

HABILITATION THESIS

LAND RECLAMATION AND IMPROVEMENT WORKS AND SUSTAINABLE LAND MANAGEMENT IN THE CONTEXT OF CLIMATIC CHANGES

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SUMMARY

The present thesis includes the results of research activities conducted by the candidate after he sustained his PhD thesis in 2010, thesis having the following title „Technical and economical efficient drainage studies for fields with humidity excess”. This PhD thesis engaged a very important and actual research theme for land reclamation and improvement and environment protection domains being focused on the necessity of land drainage studies in the perspective of implementing a sustainable agriculture considering the necessity of conserving soil and water resources and the challenges generated by climatic changes.

Because drainage is a vital component of water resources integrated management, process which promotes the coordination of water, soil and other natural resources management and which relates with those for maximizing the economical and social sectors in an equitable manner and without compromising the sustainability of vital ecosystems, this work supposed an interdisciplinary research comprising problems connected with soil science, climatology, drainage, mathematics, informatics, modeling. For realizing some technical and economical efficient drainage studies, IT component become in the last years extremely important, modeling programs being those which can offer the best information referring to the evolution of ecosystem components and services provided by those ecosystems following the implementations of a land drainage system.

The candidate activity after PhD defending focused on the following research topics:

1. Modern approaches and concepts in land reclamation and improvement technique
2. Natural resources integrated management using technical measures from civil engineering domain
3. Sustainable development, climatology, climatic changes

In a first stage, as a follow of previous activities conducted by the candidate for his PhD thesis, the candidate activity focused on issues referring to IT products used in land reclamation and improvement technique, especially in studying land drainage systems. Research activity was mainly dedicated to the study of using different software in land drainage systems design and operation, the study of head losses in conditions of using (or not) filtering materials. These studies have a special relevance in determining the distance between drains and in avoiding some considerable errors at this level. A detailed analysis can be realized in identifying the dominant variables of head losses in land drainage design. The results can be used in determining the parameters used subsequently as input data in designing an underground land drainage system. Distance between drains is sensitive to changes of radial component and soil hydraulic conductivity but doesn't present any kind of alterations related to vertical and horizontal components variations. All these correlations between different parameters must be analyzed

deeply and accurately in order to improve the efficiency of designing underground land drainage systems to increase the effectiveness of these systems exploitation.

The candidate also present interest and submitted a relevant activity in the field of qualitative and quantitative management of water resources using specialized software respectively in analyzing the ecosystem services provided by land reclamation and improvement arrangements. The final aim of irrigation and drainage arrangements is to improve the agricultural production, to increase the income from rural space and to minimize the risks generated by drought periods. Irrigated agro-ecosystems strive to maximize agricultural productions but, with an adequate management, they can offer other services like soil erosion control, flooding retention, sediments retention, aquifers recharge, habitats for fauna. The economical value of these services can overrun in some cases the crops value from the lands covered by these arrangements.

Strongly connected with the first stage are two other major themes of research covered by the candidate: Natural resources integrated management using technical measures from civil engineering domain and Sustainable development, climatology, climatic changes. These themes were studied and in the context of candidate participation at 2 COST projects: COST ES1104 Arid Lands Restoration and Combat of Desertification: Setting Up a Drylands and Desert Restoration Hub respective COST ES1308 Climate Change Manipulation Experiments in Terrestrial Ecosystems - Networking and Outreach (ClimMani).

Currently, worldwide there is an extraordinary pressure on farmers for maximizing their social and economical benefits from their lands facing at the same time land degradation and desertification. Sustainable land management is the key answer for these challenges and represents land management through which human society strive to agricultural production living conditions and ecosystems improvement. For including irrigation and drainage arrangements in a natural resources integrated management there are necessary the establishing of a set of factors consisting in coordination and support measures dedicated to the final users (farmers, water users associations, experts from land reclamation domain).

The candidate also granted a special attention to drought study by analyzing some climatic indicators for monitoring climatic changes in western Romania. In drought study, as well as when we analyze climate changes, some aspects must be considered in order to get some relevant results. Drought phenomenon is a real one, natural and recurrent but characterized by an uncertain frequency, variable length and severity being hardly predictable. We can even say that drought can't be predicted, only studied which leads the researches conceptual framework in another direction, from prevention to mitigation. Drought can't be stopped from the beginning (drought doesn't have clearly defined start and end points) allowing in a relative measure only interventions on her effects. Therefore, drought study can offer information after-event and researches results can be used for implementing some mitigation measures of these effects.

All these studies were correlated with research conducted at international level on climate changes, climate changes effects and management measures practiced at local, regional, national and international levels.