UCL Université catholique de Louvain

LBIRE2105

2013-2014

Water and soil quality

3.0 credits	30.0 h + 7.5 h	2q

Teacher(s) :	Halen Henri ; Rollin Xavier (coordinator) ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	Icampus
Prerequisites :	The present course uses notions in the following fields: « Transfert phenomena », « General and applied ecology », « Environmental law », « General hydrology », « Toxicology and ecotoxicology » et « Soil science » ; these notions are reminded in order to avoid any barrier to the general understanding of the course.
Main themes :	1. Concepts studied during the course : - Soil and water quality. - Causes, mechanisms and consequences of water and soil alterations. - Legal contexts of soil and water protection. - Soil and water quality standards and their scientific bases. - Selection of physico-chemical, chemical, and biological diagnostic criterions for assessing water and soil quality. - The development and setting up of permanent monitoring programmes on water and soil quality. - The physico-chemical characteristics of pollutants that determine their behaviour (including transport) in soils and waters. - The principles of Risk Based Land Management. - Strategies and techniques for water treatment and soil remediation.
Aims :	a. Contribution de l'activité au référentiel AA (AA du programme) M.1.1 ; M.1.2 ; M.1.3 ; M.1.5., M. 2.1 ; M.2.2 ; M.2.3 ; M.4.5., M.4.7., M.7.1, M.7.2., M.7.3., M.8.1. b. Formulation spécifique pour cette activité des AA du programme (maximum 10) At the end of the activity the student should be able to : - summarize the European legal framework on water quality and for soil protection ; - explain the concepts of "good ecological and chemical status" of water bodies, soil quality and soil degradation; - identify the main potential pollutants in waters and soils, as well as their main characteristics and properties, and explain the main mechanisms by which they could affect the different possible targets and produce an impact, at different spatial and temporal scales; - explain, and differentiate for soil and water, the concepts of the DPSIR analysis scheme, and the concepts of water- and land- use; - list the key elements and indicators (physico-chemical, chemical, biological and hydromorphological) of water or soil pollution, prioritize and explain their methods of measurement; -define the concept of "quality standards" for water and soil, explain their scientific bases, critically interpret their values and use them adequately; - make a first interpretation of data concentrations of contaminants in soil and groundwater in terms of risk; - explain the principles of water flow and pollutant transport in soils, groundwater and surface waters; - propose a monitoring network focussing on either water or soil quality that would be based on defined objectives and development means ; for each kind of network : justify the choices made concerning the measuring station locations and types of indicators; - make good use of the legislations on water quality or on soil protection and contaminated site management; - make good use of the principles of Risk Based Land Management ; - identify, predict and justify the main treatment technologies for water treatment or for site remediation applicable for a given context. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	- Part « water quality »: closed-book written exam with theoretical questions + case resolutions. - Part « soil quality»: open-book written exam on case resolutions.
Teaching methods :	- « Classroom » lectures with many questions asked in direct to students in order to favour interactions and student attention. - Tutorial illustrating complex hydrodynamic phenomena. - Practical group training session with oral reporting of the main field observations and discussion on the influence of these observations on the environmental status, humaon productive uses, remediation actions to do...).
Content :	Lectures : Part I « water quality » : After a short summary of the European and Walloon legal context related to water protection and monitoring (chapter 1), the first part of the course analyses, in a second chapter, the main causes of water alterations on the basis of physical, chemical and biological processes involved. Chapter 3 introduces the methods used to measure the physico-chemical and biological quality of water as well as water quality standards applicable to natural ecosystems and different human productive uses (food,

	domestic services, agriculture, industry). Chapter 4 evaluates the effects of water pollutions at different spatial and time scales. Different ecotoxicological concepts are briefly exposed (sentinel species, bioindicators of contamination and effects...) as well as the main methods of evaluation of the ecological status of water bodies in Europe. Will also be introduced the interest of physiological, molecular and behavioural biomarkers as an alarm system related to undetectable disturbances by usual biotic indexes. Chapter 5 introduces to the design of water quality monitoring networks as well as the integration of their biological and physic-chemical indictors. Finally, Chapter 6 provides a broad perspective on the issue of the physic-chemical and biological processes and technologies used in waster-water treatment plants. Part II « soil quality »: Chapters 1 and 2 of the 2nd part of the course introduce to the concepts of soil quality, soil degradation and soil resilience and to the stakes and principles associated to soil policies and regulations dealing with soil protection. Through some examples, these chapters also introduce to the principles and methods currently used or proposed in E.U. countries for measuring and monitoring soil quality. Chapters 3 and 4 then introduce to the strategic principles for the management of contaminated land. By taking the Walloon "soil decree" as an example, details are given about the fundamental issues that are apprehended in laws and regulations relating to contaminated land management. Finally, Chapters 5 to 8 present the main types of soil pollutants and their fundamental (physico-chemical, toxicological and ecotoxicological) characteristics that allow to anticipate their behaviour and finally the risks associated with their presence in soils and groundwater. Basical principles for assessing risks associated with soil contamination are then introduced, together with the principles for the selection of the most appropriate remediation techniques. Practical training session: A field trip is organized that will allow : : (1) part « water quality » : to evaluate the ecological status of a small brook with different physico-chemical, biological and hydromorphological indicators. (2) part « sol quality » :to understand and visualize different remediation- and risk management- solution types that have been set up for the redevelopment of contaminated land (with 2 examples .
Bibliography :	- Copy of slides - Tutorial in ExcelTM - Reference materials : 1. Part « water quality » : - Benedini M. & amp; Tsakiris G. (2013) Water Quality Modelling for River and Streams. Water Science and Technology Library, Vol. 70. Springer. 2. Part « soil quality » : - L. Citeau, A. Bispo, M. Bardy, D. King. coord. (2008). Gestion durable des sols. Collection Savoir Faire, Editions Quae, 320p. - F. A. Swartjes (Ed.) (2011). Dealing with Contaminated Sites: From Theory towards Practical Application . Springer - O. Atteia (2005). Chimie et pollutions des eaux souterraines, Tech & amp; Doc Lavoisier.
Cycle and year of study :	> Master [120] in Environmental Science and Management > Master [120] in Biology of Organisms and Ecology > Master [120] in Agricultural Bioengineering > Master [120] in Environmental Bioengineering > Master [120] in Forests and Natural Areas Engineering
Faculty or entity in charge:	AGRO