



**Universidad Juárez del Estado de Durango**  
**Facultad de Ciencias Forestales**



*Learning Unit Programme*  
*With an integral professional competences approach*

**I. LEARNING UNIT GENERAL DATA**

<b>1. learning Unit Name</b> SOIL CONTAMINATION		<b>2. Code</b> 8501			
<b>3. Academic Unit</b> FORESTRY SCIENCES FACULTY					
<b>4. Academic programme</b> Environmental Engineering		<b>5. Level</b> Higher			
<b>6. Training Area</b> Discipline					
<b>7. Academy</b> Environmental Engineering					
<b>8. Modality</b>					
<b>Mandatory</b>	<b>X</b>	<b>Course</b>	<b>X</b>	<b>Attendance</b>	<b>X</b>
<b>Elective</b>		<b>Course-workshop</b>		<b>Non-attendance</b>	
		<b>Workshop</b>		<b>Mixed</b>	
		<b>Seminar</b>			
		<b>Laboratory, field practice, etc.</b>			
		<b>Professional Practice</b>			
		<b>Academic Stay</b>			
<b>9. Pre-requirements</b>					
The student had to take and pass the subjects of Sampling, Chemistry, Physicochemistry, and Microbiology.					

10. Theory hours	Practice hours	Independent study hours	Total hours	Credits
3	1	0	76	4
<b>11. Names of the teachers who participated in the development and/or modification of the programme</b>				
Dra. Felipa de Jesús Rodríguez Flores				
<b>12. Date of development</b>		<b>Date of modification</b>	<b>Date of approval</b>	
01/10/2013		20/02/2016	08/08/2017	

## II. LEARNING UNIT SPECIFIC DATA

### 13. Presentation

With this learning unit the student intended to deepen those skills acquired Soil Pollution previous semesters, complemented by the new and acquire skills enabling subsequent application in their training in engineering to solve environmental problems. Showing respect for the environment by applying professional ethics.

Complying with the graduate profile in: Management and quality management and air treatment, management and quality management and soil treatment.

The course has a mixed theoretical and experimental character, so the theoretical components are added the practical, in terms both resolving cases, exercises and problems, such as that of practical cases of laboratory by the concepts and techniques studied theoretically and familiarize students with the material and human working environment in the laboratory considering generating significant learning apply.

The Education Plan Environmental Management Engineering, Soil pollution is essential for learning: soil contamination, pollution management, solid waste management, hazardous waste management and soil bioremediation.

Besides being related to specific areas such as physics, chemistry and mathematics

### 14. Integral professional competences to develop in the student

<b>Generic competences</b>	<ul style="list-style-type: none"> <li>Capacity for analysis and synthesis.</li> <li>Oral and written communication skills.</li> <li>Ability to manage information.</li> <li>Decision making.</li>   <li>Ethical and quality commitment.</li> <li>Teamwork.</li> <li>Systemic</li> <li>Motivation for quality.</li> <li>• Ability to apply theoretical knowledge in practice.</li> </ul>
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<b>Professional competences</b>	<ul style="list-style-type: none"> <li>• Management of the natural environment</li> <li>• The graduate manages natural spaces and their use, assessing environmental risk and supported by advanced technologies with ethical and professional criteria.</li> <li>• Disciplinary (know)</li> <li>• Planning, management and conservation of natural resources.</li> <li>• Economic valuation of goods, services and natural resources.</li> <li>• Ability to address environmental problems in a multidisciplinary manner.</li> <li>• Professionals (how know ...how)</li> <li>• Design and execution of programs</li> <li>• Development, management, monitoring and control of environmental projects.</li> <li>• Management of the natural environment.</li> <li>• Waste disposal and control planning</li> </ul>			
<b>General purpose of the course</b>	Understand, handle and correctly apply the fundamental issues of soil contamination, such as the concepts, fundamentals, pollution, regulations that are basic in environmental engineering after being used in any type of industry.			
<b>15. Joint of axes</b>				
The learning unit articulates the environment, social responsibility and research so that students develop viable projects within a sustainable framework				
<b>16. development of the course</b>				
<b>Module 1</b>	INTRODUCTION			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Identify the basic characteristics as its components, properties, functions and fundamental process of the subsystem of soil.	1.1 Introduction 1.2 Soil chemistry 1.3 Introduction to Microbiology 1.4 Physical and chemical properties of the soil 1.5 Chemical and biochemical reactions 1.6 Ecological systems and pollution	1. Timeline of soil management concepts 2. Conceptual map of the characteristics, properties, functions and processes that are carried out on the ground. 3. Poster presentation of ecological systems and pollution	1. Teacher presentation. 2. Checklists for Conceptual map. 3. Exposure observation guide 4. Checklist for documentary research	Computer, internet, paintbrush, marker for pintarrón, cannon, Power Point presentations, bibliography.

<b>Module 2</b>	<b>FUNDAMENTALS OF SOIL CONTAMINATION</b>			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Identify the waste and associate it with the potential contamination of the soil and the loss of nutrients, proposing solutions according to the current regulations	2.1 Production of waste 2.2 Potential contamination 2.3 Losses of nutrients 2.4 Legislation 2.5 Problems	. Power Point presentation potential contamination 2. Summary of nutrient loss in the soil 3. Written summary on environmental legislation and regulations 4. Power Point presentation on case studies	1. Teacher presentation. 2. Analysis synthesis of the topics 3. Exposure observation guide 4. Knowledge test of units 1 and 2  5. Examination of knowledge of units 1 and 2	Computer, internet, paintbrush, paintbrush marker, cannon, Power Point presentations, bibliography
<b>Module 3</b>	<b>AGRICULTURAL POLLUTION</b>			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
identify nutrient cycles in agricultural systems defining the polluting residues that cause the loss of nutrients and their deterioratiol	3. 1. Introduction 3.2 Nutrient cycles in agricultural systems 3.3 Physical and chemical properties of the soil 3. 4 Production of agricultural waste 3.5 Potential contamination of agricultural waste 3.6 Losses of nutrients 3.7 Other wastes and contaminants 3.8 Regulations	1. Power Point presentation of potential contamination of agricultural waste 2. Summary of the theme of nutrient cycling in agricultural systems 3. Field practice report and laboratory report	Presentation of the teacher. 2. Analysis Summary of the topics 2. Checklists for review of practices 3. Open discussion in classes 4. Checklist for summary review 5. Knowledge test	Computer, internet, paintbrush, paintbrush marker, cannon, Power Point presentations, bibliography

	3.9 Problems			
<b>Module 4</b>	<b>CONTROL OF CONTAMINATION</b>			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Measures and prevention techniques mitigation and remediation of contaminated soils	4.1 Obstacles to control pollution 4.2 Principles of pollution control 4.3 Control of point sources 4.4 Control of non-point sources 4.5 Land application of waste 4.6 Standards 4.7 Control of air pollution caused by soil contamination	1. Power Point presentation on Control of point and non-point sources of pollution 2. Research report on legal specifications for final disposal of soil residues 3. Power Point presentation on principles for the recovery of contaminated soils 4. Research report on techniques for the recovery of contaminated soils.	1. Teacher presentation. 2. Analysis Summary of the topics 3. Checklists for practice review 4. Open discussion in classes 4. Checklist for summary review	Computer, internet, pintarrón, marker for pintarrón, cannon, multimedia presentations, reading of documents, evaluation instruments, bibliography
<b>Module 5</b>	<b>MINIMIZATION, EVALUATION AND MODELING</b>			
<b>Intended learning</b>	<b>Learning contents</b>	<b>Learning product(s)</b>	<b>Strategies</b>	<b>Teaching resources and materials</b>
Design strategies for the minimization, evaluation and modeling of soil contamination	5.1 Strategies and benefits of minimizing soil contamination 5.2 Waste reduction techniques 5.3 Environmental impact assessment	1. Power Point Presentation of Strategies and Benefits of Minimizing Soil Pollution  2. Power Point presentation In techniques for the reduction of soil polluting waste	1. Presentation of the teacher. 2. Analysis and synthesis of the topics. 3. Exposure observation guide 4. Knowledge test	Computer, internet, pintarrón, marker for pintarrón, cannon, multimedia presentations, reading of documents, evaluation instruments and referred bibliography

	procedures 5.4 Scope of EIA 5.6 Population models 5.8 Modeling 5.9 Case study	3. Research report on procedures, scope, modeling and case studies		
<b>17 Performance evaluation</b>				
<b>Performance evidence(s)</b>		<b>Performance criteria</b>	<b>Application scopes</b>	<b>percentage</b>
Module 1.		Delivered in time and form. - Content and structure requested. - Clarity -Bibliography  - Delivered in time and form. - Content and structure - Conclusions and Bibliography  - Delivered in time and form. - Content and structure requested. - Clarity in Discussion or --Conclusions and bibliography	- Local. - Regional. - National	<b>20%</b>
Individual timeline				
Individual conceptual map				<b>20%</b>
Poster exhibition For team				<b>60%</b>
Module 2		- Delivered in time and form. - Content and structure requested. - Clarity in Discussion or Conclusions -Bibliography. - Delivered in time and form. - Content and structure requested  - Delivered in time and form. - Content and structure requested. - Clarity in Discussion or Conclusions	- Local. - Regional. - National	<b>60%</b>
Exam				<b>10%</b>
Presentation in Power Presentation in Power				<b>10%</b>
Summary Summary				<b>10%</b> <b>10%</b>
Module 3 Presentation in Power		- Delivered in time and form.		<b>10%</b>

<p>Presentation in Power</p> <p>Summary</p> <p>Practice report. Individual of field and Laboratory.</p> <p>Exam</p>	<ul style="list-style-type: none"> <li>- Content and structure requested.</li> <li>- Clarity in Discussion or Conclusions</li> <li>-Bibliography.</li> <li>- Delivered in time and form.</li> <li>- Content and structure requested</li> </ul> <ul style="list-style-type: none"> <li>-Delivered in time and form.</li> <li>- Content and structure requested.</li> <li>- Clarity in Discussion or Conclusions</li> </ul> <ul style="list-style-type: none"> <li>- Delivered in time and form.</li> <li>- Content and structure requested.</li> <li>- Clarity in Discussion or Conclusions</li> </ul> <p>clarity</p>	<ul style="list-style-type: none"> <li>- Local.</li> <li>- Regional.</li> <li>- National</li> </ul>	<p><b>10%</b></p> <p><b>10%</b></p> <p><b>20%</b></p> <p><b>60%</b></p>
<p>Module 4</p> <p>Presentation in Power Presentation in Power Presentation in Power</p> <p>Investigation report Investigation report</p> <p>Exam</p>	<ul style="list-style-type: none"> <li>- Content and structure requested.</li> <li>- Clarity in Discussion or Conclusions</li> <li>-Bibliography.</li> <li>- Delivered in time and form.</li> <li>- Content and structure requested</li> </ul> <p>Delivered in time and form.</p> <ul style="list-style-type: none"> <li>- Content and structure requested.</li> <li>- Clarity in Discussion or Conclusions.</li> </ul> <p>Clarity</p>	<ul style="list-style-type: none"> <li>- Local.</li> <li>- Regional.</li> <li>- National</li> </ul>	<p><b>20%</b></p> <p><b>20%</b></p> <p><b>60%</b></p>
<p>Module 5</p> <p>Presentation in Power Presentation in Power</p> <p>Investigation report</p>	<ul style="list-style-type: none"> <li>- Content and structure requested.</li> <li>- Clarity in Discussion or Conclusions</li> <li>-Bibliography.</li> <li>- Delivered in time and form.</li> <li>- Content and structure requested</li> </ul>	<ul style="list-style-type: none"> <li>- Local.</li> <li>- Regional.</li> <li>- National</li> </ul>	<p><b>20%</b></p>

Exam	Delivered in time and form. - Content and structure requested. - Clarity in Discussion or Conclusions.		<b>20%</b>
	Clarity		<b>60%</b>

### 18. Evaluation criteria:

Criterion	Value
<b>Formative Evaluation</b>	0% Attitudes (participation, formality, respect, honesty and responsibility) 45% (evidence of performance indicated in point 17) 25% (written exam, indicated in point 17)
<b>Summative evaluation</b>	25% (written exam, indicated in point 17)
<b>Criteria summation</b>	<b>100%</b>

### 19. accreditation

The accreditation of the learning unit is aligned with the provisions of the regulations of the Faculty of Forestry Sciences. It is necessary to approve with a minimum of 6.0. The student who has obtained in the learning unit a minimum performance of 8.5 (eight point five) and minimum 80% attendance, will be exempt from presenting ordinary exam

### 20. Information sources

<b>Basic</b>	
<b>Complementary</b>	<ol style="list-style-type: none"> <li>1. Eweis, Juana. 1999. Principios de Biorrecuperación. Tratamientos para la descontaminación y regeneración de suelos y aguas subterráneas mediante procesos biológicos y físico-químicos. McGraw-Hill. México. 327 pp.</li> <li>2. La Grega, M. y <i>et al.</i> 1996. Gestión de Residuos Tóxicos. Tratamiento, eliminación y recuperación de suelos. Vol. I. McGraw-Hill. México. 642 pp.</li> <li>3. La Grega. M. y <i>et al.</i> 1996. Gestión de Residuos Tóxicos. Tratamiento, eliminación y recuperación de suelos. Vol.</li> </ol>



II. McGRAW-HILL. México. 1261 pp.

4. VV.AA, 2005. Biotecnología ambiental. Editorial Tebar. Pág. 614 ISBN 9788473602112.
5. Richard Bartha ,2001. Ecología microbiana y microbiología ambiental. Editorial: ADDISON-WESLEY, España, 696 págs. ISBN 9788478290390.
6. Christopher K. Mathews; Kevin G. Ahern; K.E. Van Holde , 2002. Bioquímica (3ª ED.). Editorial Addison-Wesley, España, 1368 Págs. ISBN 9788478290536
7. Gines Navarro García, 2013. Química agrícola. Editorial: S.A. MUNDI-PRENSA. 508 págs. ISBN 9788484766568
8. COLIN BAIRD, 2014. QUIMICA AMBIENTAL (2ª ED.). Editorial: REVERTE, ESPAÑA. 850 págs. ISBN 9788429179156
9. JUAN ANTONIO VELASCO TREJO, TANIA VOLKE SEPÚLVEDA 2002. TECNOLOGÍAS DE REMEDIACIÓN PARA SUELOS CONTAMINADOS. LUGAR DE EDICIÓN: MÉXICO; PAG: 62; ISBN: 968-817-557-9
10. David Flores, Héctor Gustavo Zegarra, Juan Manuel Arce, Luis Carlos Fernández, Martha Elena Ramírez, Norma Gabriela Rojas. Raúl Uribe, Romeo Jesús Reyes, Teresa Guadalupe Roldán. 2006. Manual de Técnicas de Análisis Suelos Aplicadas a la Remedación de Sitios Contaminados. Lugar de Edición: México; SEMARNAT, INE.; Núm. Edición: Primera; Número de Páginas: 180 ;ISBN: 968-489-039-7
11. Jördening, H.-J.; Winter, J. 2005. Environmental Biotechnolgy. Wiley-VCH Verlag GmbH & Co.  
<http://onlinelibrary.wiley.com/doi/10.1002/3527604286.fmatter/pdf>
12. Eduardo Bes Fuster. 2013 Descontaminación de suelos y acuíferos. Procesos de remediación. Editorial: Vértice Books. España. Páginas: 262. ISBN: 9788494073762

13. Mariana Tejado Gallegos. 2014. La contaminación del suelo por residuos peligrosos y su regulación en México. UNAM. México. No. De painas 384. ISBN: 9786076101681

14. Vassallo, Luis Fernando, (2008). Yacimientos Minerales. Versión OnLine, 4ta Edición. Boletín Electrónico (Bol-e). Centro de Geociencias UNAM, Querétaro, MEXICO.

Secretaria de Medio Ambiente y Recursos Naturales-(SEMARNAT/SSA1-2004), Norma que establece los criterios para determinar las concentraciones en la Remediación de Suelos Contaminados por Arsénico, Bario, Berilio, Cadmio, Cromo hexavalente, Mercurio, Niquel, Plata, Plomo, Diario Oficial de la Federación, Segunda Edició

### **21. Profile for the teacher who imparts this learning unit**

Have a bachelor's degree in Environmental Management, Ecology, Biology, or postgraduate in related area.

Preferably with a Master's or Doctorate degree.

Professional university experience as a teacher in front of a group.

Availability to work as a team

