SWITCH

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Sustainable Water Management in the City of the Future

Integrated Project
Global Change and Ecosystems

International Seminar

Wetlands as Sustainable Technology for Water Management and Climate Change Mitigation

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

International Seminar

Wetlands as Sustainable Technology for Water Management and Climate Change Mitigation

Report

Cali, November, 2009

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1 INTRODUCTION

The transformation of organic matter and nutrients in wetland ecosystems both, natural and artificial, is a central theme of study, given its importance to various natural and bioremediation processes that occur in these ecosystems. The advent of ecological engineering, defined this as the application of ecological principles to the sustainable management of ecosystems (i.e., restoration of soils contaminated with heavy metals via phytoremediation, decontamination of water using assembled populations of plants and microorganisms, sustainable management of soil fertility and eutrophication control of lentic water bodies) may improve the management of strategic natural resources like water and soil, and their associated biological resources.

A systematic view from ecological engineering to wetland ecosystems (both natural and constructed) will enable the integrated management of these ecosystems, and enhance the various environmental services they can offer. In this sense, natural wetlands conservation is a key aspect, since strategic resources such as their water and biodiversity characterize them as vital ecosystems for life. Meanwhile, constructed wetlands are known as an eco-technology for natural cleaning of contaminants using both microorganisms and plants. However, depending on the type of plant used, these engineered ecosystems could also provide other environmental services with added value.

The interactions that occur between the biotic and abiotic components in an ecosystem are very diverse, and perhaps the most extensively studied are the ones based on bio-geochemical cycles of elements like Carbon, Nitrogen and Phosphorous. Furthermore, the dynamics and ecology of diverse populations of organisms are also studied. However, many processes and interactions have not been fully understood and there is little information in the literature on the anthropogenic causes that disrupt the functioning of both natural and constructed wetlands, particularly in tropical environments. The vast majority of reported research and experiences correspond to seasonal countries or regions. Therefore, the proper understanding of either natural or constructed wetlands functioning must include disciplines such as water chemistry, biology and hydrodynamics (i.e., transport processes of matter within the ecosystem).

In this manner, the seminar “Wetlands as Sustainable Technology for Water Management and the Mitigation of Climatic Change” is framed within the SWITCH project context, since it is one of the six central axis of the macro project. The implementation of wetlands as natural wastewater treatment systems, contributes to changing the paradigm of water Management in urban areas.

This report describes the contents of the seminar, including the proposed objectives, description of thematic areas, work methodology and the members of the Scientific and Steering Committee.

2 SEMINAR DESCRIPTION

2.1 Objectives

The proposed objectives of the seminar were:

- To contribute to processes understanding in natural and constructed wetlands providing different environmental services in the tropics
- To review and discuss successful experiences on management, conservation and reclamation of natural wetlands
- To disseminate advances and experiences on bioremediation processes in wetlands
- To discuss issues and research topics aimed at the improvement and efficiency of bioprocesses in wetlands
- To discuss applied modelling issues to the management and use of wetlands for different environmental purposes

2.2 Topics

The seminar was developed using the following four themes with each theme related to progress made in relation to research, conservation and experience obtained:

Natural Wetlands

As a fundamental part of the seminar, this section presented some experiences related to the permanent implementation and monitoring of wetlands in Valle del Cauca. It also included the appraisal and modelling of metal accumulation processes of the trophic chains.

Constructed Wetlands

Within the context of wetlands as a sustainable water management technology, the use of these waste water treatment systems for water contaminated with commercial plaguicides and pesticides, as well as recent experience in modelling these natural treatment systems, as well as hydrodynamics and organic matter removal in wetlands for the treatment of waste water in tropical regions.

Seminar-Workshop "Green Infrastructure for the City of the Future (1) and (2)

Experiences with the implementation of wetlands as a wastewater treatment method and the contribution to climatic change in urban areas and tropical regions. Additionally, experiences with hydrodynamic modelling of wetlands and stabilization lagoons for the control of water pollution and aspects such as greenhouse effect gas emissions in natural systems and bioremediation of heavy metals in leachates at sanitary landfills.

Field Trip

A field trip was made to SUCROMILES and the Research Station of Ginebra. These visits were made during the third day of the Seminar (November 12).

2.3 Methodology

The seminar was held during two days, each one including two thematic areas. Each area completed its main conferences and lectures within a time frame of 30 minutes. The introduction to the Seminar-Workshop of the second day was made by MSc. Alberto Galvis, Coordinator of the SWITCH Project–Cali, Universidad del Valle. A session of questions and answers was made at the end of each thematic area with the speakers of the corresponding presented area.

Annex 1, shows the detailed agenda of the seminar held.

2.4 Scientific Committee

The Seminar's Scientific Committee included these 12 experts from Europe (4), Latin America (7) and Australia (1):

- Diederik Rousseau, Ph.D. UNESCO-IHE (NL)
- Carlos Arias, Ph.D. Universidad de Aarhus (DEN)
- Jordi Morato, Ph.D. Universidad Politécnica de Cataluña (ESP)
- Cesar Motta, Ph.D. Universidad de New Castle (UK)
- Gustavo Peñuela, Ph.D. Universidad de Antioquia (COL)
- Apolinar Figueroa, Ph.D. Universidad del Cauca (COL)
- Douglas Laing, Ph.D. Consultor Internacional (AUST)
- Diego Paredes, M.Sc. Universidad Tecnológica de Pereira (COL)
- Enrique Peña, Ph.D. Universidad del Valle (COL)
- Miguel Peña, Ph.D. Universidad del Valle (COL)
- Carlos Madera, M.Sc. Universidad del Valle (COL)
- Juan Pablo Silva, M.Sc. Universidad del Valle (COL)

2.5 Organizing Committee

The seminar was set up by these members of the Environmental Sanitation Group of Cinara – Universidad del Valle and UNESCO – IHE (Netherlands):

- Diederik Rousseau, Ph.D. UNESCO-IHE (NL)
- Apolinar Figueroa, Ph.D. Universidad del Cauca (COL)
- Miguel Peña, Ph.D. Universidad del Valle (COL)
- Carlos Madera, M.Sc. Universidad dl Valle (COL)

Support was also provided by Alejandra Arreaga, student of Sanitary Engineering.

Annex 1
Agenda of the seminar

Annex 1. Agenda of the seminar

Wetlands as Sustainable Technology for Water Management and Climate Change Mitigation

November 10 – 12 Cali, Colombia

Hora	Día 1. Noviembre 10
Jornada de la mañana	**Bloque 1. Humedales Naturales**
8:00 – 8:30	Inscripciones
8:30 – 9:00	Acto de Instalación
9:00 – 9:30	Apolinar Figueroa Casas, Ph.D. Dpto. de Biología, Universidad del Cauca. Monitoreo ambiental para cambio climático en ecosistemas acuáticos alto andinos.
9:30 – 9:55	Francisco L. Hernández Torres,Escuela de Ingeniería Civil y Geomática,Universidad del Valle. Identificación y delimitación de los humedales lénticos naturales en el departamento del Valle del Cauca con imágenes de satélite.
09:55 – 10:10	**RECESO**
10:10 – 10:35	Leonardo Herrera, Cand. Ph.D. Grupo Ecomanglares, Dpto. de Biología, Universidad del Valle. Sectorización de los humedales del Valle alto del río Cauca – Colombia.
10:35 – 11:00	Martha Patricia Fajardo Vásquez, Estudiante de Economía. Universidad del Valle. Valoración económica de los manglares del Pacifico Vallecaucano.
11:00 – 11:25	Enrique J. Peña Salamanca, Ph.D. Dpto. de Biología, Universidad del Valle. Aproximación a la modelación de los procesos de acumulación y transformación del Cromo a lo largo de una cadena trófica en la laguna de Sonso, Valle del Cauca.
11:25 – 11:50	Willy Montoya, Estudiante de Maestría. Dpto. de Biología, Universidad del Valle. Efectos de la acumulación de metales pesados en la estructura celular de macrófitas asociadas a la laguna de Sonso.
11:50 – 12:15	Apolinar Figueroa Casas, Ph.D. Dpto. de Biología, Universidad del Cauca. Análisis espacio temporal de parámetros bio-geoquímicos en la laguna de Sonso.
12:15 – 12:40	German Restrepo, M.Sc. Corporación Ambiental Regional, CVC. Trophic state determination and nutrient dynamics of Sonso Pond in Colombia.
12:40 – 02:00	**ALMUERZO**

Hora	Día 1. Noviembre 10
Jornada de la tarde	**Bloque 2. Sesión Humedales Construidos**
02:00 – 02:30	Gustavo A. Peñuela Mesa, Ph.D. Facultad de Ingeniería. Universidad de Antioquia. Tratamiento de aguas contaminadas con plaguicidas usando Humedales sub-superficiales.
02:30 – 02:55	Jose Angel Colina Marquez Ph.D. Grupo GAOX, Universidad del Valle. Tratamiento foto-catalítico heterogéneo acoplado a un humedal sub-superficial para aguas contaminadas con pesticidas comerciales.
02:55 – 03:20	Carlos A. Arias. Ph.D. Department of Biological Sciences, Aarhus University, Denmark. Heavy metal and nutrient accumulation from the soil in municipal stormwater treatment ponds in Denmark.
03:20 – 03:45	Douglas Laing, Ph.D. Fisiólogo Vegetal, Ex- director del CIAT Consultor, Australia. El rol de la guadua (Angustifolia Kunth) en ecosistemas mixtos para el control de la contaminación y otros servicios ambientales relacionados.
03:45 – 04:00	**RECESO**
04:00 – 04:30	Diederik Rousseau, Ph.D. UNESCO-IHE Institute, The Netherlands. Recent advances in modelling of natural treatment systems.
04:30 – 04:55	Dennis Konnerup, Ph.D.Department of Biological Sciences, Aarhus Sustainability of Park-like Constructed Wetlands for Wastewater Treatment in the Tropics.
04:55 – 05:20	Erika Mazo, Ing. Sanitaria. Universitat Politécnica de Catalunya. España. Estudio comparativo de la eliminación de microorganismos en diferentes tipos de humedales construidos, a escala piloto y real.
05:20 – 05:45	Luis Fernando Pérez Mercado, Centro AGUA Universidad Mayor de San Simón. Bolivia. Influencia de la madurez biológica sobre la hidrodinámica y eliminación de materia orgánica, en humedales de flujo sub-superficial para el tratamiento de aguas residuales domésticas en regiones tropicales.
05:45 – 06:10	Enrique J. Peña Salamanca, Ph.D. Dpto. de Biología, Universidad del Valle. El papel de Heliconia psittacorum en el balance y dinámica de transformación de Nitrógeno en un humedal artificial sub-superficial para el tratamiento de aguas residuales domésticas.

Wetlands as Sustainable Technology for Water Management and Climate Change Mitigation

November 10 – 12 Cali, Colombia

Hora	Día 2. Noviembre 11
Jornada de la Mañana	**Bloque 3. Seminario – Taller Infraestructura Verde para la Ciudad del Futuro.**
08:00 – 08:30	Alberto Galvis C. M.Sc. Candidato Ph.D. Cinara, Universidad del Valle.Introducción al Taller en el marco del Proyecto SWITCH
08:30 – 09:00	Carlos Gutierrez. M.Sc. Dirección de Parques Nacionales, MAVDT.Efecto de la variación de carga hidráulica y la presencia de plantas sobre la eficiencia de eliminación de materia orgánica y nutrientes en humedales construidos tropicales.
09:00 – 09:30	Carlos A. Arias. Ph.D. Department of Biological Sciences, Aarhus University, Denmark.Eliminación de Fosforo en humedales construidos: De las expectativas a la viabilidad.
09:30 – 10:00	Duncan Mara. Ph.D, D.Sc. Profesor Universidad de Leeds, UK. Climate change and natural wastewater treatment & reuse: the way forward?
10:00 – 10:15	**RECESO**
10:15 – 10:45	Duncan Mara. Ph.D, D.Sc. Profesor Universidad de Leeds, UK. Utility-supplied community-managed water supplies and sanitation: ecological solutions for poor urban communities.
10:45 – 11:15	Conferencista por confirmar. Department of Biological Sciences, Aarhus University, Denmark. El rol de los sistemas naturales en el manejo de la contaminación difusa de origen urbano.
11:15 – 11:45	Enrique J. Peña Salamanca, Ph.D. Dpto. de Biología, Universidad del Valle. Ecosistemas diseñados con especies vegetales tropicales para la bio-remediación de metales pesados en suelos y aguas.
11:45 – 12:15	Expositores y coordinador de la sesión. Sesión de preguntas con los conferencistas de la mañana.
12:15 – 02:00	**ALMUERZO**

Hora	Día 2. Noviembre 11
Jornada de la Tarde	**Bloque 4. Seminario – Taller Infraestructura Verde para la Ciudad del Futuro.**
02:00 – 02:30	Diana A. Zambrano. Instituto Cinara, Universidad del Valle. Colombia. Aplicación de sistemas naturales de tratamiento para el control de la contaminación hídrica en el área de expansión de Cali.
02:30 – 03:00	Miguel R. Peña, Ph.D. Instituto Cinara, Universidad del Valle. Colombia. Múltiples servicios ambientales de los sistemas naturales de tratamiento de aguas residuales.
03:00 – 03:30	Johnny Rojas, M.Sc. Instituto Cinara, Universidad del Valle. Colombia. Valoración de servicios ambientales en ecosistemas diseñados con propósitos de descontaminación.
03:30 – 03:50	**RECESO**
03:50 – 04:10	Juan Pablo Silva. M.Sc. Candidato Ph.D. EIDENAR, Universidad del Valle. Colombia Emisiones de gases de efecto invernadero (GHG) en sistemas naturales de tratamiento de aguas residuales.
04:10 – 04:40	Alexander Aponte. M.Sc. Candidato Ph.D. Instituto Cinara, Universidad del Valle. Colombia. Modelación eco-hidrodinámica de lagunas de estabilización para el control de la contaminación hídrica.
04:40 – 05:00	Carlos A. Madera. M.Sc. Estudiante Ph.D. EIDENAR/Instituto Cinara, Universidad del Valle. Colombia. Bio-remediación de metales pesados en lixiviados de rellenos sanitarios.
05:00 – 05:20	Israel Gomez O. M.Sc. Estudiante Ph.D. Instituto Cinara, Universidad del Valle. Colombia. Modelación eco-hidrodinámica de humedales construidos para el control de la contaminación hídrica.
05:20 – 06:00	Comité Organizador del Evento. Foro sobre la temática del taller con los funcionarios de las instituciones y demás participantes.