

TEACHING STRATEGIES IN THE MSc PROGRAMME IN CLIMATE CHANGE AND RESTORATION ON DEGRADED LAND

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Abstract

Erasmus 2009-2013 is a cooperation program in the field of Higher Education that aims to enhance the quality of European education provision. In 2012 it was proposed a training program (Master Degree level) related to Climate Change and the Restoration of Degraded Lands. UPM, the promoter of this project, has identified a clear lack of educational provision regarding Climate Change, Degraded Land and its Restoration, in both educational and non-educational settings. UPM has got extensive expertise in developing tailored e-learning programs. Their strengths rely on their ability to tailor ICT solutions to the particular needs of the educators by incorporating the latest developments in communication. UPM is a leader on landslide assessment and environmental restoration, as well as in waste management. The study of climate change and degraded land requires innovative techniques in teaching that will be analyzed and discussed in the following paper. These techniques should be integrated among the various project partners, which increase the difficulty of applying homogeneously. Another complex issue is the environmental conditions differences across the project consortium, from a subtropical one (Canary Islands) to a continental climate with Mediterranean influence and further to a boreal one in the Baltic states. This makes challenging the production of generic documents that may have application in all consortium participants.

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1 BACKGROUND

The United Nations Climate Change Conference, Durban 2011, delivered a breakthrough on the international community's response to climate change. In the second largest meeting of its kind, the negotiations advanced, in a balanced fashion, the implementation of the Convention and the Kyoto Protocol, the Bali Action Plan, and the Cancun Agreements. The outcomes included a decision by Parties to adopt a universal legal agreement on climate change as soon as possible, and no later than 2015.

One of the decisions adopted by COP 17 and CMP 7 regard to the land use, land-use change and forestry, and *invites* the Intergovernmental Panel on Climate Change to review and, if necessary, update supplementary methodologies for estimating anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from land use, land-use change and forestry activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Land degradation is a human-induced or natural process which negatively affects the productivity of land within an ecosystem. The direct causes of land degradation are geographically specific. Climate change, including changes in short-term variation, as well as long-term gradual changes in temperature and precipitation, is expected to be an additional stress on rates of land degradation.

- Climate change-induced land degradation is expected through (Eswaran *et al*, 2004).

- Changes in the length of days and/or seasons;
- Recurrence of droughts, floods, and other extreme climatic events;
- Changes in temperature and precipitation which in turn reduces vegetation cover, water resource availability, and soil quality;
- Changes in land-use practices, such as conversion of lands, pollution, and depletion of soil nutrients.

Research suggests that climate change-induced land degradation will vary geographically. The underlying adaptive capacity of both the ecosystem and communities will determine the extent and direction of impacts.

Adaptation-related projects on land degradation should apply incremental reasoning during the design and preparatory phase. The focus of projects should be on reducing the impacts of climate change on land degradation over and beyond measures that would normally be undertaken as a land degradation focal area activity. In line with the adaptation funding window that applies in this case (see below), maintaining and/or strengthening the resilience of ecosystems and communities to climate change by reducing the rates of land degradation (caused by climate change) is a priority. Projects should reflect dynamic, long-term response measures that can effectively contribute towards the reduction of climate change-induced land degradation.



Figure 1; Desertification in Negev desert, Israel (Santamarta JC, 2009)

EU Policy on Climate Change (WHO/Europe, Parma Italy, 2010) for member states envisage to strengthen health, social and environment systems and services to improve their capacity to prevent, prepare for and cope with climate change. Within this context the consortium of this project evaluated EU' HE offer of Climate Change and Degraded Land to identify if the next generation of environmental scientists and managers are offer a solid and well prepared curricula. A survey of existing curricula at educational institutions in partner institutions was conducted and followed by a thorough analysis. This survey covered the ways how the practice is organized for students. This and all other data was discussed in the preparatory phase of the project idea. The proposed project draw lessons from this evaluation identified educational practices that need to change to embrace climate change and land degradation and restoration as a subject, gaps in education from employers and professionals perspective. Based on this a MSc program of modules will be accredited jointly or dually at partner institutions and the overall MSc will be jointly piloted by the consortium leader, Buckinghamshire New University with the intention to offer restoration of degraded land within a transdisciplinary context with enterprises support and endorsement; and that opportunities, such as internships and other methods of applied learning, are included in the curriculum as a result of the partnership with stakeholders. All partners will participate in the piloting of the MSc on Climate Change, and Restoration of Degraded Land and will also include accredited modules in their accredited MSc programs offer with the intention of joint delivery.

Rationale:

- There is strong scientific evidence indicating that land degradation has become a substantial problem for most of Europe as a result of climate change. This has been highlighted by the EUROPEAN COST Action FP0601 "Forest management and the Water Cycle".
- The results of the United Nations Climate Change Conference, Durban 2011, delivered a breakthrough on the international community's response to climate change and ratified the importance of the land use and land use change as related to Climate Change.
- For the restoration of degraded land and mitigation of the effects of climate change in land use there is a need for greater awareness and training among ground staff.
- There is a serious shortage of staff specialized in the technology enhanced restoration of degraded land in Spain, the UK, Romania, Hungary and Estonia.
- Many EU students have still not being involved in a mobility program and therefore the proposed MSc program is intending to encourage students from partner Universities to become involved with exchange programs and to study some of the MSc at partner institutions were jointly accredited.

All partners have been involved in joint of dual partnership projects under the TEMPUS, Erasmus students and staff exchange, Erasmus Mundus, LIFE, Leonardo da Vinci, and Copernicus Programs.

2 INVESTIGATION OF THE FIELD (STATE OF THE ART) AND INNOVATIVE CHARACTER

Atmospheric CO₂ is too high. Degradation of lands can result in the emission of greenhouse gases. Through restoration of lands, these emissions can be reduced. Restoration of degraded soils and ecosystems can fix up to 1.9 billion tons C/year. So there is a need to link mitigation of Climate Change with restoration of land and land uses.

The problem is exacerbated by harsh climates like Iceland, and fragile soils like sub-Saharan Africa. Principal factors include climate change, land misuse and soil mismanagement, such as extractive farming practices based on mining soil fertility and depleting soil organic matter reserves. The scarcity of prime soil resources, competing uses of soil for urban and industrial purposes, and population necessitate restoration of degraded land and ecosystems.

Many learning programmes in Europe see the role of environmental education as a means to provide a platform for sound scientific research rather than to introduce decision-making concepts and tools.

The study of climate change and degraded land requires the study of causal relations between human causes and land use changes. RECLAND will dynamically link people from different disciplines and from outside academia to improve students' experience which will enable them to learn to deal with multi disciplinary decision making solution. This allows for students not to be just inserted into one system or discipline, but simultaneously into a process of learning about the relation between education, political, social, ecological and economic environment.



Figure 2; Restoration of quarries in the North of Spain (Santamarta JC, 2010)

Experience accumulated by consortium members on locations in Bosnia Herzegovina and in Spain and Romania found that knowledge on climate change and degraded land restoration within the context of civil society is scarce at practitioner level. A normal degree or MSc course on degraded land restoration does not prepare practitioners on how to deal with the effects of climate change on water, soil, waste land... each of them can be taken in account as new scenarios for the mitigation of causes and restoration from the beginning.

The project considers a framework for the establishment of learning outcomes and assessment tools for each module based on the following set of four goals:

1. To generate new knowledge about Climate Change, its causes and its effects.
2. To relate degradation of land to Climate Change.
3. To identify the mitigation and adaptation measures.
4. To promote deeper knowledge of, debate about, and practice of climate change and degraded land restoration.

3 AIM AND OBJECTIVES OF THE PROJYECT

Aim: To modernize curriculum provision in partner countries by implementing a strategic approach for applied and unified credit transfer type of postgraduate education that prepares students for the regional and global postgraduate job market. To jointly develop and deliver a European Masters modules program technology enhanced in *MSc Program in Climate Change and Restoration of Degraded Lands* based on the "Tuning" project framework.

Objectives:

- To develop modules tailored to technology assisted on Climate Change and Restoration of Degraded Land.
- To develop teaching materials that utilise learning objects.
- To develop a virtual learning environment that facilitates learning and assessment.
- To disseminate the results to a wider European audience.
- To exploit the results by organising the transfer to other practitioners.

Accordingly this project will do the following:

- To develop and validate jointly a MSc modules programme on enhanced technology on Climate Change and Restoration of Degraded Land and run the new course piloted at UPM, Madrid, Spain.
- To update existing libraries.
- To enhance applied postgraduate education for consortium countries practitioners closer to a harmonised Standard.

Development of an innovative joint continuing postgraduate education curriculum and coordinated continuing education organizational structure for partner countries represents good example of optimal and coordinated resource utilization. The proposed MSc modules program will provide provision for continuing education and cover the shortage of skills and educational resources on Climate Change and Restoration of Degraded Land at European level.

The proposed MSc modules program philosophy is that *Climate Change affects land and its uses, as well as degradation of soil and vegetation aggravates the emission of greenhouse gases into the atmosphere*, so it becomes necessary to focus the problem from a global perspective.

The proposed MSc modules program allows students to analyze the impacts of climate change on land, and on the sustainability and resilience of fragile ecosystems. It also enhances their capacity to design policies to mitigate the impacts arising from climate change and environmental degradation.

4 INNOVATIVE METHODOLOGY

The most innovative aspect of this Masters Degree is that it links Climate Change to Land degradation and its restoration. There is not such an offer that combines and links these two major aspects directly

related en focuses the educational program is this combination. From this perspective, which is widely recognized by experts, students will have an innovative and useful point of view of the issue covered by the program, in an unique way.



Figure 3; Field trip with ULL and UPM Universities

Another strong point of the innovative methodology in the Master is the practical trip it shows us a way in order to meet educational objectives, such are: to get basic knowledge and skills to manage, develop, design and understand environmental projects, to be able to integrate concepts when information is limited or incomplete, to develop abilities for communication and reasoning, to give them skills to learn in the future like a part of their educational career.

The results and effects that they were observed through a specific survey:

1. Significant increase student motivation for the subject.
2. Significant increase student motivation for the career.
3. Better understanding of the academic world.
4. Increasing teacher's motivation
5. Increasing rates of achievement in learning the learning results.

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