buildings. The ecosystems within an urban setting, like green roofs, parks and gardens, can provide different ecosystem services while minimizing water requirements without compromising aesthetic value, enhancing biodiversity and providing a tool for climate change adaptation.

2.2. Geoethics



It is undisputable that geology influences the economic growth and development of each country and thereby its cultural framework. Geoethics may help to re-evaluate behaviours, to increase awareness for alternative human activities or even to redirect economic models of growth and development (Vasconcelos et al., 2016). Geoethics is a path for Sustainable Development (Vasconcelos and Almeida, 2015). Sustainable Development integrates the ethical dimension of

Geoethics linked to the concern and the responsibility of guaranteeing that the needs of the present are met without compromising the sustainability of future generations. Bearing this ethical dimension in mind, Geoethics is particularly concerned with the way humans relate to the geosphere (Matteucci et al., 2014). At the same time, Geoethics focuses on how geologists develop their academic and professional work which impacts in sustainability (Almeida and Vasconcelos, 2015).

Despite its infancy as a renewed scientific and disciplinary field, it took less than two decades to (re)develop this concept, which initially only focused on natural resources. An elaborated and wider definition, from 2013, can be found in the site of the International Association for Promoting Geoethics (IAPG):

- . *Geoethics consists of the research and reflection on those values upon which to base appropriate behaviours and practices where human activities intersect the Geosphere.*
- . *Geoethics deals with the ethical, social and cultural implications of geological research and practice, providing a point of intersection for Geosciences, Sociology and Philosophy.*
- . *Geoethics represents an opportunity for Geoscientists to become more conscious of their social role and responsibilities in conducting their activity.*
- . *Geoethics is a tool to influence the awareness of society regarding problems related to geo-resources and geoenvironment.*

As Geoethics is a renewed field of Geosciences, the diagnosis and dissemination of its knowledge is pressing for future geologists and geology teachers (Almeida and Vasconcelos, 2015), as well as for students and citizens.

Taking this framework into consideration, we will discuss in this chapter the geoethics issues regarding mining activities and the social and environmental impacts and geoethics values in geoparks.

The toxic legacy resulting from the abandoned mining has attracted the interest of the scientific community in the past few years. The huge amounts of waste materials with high concentrations of metallic elements and chemical compounds, contribute to the contamination of sediments, waters and soils and, has a consequence, endanger the Biosphere. The dispersion and contamination by As, Pb and Zn resulting from the Terramonte mining waste compromise the ecosystem viability.



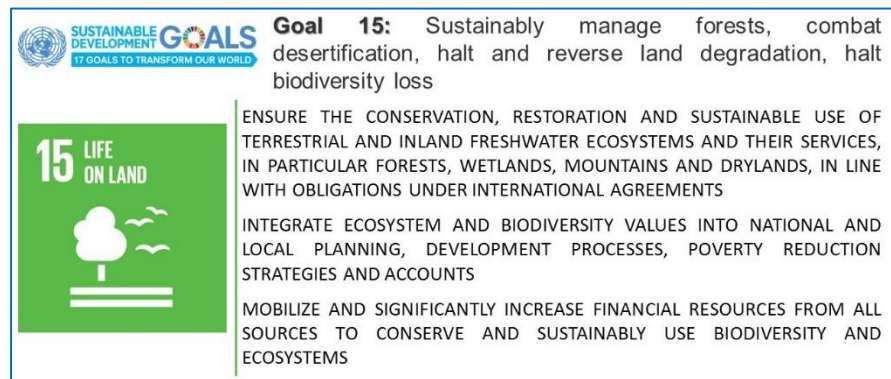
Figure 6. Terramonte mining waste led to the collapse of the heap and the materials started being transported along the Ribeiro da Castanheira to the Douro River.

The Castromil Gold Mines are ancient mines that are situated at Sobreira, Paredes Municipality, near Porto Town, Portugal. These mines exploited a deposit geologically situated at the contact between metasediments and magmatic rocks. These were exploited by the Romans during their occupation of the Iberian Peninsula. Castromil, is a territory that includes a proved Geological Resource (gold deposit) and a particular mining heritage that holds historical and cultural interests, and is very close to local village, what implies geoethics dilemmas.

Geodiversity elements are non-living components of nature, namely minerals, rocks, fossils, soils, and landforms. Since the dawn of human civilization that geodiversity elements are used to produce shelter, tools, and food. Some geodiversity elements may have a particular meaning for local communities – cultural use – and others can attract visitors, particularly when they have a high aesthetic value – geotourism use. All these uses of geodiversity elements are usually considered examples of a new sustainable usage of nature.

There is an intricate relationship between nature, resources, environment, economic activities, growth, sustainable development and social well-being. A respect for this relationship is a paramount concern for the survival and the future of planet Earth and of mankind.

2.3. Biodiversity



As biodiversity is considered the major driver of ecosystem functioning and the provision of ecosystem services, it also impacts our human well-being (Millennium Ecosystem Assessment, 2005). Thus, biodiversity loss and ecosystems degradation will have important impacts on future generations costly for society as a whole, particularly for economic actors in sectors that depend directly on ecosystem services.



Figure 7. The installation or preservation of ecological infrastructures, such as: hedges, bushes, copses, traditional orchards or spontaneous vegetation strips contributes to provide adequate functional biodiversity of the Douro demarcated region.

In demarcated region of Douro it has been applied different strategies to control pests, in the attempt to promote functional biodiversity without compromising sustainability (Figure 7).

Beneficial insects are used to control pest insects while performing valuable services like pollination. Mating Disruption Technique is another way of controlling pests in this region by introducing artificial sex pheromones that confuses the individuals and disrupt mate localization, thus preventing mating and blocking the reproductive cycle. The main goal is to reduce the use of insecticides and the impact in the viticulture activity in the Douro Demarcated Region, while preserving biodiversity.

Biodiversity conservation through actions such as the reintroduction of nature into the urban environment and urban landscaping is increasing. On the other hand, growing urbanization of the European Union has raised awareness of the importance of the natural environment in urban areas.



Figure 8. Wild garden in the Faculty of Sciences, University of Porto, Portugal.

The concepts of ecological restoration, wildlife gardens and naturalness are practiced as theoretical or speculative narratives, but less as concrete experiences. This is the motivation for an ongoing experiment based on the creation of a “wild garden” in the Faculty of Sciences, University of Porto, Portugal (Figure 8).

Preserving native vegetation requires considerable effort from green managers, because urban environments often appear to favor exotic above native species. Intensive management to protect native vegetation may only be possible (or fundable) if protecting this vegetation is of interest to citizens and other parties. FCUP “wild garden” allows teachers and students of biology and landscape architecture to learn, survey and monitor, with easy access, the dynamics of urban ecosystems, the performance of invasive species, the pulse of natural succession influenced by minimal human intervention with the attributes of “native” aesthetics, with its bright and dull moments according seasonal cycles.

Just as humans have the ability to alter habitat and even to extinguish other species, we can also protect and restore biodiversity. Therefore, we have the responsibility to act as custodians for nature, for example, giving a first step by planting a tree (Figure 9).



Figure 9. Planting a tree by WISE team

Nature is more than a commodity for the benefit of humans. It is through direct experience with nature that people come to understand its value and gain a better appreciation of the importance of healthy habitats and ecosystems. This connection provides them with an appreciation of the need to manage their interactions with nature empathetically.

3. The Objectives for Education for Sustainable Development

Sustainable development aims to guarantee that humankind finds equal opportunities for both genders, peace, security, and social, economic and environmental conditions required to have quality of life. But to ensure sustainability and sustainable development, it is urgent to improve not only the governmental policies but also invest in strategies that focus on improving social awareness. And therefore it is through Education and educators that we can achieve that goal.

Education has always been an integral part of the sustainable development agenda. The World Summit on Sustainable Development (WSSD) in 2002 adopted the Johannesburg Plan of Implementation (JPOI) which addressed the need to integrate sustainable development into formal education at all levels, including higher education, as well as through informal and non-formal education opportunities (United Nations, 2016). More recently, the 2030 Agenda also addressed the educational role in the promotion of sustainability and sustainable development through Goal 4 (*Ensure inclusive and quality education for all and promote lifelong learning*) and its targets.

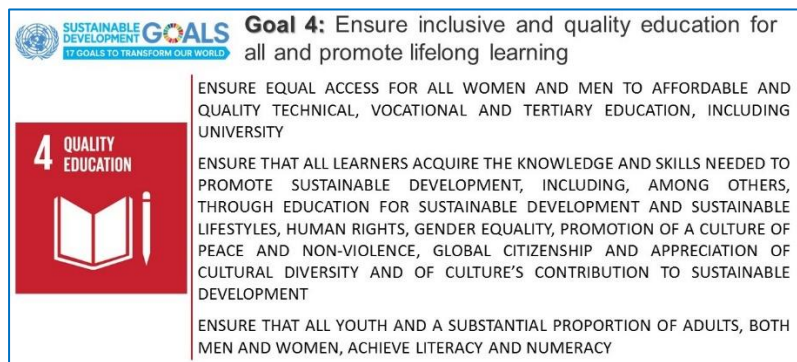
At the higher education level, Education for Sustainable Development (ESD) aims to enable people to build new knowledge regarding sustainability, but also aims to reflect the complexity and the consequences of behaviour and decision making process in a future-oriented and global perspective of responsibility (Barth et al., 2007). Higher ESD has to promote the discussion about sustainable solutions for the problems we face today. And for that, educators should always remember that it is education *for* sustainable development rather than education *about* sustainable development.

Therefore, we can define some goals for Education for Sustainable Development (Haan, 2006, cited in Barth et al., 2007):

- (1) to develop competency in foresighted thinking;
- (2) to develop competency in interdisciplinary work;
- (3) to promote competency in cosmopolitan perception, transcultural understanding and co-operation;
- (4) to enhance participatory skills;
- (5) to develop competency in planning and implementation;
- (6) to develop capacity for empathy, compassion and solidarity;
- (7) to develop competency in self-motivation and in motivating others;
- (8) to enhance competency in distanced reflection on individual and cultural models.

These key competencies are expected to enable active, reflective and co-operative participation toward sustainable development. In order to develop the students' ability to reflect on their actions and make informed decisions, ESD should consider four basic aspects: what, how, why and where. This means that holistic thinking should be promoted which can only be accomplished if we use an interdisciplinary approach and different methods and teaching strategies.

3.1. Education and Sustainable Development



There is a concern to aware teachers for the importance of sustainable development and its goals. Since Agenda 2030 is a plan for the people, the planet and its prosperity, it is important that schools work as a venue to better inform and aware young students of the local actions that can promote a sustainable development. It is also essential that teachers and the school community make efforts to prepare informed citizens capable of recognizing the research fields of critical importance for mankind.

In Augusto Gil School (a school for students with ages between 10 and 15 years old), located in Oporto's center, the teachers improve the understanding of sustainable development by proposing a series of activities, like planning a sustainable city or constructing the model of an ecological house (Figure 10).



Figure 10. Ecological models developed by students, ages 10-15 years old.

With these activities, the school students learn the importance of natural resources and ecosystems services and obtain future competencies that will help them to preserve the quality of the environment.

In higher education, activities for the promotion and awareness of sustainable development are more demanding. For that reason, a conceptual modelling exercise was developed in an interdisciplinary setting. The fact is that today's environmental problems require interdisciplinary solutions. As such, interdisciplinary activities should be promoted, namely through conceptual modeling. Our experience suggests that the development of conceptual models can guide and facilitate discussion about socio-ecological systems like green roofs among different disciplines.

A conceptual model exercise (Appendix I) can also be used as a tool for communication across several disciplines and to increase literacy among the participants.

The different cases of the green roofs is the springboard for this interdisciplinary exercise. The activity intends to develop collaborative work and increase the participants' exchange of knowledge (Figure 11).



Figure 11. Example of the presentation and confrontation of conceptual models by members of WISE Project.

During the exercise, participants enjoyed the activities and learned from one another. Such an exercise provided great benefits because individual conceptualizations were clearly presented and reframed by the need to develop a common model.

4. The educational methodology

4.1. Case-based methodology

Case-based methodology was first applied in 1870, in a Law School in the United States of America, where a newly appointed dean, Christopher Langdell, began teaching by referring to real cases, breaking away from decades of teaching through lectures and transmissive approaches to teaching. The introduction of this methodology significantly revolutionized teaching, to such an extent that learning became much more active. The presentation of cases, usually in a narrative form, and the issues and activities that accompany it, promote group discussion and develop analytical skills and evaluation and application capabilities. When teaching, using the perspective of one single discipline is limited, since it offers one only view of a given case. An interdisciplinary approach draws on a variety of disciplines and develops a deeper and more thorough understanding, encouraging students to go beyond each individual discipline. The case method favours interdisciplinary reasoning (Booney, 2015) and can be used to highlight connections between different scientific fields, everyday problems and possible solutions.

A case-based methodology is based on a socio-constructivist perspective in which the teacher is a mediator and students work in groups and learn from their peers. Case-based methodology can be characterized as student-centered, group-based (but also individually-based), associated to self-directed learning and beginning with a case (Foran, 2001). The design of the case must adhere to the following principles:

- * The case is real (a dilemma is taken from real life and laid in the form of a case);
- * The case relies on careful research and study;
- * The case fosters the development of multiple perspectives by users;
- * The case is meant for students to explore interactively;
- * The case directs students towards a conclusion by providing them the resources and the context to discuss issues dynamically;

The cases can be:

a) *presented as examples*. It can be used to give emphasis to theory and general propositional knowledge. Its purpose is to develop the knowledge of a particular theory and/or to build new theories. Using cases as examples can also honor best practices or make effective teaching more public and available for analysis and review (Sykes & Bird, 1992).

b) *presented as an opportunity to practice analysis, assimilate different perspectives and contemplate action*. It can be used to practice decision-making and problem-solving. Here, case materials can help students "to think like a teacher" (Shulman, 1992; Wassermann, 1994) by presenting situations from which theory emerges. The cases portray problematic situations that require problem-identification and analysis, decision-making and the definition of action. This use of cases works well when teaching is conceptualized as a complex, cluttered, and context-specific activity.

c) *presented as a stimulus for personal reflection*. It aims to stimulate personal reflection. Here, the emphasis is on introspection and the development of personal professional knowledge. Teacher and educators that use this type of case (such as self-written reports of personal experiences), suggest that they are a powerful means to develop habits and reflection techniques (Kleinfeld, 1992; Richert, 1991), as well as a stimulus to analytical thinking.

The use of this methodology entails some previous conditions, such as ensuring the existence of mutual respect between teachers and students (thus enhancing learning), promoting interdisciplinary approaches, challenging students to discuss and to find a solution, and allowing students to develop new perceptions through a critical, although guided, attitude (Harvard College, 2005).

Within this methodology there are several strategies that can easily be applied in the classroom. Strategies or techniques aim to guide students through the case at hand and lead them to its resolution. These learning strategies must be proper to the problem at hand, and should allow students to achieve the previously defined objectives and, as a result, their success. Some useful and common strategies or techniques are: working with games; modeling activities; field trips; laboratory work; computer work; practical work and role-plays.

Compared to the traditional methodology, this method involves the use of different materials and puts the focus on the student in learning process (Williams, 2005). The teacher is no longer an automatic knowledge transmitter and instead begins to steer and guide students in their learning process and self-recognition. The teacher is a mean to achieve excellence and to encourage students in their learning process. Whereas traditional methodology fosters individual learning, this

methodology encourages learning with others (Golich, Boyer, Franko, & Lamy, 2000), a strategy that promotes one of the main objectives of education for sustainable development: to build up students' abilities to act—their action competence—with reference to environmental concerns (Jensen & Schnack, 1997).

4.2. The Portuguese case: Sustain a Sustainable decision - remodelling an antique farm

The Portuguese case “*Remodelling an antique farm*” presents the scenario of Paço de Calheiros farm, located in Ponte de Lima, Portugal. As a strategy to develop the case, it was decided to do a fieldtrip to Paços de Calheiros (Figure 12). The fieldtrip able the Wise team to observe all the remodelling that has been done forecasting a sustainable development of this antique farm.

On the slopes of one of the hills surrounding the village of Ponte de Lima, in the Minho region, an area characterized by green fields, vineyards, cornfields, granite villages and manors, stands a grand and illustrious building that dominates one of the most remarkable scenarios in this area.



Figure 12. The field-trip to Paços de Calheiros.

The noble house of Paços de Calheiros, built in the seventeenth century, tells the story of family Calheiros, which is also linked to the foundation of Portugal. Throughout history, this family served the kingdom in a unique way, while maintaining a particular link to this Manor and its surrounding region. As such, Paço de Calheiros is exemplary included in *Solares de Portugal*, under the category of Old Houses, which represent the memory and history of Portugal. *Solares de Portugal*

constitute an estate heritage, a legacy of ancient families and symbols of the glorious Portuguese history and culture, that additionally provide high quality housing tourism, nationally and internationally recognized. (Cardoso & Carvalho, 2007). Today, Paço de Calheiros is a place to enjoy while entering the history and life of the illustrious Counts of Calheiros.

The Manor has been recovered so as to offer comfort, elegance and wellbeing to its guests. It is a beautiful granite building with wooden ceilings and floors, portraits of ancient times and impressive tears chandeliers (Paço de Calheiros, 2016a). The gardens are considered historical. They look different at different times and keep the romantic features that characterized the date when they were first planted in the seventeenth century. The tree species are varied and range from magnolias and camellias to olive and orange trees. There is also a chestnut forest of great beauty (Paço de Calheiros, 2016a). The Vineyard, which produces the distinctive *Vinho Verde* (green wine), is located in the middle of the hillside and combines the most typical varieties of wine grapes of the Minho region, thus producing a fruity wine, fresh and easy to drink.

Sustainable tourism, which is defined as a responsible tourism developed in harmony with the environment, meeting current needs and enhancing future opportunities, is one of the biggest bets of Paço de Calheiros. Paço de Calheiros regularly organizes dissemination and awareness activities related to good environmental practices. The activities led to the creation of the Eco Circuit, which addresses sustainable management under two main perspectives related to energetic and hydric resources (Paço de Calheiros, 2016b).

In practice, the Eco Circuit shows what it is being done in terms of green energy. This includes (Paço de Calheiros, 2016b):

- A photovoltaic system that transforms the solar radiation into electric energy, thus resorting to clean energy, reducing the use of the public electricity network and lowering the CO₂ emissions;
- A mini-hydric that uses the available clean and renewable energy to produce electric energy; this mini hydric benefits from the difference in height in the water flow which allowed the installation of a small turbine in the old water mill;
- A Phyto-WWTP (wastewater treatment plant) or constructed wetland that uses plants to promote the treatment of wastewater; through a biological system in a subsurface flow mode, thereby becoming purified.

Following the creation of the Phyto-treatment plant directed to sustainable wastewater management, a small pond integrated in the landscape, Poça de Peirão, was also created, with low implementation, operation and maintenance costs. This pond area serves as a strategic point for water retention, and further promotes biodiversity and conservation of natural resources. Biodiversity is supported, water is reused, and the site represents a practical and effective technological and economic solution (Paço de Calheiros, 2016a; Calheiros, et al., 2015).

A constructed wetland is a man-made biological system that intends to mimic the biogeochemical processes that occur in nature, with the aim of promoting water depuration (Calheiros, et al., 2015). In Paço de Calheiros, this construction helps to obtain a more efficient management of water resources, by improving the quality of wastewater and making it reusable. In this process, different

species of plants are used, so as to guarantee harmony with the landscape and support of biodiversity) (Paço de Calheiros, 2016b).



Figure 13. Team discussion and discussion of the Portuguese case after the fieldtrip.

Today, in addition to disseminating good environmental practices, the owners intend to promote the use eco-technologies, multiplying information activities, promoting local biodiversity, preserving the historical, geological, cultural and environmental heritage. The tourism at Paço de Calheiros offers comfort, wellbeing and exquisite elegance to its guests. Nevertheless, a sustainable tourism encompasses a responsibility in relation to local people, the traveler, cultural heritage and the environment. It comprises a thorough management of the necessities and economic, social and environmental resources. There is the intention to potentiate the assets but at the same time protect them, in order that the new generations may enjoy similar possibilities and conditions. This is a process of consistent management of all resources that entitles the satisfaction of several requirements, assuring simultaneously the continuity of the cultural and social integrity, of the ecological processes, biological diversity and the life sustainable systems. These aspects made of this attractive touristic spot a reference in terms of sustainable development.

The case “Remodeling an Ancient Farm” enrolled participants in themes such as biodiversity, environmental protection, social and economic sustainability. Prior to the development of the case, the main aims were established (for example: to develop interest and motivation; to discuss the values of the three pillar of a Sustainable Development, to evoke knowledge related to ecosystem services). The field trip to Paço de Calheiros represented a valuable opportunity to explore good practices regarding sustainable development. This kind of strategy can be of great significance in higher education teaching and learning. A conceptual modelling activity established after the field trip proved to be very appealing and capable of develop key abilities to the inquiry process, such as observation and inference. These abilities are central to enhance higher education students’ scientific reasoning and critical thinking which will mature their understanding of Education for Sustainable Development.

The second strategy used to discuss the case was a role playing activity where specific roles were given to each team member of WISE project (Figure 13). Five teams where involved in the case development (Portuguese team, Polish team, Czech team, Greek team, Swedish team) and each

team had four members. The contributions of all team members enhanced the exchange of knowledge regarding the biodiversity, environmental protection, social and economic sustainability, integrating the different backgrounds and expertise of all team members (see Appendix III).

4.3. The Greek Case: Organic Farming and Public Finance

Organic Farming is a holistic system designed to optimize the productivity and fitness of diverse communities within the agro-ecosystem, including soil organisms, plants, livestock and people (OMAFRA, 2009).

Organic farming seeks to provide the consumer with fresh, tasty and authentic food while respecting natural life-cycle systems, providing enterprises that are sustainable and harmonious with the environment.

In 2014, there were almost 260,000 organic producers in the EU and almost 340,000 in Europe (Figure 14). In the EU, the country with the largest number of producers is Italy (almost 49,000), in Europe it is Turkey (over 71,000). Although there was not much growth in the number of producers in 2014, over the past decade the number of producers in the EU grew by 57% and in Europe by 81%. Almost 15% of the world's organic farmers are in Europe (data from IFOAM, 2016).

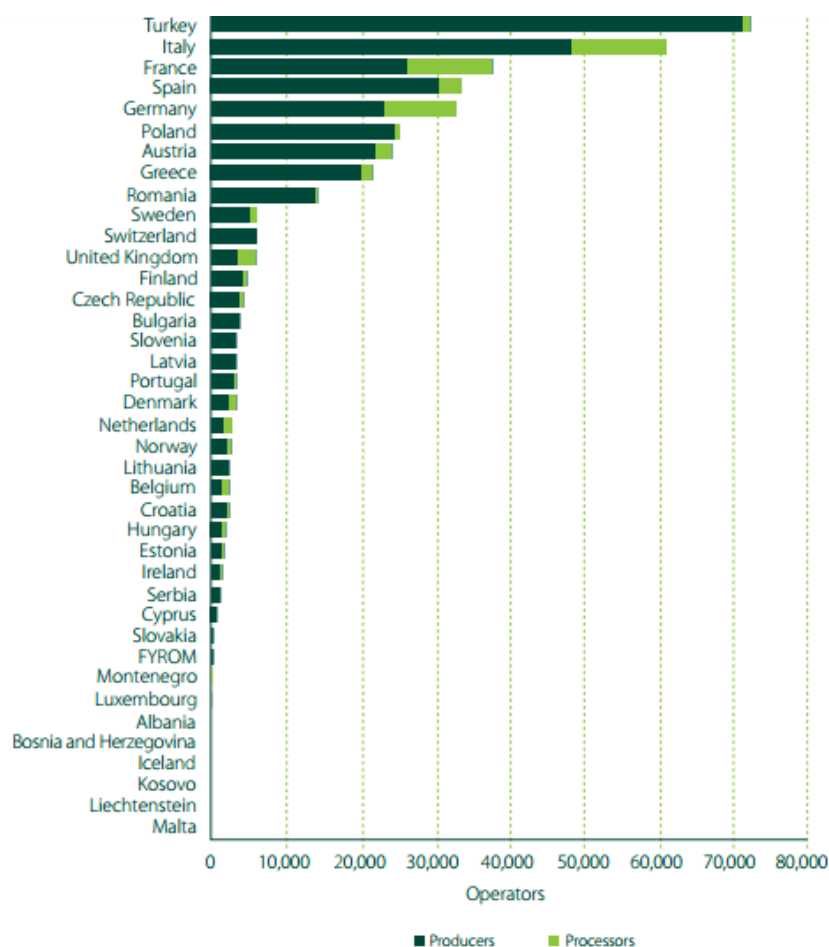


Figure 14. Number of organic farming producers and processors, by country, in 2014. Retrieved from IFOAM (2016)

The total contribution from the European Agricultural Fund for Rural Development (EAFRD), for 2014 – 2020 to organic farming payments amounts to €6.286 billion. As to the relevance that each Member States gives to organic farming area support compared to its total organic farmland area, there is no common pattern across the different Member States. Countries like Belgium, Bulgaria, Cyprus, Denmark, Germany or Greece, for example, seem to give a higher relevance to organic farming support under the new Rural Development Programmes (RDP) than countries like Estonia, Finland, Portugal, Slovenia, Slovakia and the UK. Differences in payment rates also exist between Member States due to factors such as payment differentiations by land-use type, different economic assumptions and different cost and income foregone components in payment calculations.

In the Greek case, organic farming has increased during the period 2009-2015 with an average annual growth rate 11.8%. Organic farming is supported under the RDP (2nd pillar of Common Agricultural Policy), providing incentive payments to farmers who voluntarily adopt organic farming systems (Figure 15). Support is given to compensate for income forgone and increased costs due to compliance with stringent farming requirements.

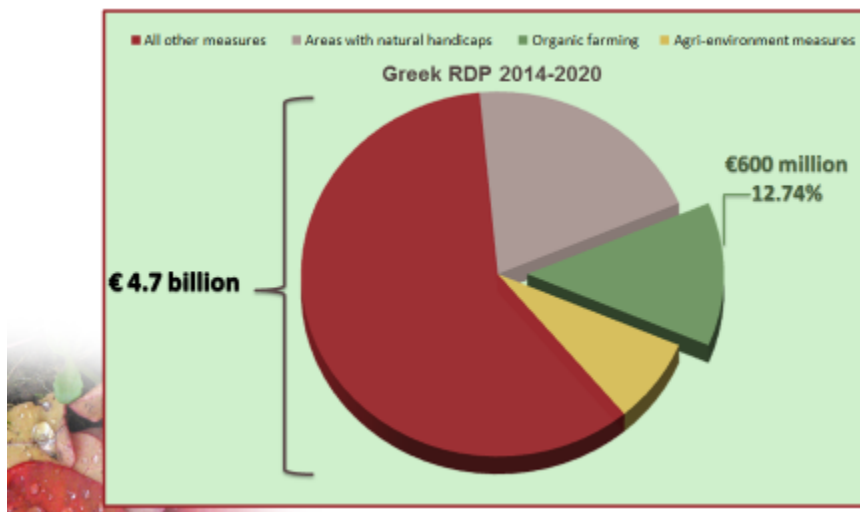


Figure 15. Public funding in Greece under the Rural Development Programme 2014-2020.

The organic products are sold at prices from 20% to 50% higher than conventionally grown products. Price premium paid to organic products is often legitimised on the grounds of differentiated goods. Different products command different treatment (prices).

At the Higher Education level, this subject was discussed using the strategy of Role Playing (see template Appendix IV). The students were divided into four groups (consumers, producers, tax payers and policy makers) to address environmental, social, economic and ethical concerns, using three questions as a starting point: (i) *do you agree with EU policy for providing financial support on organic agriculture?* (ii) *what are the reasons that subsidies are provided to organic farmers?* and (iii) *Are price premiums to organic products justified? On which grounds?*

Students were informed about the role-playing exercise two weeks prior to its implementation. The organic farming peculiarities were briefly addressed to the students, while the four different interest groups were identified and supporting material was given to them. To complete the exercise, each group had to present and discuss with the rest of the class the issues regarding organic farming (Figure 16).



Figure 16. Role playing exercise held at Agricultural University of Athens

Overall, it is deemed necessary to substitute interactive methods, such as role playing exercises and debate in order to enhance communication skills and critical thinking abilities as well as knowledge construction on the part of students.

5. Synthesis and guidelines for future work

At the level of ecosystem services and biodiversity, green roofs stand as an appealing alternative capable of providing different ecosystem services but also functioning as a lure point for biodiversity.

The renovated area of Geoethics can be addressed by presenting cases which discuss controversial aspects of mining and its economic, social and environmental impacts. It is important that Higher Education teachers allow the discussion and reflection of the geoethical dilemmas in order to develop a deeper understanding of the diverse realities of each one of the countries represented in this project. Regarding this matter, Geoparks can become an intelligent way of balancing exploitation of resources, tourism, culture and sustainability.

At the educational level, the different teaching strategies and methodologies to address the portrayed cases with students may help to develop ESD competences. WISE partners consider that the field trip to *Paço de Calheiros* represents a valuable opportunity to explore good practices regarding sustainable development. This kind of strategy can be of great significance in higher education teaching and learning. The conceptual modelling exercise and the role playing activities are also proved to be very appealing and capable of develop key abilities to the inquiry process,

such as observation and inference. In the end, these abilities are central to enhance students' scientific reasoning and critical thinking which will develop their understanding of Education for Sustainable Development.

As a whole, this document results from the exchange of different views and experiences in order to **Widen an Interdisciplinary Sustainable Education** in higher education.

6. References

Almeida, A., & Vasconcelos, C. (2015). Geoethics: Masters' Students knowledge and perception of its importance. *Research in Science Education*, 45 (6), 889–906.

Barth, M., Godemann, J., Rieckmann, M., & Stoltenberg, U. (2007). Developing key competencies for sustainable development in higher education. *International Journal of Sustainability in Higher Education*, 8(4), 416-430.

Beatley, T. (2011). *Biophilic Cities. Integrating Nature into Urban Design and Planning*. London: Island Press.

Bonney, K. M. (2015). Case Study Teaching Method Improves Student Performance and Perceptions of Learning Gains. *Journal of microbiology & biology education*, 16(1), 21-28. doi: dx.doi.org/10.1128/jmbe.v16i1.846

Calheiros, C. S., Bessa, V. S., Mesquita, R. B., Brix, H., Rangel, A. O., & Castro, P. M. (2015). Constructed wetland with a polyculture of ornamental plants for wastewater treatment at a rural tourism facility. *Ecological Engineering*, 79, 1-7. doi:doi:10.1016/j.ecoleng.2015.03.001;

Cardoso, A. H., & Carvalho, T. (2007). *A Arte de Bem Receber - Solares de Portugal*. Lisboa: INAPA;

Foran, J. (2001). The Case Method and the Interactive Classroom. *The NEA Higher Education Journal*, 41-49.

Francis, R.A. & Lorimer, J. (2011). Urban Reconciliation Ecology: The Potential of Living Roofs and Walls. *Journal of Environmental Management*, 92: 1429-1437.

Golich, V. L., Boyer, M., Franko, P., & Lamy, S. (2000). *The ABC's of Case Teaching*. Georgetown: Institute for the Study of Diplomacy.

IFOAM (2016). *Organic in Europe: Prospects and Developments 2016*. Retrieved from <http://www.ifoam-eu.org/>. ISBN: 978-3-03736-313-3

Instituto Nacional de Estatística. (2011). *Quadros População*. Retrieved from http://censos.ine.pt/xportal/xmain?xpid=CENSOS&xpgid=censos_quadros_populacao

Harvard College. (2005). *Characteristics of Effective Case Teaching*. EUA: Harvard Business School.

Jensen, B. B., & Schnack, K. (1997). The action competence approach in environmental education. *Environmental education research*, 3(2), 163-178.

Kleinfeld, J. (1992). Learning to think like a teacher: The study of cases. Em J. H. Shulman, *Case methods in teacher education* (pp. 33-49). New York: Teachers College Press.

Matteucci, R., Gosso, G., Peppoloni, S., Piacente, S., & Wasowski, J., (2014). The “Geoethical Promise”: A Proposal. *Episodes*, 37 (3), 190-191.

Millennium Ecosystem Assessment (2005). *Ecosystems and Human Well-being: Health Synthesis*. World Health Organization Press, Geneva, Switzerland.

OMAFRA Ontario Ministry of Agriculture, Food and Rural Affairs (2009). Introduction to Organic Farming. Retrieved from <http://www.omafra.gov.on.ca/english/crops/facts/09-077.htm>

Paço de Calheiros. (2016a). *Bem-vindo ao Paço de Calheiros*. Retrieved from <http://www.pacodecalheiros.com/>;

Paço de Calheiros. (2016b). *Sustentabilidade*. Retrieved from <http://www.calheiros.eu/apex/f?p=105:1:::NO>

Richert, A. E. (1991). Using teacher cases for reflection and enhanced understanding. Em A. Lieberman, & L. Miller, *Staff development for education in the '90s* (pp. 113-132). New York: Teachers College Press.

Shulman, J. (1992). *Case methods in teacher education*. New York: Teachers College Press.

Sykes, G., & Bird, T. (1992). Teacher Education and The Case Idea. *Review of Research in Education*, 18, 457-521

United Nations (2016). Sustainable Development Knowledge Platform : Education [online]. Available in <https://sustainabledevelopment.un.org/topics/education>. Consulted in 06-01-2017.

Vasconcelos, C, Torres, J, Vasconcelos, L. & Moutinho, S. (2016). Sustainable development and teaching geoethics: Citizens views and teachers perspective. *Episodes*, 39 (3). 509-517.

Vasconcelos, C., & Almeida, A. (2014), Sustainability and Questions of Geoethics. *Revista de Ciência Elementar*, 2 (3), 41- 44.

Wassermann, S. (1994). Using cases to study teaching. *Phi Delta Kappan*, 75, 602-611.

Williams, B. (2005). Case based learning - a review of the literature: is there scope for this educational paradigm in prehospital education? *Emerg. Med*, 22, 577-581.

Appendix list

- I. Conceptual Modelling exercise.
- II. Template of the Portuguese Case.
- III. Contributions of partner teams.
- IV. Template of the Greek Case.

Appendix I – Conceptual Modelling exercise

Workshop on Interdisciplinary conceptual modelling “The case of sustainable green roofs: conceptual modelling”

Framework

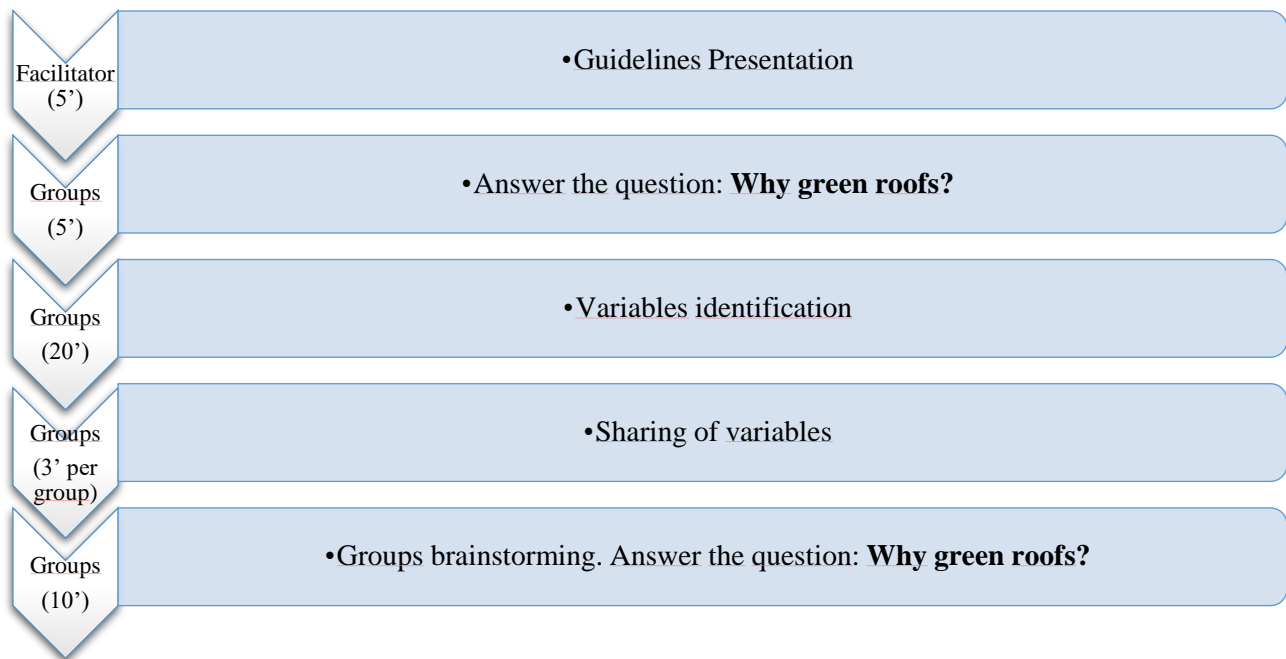
Science and policy integration within management of natural resources is proclaimed by several scientific fields as well as by regulation. This integration is not novel however, previous formats based in a top down approach and in reductionist specialized knowledge have frequently failed in defining sustainable actions. This failure promoted the development of alternative formats based on systems view, knowledge integration and stakeholders’ participation.

Conceptual models act as facilitators tools to communicate across different disciplines and promote knowledge integration. This is a relevant issue when available material resources and computer simulation processes are limited. The use of diagrams and boxes that show the main elements and relations within the system are typically used in this conceptual model approaches.

Within this framework there is the intention to address the sustainability of green roofs having in consideration the crossover between different disciplines resulting in a representation as a conceptual model in order to understand and try to answer the question: Why green roofs?

Procedure of the conceptual modelling exercise: WHY GREEN ROOFS?

Schematic representation:



Detailed description:

» Guidelines presentation (Facilitator) (5')

- . Groups formation according to the proposal (4 groups)
- . Each group must have a participant of a different country

» Answer the question: why green roofs? (Groups) (5')

- . A white card is given to each group in order to answer the question: why green roofs?
- . The cards will be putted in a box for further reflection in the end of the exercise

» Variables identification (Groups) (20')

. **Task:** group reflection about the variables which best describe and how they relate with the green roof system building a conceptual model with the cards given.

Variables will be written down on cards of different colors. Each card color represents a component of the system: ecological/environment (**green**), economic (**orange**) and social (**blue**).

Examples of variables will be made available for each group to use, consult, modify or ignore as they intent.

Aim: to be aware about the GR as an urban ecosystem through a conceptual model

» Sharing of variables (Group presentations) (3+3+3+3')

- . Each group will present their point of view and set their own conceptual model.
- As a final remark they will be asked to answer again to the question: why green roofs?

» Group brainstorming and final remarks (10')

- . Comparison between the answer given in the beginning and the end of the exercise concerning the question: why green roofs?

Groups proposal			
Group 1	Group 2	Group 3	Group 4
Alexandros Koutsouris Katarzyna Iwińska Jan Činčera Peter Aspengren	Athanasios Kampas Marta Sałkowska Mikulas Cemik Marcus Hedblom	George Vlahos Paulina Codogni Tomas Chabada Magdalena Kraszewska	Alexandra Smyrniotopoulou Xymena Bukowska Veronica Chvatalova Grzegorz Mikusinski

Appendix II – Template of the Portuguese Case

LESSON PLAN

Case: Sustain a Sustainable Decision - Remodeling an ancient farm.

Authors: Clara Vasconcelos, Cristina Calheiros, Luís Calafate, Joana Faria and Joana Torres

Keywords: Ecosystem services, cultural heritage, tourism, tradition, sustainable decision.

Language: English.

Topical Area: Education for an Interdisciplinary Sustainable Development.

Level: Higher Education.

Strategy: Role Playing.

Length: 2,5 hours.

Aims:

- To develop interest and motivation.
- To discuss the values of the three pillar of a Sustainable Development.
- To demonstrate the relevance of each pillar of a Sustainable Development in taking a sustainable decision for the reconstruction of an old farm.
- To evoke knowledge related to ecosystem services.
- To encourage students to use knowledge acquired in another setting.
- To develop collaborative work competences.
- To develop presentation skills.
- To improve time management competences.

Paço de Calheiros is a Manor House located in the North of Portugal, close to the medieval town of Ponte de Lima. It is classified as a Monument of National Interest and its surroundings are classified as Historic Gardens by the Association of Historic Gardens of Portugal.



Figure 1 – Farm and Manor House of Paço de Calheiros, Ponte de Lima, Portugal (1905-1930).

It is a 13-hectare property, placed in a hill and within a context of a white wine production region. Several elements are identified in the property such as: chestnut grove, old mill, archaeological findings and old stables. Water runs in several fountains and tanks in the property. A vegetable garden is situated near the house for self-production.



Figure 2 – Postcard of the Main Entrance of Paço de Calheiros, Ponte de Lima, Portugal (1905-1930).

Built in the XVII century by the Calheiro's family, a recognized clan since the beginning of our nation, the Manor House has 9 bedrooms and a wine cellar. The family was faithful to all Kings of Portugal and made an effort to preserve the originality and culture of the region. Paço de Calheiros is a century manor House, built of granite and wood.

Currently the Farm is owned by the Count of Calheiros, Francisco de Calheiros e Menezes, which is looking for a sustainable way to run the house and promote its sustainable development in a region full of tradition and with a strong commitment to promoting tourism.

Questions to solve:

- 1) What pillar of Sustainable Development should be more relevant to the sustainable development of this farm and the Manor House?
- 2) Which decision would be more profitable and would sustain the farm for the upcoming generations?
- 3) Which arguments can be used to stand up your decision?
- 4) Which values do you think are more important to be preserved (cultural, historical, environmental, social, economic...)?
- 5) Is there a sustainable decision to remodel the House and the farm?

Data source:

- POLITICO. Portugal to Syrians: Come West. Available on: <http://www.politico.eu/article/portugal-to-syrians-come-west-refugee-crisis-portuguese-prime-ministerantonio-costa/>
- EurActiv. Portugal wants more refugees to help revive dwindling population. Available on: <http://www.euractiv.com/section/global-europe/news/portugal-wants-more-refugees-to-help-revive-dwindling-population/>
- News online. Portugal prepares for migrants. Available on: <http://theportugalnews.com/news/portugal-prepares-for-migrants/35809>
- The Guardian. Portugal runs for four days straight on renewable energy alone. Available on: <https://www.theguardian.com/environment/2016/may/18/portugal-runs-for-four-days-straight-on-renewable-energy-alone>
- World Economic Forum. As Portugal runs on renewable power, which countries are best equipped for a clean energy future? Available on: <https://www.weforum.org/agenda/2016/05/as-portugal-runs-on-renewable-power-which-countries-are-best-equipped-for-a-clean-energy-future/>
- Vinho Verde. In English. Available on: <http://www.vinhoverde.pt/en/homepage>

- Porto and the North. Three days in the region of Vinho Verde wine. Available on: <http://uk.visitportoandnorth.travel/Porto-e-Norte/Visitar/Artigos/Tres-dias-na-regiao-do-Vinho-Verde>
- Visit Portugal. Ponte de Lima. Available on: <https://www.visitportugal.com/en/NR/exeres/FD8C91D2-0347-4A8B-8C50-024BCFEC663B>
- Quinta do Paço de Calheiros. Available on: www.calheiros.eu

Final product: A role play will be performed after work development in small groups (each team is a group) for 15 minutes (much of the work has to be done before the class). The role play will promote a discussion so that every group can present arguments to stand up their decision. It is expected that the mediator (a member from the Portuguese team) facilitates the discussion allowing each team to present arguments to support their own points of view. In the end, the team that has the role of the stakeholder (the Portuguese team) will present a PowerPoint with the final sustainable taken decision.

Roles of each team: Each team has to find arguments to stand up its decision and it is possible to use some resources, like a PowerPoint (with a maximum of 3 slides) to synthetize and present its opinions during the discussion.

Swedish team - these four members belong to EER (Eco-centric Environmental Relationships) an ecologic association that devotes their lives to support the idea that Humans must have an eco-centric relationship with the environment. They define themselves as a political and ethical movement that seeks to improve and protect the quality of the natural environment.

Polish team - these four members are not associated to any group. They represent the movement of citizens interested in defending the inclusion of immigrants in the country. They have informal activities which focus their concern in social or political issues. They carry out, resist or undo a social change.

Check Republic team – they are four members of the Town Hall of Ponte de Lima interested in preserving the cultural and historical aspect of the region. The touristic development and the conservation of the cultural heritage is the most important mission to be accomplished.

Greek team – the four members are economists with a background in Agriculture Sciences and are interested in finding a place to produce good wine to sell to foreign countries in order to make the best profit possible without compromising the sustainable development of the region.

Portuguese team- the four members (stakeholders) belong to Calheiros' family and want to find the best sustainable decision to remodel the farm and the manor house so as to be able to preserve its' identity to future generations.

Assessment: Group presentation and application.

Application: The Case of Terramonte Abandoned Mines

The Terramonte mines are located in Castelo de Paiva municipality, about 20Km SE of Porto, Portugal. The mine is crossed by the Ribeira da Castanheira which flows into the Douro River, upstream the Crestuma-Lever dam. In the mine, one of the most important ones at the time in Europe, were extracted lead (Pb), zinc (Zn) and silver (Ag) around the designated Load of Terramonte. The responsible company for the extraction in the mine, the Minas de Terramonte, SA (MITEL), has started the activity in 1966 and finished it in 1973, due to the progressive weakening of the mine. The mine was abandoned with no recovery plan until the year of 2007. The waste from exploitation of that load length was accumulated in three heaps, two upstream the mining facilities and one downstream, in the valley of the Ribeira da Castanheira. This one supported by two walls but in the 80's decade one of them caved and the materials started being transported along the Ribeiro da Castanheira to the Douro River (Fig.3).



Figure 3 – Heap after the collapse.

In 2007, the Mining Development Company, SA (EDM), started rehabilitation works of the mining area, but the efforts did not prevent the waste carried by the waters of the heap, which still remain on the banks of Ribeira da Castanheira without any intervention. The high levels of the metals in the water and the land are harmful for the surrounding ecosystems, damaging its flora and fauna surrounding. This metals are responsible for nervous system disorders and cancers in humans.

Question to ponder:

Think that you have the power to decide about the recuperation of the area and indicate the best way to rehabilitate it in a Sustainable Development perspective. Please, consider three perspectives:

1. Promote tourism for the citizens in the area.
2. Recovery the local from an environmental perspective, sealing the heaps and replant the place with autochthonous species.
3. Continue the mine exploitation with suitable plans to minimize the risks.

Justify your final decision supporting it with three valid arguments

Appendix III – Contributions of partner teams

1) Swedish team

Paco del Calheiros – redeeming the natural ecological system

EER (Eco-centric Environmental Relationships)



- Tourist value is the symbol and good example, of local, regional, national interest
- According to the Nagoya protocol we will protect 17% of the estate selected for free development with the exception of invasive species (consult P. Farinha-Marques).
- Energy systems – wind, water and sun – self reliant
- Cultivation of wine kept with increased biodiversity of grapes leading to increased resilience and increased quality of green infrastructure
- Flower meadows for butterflies and other insects in wind protected places



- Flower meadows for butterflies and other insects in wind protected places
- Manor house run and inhabited by EER-members for seminars and courses for ecological management with minimum impact
- All food for visitors produced within the farm
- Change horse riding facility into local breeds of grazing animals
- Sustainable production of fish
- Regulatory hunting only
- Recreation area (tennis and swimmingpool) converted into treetop adventure trail with information signs and teamworking tasks.





Natural water purification



Present state

After
Shading
Increasing biodiversity
Privacy
Natural cleaning of water



Think globally act locally

Education

Peter A.
Marcus
Greezore

- the family is already much more towards ideas of sustainable development than we thought from the beginning
- ~~to~~ less radical approach — things are already good in many dimensions
- understood that we must be more specific/interested in economic issues

Education value:

- ~~a~~ questioning/changes your worldview
- ~~exp~~ training in encompassing all three pillars of sustainability

2) Polish Team

Fact 1: socio-economic

- Deserted towns and villages, import of labour required for agricultural jobs and for the future development of Portugal
- During last 4 years half a million of mostly young Portuguese people searched for job opportunities outside of their country of birth — that is around 5%.
- Unemployment rate in Portugal is about 12% but low-qualified jobs are vacant
- Portugal has the lowest birth rate in Europe, thus, declining population

Fact 2: socio-cultural

- Portugal has a unique historical experience related to migration including in reintegrating — accepting 1 million from Angola and other colonies.
- Anti-refugee movement in Portugal remained weak and small
- Portuguese prime minister Antonio Costa strongly supports refugees (qualified workforce and talented ones)
- Portugal is not a popular destination for refugees, they prefer Northern Europe

output 2

Actions	Consequences
<p>Our assumption Paco de Calheiros will flourish only when the region flourishes. It is in the interest of Paco de Calheiros to support region development.</p> <p>Our solution:</p> <ul style="list-style-type: none"> Stable, affordable place to live for a number of refugee families (3-5) job offer for an adaptation period both for men and women, guaranteed job for the starting period at the Paco de Calheiros (garden, stables, agriculture, manor) support in further professional development. 	<ul style="list-style-type: none"> Acquirement of talents and competences that the region lacks a starting point for the refugees before they integrate in the region Performing a new role of an experienced leader in the area of refugees integration, builds the image of a responsible and sustainable agent of the community. Benefiting as a touristic place from the increased media appearance and recognition.

1. maintenance the position?
 - working not only in the farm but also in the region
 - subsidies for refugees
 - new ^{entrepreneurship} instruments, activities → ~~bee~~ honey production
 - new initiatives can have ~~different~~ required workforce

2. Point out most imp. elem. ^{of this case} rel. for education for sust. develop.
complexity and interrelation of priorities
real case with the limitations to be considered

Policy learn.

3) Czech Team

Paço de Calheiros as a cultural heritage

- Aims:
 - To keep it opened for all visitors
 - To preserve it as it is for the future generations
- Decision:
 - No changes



Town Hall of Ponte de Lima

Paço de Calheiros as a cultural heritage

- Why:
 - A living image of the past time
 - Unique
 - Keeping **traditions** in the time of fast changing

"Staying in Calheiros is going back to the time where everything was as it's supposed to. The water is fresh from the mountains, the fruits and vegetables from the garden and even the bread is made in the same wood fired oven as our great grandparents."



Town Hall of Ponte de Lima

Paço de Calheiros as a cultural heritage

- Arguments for the discussion
 - 1) There are many other places more suitable for either environmental or social pillar of sustainable development - providing space for migrants, or renewable energy sources
 - 2) New technologies and people could harm unique and conserved character of the site.
 - 3) Income from tourism can be later used for subsidies for migrants and renewable energy resources, therefore we have to try to conserve the current state as much as possible.
 - 3) Local inhabitants identify themselves with the current state of the art in Paço de Calheiros, why then is there a need to change?

Town Hall of Ponte de Lima

WHAT CHANGES WOULD SUPPORT:

- SUSTAINABLE AGRICULTURE
VINE PRODUCTION,
& HONEY
TRADITIONAL GRAZING
- SWIMMING POOL TO POND (TRADITIONAL)
- NOT ACCEPT 2-3 FAMILIES of REFUGEES
(TRADITIONAL) (FOR AGRICULTURAL WORK)

LINKS TO ESD

- PROTECTION CULTURAL HERITAGE (4th PILLAR of ESD)
- SOCIAL SUSTAINABILITY IN RURAL AREAS
- ENVIRONMENTAL EDUCATION & HERITAGE INTERPRETATION

4) Greek team



WISE Widening
Interdisciplinary
Sustainability
Education

2nd Project Workshop "Ecosystem services, geoethics and biodiversity" 27th Nov. – 2nd Dec. 2016, Porto

Greek team's role

A. Smyrniotopoulou, A. Koutsouris, G. Vlahos, A. Kampas

01.12.2016

Strengths		Weaknesses	
Economic	<ul style="list-style-type: none"> Classified as a Monument of National Interest Surroundings are classified as Historic Gardens A vegetable garden is situated near the house for self-consumption 	Environmental	<ul style="list-style-type: none"> 13-hectare property, placed in a hill Chestnut grove, old mill, archaeological findings and old stables Water runs in several fountains and tanks Appropriateness of the conditions for vines
Environmental	<ul style="list-style-type: none"> Owner dedicated to sustainable way to run the house 	Social	<ul style="list-style-type: none"> Vineyards in not adequate conditions Increased maintenance and repairing costs of the estate High % of land abandoned Lack of skilled labour
Opportunities		Threats	
Economic	<ul style="list-style-type: none"> Located close to the medieval town of Ponte de Lima White wine production region Established fame of the wine Exclusivity of the product Availability-affordability of technology RDP funds available 	Environmental	<ul style="list-style-type: none"> Low accessibility from local urban centers Economic crisis limits number of visitors from Portugal Area – estate not known abroad Increased competition
Environmental	<ul style="list-style-type: none"> Interest on vineyard landscapes increased Amenity values of vineyards valued 	Social	<ul style="list-style-type: none"> Pressures for intensification of production Changes of land use Pressures towards a rapid development of the area

➤ Developing a business plan for the vineyard:

- Adopting rational and environmentally friendly natural resources management technologies and practices (organic or integrated farming system)
- Covering seasonal labor work with immigrants who will be trained on good and environmental agricultural practices

➤ Capture added value of vineyards by producing wine Developing a business plan for the winery:

- Constructing a winery (eco-friendly wine making)
- Developing a brand identity (respect for the environment)
- Conducting market analysis (niche markets)

Benefits

- **Economic:**
viability of vineyard and winery
development of wine tourism
- **Environmental:**
conservation of natural resources
maintenance of agricultural landscape
- **Social:**
preservation and strengthening of the cultural heritage
good example for other farmers
encouragement of local development

- We maintain our position concerning the wine-making.

- Students will be able to:

- a) reflect on the topic
- b) discuss different points of view
- c) negotiate complex issues
- d) collectively attempt to reach a consensus.

Greek team

Appendix IV – Template of the Greek Case

LESSON PLAN

Case: Organic Farming and Public Finance

Authors: Alexandra Smyrniotopoulou, Athanasios Kampas, George Vlahos, Alexandros Koutsouris

Keywords: agricultural policy, organic incentives, public goods provision

Language: English

Topical Area: Education for Sustainable Development

Level: Higher Education

Strategy: Role playing, debate

Length: 4 hours

Aims: to develop students' normative and interpersonal competencies. After completing this lesson, students will be able to:

- Evaluate the environmental, economic and social aspects of organic farming as an approach towards sustainability in agriculture/rural space
- Understand, analyse and criticise the rationale of organic farming support
- Work collaboratively with others and develop decision making abilities
- Improve communication skills and critical thinking abilities

Results: Group work presentations and discussion

CASE: Organic Farming and Public Finance

The International Federation of Organic Agriculture Movements (IFOAM) defines organic agriculture as a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Consequently, organic agriculture is a holistic approach of sustainable farming, meeting society's demand for environmentally-friendly farming practices and higher quality food products. Moreover, it encourages the provision of public goods contributing thus to environmental protection and animal welfare. The environmental benefits of organic agriculture include improved soil health, soil erosion control, water quality, enhanced biodiversity and climate change mitigation.

According to data of the Hellenic Ministry of Rural Development and Food, the total agricultural area under organic farming in Greece has increased during the period 2009-2015 with an average annual growth rate 11.8%. Between 2009 and 2011 organic farming displays a decrease of about 35%, followed by a sudden increase in 2012, when it reached its peak (462,618 ha), while during the period 2013-2015, the organic area seems to be stabilised. The significant decrease in organically farmed area during the period 2009-2011 coincides with the beginning of economic crisis in Greece, while the sharp increase in 2012 can be attributed to the launch of the organic farming measure of the Greek Rural Development Programme 2007-2013. Figure 1 presents the evolution of total organic farmland in Greece.

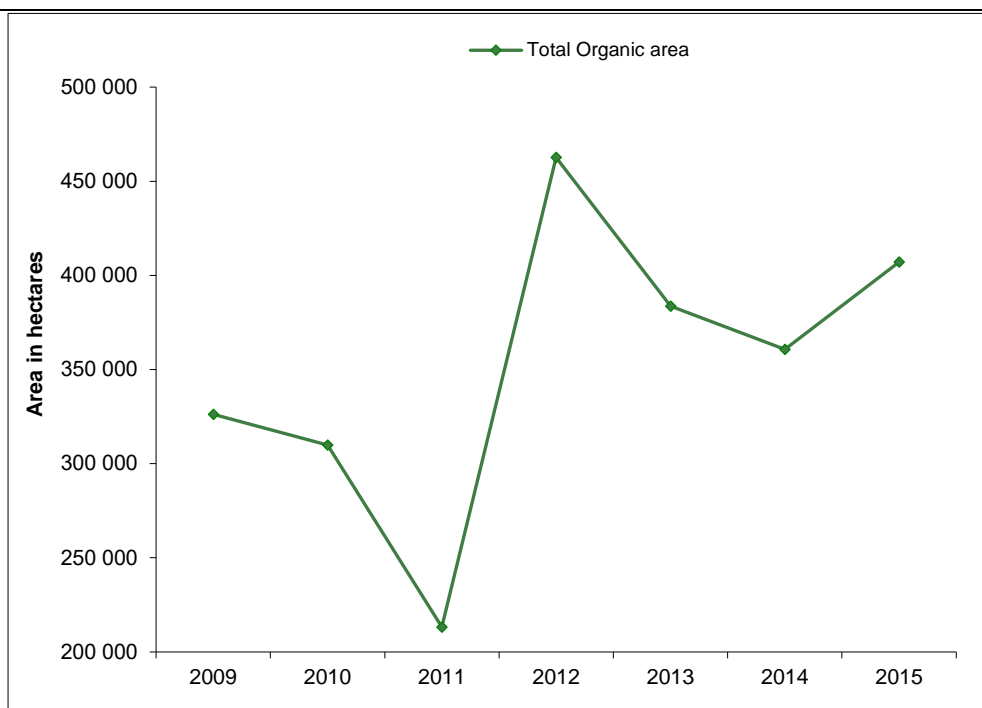


Figure 1 Evolution of organic agricultural area in Greece 2009-2015

Source: www.minagric.gr, elaborated by the research team

The agricultural area that is organically farmed in Greece consists of arable land crops (such as cereals, fodder plants, fiber plants, oilseeds, vegetables, pulses, medicinal-aromatic plants and herbs), permanent crops (such as fruit trees, nuts, citrus, vines and olive trees), as well as pastures and grassland.

In terms of surface, excluding the pastures, arable land holds the largest share of total organic area over the examined period, with cereals and fodder plants being the most important crops, followed by the permanent crops, and in particular olive trees and vines. Figure 2 shows the organic agricultural area under major crops in Greece within the period 2009-2015.

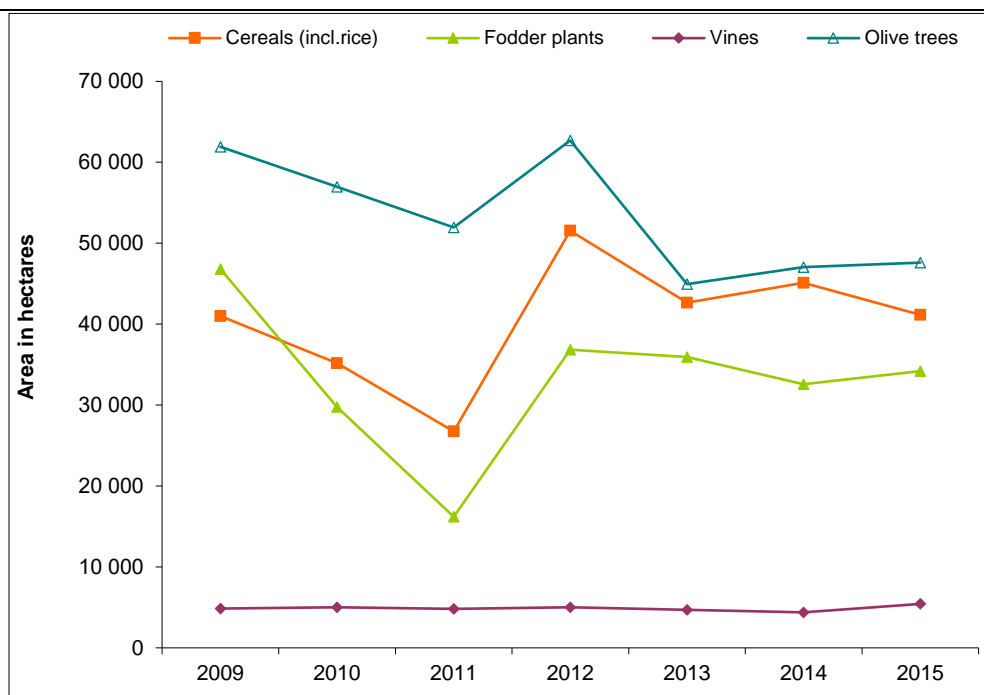


Figure 2 Organic agricultural area under major crops in Greece 2009-2015

Source: www.minagric.gr, elaborated by the research team

The organic livestock production in Greece seems to follow the same trends. According to the available data, the total number of animals organically reared has slightly increased between 2009 and 2015, with an average annual rate of 5%, while the most important animal species seems to be sheep and goats. The evolution of organic livestock production in Greece is depicted in Figure 3.

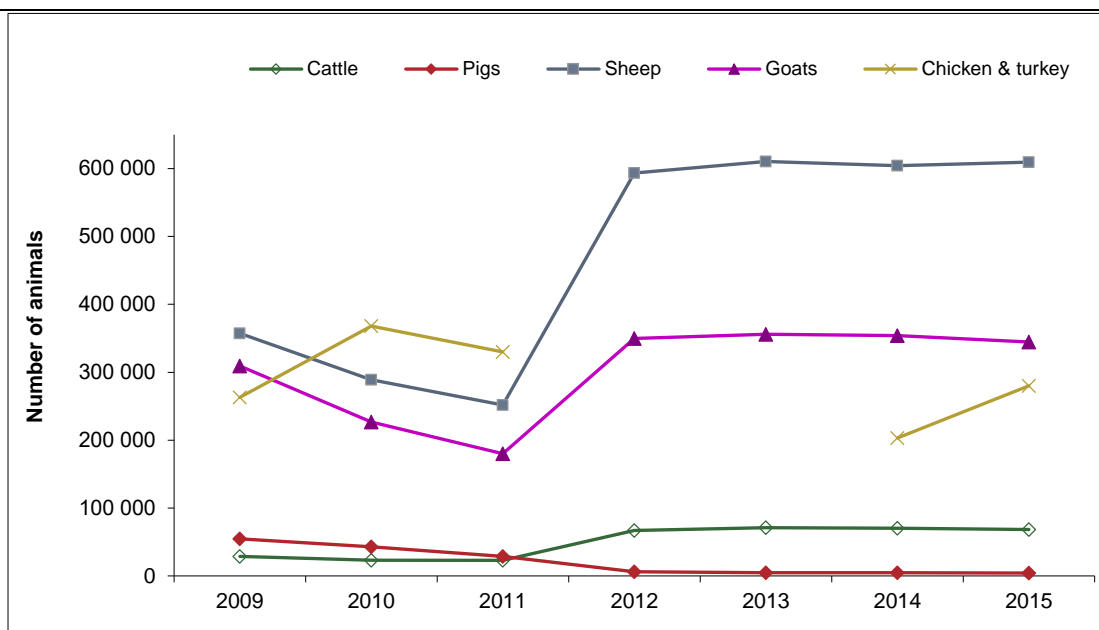


Figure 3 The *evolution of organic livestock production in Greece 2009-2015*

Source: www.minagric.gr, elaborated by the research team

Organic farming is supported under the Rural Development Programmes (2nd pillar of Common Agricultural Policy), providing incentive payments to farmers who voluntarily adopt organic farming systems. Support is given to compensate for income forgone and increased costs due to compliance with stringent farming requirements. Out of the €4.7 billion Euro of the Greek Rural Development Programme for the current programming period (2014-2020), €600 million are allocated to organic farming, thus accounting for 12.74% of the total public funds.

At the Greek marketplace, the organic products are sold at prices from 20% to 50% higher than conventionally grown products. Price premium paid to organic products is often legitimised on the grounds of differentiated goods. Different products command different treatment (prices). The reason for such a differentiation is usually based on two aspects, namely quality and safety.

Food quality can be judged on objective (e.g. energy content, proteins, vitamins) or subjective (it tastes nice to me) grounds. Although nothing can be said on the subjective argument of food quality, there are many research papers (and meta-analyses) that do not support the nutritional differences between organically and conventionally produced goods.

As far as food safety is concerned, conventional food products bear the risk of having chemical residues (pesticides and fungicides) above the allowable safety limits Maximum Residual Limits (MRLs). However, if producers follow good agricultural practices and comply with safety regulations, then there is no known risk element. On the other hand, organically produced goods by default have negligible risk of chemical residues, but increased probability of other risk elements (mycotoxins) cannot be excluded.

Questions to solve:

- 1) Do you agree with EU policy for providing financial support on organic agriculture?
- 2) What are the reasons that subsidies are provided to organic farmers?
- 3) Are price premiums to organic products justified? On which grounds?

Selective references:

Bourn Diane and Prescott John, 2002, A Comparison of the Nutritional Value, Sensory Qualities, and Food Safety of Organically and Conventionally Produced Foods, *Critical Reviews in Food Science and Nutrition*, 42 (1), 1–34

Dangour Alan D., Dodhia Sakhi K., Hayter Arabella, Allen Elizabeth, Lock Karen and Uauy Ricardo, 2009, Nutritional quality of organic foods: a systematic review, *The American Journal of Clinical Nutrition*, 90, 680-685

Hoefkens Christine, Vandekinderen Isabelle, De Meulenaer Bruno, Devlieghere Frank, Baert Katleen, Sioen Isabelle, De Henauw Stefaan, Verbeke Wim and Van Camp John, 2009, A literature-based comparison of nutrient and contaminant contents between organic and conventional vegetables and potatoes, *British Food Journal*, 111 (10), 1078-1097

ICAP Group, 2014, Sector Study on Organic Farming – Organic Products

IFOAM, 2016, Organic 3.0 for Truly Sustainable Farming & Consumption, 2nd Updated Edition (http://www.ifoam.bio/sites/default/files/organic3.0_v.2_web_0.pdf)

Magkos Faidon, Arvaniti Fotini and Zampelas Antonis, 2006, Organic Food: Buying More Safety or Just Peace of Mind? A Critical Review of the Literature, *Critical Reviews in Food Science and Nutrition*, 46, 23–56

Magkos Faidon, Arvaniti Fotini and Zampelas Antonis, 2003, Organic food: nutritious food or food for thought? A review of the evidence, *International Journal of Food Sciences and Nutrition*, 54 (5), 357-371

Magkos Faidon, Arvaniti Fotini and Zampelas Antonis, 2003, Putting the safety of organic food into perspective, *Nutrition Research Reviews*, 16, 211–221

Malmauret L., Parent-Massin D., Hardy J.-L. and Verger P., 2002, Contaminants in organic and conventional foodstuffs in France, *Food Additives and Contaminants*, 19 (6), 524-532

Niewold T. A., 2010, Organic more healthy? Green shoots in a scientific semi-desert, *British Journal of Nutrition*, 103, 627-628

Rosen Joseph D., 2010, A Review of the Nutrition Claims Made by Proponents of Organic Food, *Comprehensive Reviews In Food Science And Food Safety*, 9 (3), 270-277

Smith-Spangler Crystal, Brandeau Margaret L., Hunter Grace E., Bavinger J. Clay, Pearson Maren, Eschbach Paul J., Sundaram Vandana, Liu Hau, Schirmer Patricia, Stave Christopher, Olkin Ingram and Bravata Dena M., 2012, Are Organic Foods Safer or Healthier Than Conventional Alternatives? A Systematic Review, *Annals of Internal Medicine*, 157 (5), 348-366

Statistical Data, Hellenic Ministry of Rural Development and Food, (www.minagric.gr)

Support on organic farming, Greek Rural Development Programmes 2014-2020 (Reg. EU No1305/2013)

Susanne Padel, Jespersen Lizzie Melby and Schmid Otto, 2007, Final Project Report of Project title: Research to support the revision of the EU Regulation on organic agriculture (Project no. SSPE-CT-2004-502397)

The common agricultural policy (CAP) and agriculture in Europe – Frequently asked questions, European Commission Press Release Database, (http://europa.eu/rapid/press-release_MEMO-13-631_en.htm)

Tybirk K., Alrøe H. F. and Frederiksen P., 2004, Nature Quality In Organic Farming: A Conceptual Analysis of Considerations and Criteria in a European Context, *Journal of Agricultural and Environmental Ethics*, 17, 249–274

Williamson C.S., 2007, Is organic food better for our health?, *British Nutrition Foundation Nutrition Bulletin*, 32, 104–108

Winter Carl K. and Davis Sarah F., 2006, Organic Foods, *Journal Of Food Science*, 71 (9), 117-124

Zoiopoulos Pantelis and Hadjigeorgiou Ioannis, 2013, Critical Overview on Organic Legislation for Animal Production: Towards Conventionalization of the System?, *Sustainability*, 5, 3077-3094.

Final product: A role playing debate will be applied. There are four interest groups who address environmental, social, economic and ethical concerns:

1. Farmers
2. Consumers
3. Policy makers
4. Taxpayers

Each group should explain their positions, formulate arguments and justify their decisions concerning the questions listed above.

Moreover groups should consider the following issues:

Farmers: What motivates farmers to adopt or reject organic farming?

Consumers: Reasons why consumers purchase or refuse to purchase organic products.

Policy makers: Policy design, e.g. organic farming subsidies, should be based on income foregone or rather on the delivery of positive externalities from this farming system?

Taxpayers: Reasons why taxpayers should bear or not cover the cost of organic support.

Assessment: Group presentation and discussion; application

Application: Water management and EU policies

Larissa is one of the four regional departments (NUTS3) of Thessaly. It is mostly a plain area, where agriculture has been traditionally the main economic activity. The previous ‘coupled’ Common Agricultural Policy (CAP), commodity support schemes led farmers to shift towards highly intensive cropping patterns, in which cotton predominated, thus causing significant pollution in surface and ground water.

One of the first Agri-environmental Measures implemented in Greece in 1995 (under Reg EEC 2078/92) aimed at combating water pollution caused by nitrates originating from agricultural sources. The Nitrate Reduction Scheme initially targeted at Thessaly, a Nitrate Vulnerable Zone (NVZ), under the Nitrates Directive (EEC/91/676), and then expanded to other NVZ areas. The scheme was designed to provide incentives to farmers in order to introduce or maintain nitrate-reducing farming practices concerning irrigated arable crops in areas with high concentrations of nitrates in their groundwater or in NVZs under Directive EEC/91/676. The stated objectives of the Nitrate Pollution Reduction Scheme were the protection of water resources from exhaustion, the restoration of quality of ground water and the improvement in soil fertility. Therefore the specific action aimed to reduce water use and the application of fertilizers as well as to create ecological compensation areas.

On the other hand, cross compliance is a key instrument for integrating major environmental concerns into the first pillar of the CAP and consists of compulsory environmental requirements and obligations that farmers should abide by in order to receive CAP subsidies. Furthermore, farmers being in a NVZ area should comply with obligations defined in the local Action Plans of NVZs and specific cross compliance legislative measures.

Question:

Comparison of the environmental, economic and social effects related to the implementation of a regulatory policy measure (cross compliance) and an incentive provision project (agri-environmental measure).

The role-playing exercise: The case of organic farming

In November 2016, the case of organic farming was suggested as a topic for discussion to the 7th semester students of Department of Agricultural Economics and Rural Development of Agricultural University of Athens. The exercise was part of the compulsory courses *Natural Resource & Environmental Economics* and *Rural Environment Protection Policies*.

Students were informed about the role-playing exercise two weeks prior to its implementation. The organic farming peculiarities were briefly addressed to the students, while the four different interest groups were identified and supporting material was given to them. In turn, they were asked to freely split into four groups, prepare arguments for or against the issue at stake and present them before the class. Students were also advised to work as a group, researching and discussing the case from their assigned perspective.

A two day debate took place, on the 8th and on the 10th of November, in which 75 students participated (21 as consumers, 16 as producers, 21 as policy makers and 17 as taxpayers). The whole procedure was recorded and lasted approximately 4 hours.

“Semi-structured session”

During the first day, representatives of the groups of producers and consumers presented their arguments and positions on the subject. Presentations were interspersed with comments, oppositions and clarification questions posed by the other three groups as well as the teacher, who clearly expressed his opinion on the case. It was a process which encouraged direct communication with questions and immediate responses, during which all groups spontaneously discussed and

shared their points of view. The teacher's role was active, challenging students, as well as providing scientific knowledge and guidance when needed.

“Structured session”

The prevailing procedure during the second day was different compared to the one followed the first day. The groups of policy makers and taxpayers had 15 minutes to present their perspectives and explain their position on two particular questions put forward at the end of the first day. After the presentations, groups responded to questions posed by students as individuals and not as a member of their group. Subsequently, each group had 15 minutes to prepare questions that they would like to ask the groups of policy makers and taxpayers. At this stage, teacher also put his questions to the aforementioned groups. After a 10 minute break for group discussion, both teams replied to the questions, along with a summary of their stance. Finally, the teacher trying to reach a consensus asked the four groups whether their initial position has been shifted during those meetings, and precisely whether a conceptual or practical convergence has been achieved. It should be stressed that the teacher's role was neutral and he acted as a moderator, facilitating the discussion and keeping the time limits.

Remarks - Conclusions:

- Given the size of the class, groups consisted of a large number of students. Although teachers encouraged the active participation of all members, many students were silent and were not engaged in the public discussion. Thus smaller groups of five or six students seem to be more effective, since all members would have the opportunity to speak and express their views, even the quieter /shy ones.
- Concerning the two different approaches used, students were more active and had a more passionate interaction with quick reactions, when no clear rules of the debate were given. On the contrary, a structured and guided procedure enabled students to prepare persuasive responses and improve time management skills. Thus both approaches are complementary and may benefit students' competencies.

- In general, students seem to lack team spirit and conflict resolution skills. In the case of taxpayers group, students presented three different positions on the topic, since they couldn't come to an agreement as a whole team. Moreover, at the end of the exercise, none of the groups was willing to reach a compromise. There is a need for improvement in students' skills to work collaboratively, negotiate and finally accomplish a shared solution. Learning activities, such as role playing and debate may promote these social skills.
- Students' feedback on role playing exercise was mixed. The majority of class seemed to enjoy the procedure and felt that it was a useful learning experience. For instance, it was the first time for some students to speak in front of a large audience and defend their opinions. However, other individuals felt that it was a waste of time, since the exercise didn't result in a solid knowledge transfer. It is a rather natural stance from people accustomed to be offered the "correct solution", when they participate in an exercise aiming at broadening their perspectives and enhance their skills to discuss, analyse and think critically a complex issue involving multiple aspects.

