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INTERNATIONAL CONFERENCE

"Frontiers In Environmental and Water Management"

**Streams-2-
SUPPRESS-
Fires**

**“Streams-2-SUPPRESS-Fires Utilizing Stream Waters
in the Suppression of Forest Fires with the help of
New Technologies” Project**

Edited by:

George N. Zaimis (Chair)

Valasia Iakovoglou

Dimitrios Kaziolas

Dimitrios Emmanouloudis

Konstantinos Ioannou

March 19-21 2015
IMARET HOTEL, Kavala, Greece



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International Conference
“New Frontiers in Environmental and Water Management”
March 19-21, 2015
Imaret Hotel, Kavala, GREECE

BOOK OF ABSTRACTS

Organized by:

Eastern Macedonia and Thrace Institute of Technology
Mohammed Ali Research Center

Editors:

G.N. Zaimes
V. Iakovoglou
D. Kaziolas
D. Emmanouloudis
K. Ioannou

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Editors Preface

The conference was organized by Eastern Macedonia and Thrace Institute of Technology (EMaTTECH) under the project "Utilizing Stream Waters in the Suppression of Forest Fires with the Help of New Technologies" with the acronym "Streams-2-SUPPRESS-Fires" that is funded under the EU INTERREG IV "Black Sea Basin Joint Operational Programme 2007-2013" framework in collaboration with the Water Institute for Research and Education (WIRE) of the Mohammed Ali Research Center.

The Conference focused on the current developments on environmental and water management with an emphasis on innovation and new technologies to enhance its effectiveness and efficiency. It provided an opportunity for scientists, decision-makers and stakeholders to meet each other. This fact promoted the cooperation in environmental and water research and management among countries from the Black Sea Basin, the Mediterranean Basin, Europe and worldwide.

This conference coincided with the International Day of Forests (March 21) and World Water Day (March 22) and provided an avenue to celebrate these important days.

The scope of the conference was mainly to:

- Present new innovative environmental and water management methodologies
- Introduce demonstration projects on efficient and effective environmental and water management
- Discuss recent advances in scientific research and technical development in regards to environmental and water management
- Promote international collaboration for more effective and efficient management
- Bring together scientists and practitioners from various parts of the world working on different aspects of environmental and water management

Participation was very encouraging. More than 80 abstracts were selected for oral and poster presentations for 11 different countries and three continents, covering a wide range of topics. The topics of the conference were:

- Watershed Management
- Wildfire Suppression
- Wildfire Risk and Climate Change
- Wildfire ecology
- Protected areas
- Wildfire Detection and Monitoring
- Forest management
- Hydrologic Models
- Hydroinformatics
- Water Resources Assessment and Conservation
- Wetlands
- Riparian areas
- Ecohydrology
- Flood control
- Drought Mitigation
- Torrent Management

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- Water Quality
- Water Pollution
- Protection and restoration of ecosystems
- Environmental Education
- GIS and Remote Sensing for Natural Resources
- Urban Water Resources
- Ecosystem restoration and protection
- Water and soil erosion
- Soil and Water Conservation
- Climate Change Impacts on Water Resources
- New technologies for watershed management
- Multicriteria Decision Analysis Tools for Watershed Management
- Water and Energy Efficiency
- Sustainable Water Infrastructure
- Sustainable Water Management
- Water Security

The editors would like to thank:

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G.N. Zaimis

V. Iakovoglou

D. Kaziolas

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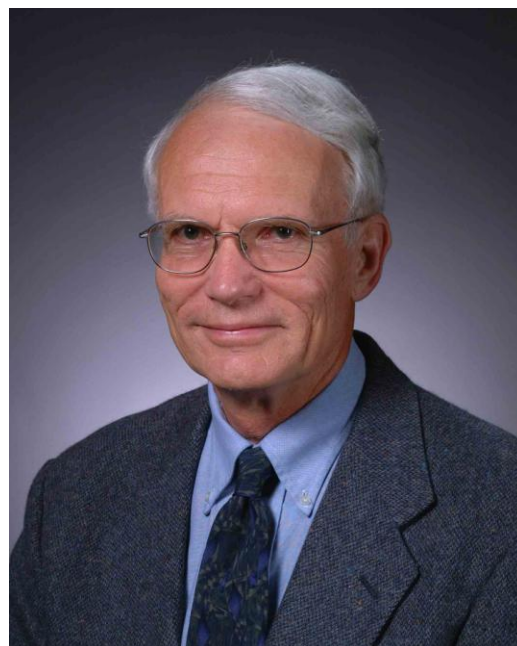
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INVITED SPEAKER

RICHARD C. SCHULTZ

University Professor
Iowa State University

Dr. Schultz is a University Professor in the Department of Natural Resource Ecology and Management and the Global Resource Systems, Environmental Science and Sustainable Agriculture Programs. He is a popular classroom teacher and has mentored many new faculty in student-centered learning. He has lead numerous efforts to expand the global education of students by recruiting international students and leading study abroad trips to numerous countries around the world. His research has focused on reducing erosion and nitrate and phosphorus runoff from agricultural fields by installing designed riparian buffers and wetlands that also improve wildlife habitat and aesthetics. The Bear Creek Watershed Project in Story County, Iowa that he helped create, has received national and international recognition.



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SESSION I

Streams-2-SUPPRESS-Fires PROJECT

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New Innovative Methods to Enhance Wildfire Suppression in the Black Sea Region

G.N. Zaimes^{1*}, M. Tufekcioglu², A. Tufekcioglu³, S. Zibtsev⁴, D. Kaziolas⁵, R. Corobov⁶, D. Emmanouloudis⁷, R. Uratu⁸, A. Ghulijanyan⁹, A. Borsuk¹⁰ and I. Trombitsky¹¹

¹Professor of Technological Applications, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Drama, Greece; ²Assistant Professor and ³Professor, Artvin Coruh University, Artvin, Turkey; ⁴Professor, National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine; ⁵Associate Professor, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Drama, Greece; ⁶Researcher, Eco-TIRAS International Association of River Keepers, Chisinau, Republic of Moldova; ⁷Professor, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Kavala, Greece; ⁸Local Project Manager, Prefect's Institution of Braila County, Braila, Romania; ⁹Head of Zikatar Environmental Centre, Zikatar Environmental Centre, Ministry of Nature Protection, Republic of Armenia; ¹⁰Graduate Student, National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine; and ¹¹Eco-TIRAS International Association of River Keepers, Chisinau, Republic of Moldova;

*Corresponding author: E-mail: zaimesgeorge@gmail.com, Tel: +30 2521060416, Mobile: +306945124720

Abstract

Many countries of the Black Sea Region do not consider wildfires currently a major threat. The higher temperatures, especially during summer, due to climate change have increased the risk of wildfires. Examples of large catastrophic wildfires in the region are those that occurred in 2010 in Russia and Ukraine. Additionally many countries of the region do not have the necessary infrastructures to face such wildfires. The objective of this study is to be proactive and enhance the knowledge of the region on wildfires while at the same time developing new, innovative, easy to use tools that should help suppress wildfires in the region. To enhance the stakeholders knowledge of the region, a Neighbourhood Network with regular quarterly meetings was established. Stakeholders for all six project countries participated in the meetings. An online Digital Geodatabase for the six pilot areas was developed. Finally dissemination activities such as newsletters, workshops, press releases, conferences, the project website etc. were conducted. To develop the innovative tools forest fire fuels and maps were developed and behavior models were run. To estimate water resources the hydrologic model SWAT was validated and calibrated for the pilot areas. The final activities included a multi-criteria decision analysis to select the optimal location of the water reservoirs and the use of spatial analyst to provide the optimal routes to reach reservoirs by the fire vehicles. The awareness of wildfire danger has increased while wildfire suppression has been enhanced in the region.

Keywords: climate change, wildfire risk, hydrologic models, multi-criteria decision analysis

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Forest fires distribution in the continental area of Kavala

D. Filiadis^{1*}

^{1*} MSc student, Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMATTECH), 1st km Drama, Mikrohorion, Drama, Greece 66100, E-mail: dimf8@hotmail.com

Abstract

Kavala prefecture has a long history of devastating fire events in both its continental part and Thasos Island. Distribution of fire events on an annual basis is a common representation and statistical analysis method. In this case study, the distribution of forest fires in the continental area of Kavala prefecture is presented for the period 2001-2014 through a series of simple-method statistics and charts/graphs. Forest fire events and burned area are presented on a month to month and annual basis. Burned forest area is categorized in three types (forest, shrub, meadow) according to Forest Service statistical records. Due to legislation changes (during the aforementioned period) regarding forest-shrub definition, the possibility of inconsistent forest fire records had to be considered. Thus spatial imagery was used for a more uniform interpretation between forest-shrub definitions. The most destructive wildfire years were 2013 and 2001 that were affected mainly by a single large event. On the opposite 2004, 2005 and 2010 were the least destructive years during the time period studied. Mediterranean type shrub lands were by far the most affected vegetation type that were also affected by the single large wildfire event. Most notable however, is 2014 with a zero forest fire record which coincides with a shift in the legislation implementation from the associated authorities regarding pasture management. The relationship between the two (pasture management and forest fires) has been a continuous on-going discussion subject matter among scientists and land managers in Greece. The best administration practices for the prevention of forest fires and their potential impact should be further researched in this respect.

Keywords: Forest Service, Forest/shrub, Forest wildfires, Kavala, Statistical analysis

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Application of a hydrologic model to estimate the water balance in Menoikio Mountain.

P. Koutalakis^{1*}, S. Astrantinis², V. Iakovoglou³, K. Ioannou², D. Emmanouloudis and G. N. Zaimis²

¹MSc Researcher Geologist, Proti, Serres, Greece 62047

²Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMATTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

³Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

*Corresponding author: E-mail: koutalakis_p@yahoo.gr

Abstract

There are many hydrologic models that are used widely and frequently for water management decision projects. They were developed in order to assist hydrologists to understand the hydrologic processes and predict the water balance. The model that was selected for the needs of this study was the SWAT model. Specifically, the ArcSWAT toolbar in ArcGIS was used in order to estimate the water balance in Menoikio Mountain. The data that ArcSWAT needs are the: topography, soil, land cover and weather data of precipitation, temperature, wind speed, relative humidity and solar radiation. Menoikio is a protected area under the NATURA2000 Network. It is situated between the Prefectures of Serres and Drama and covers an area of 500 km². The calibrated results of the streamflow show a good performance as they were validated by multiple coefficients. The Pearson Correlation Coefficient (R^2) was equal to 0.85, the Root Mean Square Error (RMSE) was equal to 0.47 and the Nash-Sutcliffe coefficient of efficiency (NSE) was 0.78. The water balance of Menoikio Mountain was estimated based on weather data from 2000-2011. The results indicated the high contribution of the water yield in the water balance, especially through the lateral and groundwater flow. Also the evapotranspiration had a high participation in the water balance of the area. The major streams and watersheds are also presented in this study. These streams were distinguished because of their water discharge. The results could help the water manager to make plans in order to manage and store water from these streams.

Keywords: SWAT, Natura 2000, sustainable water use, Greece

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A methodology for optimal network routing. The case of Menoikio Mountain

K. Ioannou^{1*} and D. Kaziolas¹

² *Labaratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMATTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100*

*Corresponding author: E-mail: ioannou.konstantinos@gmail.com

Abstract

One of the greatest problems along many Mediterranean and Black Sea basin countries are forest fires, especially during the summer period. In Greece, only between January 1st and July 31st 2014, we had 3.846 fires in forests and agro forests. This enormous number of fires in conjunction with the economic crisis makes the need, today more urgent than ever, to properly locate water reservoirs. Additionally it is also important to strategically disperse fire fighters in order to burn out fires faster, especially during the earliest stages. This paper presents a methodology for implementing a combination of a spatial analysis tool with decision methodologies, in an effort to help fire service to find the optimal route between a fire and their units and also propose the best sites for water reservoirs based on a series of parameters.

Keywords: *Decision Support Systems, Forest Informatics, GIS, Spatial Analysis*

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Perspectives on Wildfire and Protected Area Management in the Black Sea Region

C. Kiosses¹, G. N. Zaimis¹, P. Tsioras³, M. Dinc⁴, A. Borsuk⁵, L. Gerosyan⁶, I. Trombitsky⁷ and R. Uratu⁸

¹Forester, Choristi, Drama, Greece 66100, ²Professor of Technological Applications, Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100, ³Department of Forestry and Natural Environment Management, Aristotle University, Thessaloniki, ⁴PhD candidate, Artvin Coruh University, Artvin, Turkey; ⁵PhD candidate, National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine; ⁶Researcher, Zikatar Environmental Centre, Ministry of Nature Protection, Republic of Armenia; ⁷Eco-TIRAS International Association of River Keepers, Chisinau, Republic of Moldova, ⁸Local Project Manager, Prefect's Institution of Braila County, Braila, Romania;

*Corresponding author: E-mail: valantiskio@yahoo.com

Abstract

The management of protected areas and wildfires presents many challenges. Protected areas are necessary for biodiversity maintenance and wildfires are major threats for forest areas, often causing irreversible damages to them or having profound impacts on them that last for decades or even centuries. The aim of this study was to investigate the opinions and perceptions of forest experts (N= 284) in six different countries of the Black Sea Region on the current status and problems pertaining to the management of protected areas and wildfires in their countries. Data collection was carried out with an online questionnaire for 9 months (September 2013- May 2014). Different problems have been identified, as a result of the different prevailing conditions in the six countries. Wildfires represent a serious problem in Turkey (96%), Armenia (95%) and Greece (94%) but this is not, to the same extent, the case for Romania (46%), Ukraine (37%) and Moldova (36%). The majority of experts in all countries except Moldova think that the currently designated protected areas are enough to maintain biodiversity. The experts' opinions are divided with regard to whether wildfires and management of protected areas are interconnected. However, there is a growing awareness of the possible adverse impacts of climate change in protected areas (74%) and the frequency of wildfires (85%) in the future. Different measures have been suggested with regard to these two issues: provision of education to the population and government initiatives (29%) are expected to facilitate the better management of protected areas, while prevention and monitoring (30%) and provision of education to the population (23%) could improve wildfire management.

Keywords: *Questionnaires, online, forested areas, stakeholders*

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SESSION II

Black Sea & Streams-2-SUPPRESS-Fires Projects

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Earthquake, Landslide and Flood disaster Prevention: The SciNetNatHaz Project

K. Papatheodorou^{1*}, E. Tzanou¹, C. Maftei², O. Kirca³ and H. Aksoy³

¹Technological Educational Institute of Kentriki Makedonia, Civil, Surveying and Geomatics Engineering Dept., Hellas

²Ovidius University, Civil Engineering Dept., Constanta, Romania

³Istanbul Technical University, Civil Engineering Dept., Turkey

*Corresponding Author: E-mail: conpap@teiser.gr; Terma Magnessias Str, 62124 Serres, Hellas

Abstract

Earthquakes, landslides and Floods (ELF) cause serious problems in the European Union (EU) and in the wider Black Sea area. The problems, which are already recognized by the (EU), have trans-boundary consequences and pose a threat to sustainable development because they can lead to disasters when combined with vulnerability and insufficient capacity to reduce the respective risks. Effective ELF disaster mitigation can only be based on hazard identification and risk assessment and these parameters must in turn, be based on scientifically sound methodologies and reliable and accurate data. Problems, including the information gap and the multitude of methodologies used to assess ELF hazards, prevent collaborative efforts to reduce the risk by designing and implementing effective preventive measures. The SciNetNatHaz project which is under implementation, aims at establishing a wide scientific network that will focus on tackling the aforementioned problems. An additional target of the project is to provide the methodologies and tools to effectively implement prevention through applied research and technology transfer among partners from different countries. A brief presentation of the project's already provided outputs shows that important goals of the project have already been achieved, including the establishment of a network with more than 80 scientists from six different countries involved, harmonization of data and metadata creation, a Web GIS platform to provide free access to maps and data, proposals for harmonized methodologies to be used for landslide and flood hazard assessment and pilot implementation of flood hazard assessment in selected areas using Open Source software.

Keywords: earthquakes, floods, hazard assessment, landslides, prevention, SciNetNatHaz

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A water value-driven interpretation of regional heritage: An application multi-mix for heritage tourists in Drama, Greece

D. Papathanasiou¹ and N. Thomaidis^{1*}

¹Drama Development S.A., Konstantinoupoleos 8, 66100 Drama, Greece

*Corresponding Author: E-mail: n.thomaidis@aned.gr

Abstract

Under the umbrella of MIS 2617 Black Sea Project ALECTOR a new cultural heritage infrastructure is introduced in the Black Sea Basin. A 3-component Open Street Museum (OSM) is operated in seven countries (GR, RO, BG, MO, UA, GE, TR). It includes a QRC-driven portable exhibition with 100 cultural heritage narratives, accessible via QRCs in the territory, an i-Book, and a highly advanced multi-vision production, to support contextual co-creation and participatory learning. A cognitive driven communication pattern has been developed and adapted to the conditions regulating the recreational learning environment. The design presupposes a limited WM capacity to deal with visual, auditory and verbal material, and an almost unlimited long-term memory (LTM), able to hold mental representations that vary in their degree of automation. It considers WM constraints, element interactivity and 3 types of cognitive loads (CL). A water value-driven Pilot Project will be implemented in Drama, Greece, as water is closely linked with socio-economic activity of the area, connected with the rise of the tobacco industry (1909-1939). It includes 10 locations related to the development of the tobacco industry and the resulting welfare expressed through a series of monuments that include gardens, mills, ware houses, mansions, theaters and educational institutions. The interpretation of this particular water culture enables visitors to gain insight and understanding about the reasons for conservation and ongoing protection through the communication of regional heritage.

Keywords: *Cultural Heritage, Black Sea, Drama, Open Stream Museum, Interpretation*

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WASTEnet: A Black Sea Network Promoting the Integrated Natural Wastewater Treatment Systems

G. Sylaios^{1*}

^{1*} *Democritus University of Thrace, Department of Environmental Engineering, Laboratory of Ecological Engineering & Technology, Xanthi 67100, Greece, E-mail: gsylaios@env.duth.gr*

Abstract

WASTEnet is an active network funded by the Operational Program of Black Sea Basin 2007-2013. The network comprises of local authorities (regional authorities, municipalities, municipal wastewater treatment enterprises etc), technical advisors (universities, research centers) and environmentally active organizations (NGOs) focusing on promoting and diffusing Natural Treatment Systems in Black Sea countries. As conventional wastewater treatment systems in most Black Sea basin countries are outdated, sustainable treatment systems, as Natural Treatment Systems, Constructed Wetlands and other small or on-site treatment systems appear as ideal solutions for this area, safeguarding improved water quality. The project explores the potentials of these systems, as low cost and low energy consumption solutions to wastewater management suitable for the rural and remote communities of the Black Sea basin. Thus, WASTEnet helps local and regional authorities and stakeholders to gain insight on the role of innovative and environmentally-friendly technologies, in improving the environment of the broader Black Sea region.

Keywords: *low cost, low energy consumption, water quality*

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Developing of the integrated fire management system for the Yalta Mountain Forest Natural Reserve

S. Zibtsev¹, A. Borsuk², V. Bogomolov³ and A. Fesenko⁴

¹Professor, National University of Life and Environmental Sciences of Ukraine, Regional Eastern European Fire Monitoring Center (REEFMC), Kiev, Ukraine

²Graduate Student, National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine

³Ukrainian Research Institute of Forestry and Forest Melioration, Ukraine

⁴Research Institute of Geological and Environmental Monitoring and Forecasting

*Corresponding author: E-mail: anatoliy.borsuk@gmail.com

Abstract

Wildfires are second major threat in Ukraine for forest. Wildfire prevention and suppression are major tasks for forest service during fire season lasting usually from March to October. Current official scale for assessment of fire hazard of forests in Ukraine is based on soil humidity, species composition and age, land use category which in connection with Nesterov fire weather index determine level of preparedness of forest fire services. Current system not fulfills needs for more precise prediction of fire risk under climate and other changes. A number of research for development of the regional integrated fire management system were provided in framework of EC INTERREG IV “Black Sea Basin Joint Operational Programme 2007-2013” project “Utilizing Stream Waters in the Suppression of Forest Fires with the Help of New Technologies” (Streams-2-SUPPRESS-Fires) on Yalta Mountain Forest Natural Reserve (YMFNR). In particularly twelve fuel models were proposed that cover all major vegetation types of the area. DEM and maps of land cover, stream network, road network and fuel models also were created. Based on collected data fire rate of spread and fireline intensity was assessed that reach 90 m/min and more than 3500 kw/h accordingly. Based on this simulations fire suppression difficulty map was created. These data, combined with data on hydrology will help improve fire suppression by optimal allocation of water pounds and optimization of water delivery on fire. Current research which was provided in Yalta MFNR can help to fulfill some gaps concerned to risks of wildfires growth. Learned experiences and methodologies of fuel mapping and studying of fuel load will help to improve current wildfire protection system in Ukraine.

Keywords: *early warning system, fuel models, fire suppression, wildfires, Yalta Natural Reserve*

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Assessment of the uncertainty analysis from mapping forest fuels using high resolution satellite imagery and its propagation in fire mapping. Case study *Small Wetland Island of Braila*

I. Șandric¹, R. Urâtu², A. Voicu², M. M. Risnoveanu², V. Cirlan² and Z. Chitu³

¹University of Bucharest, Faculty of Geography,

²Prefect's Institution - Braila County

³National Institute of Hydrology and Water Management

*Corresponding author: E-mail: ionut.sandric@geo.unibuc.ro.

Abstract

The mapping of forest fuels plays an important role for spatial and temporal fire hazard and risk mapping. The process starts with the identification of forest fuels types, mostly done in the field and continues with the mapping of these using satellite images. The latter is exposed to uncertainties related with the accuracy of the mapped forest fuels. The present study assesses how the uncertainty from the mapped forest fuels influences the forest fire analyses. For the Small Wetland of Braila the following forest fuels types have been identified in the field: Rush and reed, Willow forest and Meados from steppe areas. The fuel sources in the **Small Wetland Island of Braila** were mapped using RapidEye imagery and Ecognition Developer 8.7 software. The RapidEye images were acquired on the 7th of August 2013 with the exception of one image that was acquired on the 15th August 2013. This difference date image acquisition pose challenges in image processing, induced by the seasonal change. These issues were overcome by applying two different segmentation and classification process, one for the images acquired in July and one for the image August. The ESP tool for Ecognition was used for assessing the optimal scale for segmentation and CART algorithm was used for generating the rule set for classification process. For Fire Intensity mapping we used for fire risk mapping was FlamMap 5 downloaded from <http://www.firemodels.org> website

Keywords: forest fuel, object based image analysis, Romania, uncertainty propagation

Acknowledgement: The study was financed from the project Utilizing Stream Waters in the Suppression of Forest Fires with the Help of New Technologies <http://www.suppressfires.eu>. The EU INTERREG IV "Black Sea Basin Joint Operational Programme 2007-2013" framework is responsible for the funding of this project. The Black Sea Basin Programme is co-financed by the European Union through the European Neighborhood and Partnership Instrument and the Instrument for Pre-Accession Assistance

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Utilization of stream water to suppress fires in Bayam Forest District with the application of the SWAT model

M. Tufekcioglu¹, M. Yavuz¹, P. Koutalakis², M. Dinc¹ and A. Tufekcioglu¹

¹Artvin Coruh University, Faculty of Forestry, Seyitler Campus, Artvin, Turkey 08100

²Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama-Mikrohorion, Drama, Greece 66100

*Corresponding author: E-mail: mtufekcioglu61@gmail.com

Abstract

Stream-2-Suppress-Fires is a European Union funded project that concentrates on the Black Sea Region. The scope of the project is to utilize stream waters sustainably in the suppression of forest fires with the help of new innovative technologies. Six partners are participating and collaborating in this project: i) Eastern Macedonia and Thrace Institute of Technology (Greece), ii) Zikatar Environmental Center (Armenia), iii) Eco-TIRAS Environmental Association of River Keepers (Moldova), iv) Prefecture of Braila (Romania), v) National University of Life and Environmental Science (Ukraine), and vi) Artvin Coruh University (Turkey). The Turkish study area is the Bayam Forest District in Kastamonu Province. It is located in north central Turkey. Bayam Forest has had serious wildfires in the past and utilizing sustainably the stream water of the region could enhance its protection against wildfires. The Soil and Water Assessment Tool (SWAT) was used. SWAT is a model that is frequently used in hydrology because it can predict the water balance and the stream discharge. It requires data such as the morphology, land-use, soils and daily or monthly weather data of precipitation, temperature, solar radiation, relative humidity and wind speed. SWAT was applied in Bayam Forest District for the period 2001-2013 in order to predict the water balance of the region and the discharge of the major stream. Actual stream discharge records of the year 2014 were used to calibrate the model. The simulated results could indicate how much water could be stored and what the ideal locations for storage are.

Keywords: *Hydrologic models, sustainable use, hydrologic cycle*

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The description of water resources of Meghri River Basin, Republic of Armenia

B. Zakaryan¹, A. Ghulijanyan² and L. Gevorgyan³

¹ Basin hydrologist, USAID, Armenia, Yerevan,

² Head at ZEC, Ministry of Nature Protection, Republic of Armenia,

³ Chief Specialist at ZEC, Water Ecologist, Ministry of Nature Protection, Republic of Armenia

*Corresponding author: E-mail: zikatar_center@yahoo.com

Abstract

Meghri river basin is located in the southern portion of Syunik marz of the Republic of Armenia. The total area of the river basin is 660.7 km² which makes up 2.2 percent of the Republic's territory. The river basin includes two urban and eleven rural communities. The population of the river basin as of 2013 made up 11380. 12,6 percent of the area was formerly occupied by agricultural lands. Meghri river basin is characterized by complex, extremely rugged terrain which makes the area very rich in climatic conditions varying from dry sub-tropical (with mild winters and hot summers) to high mountain nival climatic conditions. Temperate continental climatic conditions are dominating in this area. Six vertical landscape zones are distinguished in the basin area including foothill desert, middle zone, mountain meadow-steppe, high-mountain sub-alpine and high-mountain alpine where the predominating zones are the low and middle mountain zones. The main river of the basin is Meghri. The total length of the river is 36km, while the total area of the catchment is 336.3 km². Major tributaries of Meghri River are Gozgoz, Ayrijur, Boghakar, Kaler and Vardanidzor. The tributaries of the basin discharging to Arax River include Karchevan, Malev, Astazurget, Nrnadzor and others. According to Meghri-Meghri gauging stations' data as of January 2013, the actual annual average discharge of Meghri is 2.87m³/s, while the ecological flux is estimated at 0.73m³/s. The actual annual average discharge of Karchevan in Agarak is 43m³/s while the ecological flux is 0.02m³/s (while the cumulative actual annual average discharge is 2.91m³/s). Other rivers discharging to Arax River from Meghri basin have ephemeral flows that typically form during March-June. According to Meghri-Meghri gauging stations' data water use from Meghri river basin as of January 2014 amounts to 23.8 mln m³.

Keywords: Arevik NP, Meghri river basin, river discharge, landscape zones

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Legal aspects of transboundary Dniester River management and role of civil society

I. Trombitsky^{1*}

^{1*}*Eco-TIRAS International Association of River Keepers, Str. Teatrala 11a, Chisinau 2012, Moldova, E-mail: ilyatrom@mail.ru;
URL: www.eco-tiras.org*

Abstract

Dniester River with a length of 1362 km, a basin area of 72100 km² and a population of about 8 mln that is shared by two post-Soviet countries – Moldova and Ukraine. The integrated management of water resources principle and transboundary cooperation are hardly applicable due to the old mentality. The movement to integrated river basin management (IRBM) started in 1990th, when ecoNGOs from both riparian countries united under the Eco-TIRAS association umbrella and started to promote the idea of the modern river basin agreement based on IRBM. The NGOs asked OSCE and UNECE to help change the attitude of both governments. Finally in the result of 16 years-lobbying, the modern basin agreement (2012) was reached. This treaty integrates ecosystems conservation in transboundary waters management. One of its main tasks is the “prevention of deterioration and rehabilitation of ecosystems, and also conservation of the biodiversity” as well as to “cooperate in protection and rehabilitation of the Dniester River basin’s bioresources, conservation and restoration of biodiversity, ecosystems, and wildlife habitats.” The signed river basin treaty opens perspectives in the watershed integrated management in case of its ratification by Ukraine. The working groups of different profiles will be created under the Commission. The positive experience of the Dniester River basin management is creating a good example for other transboundary watercourses in the post-Soviet areas. The important feature of the whole Dniester activities is the fact that they were initiated and implemented by the civil society acting in coordination on the transboundary level in the river basin.

Keywords: *Dniester River, Moldova, Ukraine, transboundary water cooperation, river basin treaty*

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Water related Indicators for sustainable forest management planning in Greece

V. Kazana¹, A. Kazaklis¹, C. Stamatiou¹, D. Raptis¹, A. Boutsimea¹ and P. Koutsona¹

¹Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama-Mikrohorion, Drama, Greece 66100

*Corresponding author: E-mail: vkazana@gmail.com

Abstract

The water and forest relationship has been recognized for a long time as a key issue for sustainable forest management planning, considering both socioeconomic interests and environmental concerns. However, there is still a need to clarify these interests and concerns particularly in the frame of different policy initiatives, such as Forest Europe and Green Infrastructures. This paper presents the water related processes reflected through specific indicators that were identified and evaluated in terms of their importance in the context of the sustainable forest management of the Greek forests and forest lands by the members of the National Forest Governance Council. This Governance Council was set up and started its operation through the INFORM-LIFE project with the aim to support the development process of a knowledge base for national policy on sustainable forest management assessment and monitoring. The water related processes that were identified and evaluated for the Greek forests and forest lands involved water for household use, groundwater and spring water, water for agricultural crops, water for biomass production (grass or woody plants), irrigation infrastructure, water for industrial use, water for hydroelectric energy, fish production (commercial, recreation), conservation of water quality, conservation of water landscape values (aesthetic and functional), conservation of water related biodiversity, erosion control and flood control. The evaluation results of the forest water related processes were analyzed for each of the thirteen regions of the country and can be used by the policy makers and the forest resource managers for sustainable forest development and management planning.

Keywords: forest governance, water indicators, sustainable forest management assessment

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SESSION III

Innovation in Water Management

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Application of chemometric methods for assessment of groundwater quality in Kavala Prefecture, Northern Greece

T. Spanos^{1*}, A. Ene², S. Mitkidou¹ and P. Simeonova³

¹*Technological Educational Institute of Eastern Macedonia and Thrace, Department of Petroleum and Mechanical Engineering Sciences, St. Lucas Street, 65404 Kavala, Greece*

²*Dunarea de Jos University of Galati, Faculty of Sciences and Environment, Department of Chemistry, Physics and Environment, 47 Domneasca St., 800008 Galati, Romania*

³*Bulgarian Academy of Sciences, G. Nadjakov Institute of Solid State Physics, Laboratory of Environmental Physics, 72 Tzarigradsko Chaussee Blvd., 1784 Sofia, Bulgaria*

*Corresponding author: tspanos@teikav.edu.gr

Abstract

Multivariate statistical methods of Cluster Analysis (CA) and Principal Component Analysis (PCA) were used for the assessment of groundwater quality on samples from forty nine different geographical locations in the region of Kavala, Northern Greece. Ten physicochemical parameters (pH, electric conductivity, nitrate, chloride, sodium, potassium, total alkalinity, total hardness, bicarbonate and calcium) were analyzed monthly from January 2010 to December 2010. The clustering of the chemical parameters gives two major clusters related to the water hardness and the mineral components (impacted by sea, bedrock and acidity factors). The sampling locations give three major clusters corresponding to the spatial distribution of the sites – costal, low-land and semi-mountainous. The principal components analysis reveals two latent factors responsible for the data structures, which are also an indication for the sources determining the groundwater quality of the region (conditionally named “mineral” factor and “water hardness” factor). The mean values of all the studied physicochemical parameters were within the limits given in the 98/83/EC Directive. The water samples are appropriate for human consumption. The results of this study provide an overview of the hydrogeological profile of the water supply system for the studied area.

Keywords: cluster analysis, groundwater quality, Kavala, Northern Greece, principal components analysis

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Classification on the water supply of the mountain river basins of the region of Pelion, using Geographic Information Systems and Fuzzy Sets

F. Maris^{1*}, A. Vasileiou¹, M. Karaiskos¹ and C. Andronis¹

¹Department of Forestry and Management of the Environment and Natural Resources,
Democritus University of Thrace, Orestiada, GREECE

*Corresponding author: tspanos@teikav.edu.gr

Abstract

According to the European Directive 2007/60, it is imperative to identify the maximum water basin supplies (Q_{max}) for different recovery times. It is therefore important to identify both quickly and accurately basins characterized by large amount of water supply and basins characterized by low to insignificant supply. The empirical formulas used to calculate the maximum water supplies have the disadvantage that their effect depends on the size of the basin, without considering other factors such as slope, soil cover etc. The deterministic methods such as Coutagne, Giantotti, Alexopoulos, Melli etc., are data intensive and time consuming. The gap between those methodologies and the accurate results can be complemented by the use of fuzzy logic. Fuzzy logic is an extension of the classic Aristotelian logic, in which a proposition can be true "with some degree of truth", and not just true or false (Oikonomou, 2013). In the present study a model for grading water basins through the terms of water supply by using fuzzy logic in conjunction with Geographic Information Systems was created, in order to enable the connection of spatial and geographic information (Mallinis, 2001). Pelion has been chosen as the study area, since topographical, morphological and climatic conditions significantly affect the diet of water. The review of the literature, focuses on seven (7) factors, which were separated into five (5) positive ones (slope basin, catchment area, hydraulic radius, runoff coefficient, rainfall rate) and two (2) negative ones (vegetation, rocks). The consolidation of both positive and negative factors took place by fuzzy set operations, and defuzzification functions revealed the final classification of the water basins. To validate the model, its results were both compared to the results of various empirical formulas and to measured water supplies from Gerampini, Sotiros and Afento streams, north-east of the study area. It was also observed that the basins No. 72 (Xerias), 71 (Lagonikas, Volias), 51 (Vasiliki stream), and 52 (Platanorrema) have the highest water supply, while the previous water basins No. 80 (Afendo), 81 (Sotiros) and 82 (Gerampini) have the smallest one. The comparison demonstrates the reliability of the model, its adaptability and its speed as well. The results of the paper may contribute to the delineation of the areas that require immediate creation of flood hazard maps, while offering substantial assistance in the implementation of various management plans.

Keywords: classification, GIS, fuzzy logic, water supply

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An integrated approach to promote GroundWater sustainability

K. Papatheodorou^{1*}, K. Evangelidis¹ and K. Ntoulos¹

¹*Technological Educational Institute of Kentriki Makedonia, Civil, Surveying and Geomatics Engineering Dept, Hellas*

**Corresponding Author: conpap@teiser.gr, Terma Magnessias Str. 62124 Serres, Hellas*

Abstract

GroundWater (GW) plays a key role both in economic and demographic development and it's preservation is a vital factor for sustainable development. GW preservation can be considered as the result of both the protection and the management of the resource. The current status and trends in the EU and around the Black Sea area in respect groundwater protection and management, are briefly presented and discussed. Additionally, a "holistic" approach to ensure protection and management of GW resources in a sustainable way is proposed. This approach is based on already proven applied research, conducted during the past years and combines the use of contemporary Geoinformatics Technologies (Remote Sensing, Geographic Information Systems and Information Technologies) with applied geology. Potential outputs, results as well as essential requirements and drawbacks of the proposed integrated approach are also discussed.

Keywords: *groundwater, environmental protection, remote sensing, hydrogeology, GIS applications.*

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Ecological Issues Related to River Damming and Ecohydrologic Tools for Watershed Restoration: The case of Nestos River, Northern Greece.

G. Sylaios^{1*}

^{1*}Democritus University of Thrace, Department of Environmental Engineering, Laboratory of Ecological Engineering, Xanthi 67100, Greece, E-mail: gsylaios@env.duth.gr

Abstract

The impoundment and abstraction of freshwater in river systems for the purposes of power generation and agricultural irrigation has provided huge economic benefits at the global scale over the last 50 years (Millennium Ecosystem Assessment, 2005). However, the environmental and social costs of large dams have been poorly accounted for in economic terms so that the wider long-term cost/benefit analysis to determine the true profitability of these projects remains elusive (World Commission on Dams 2000). The construction of large dams reduces the threat of devastation from extreme floods; however, large dams change watershed biosphere, creating a completely different hydrologic and ecologic regime with more severe alterations at the downstream part of the watershed, affecting river deltas and the broader coastal zone and coastal ecosystem (Postel & Richter, 2003). The environmental changes associated with river damming at the downstream part of the watershed, are summarized below:

1. River water temperature regulation, with generally lower temperatures prevailing throughout the year.
2. River water stage regulation and frequent short-term flooding incidents, as a result of energy-demand peaks.
3. Changes in aquatic flora and fauna, with significant changes in fish fauna, due to physicochemical alterations.
4. Retention of dissolved and particulate substances and pollutants within reservoirs.
5. Reduction of sediment loads at the deltaic and coastal zone areas, resulting in the alteration of coastal sedimentary budget and the occurrence of coastal erosion.
6. Dams tend to smoothing hydrologic peaks and floods, while systematic water abstractions for irrigation tend to reduce the freshwater flux reaching the coastal sea.
7. Retention of nutrients in the reservoir, thus changing the stoichiometry of river water transported in the sea.
8. Stoichiometric change leads to biogeochemical cycling alterations for dissolved and particulate substances in coastal ecosystems.
9. Dams shift primary production from the coastal sea to the lacustrine environment developed at its reservoir.
10. Dams affect the spawning and nursery grounds of riverine and coastal fish species, influencing coastal fisheries.

Almost 15 years after the construction and operation of the two large hydropower dams (Thissavros and Platanovrisi), and approximately 50 years after the operation of the irrigation dam and system at Toxotes, the environmental consequences at the deltaic and coastal area of Nestos River are evident. The application of specific eco-hydrological concepts aims to mitigate the imposed environmental effects. Ecohydrology is an innovative and exciting topic, considered as the science of interplay between biota and hydrology in an ecosystem. Riparian and coastal ecohydrology concepts, together with the concept of 'Green Hydropower' may be adopted as a tool for assessing the effectiveness of the measures adopted by the Hydropower companies aiming to improve the environmental functioning of the system.

Keywords: *aquatic flora & fauna, nutrients, sediments, floods*

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Riparian Land-use and Stream Bank Erosion within Grazed Pastures in Southern Iowa, USA

M. Tufekcioglu^{1*}, T. M. Isenhardt², R. C. Schultz², J. L. Kovar³ and J. R. Russell⁴

¹Department of Forest Engineering, Artvin Coruh University, Seyitler Yerleskesi, 08000, Artvin, TURKEY.

²Department of Natural Resource Ecology and Management, Iowa State University, Ames, Iowa, USA.

³National Laboratory for Agriculture and Environment, Soil Tilth, USDA-ARS, Ames, Iowa, USA.

⁴Department of Animal Science at Iowa State University, Ames, Iowa, USA.

*Corresponding author: mtufekcioglu61@artvin.edu.tr; Artvin Coruh Universitesi Orman Fakultesi, Seyitler Yerleskesi, 08000

Abstract

Riparian land-uses such as cropping and grazing are major agricultural practices that have impacts on stream bank erosion. The aim of this study is to assess the effects of riparian land use considered in both field and catchment scale on stream bank erosion within grazed riparian pasture sites in the Southern Iowa Drift Plain. Thirteen cooperating beef cow-calf farms and their catchments in the Rathbun Lake watershed in South Central Iowa were chosen to conduct this study. Stream bank erosion rates were determined during three years using the erosion pin method. Although no relation was found between grazing practices (stocking rates) and bank erosion, there were some correlations between bank erosion rates and both stream bank soil texture and catchment stream length. Overall, intensive agricultural use of riparian areas in such extent of time and scale could be directly and/or indirectly related to excessive amounts of stream bank soil loss to stream and lake leading to their impairment and reduction of ecological services.

Keywords: stream water quality, pasture grazing, conservation practices

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SESSION III

Innovation in Water and Erosion Management Projects

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Evaluation of Artvin- Murgul Black Locust Plantations in Terms of Biomass Production, Carbon Storage, Soil Quality Improvement and Erosion Control Compared to Adjacent Grassland Areas

A. Tufekcioglu^{1*}, S. Guner¹, M. Kucuk¹, M. Tufekcioglu¹, A. Duman¹ and M. Dinç¹

¹Department of Forest Engineering, Artvin Coruh University, SeyitlerYerleskesi, 08000,Artvin, TURKEY.

*Corresponding author: atufekcioglu@artvin.edu.tr; Artvin Coruh Universitesi Orman Fakultesi, Seyitler Yerleskesi, 08000

Abstract

Black locust plantations in Artvin-Murgul (established in 1996) were investigated for the purposes of: 1) wood production, 2) above- and belowground biomass, 3) carbon storage, 4) soil quality improvement, 5) erosion control and economic value. For these purposes, soil samples were taken from black locust plantation sites and adjacent grassland (control) sites, and soil respiration, soil infiltration, surface runoff, sediment removal, water holding capacity, soil organic matter, texture, pH, N, P, K, Ca, and Mg contents were determined in both areas. Sample trees were cut to determine aboveground biomass and carbon storage. Root samples were taken to determine root biomass and root carbon storage. Surface runoff and erosion were five-fold lower in black locust stands compared to controls (grasslands). Soil quality improvements in black locust areas were not significantly higher than in grasslands. Grasslands had higher soil respiration rates compared to black locust areas. Soil organic matter did not differ significantly between grasslands and black locust areas. Above- and belowground carbon storage were higher in black locust areas than in grasslands.

Keywords: Black locust, root biomass, production, carbon storage, erosion, soil respiration

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Estimation of Soil Erosion Losses for Uzundere Subwatershed in Erzurum, Turkey using Revised Universal Soil Loss Equation (RUSLE) and Geospatial Technologies

M. Yavuz^{1*}, M. Tufekcioglu¹, A. Tufekcioglu¹, D. Akdeniz², A. Duman¹, M. Dinc¹ and C. Vatandaslar¹

¹Department of Forestry, Artvin Coruh University, Artvin, TURKEY

²Piramid Photogrametric and Tech. Services Inc., Ankara, TURKEY

* Corresponding author: [E-mail: myavuz32@gmail.com](mailto:myavuz32@gmail.com); Seyitler Yerleşkesi, 08000 Seyitler/Artvin, TURKEY

Abstract

Integrating Revised Soil Loss Equation (RUSLE) model and geospatial technologies to estimate soil erosion losses gained popularity among the researchers around the world. Yet, assessing the soil erosion risk for arid, semi-arid and humid continental mountainous sub-watersheds require more challenge. The purpose of this study was to assess soil erosion risk areas for Uzundere Sub-watershed in Erzurum, Turkey using RUSLE model and 50 cm pan-sharpened WorldView-2 imagery within GIS and remote sensing framework. The sub-factors of RUSLE model estimated using seven years of meteorological data for rainfall erosivity (R factor), 5-m DEM for slope length and steepness (LS factor), Forest Services' forest inventory data and NDVI for land use and crop management (C factor), soil erodibility (K factor) from soil samples that were surveyed in 35 sampling plots (20x20 m) and conservation practices (P-factor) by the Forest Services. It was found that 28.3 tons of soil per hectare was washed away from the Uzundere Sub-watershed every year. 31.7% of the study area was under very low erosion risk while 15.9% of it was under very high erosion risk. 21.3% of the area was high, 17.2% of it was moderate and 13.8% of the area was under low erosion risk categories. It can be concluded that despite the very low average annual rainfall (585 mm/year), a very steep topography and high slope length were the main contributors of the high erosion losses for the study area.

Keywords: Soil Erosion Risk, Revised Soil Loss Equation (RUSLE), Geospatial Technologies, Uzundere Sub-watershed

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Danube WATER Integrated Management Project

M.J. Adler¹, R. Macaieș¹, R. Bălăeș² and Z. Chițu¹

¹National Institute of Hydrology and Water Management, Romania,

²Ministry of Environment and Forests, Romania

*Corresponding author: E-mail: mj.adler@hidro.ro

Abstract

Danube WATER project is a strategic project for both the implementation of the Danube Strategy and Programme Romania-Bulgaria cross-border development. The aim of the project is the modernization and development of the integrated qualitative and quantitative measurements on common sector of the Danube, by Romania and Bulgaria by improving the monitoring of the Danube plain water, for the river and the aquifer in which the water exchange and downstream of the main users of water and by linking methodologies and data processing in a common methodology, geodatabase for project implementation and a warning platform in case of extremes discharges. Two Guidelines regarding common Danube monitoring system and Low Flows and Drought Management in the Danube flood plain are the main outputs regarding water resources management. This work present the analysis of the surface and groundwater issues related to the European implementation strategy for the Water Framework Directive (2000/60EC), the EU standards for quantitative and qualitative parameters of water and transposition of the EU Directives in Romania legislation.

Keywords: Danube Water Project, EU standards, geodatabase, monitoring system, qualitative and quantitative measurements.

Acknowledgement: This work is financed by the Romania-Bulgaria Cross Border Cooperation Programme 2007-2013, under the contract MIS ETC 161/2012

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Monitoring a bioengineering technique applied to combat impacts of forest fires: the technique of mixture dykes of masonry and forestry residues

J. L. García^{1*} and G. Tardío¹

¹Universidad Politécnica de Madrid (UPM), Madrid, Spain

*Corresponding author: E-mail: josel.garcia@upm.es

Abstract

During 30 and 31 July and 1 and 2 August 2007, the Canarian several towns were affected by a huge forest fire that burned down a remarkable part of the forests of *Pinus canariensis*. The total surface burned was over 18,000 ha. The mixture dykes were conceived in early 2008, during actions to control the onset of erosion processes in Teide National Park subsequent to the forest fire. Besides this, rocks are placed on both sides of the dyke. The vertical elements are tied to each other by means of a biodegradable rope and the extremes of the dyke are anchored to the ground or to any adjacent tree or bush. Usual calculations of wooden structures and hydrology were used. The matrix formed by the fine residues creates a fertilized substrate that, as time goes by, is colonized by indigenous species. The sediment wedges caused by the cross barriers turn into a series of green islands throughout the gullies. The body of this dyke is permeable and because of this the water flows through its body, but in a controlled way. This dyke is a temporary structure because its core will mineralize in a few years (from 5-10 depending on the size of the forestry residues used). After a 7 year monitoring work some conclusions can be arisen. Both sedimentation wedges and soil and plant densities were measured. With the collected data the performance of this technique can be already characterised

Keywords: Forest fire, mixture dyke, Soil bioengineering

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Environmental and Social Effects of Both Large Dams and Run-of-River Hydroelectric Power Plants within the Coruh River Watershed in Artvin, Turkey

M. Özalp ¹, S. Yildirimer ^{1*} and E. E. Yüksel ¹

¹Department of Forest Engineering, Faculty of Forestry, Artvin Coruh University, Artvin, Turkey

*Corresponding author: E-mail: saim@artvin.edu.tr

Abstract

In order to help reducing Turkey's energy dependency on foreign resources, building both large dams and run-of-river type hydroelectric power (HEP) plants have been one of the most preferred development projects carried out lately. However, they also cause some environmental and social problems including land use change, reducing arable lands, sedimentation, destruction of ecosystems, and forced migration of people. The Coruh River Watershed (CRW) has been experiencing similar problems due to the series of large dams planned on the Coruh River by the General Directorate of State Hydraulic Works of Turkey. Important negative changes have been observed in the area especially in respect to land use and severe destructions on ecosystems due to the construction of the dams and the renewing of road network. In this study, using the Geographical Information Systems (GIS) with the data gathered from both the forest stand maps and CORINE 2006, we found that a total of 8137 ha area, mostly forest, will be inundated by the reservoirs of these dams. In addition, because of the Yusufeli Dam alone, the largest project among all, about 12124 people and 3031 homes are going to be affected directly and almost all arable lands along the floodplains of the valley are going to be lost as well. Besides these large dams, dozens of run-of-river type HEP plants are also being constructed on the steep tributaries of the CRW, causing ecological (damaging both natural forest ecosystems and ecology of riverine systems) and social issues (especially for local people living along these rivers). Results obtained from the questionnaires applied on local people showed that between %50 to %90 of them are strictly against these plants to be constructed within their living environments.

Keywords: Large dams, run-of-river HEP plants, Land use change, survey, CORINE, GIS

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Water Environment in urban Sri Lankan wetlands-Case study in Diyawannawa wetland

R. Piyadasa^{1*}, C. Naverathna² and P.M.T.S Kumari²

¹Department of Geography, University of Colombo, Sri Lanka,

²Department of Agricultural Engineering, University of Ruhuna, Mapalana, Sri Lanka

*Corresponding author: E-mail: ranjana@geo.cmb.ac.lk

Abstract

The rapid face of urbanization, economic growth as well as un-controlled migration especially in urban areas are now causing significant adverse impact on wetland environment. Wetland ecosystems are dynamic and heterogenic, which can exhibit substantial spatial and temporal variability in soil properties which can be influenced by the land use pattern of the area. This variability can have important consequences on wetland biota and biogeochemistry. High population densities and continued economic growth and industrialization are causing serious environmental damage in urban wetland areas in Sri Jayawardenapure administrative capital of Sri Lanka. The main objective of the study was to identify spatial variability of soil and water chemical and physical parameters in a land use gradient in the Diyawannawa wetland located in the Sri Jayawardenapura urban area. Water and soil samples were collected systematically from 20 locations in wetland twice a month from November 2013 to January 2014. The study revealed that the area is dominated by clay soil type but top and bottom layers are dominated completely different soil characteristics. Spatial distribution of water quality parameters could be identified using developed preliminary GIS maps for the study area. Lower pH values are in the wetland area while highest pH values are recorded near to the settlement areas. The lower pH values indicate inherent acidic nature of wetland soils. In chloride distribution map it was observed that chloride content in water in wetland areas are much lower than the other areas. Nitrate content is slightly higher near settlement areas may be because of increased human activities. Comparatively Phosphate condition indicates the same distribution like Nitrates. Interestingly Sulphate is much concentrated in wetland water proving that wetlands are sulphate sinks as well as pollution filters.

Keywords: Chloride, Nitrate, pH, soil, sulphate,

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SESSION V

MaP-Erosion Project

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Innovative Solutions to Reduce Agriculture Field Erosion From Around the World

R. C. Schultz^{1*}

¹University Professor

^{1*}Department of Natural Resource Ecology and Management and the Global Resource Systems, Environmental Science and Sustainable Agriculture Programs, Iowa State University, Ames, Iowa, USA, E-mail: rschultz@iastate.edu

Abstract

Most of the major agricultural regions of the world have degraded soils with significant areas of each having very degraded soils. According to the UN Environmental Program and FAO, 56% of the degraded soils are a result of water erosion, 28% wind erosion, and 16% chemical and physical degradation. The underlying causes for this degradation are the result of overgrazing (35%), deforestation (30%), agricultural practices (27%), overuse of vegetation for uses such as fuelwood (7%); and industrial activity (1%). Major causes vary between regions in the world with deforestation the major cause in Asia, Europe and South America, overgrazing, the major cause in Africa and Oceania, and agricultural practices in North and Central America. This degradation is not sustainable and innovative practices must be introduced and used to conserve the soil that is left. This presentation uses local areas of China, Tanzania and Ethiopia and the Corn Belt region of the United States to provide examples of the problems and potential solutions to soil degradation.

Farmers in Inner Mongolia, China have continually moved closer and closer to the Gobi desert with the consequence of major wind erosion and dust and sand storms covering agricultural fields. Use of trees and shrubs to act as wind breaks as well as woven plant mats to cover advancing sand are used to try to reduce erosion and stabilize the advancing desert. Over-population and trying to move from subsistence to income generating agriculture in Yunnan Province of southwest China has resulted in massive clearing of very steep hillsides at the edge of the Tibetan Plateau and planting of maize. Significant water erosion has moved massive amounts of soil down hills with little effort at present to stop it.

Similar situations exist in the mountains of Tanzania and the hills of Ethiopia. In Tanzania whole hillsides have lost all of their soil and have been abandoned with farmers moving further uphill and deforesting even steeper slopes to grow crops. Use of grass and shrub terraces and agroforestry practices of woody and annual crops are being used to try to reduce soil erosion driven primarily by water.

In the Corn Belt of the United States millions of hectares of land have been cleared for cultivation of maize and soybeans that cover the soil for only about 4-5 months of the year. Large fields are cultivated by large machines designed to work on fields of 1000 or more hectares in size. These large expanses are very prone to water and wind erosion. Many conservation practices are now being implemented to try to reduce that erosion. These include grass waterways, field borders, infield perennial plant strips and riparian buffers that all try to capture soil that moves towards surface waters. No-till and minimum tillage practices are also being used and crop residue is left in the field over winter before being tilled into the soil. Cover crops are also being used in areas that have sufficient growing days for them to become established.

Over population and dependence on larger and larger farming equipment are at the root of much of the soil erosion. Efforts to provide poly-cropping and agroforestry systems that can improve livelihoods must be made to address problems that arise from over population while perennial plant communities must be reintroduced on 2-4% of the landscape farmed with large equipment.

Keywords: Africa, China, conservation practices, Midwestern United States

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Wildfire and Erosion Problems of Thasos Island

G. Ranis^{1*}

^{1*}Forest Service, Thasos Greece, E-mail: g.d.ranis@gmail.com

Abstract

High-intensity and fast-spreading wildfires are natural in the Mediterranean region. Thasos Island, the northernmost island of Greece, is no exception to the rule. Since 1984, a series of wildfires led to the destruction of almost two thirds of island's forests. The wildfires were devastating in many different aspects to the island. The absence of plant cover, post-wildfire precipitation and high relief were the major factors causing soil erosion and intense flooding events. The results of both were serious problems to local communities, economy of the island and the regeneration of the burnt areas. Despite the significant amount of published research and studies regarding Thasos wildfires, there is a lack of data for post-wildfire hydrology and soil erosion. More research efforts are recommended that will help to improve the integration of wildfire into an overall assessment of the processes and impacts they can have on land degradation, through processes such as soil erosion and flooding.

Keywords: soil erosion, Mediterranean, post-fire effects, regeneration

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New Innovative Tools to Enhance the Protection of Greek Islands from Soil Erosion

G. N. Zaimes^{1*}, K. Ioannou¹, V. Iakovoglou², T. Laopoulos³, P. Tsardaklis³, R. C. Schultz⁴, D. Emmanouloudis¹ and D. Kaziolas¹

¹Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohorion, Drama, Greece 66100

²Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

³Aristotle University of Thessaloniki, Faculty of Sciences, School of Physics, Thessaloniki, Greece, 54124

⁴University Professor, Department of Natural Resource Ecology and Management and the Global Resource Systems, Environmental Science and Sustainable Agriculture Programs, Iowa State University, Ames, Iowa, USA

*Corresponding author: E-mail: zaimesgeorge@gmail.com, Tel: +30 2521060416, Mobile: +306945124720

Abstract

Ninety nine percent of the world's food comes from the soil, so its protection should be a priority. Although soil erosion is a natural geomorphologic phenomenon, unsustainable anthropogenic activities such as agriculture, have caused excessive erosion rates that exceed soil formation rates. Experts estimate more than 25 m hectares per year of crop land are degraded or lost due to erosion. One of the regions that have experienced severe problems of erosion and still does is the Mediterranean. These problems are expected to increase due to the impending climate change impacts. Specifically climate change will lead to more intense rainfall events and even longer periods of drought. Greater intensity rainfall events will enhance surface runoff and flooding that will increase soil erosion potential. The overall objective of this paper is to present new tools to land managers to mitigate surface soil erosion. The first tool will be a new instrument that will be based on the physical properties of ultrasound to detect erosion locally with great accuracy while measuring precipitation and soil moisture will simultaneously. The second will be the development of an Information System able to indicate soil erosion risk accurately that can be applied to large areas. This system will allow land managers to accomplish their job cost-effectively for example by placing soil erosion conservation practices in areas with the highest soil erosion potential and by utilizing scientifically sound methods. Finally, this system will be user friendly and provide easily readable data.

Keywords: Soil erosion risk, wildfires, climate change, Decision Support System

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Soil erosion studies in Greece: A literature review.

P. Koutalakis^{1*} and V. Iakovoglou²

¹MSc Researcher Geologist Proti, Serres, Greece 62047

²Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

*Corresponding author: E-mail: koutalakis_p@yahoo.gr

Abstract

Soil erosion is an environmental threat especially for Mediterranean countries such as Greece. In this paper, scientific publications related to soil erosion studies in Greece were reviewed and categorized. To accomplish this, the online search engine of Scopus was used. The key words were “soil”, “erosion” and “Greece.” An analysis of the published articles was conducted at four levels: i) type of publication, ii) chronologic, iii) spatial distribution and iv) thematic. A hundred and thirty publications were found with most published in scientific journals (85%). The results showed that the awareness regarding the soil erosion in Greece has increased in the last decades and an empirical equation for future predictions was generated based on the chronologic analysis. Spatial distribution analysis depicted the areas that were studied most or had few publications. The publications covered a wide range of thematic categories such as the *type of studied areas*, the *physical phenomena* that trigger and influence the soil erosion, the negative *anthropogenic impacts* on them, the *assessment tools* that were used in order to examine the threat and the proper *management*. The analysis was significant and necessary in order to find the gaps of soil erosion studies in Greece.

Keywords: *anthropogenic impacts, soil management, scientific journals*

Acknowledgement: This research is implemented through from the General Secretariat for Research and Technology under the operational program “Education and Lifelong Learning” called “Aristeia II” and is co-financed by the European Union (European Social Fund) and Greek National funds.

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Development of a Wireless Erosion Measuring Network

K. Ioannou^{1*}

^{1*}*Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohorion, Drama, Greece 66100, E-mail: ioannou.konstantinos@gmail.com*

Abstract

During the last 20 years, humanity is facing a series of major environmental problems, which are mainly caused from the increase of human activities, land use changes, the uncontrolled exploitation of natural resources etc. Greece being located in the southern part of the Balkan Peninsula is greatly affected by these changes. This is particularly obvious from the increased number of extreme weather events which take place every year across the country, causing environmental problems, social problems, economic problems, and even resulting in loss of human lives. The purpose of this paper is the presentation of a methodology which can be used to remotely collect data from study areas, in order to monitor a series of environmental parameters, and helping scientists in timely problem solving.

Keywords: *remotely collected data, human activities, land-use changes*

Acknowledgement: This research is implemented through from the General Secretariat for Research and Technology under the operational program "Education and Lifelong Learning" called "Aristeia II" and is co-financed by the European Union (European Social Fund) and Greek National funds.

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An Automated Soil Erosion Monitoring System

P. Tsardaklis^{1*}, I. Kosmadakis¹ and T. Laopoulos¹

¹Aristotle University of Thessaloniki, Faculty of Sciences, School of Physics, Thessaloniki
Greece, 54124

*Corresponding author: E-mail: ptsardak@gmail.com

Abstract

The use of sensors and experimental instrumentation systems is becoming increasingly important in the characterization of the physical terrain. An automated compact acquisition and analysis system to be used in a research project is presented in this work. In addition to this, an effort is made to present the design consideration of the experimental setup as per the functions performed. The custom designed setup is to investigate the physical characteristics of the ground terrain and it is designed for data collection concerning this matter. The main characteristic measured is the soil erosion (changes in ground level) occurring in certain geographic areas. Parameters such as temperature and ground humidity are also taken into account. The proposed configuration takes advantage of data logging techniques. The setup uses GSM communication techniques for transmitting the desirable parameters. A solar charger is also being used in order to ensure the constant viability of the experimental configuration. The whole setup designed may be used in any geographic area that suffers of soil erosion.

Keywords: Automated monitoring system, Ground level changes, Soil erosion

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SESSION VI

Frontiers in Environmental Management

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Fire management in territories contaminated by radionuclides: case study of the Chernobyl exclusion zone

S. Zibtsev^{1*} and O. Borsuk²

¹Professor, National University of Life and Environmental Sciences of Ukraine, Regional Eastern European Fire Monitoring Center (REEFMC), Kiev, Ukraine

²Graduate Student, National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine

*Corresponding author: E-mail: sergiy.zibtsev@nubip.edu.ua

Abstract

Increasing of the number of new nuclear power facilities in the world requires more attention to natural resource management and protection in the zones that could be potentially contaminated by radionuclides. In particular, important issue is fire management that must take into account risks of additional doses for fire fighters and secondary contamination of environment as a result of contaminated biomass burning. The analyzes of wildfire risks and hazards for fire fighters, personnel and environment as well as peculiarities of current fire management in the most well studied case – the Chernobyl Exclusion Zone (CEZ) is performed. Insufficient forest and fire management along with impacts of insects and diseases during the last 28 years have resulted in high wildfire hazard on the 260,000 hectares of forests and grasslands of the CEZ, an area that is highly contaminated with long-resident radionuclides of ²³⁸Pu, ²³⁹⁺²⁴⁰Pu, ¹³⁷Cs and ⁹⁰Sr. Up to 9000 ha of pine forests are died during last decade and are subject of high wildfire risks. This development will essentially increase fuel loads and wildfire risk. Fire prevention and suppression pose serious risk of additional inhalation doses for firefighters who can obtain their annual limit dose during a relatively small number of days in active participation in fire management. Fire management infrastructure is inadequate to address the existing and future wildfire risks. Recommendations on urgent steps on improvement of fire management in CEZ are proposed.

Keywords: wildfire, fire management, wildfire hazard, Chernobyl exclusion zone, radioactive contamination

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LIFE for European forest genetic monitoring system

F. Aravanopoulos^{1*}, F. Kiourtsis², E. Avramidou¹, X. Sarvani², P. Bekiaroglou² and E. Maliarou¹

¹Forestry & Natural Environment, Aristotle University of Thessaloniki, Greece

²Decentralised Administrator of Macedonia & Thrace, Greece

*Corresponding author: E-mail: aravanop@for.auth.gr

Abstract

Sustainable forest management is based on the long-term adaptability of forest ecosystems and starts at the first level of biodiversity, namely at the gene level. Forest genetic monitoring (FGM) is therefore a crucial component of any sustainable forest management system as it presents an opportunity to detect potentially harmful changes in forest adaptability before they are seen on higher levels, especially at the phenotypic stand level. Forest genetic resources face a large number of increasing threats. By introducing genetic monitoring into conservation programmes and sustainable forest management one has the tool in hand to assess information on relevant changes of a species and/ or populations' adaptive and neutral genetic variation through time. In fact, genetic monitoring can be based on indicators and their verifiers in order to serve as an early warning system to aid the assessment of a species response to environmental change at a long-term temporal scale. This project is the first attempt to take up genetic monitoring methodologies in order to implement them in an applied setting and derive detailed guidelines for the realization of genetic monitoring on a European level. The approach is meant to test the connection of scientific concepts, their practical application and economic feasibility and thereby develop a stepwise concept with different levels of observation intensity, experimental/analytical tools and related costs.

Keywords: *biomonitoring, 'Sustainable forest management, genetic monitoring*

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Morphological and physiological responses of forest species under drought preconditioning: A review

V. Iakovoglou^{1*}

^{1*} Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006,
E-mail: viakovoglou@yahoo.com

Abstract

Mediterranean ecosystems are subjected to frequent and intense levels of disturbances due to extreme disastrous natural events (e.g. fires) and anthropogenic interference (e.g. land use alterations). Unfavorable prevailing semi-arid climatic conditions pose obstacles to a successful regeneration, especially during summer that are prevailing in Greek ecosystems. Forest nurseries need to produce the best quality of transplanting material in order to achieve greater seedling survival. The aim of this paper is to review research conducted on drought preconditioning of forest seedlings prior to regeneration in order to enhance the transplanting success. The hypothesis is that seedlings that have undergone a degree of water stress have a greater biomass accumulation in the roots that help seedlings overcome transplanting stress. Studies showed that seedlings tend to decrease their height and shoot/root ratio indicating greater dry mass accumulation to the below ground seedling parts. Also, it was suggested that acclimation occurred mostly through the reduced level of stomata conductance and transpiration rates. Overall, this review will provide a better understanding on the morphological and physiological responses of seedlings that experience drought preconditioning prior to transplant. In addition, nursery specialists will benefit by utilization of smaller water quantities for irrigation purposes while producing seedlings that could better adapt under dry growth field conditions and help increase the success of reforestation efforts.

Keywords: *Ecological implications, forest species, rehabilitation, restoration, semi-arid ecosystems*

Acknowledgment: This research project is funded under the Project 'Research & Technology Development Innovation Projects'- AgroETAK, MIS 453350, in the framework of the Operational Program 'Human Resources Development'. It is co-funded by the European Social Fund through the National Strategic Reference Framework (Research Funding Program 2007-2013) coordinated by the Hellenic Agricultural Organization – DEMETER (Institute: Forest Research Institute/ Scientific supervisor: George Chalyvopoulos).

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Towards an integrated forest management system: components for environmental sustainability and against illegal logging –

F. Kiourtsis^{1*}, D. Anastasiadou², A. Ourouzi¹, E. Euaggelidou¹ and I. Athanasiadis³

¹Decentralised Administrator of Macedonia & Thrace

²Information Technologies Institute, Centre for Research and Technology Hellas

³Democritus University of Thrace

*Corresponding author: E-mail: fkioyrt@gmail.com

Abstract

Illegal logging and the cross-border trade in illegally logged timber is currently a major concern among all countries worldwide. Illegal logging and trade is a worldwide concern, as based on a recent WWF report, the share of illegal logging is estimated at 20% to 40% of the total global industrial wood production. Illegal logging and trade has a multi-dimensional impact, ranging from environmental damage, foregone governmental revenues and crime. In this context, EC published its Action Plan on Forest Law Enforcement, Governance and Trade (FLEGT) in 2003; legislation (EU timber regulation) finally is in force by March 2013. Greece and FYROM, as also experienced by most countries worldwide, face significant problems with regards to illegal logging and timber trade. Based on recent studies, the volume of illegally logged wood in FYROM ranges from 25 to 30% of total harvest annually. Similarly, Greece faces serious issues from illegal imports of wood from both EU and non-EU countries across its north borders. The project aspires to develop specific recommendations for enhancing and modernizing relevant illegal logging legal and regulatory framework, develop policy pillars and specific guidelines for restricting illegal timber trade, develop regional operational/implementation plan, as cascaded by policy guidelines, describing actions steps required, modus operandi and governance model, prescribed technology solution and platform architecture. These activities will be also complemented by an actual implementation pilot, conducted in participating regions across borders of both countries, where operational soundness and execution effectiveness of plan will be tested, providing specific feedback for further plan's improvement and acting as "test-bed" for full-scale implementation. The new approaches to ensure more efficient management of ecosystems and implement intensive forestry is to increase timber yields and also Enhancing Biodiversity. To achieve this, we need to determine the macroeconomic potential of the various options available, including the use of biotechnology, genetics and ICT solutions.

Keywords: *Illegal logging, forest management, policy*

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The Protective Role of Forests in Greece: The INFORM Spatial Approach –

D. Raptis^{1*}, V. Kazana¹, C. Stamatiou¹, A. Kazaklis¹, P. Koutsona¹ and A. Boutsimea¹.

Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama-Mikrohorion, Drama, Greece 66100

**Corresponding author: E-mail: d_rapt@yahoo.gr*

Abstract:

One of the basic indicators that are used to assess and monitor sustainable forest management at the national level in the Forest Europe policy initiative concerns the area occupied by the protective forests. The role of protective forests is mainly related to soil, water and human infrastructures risks. There is no unique definition of the “protective forest” term in the Forest Europe policy frame. In Greece, a number of spatial criteria have been included in a recent legislation to define which forests of the country could be considered as protective forests. However, only recently in Greece through INFORM, an on-going EU LIFE project, a spatial approach was adopted and the area of the country’s protective forests was clearly identified and mapped through a Geographic Information System. Through this approach a clear set of spatial rules was introduced that were combined with several vector layers representing critical variables, such forest boundaries, topography and human presence. The relevant spatial data were included in the INFORM knowledge base for sustainable forest management. This article presents in detail the spatial approach that was used to define and map the protective forests of the country, as well as the spatial distribution of this type of forest areas. The analysis showed that in Greece the area covered by forests with increased protection effect constitutes almost 40% of the country’s total forest area, a fairly high percentage that can be attributed to the complex terrain of the Greek territory. There is much potential in the adopted spatial methodology for defining and mapping the area of protective forests to be applied in other countries of the Mediterranean basin too.

Keywords: *protective forests, spatial distribution of protective forests, sustainable forest management*

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Vegetation and quality assessment of Natura 2000 forest habitat 9050 “Fennoscandian herb-rich forests with *Picea abies*”

T. Paluots^{1*} and H. Korjus¹

¹*Institute of Forestry and Rural Engineering, Estonian University of Life Sciences, Kreutzwaldi 5, Tartu, Estonia*

*Corresponding author: E-mail: teele.paluots@emu.ee

Abstract

Natura 2000 is an European Union wide network of nature protection areas established under European Council's Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC). Consequently, roughly 30% of European forests are designated as Natura 2000 protected areas and therefore better overview of these areas and their values is needed. The purpose of the study was to examine vegetation and structural and functional qualities of Habitats Directive Annex I forest habitat – Fennoscandian herb-rich forests with *Picea abies* in Southern Estonia. This study is based on 35 areas and 14 sample plots from the Estonian Network of Forest Research Plots measured in 2014. The areas were located in protected (77%) and non-protected (23%) areas. The comparison with existing Estonian Nature Information System data showed that the site type value had increased in 4, been stable in 14, decreased in 12 and has been lost in 5 areas. The main reasons for habitat value negative change were clearcuts, thinnings, drainage ditches and errors in mapping. The increase occurred when there was abundance of dead wood, old trees, graminoids and rare species. On 20 areas the site vegetation classification showed us differences with Estonian interpretation manual of EU habitats. When *Aegopodium*, *Filipendula* and *Hepatica* were expected site types then *Oxalis*, *Vaccinium myrtillus* drained peatland, *Oxalis-Vaccinium myrtillus* and minerotrophic stagnant water swamp forest site types were not so suitable. That means some stands will need to be reclassified. Therefore the area of some forest habitat types may increase or decrease in the future.

Keywords: *Forest habitat types, Forest naturalness, Habitat quality, NATURA 2000 network, Tree and stand variables*

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Modeling and remote sensing for the estimation of forest's sustainability in the Middle Povolgie of Russia

E. Kurbanov^{1*} and O. Vorobev¹

¹Volga State University of Technology

*Corresponding author: E-mail: kurbanovea@volgatech.net

Abstract

Global warming may have sufficient impact on the sustainability of boreal forests. The present study compared several models that address the impacts of climate change on forests of the Russian Middle Povolgie at the different levels of biological organization: regional, administrative unit and forest ecosystem (polygon). We analyzed the models in the MATLAB software with the use of GIS and remote sensing techniques. The general geo-spatial model of the forest ecosystems temporal dynamics during the last 30 years included three sub-models: i) vegetation indexes (NDVI, EVI), ii) forest (ha level) characteristics on the level of ha (stock, basal area, mean diameter and height), iii) climatic variables (temperature, precipitation potential evapotranspiration and aridity index). For the evaluation of spatial distribution and sustainability of forest ecosystems an unsupervised and supervised classification was applied for the Landsat images of 1975-2014. Ground truth reference and field data about the state of forests have been obtained on the territory of test sites of the investigated area during summer experimental works. This study showed a promising prospective for the remote monitoring of the boreal forest ecosystem's vegetation based on the developed technique and models.

Keywords: *Forest ecosystems, GIS, Landsat, Remote sensing*

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Altitudinal Zonation of Floral Biodiversity and its Conservation Pattern in Mizoram, North-East India

V. P. Sati^{1*}

^{1*}Department of Geography and Resource Management, School of Earth Sciences, Mizoram
University, Aizawl- 796004, Mizoram, India; E-mail: vpsati@mzu.edu.in

Abstract

This paper examines altitudinal zonation of floral biodiversity and its conservation patterns in Mizoram, North-East India. Floral biodiversity in Mizoram is tremendously high in the forms of forests –tropical, montane and temperate; grasses and bamboo forests. Out of the total geographical area, 19,240 (91.3%) land is under vegetation and about 75% land is tree cover. The state of Mizoram is located in the eastern extension of the Himalaya and it is one amongst the biodiversity hotspots of the world. Floral biodiversity vary according to altitudinal zones and the amount of rainfall, from tropical evergreen forest to montane and temperate forest. Forest products are the second major sources of livelihood, as a large number of people are dependent on them. Forests are conserved by the local people though traditional knowledge. As a result of this even, the whole country received decrease in forestland; Mizoram has registered about 1.4% increase during the last three decades. Data were mainly gathered from the secondary sources, largely from the India State Forest Report (ISFR) 1991, 2001 and 2011. Similarly, data from the Department of Environment and Forest, Government of Mizoram on forest diversity and their distribution were also collected. Further, wide range of discussion was made with the officials working in the forest department and with the local people to elaborate the other aspects of forest resources such as use pattern of forest products and their conservation pattern. Personal observation on forest diversity use pattern and their conservation was also carried out after rapid field visits.

Keywords: *Floral biodiversity, conservation, altitudinal zones, climate, rainfall, Mizoram.*

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SESSION VII

Water Management in the Mediterranean 1

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Urging the Sustainable Usage of Irrigation Water through the Evaluation of Farms' Infrastructures and Good Practices

I. Dimitriadis^{1*} and K. Ioannou¹

¹ Department of Forestry and Management of Natural Environment, Technological Institute of Eastern Macedonia and Thrace, 1st Km Dramas Microchoriou, 66100, Drama, Greece.

*Corresponding author: E-mail: dijomarine@hotmail.com

Abstract

The intensification of agriculture activities leads to increased pressures on natural resources, especially on water resources. The combination of high demand for irrigation water with the semi-arid conditions of Greece is the reason why this sector is the largest consumer of water (80%). The existing water use are considered inefficient due to large leakages from inappropriate infrastructures and the failure to implement best practices for water saving. For these reasons, the construction of a multi-criteria decision analysis (MCDA) model to estimate water consumption was deemed necessary, with the intent to assign the socio-economic values of water. The model was constructed by using the Analytical Hierarchical Process (AHP) method. The aim of the model was to select the field with the lowest theoretical consumption, regardless of the size of the field. Quantitative and qualitative factors were used for criteria. The criteria selected affected the consumption of irrigation water directly or indirectly. In addition, the majority of the criteria could be modified directly by the farmers. The methodology foresaw the conduct by the Decision Maker (DM) of pairwise comparisons between the studied fields per criterion. Professional agriculturists were defined as suitable for DMs due to the criteria's complexity. The ultimate goal of this study was to administer government agencies a convenient and flexible tool as a reference for policy-strategy on government subsidies, economic incentives, quality certifications etc.

Keywords: Analytical Hierarchy Process, Expert Choice, Water Recycling, Water Use Efficiency

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Estimating surface runoff from an ephemeral torrents in a small rural watershed in Northern Greece for agricultural uses

E. Gialamas¹ and G. N. Zaimis²

¹Mineral Resources Engineer, Georesources Technology S.A. P.O. Box 1431, Kavala, Greece,

²Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100.

*Corresponding author: E-mail: v.gialamas@georesources.gr

Abstract

Agriculture uses substantial amount of water since water is essential for crop production, especially in semi-arid and arid regions. This is also true for Greece with agricultural uses of the total water estimated at 86%. Greece has a Mediterranean climate with limited precipitation during the summer months; a period that crop needs substantial amounts of water. This study estimated surface runoff from ephemeral torrents, in a small rural watershed in Orfanos, Kavala, Greece. Water from ephemeral torrents is a source of water that has rarely been use in Greece, although are the most common type of streams in the region. To determine the surface runoff volume, the Soil Conservation Service – Curve Number (SCS-CN) method was used with a GIS approach. The contour lines, the hydrographic network, the hydrologic soil group, the land cover, the meteorological data, and antecedent soil water conditions were used as inputs variable in ArcGIS and the Arc-CN runoff model extension. The model was run for a dry (2000), average (2004) and wet (2006) year were selected in regards to the rainfall data. The estimated annual runoff for the dry year represented only 0.49% of the total rainfall, while for the average and wet year this percentage increased to 3.39 and 4.00% respectively. When compared to the actual water demands for agriculture uses in the study area, the runoff volume for the average and wet year could increase the total irrigated land by 15% and 25%, respectively. Thus, the constructions of water storage systems is recommended.

Keywords: Arc-CN Runoff Model, Curve Number, Ephemeral flow, GIS, Rural watersheds

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Simulation of water allocation using MIKE SHE, a spatially distributed hydrological model

A. Papagera^{1*} and K. Ioannou¹

¹*Eastern Macedonia and Thrace Institute of Technology, Dept. Forestry and NEM, Greece*

*Corresponding author: E-mail: linapp3@gmail.com

Abstract

Wetlands are important ecosystems influencing water resources sustainability. During the past decades many of these ecosystems have and continue to experience ecological stress due mostly to human activities and the high demand of water consumption. Agriculture activities are considered the main cause of wetlands lost worldwide. Lake Koronia is part of Mygdonia basin and it is located in the Northern part of Greece in the Region of Central Macedonia. The Lake belongs in the Ramsar Convention of wetlands and the last twenty years presents a negative water budget due mostly to excessive irrigation uses. Ramsar guidelines indicate the need to implement water management plans on a self- sustainable wetland system at the catchment level. Hydrological models are efficient tools offering great advantages in the field of water management. In this study we used a physically-based spatial distributed model MIKE SHE developed by the Danish Hydraulic Institute (DHI) in order to better understanding the causes and the consequences that contribute to the water deficit of the Lake Koronia. We used MIKE SHE model in order to simulate the water flow and water balance tool to estimate the water balance for the period 1/10/2008-30/9/2012 in the catchment of Lake Koronia. Furthermore the calculation of the water budget will also offer information on the hydrological conditions of the lake. An acceptable error was found at 0.05% of total precipitation in the simulation of water balance. The greatest loss of water balance is from the amount of evapotranspiration (63, 8% of total precipitation).

Keywords: *Lake Koronia, MIKE SHE, Water Allocation, Water Balance, Wetlands*

Acknowledgment: The authors would like to acknowledge DHI for the kind provision of the modelling software MIKE SHE that was used in this research study

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Odonata as indicators of stream water quality: a case study in the basin of Sperhios River

N. Manikas^{1*}, T. Spanos¹, V. Christopoulos², G. N. Zaimis¹ and D. Avtzis²

¹Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohorion, Drama, Greece 66100

²Forest Research Institute, Hellenic Agricultural Organization Demeter, Vassilika, Thessaloniki, Greece

*Corresponding author: E-mail: neoklism@otenet.gr

Abstract

Biological monitoring is often used to measure the response of organisms to anthropogenic stressors such as decreased water quality. Species within the insect order Odonata can be used as biological indicators because they are often considered valuable indicators in assessing the quality of aquatic environments, as they spend their nymphal stage in the water. For that reason, they are very sensitive even to slight modifications of the water and riparian conditions. In the current investigation we sampled the Odonata-fauna from three streams of Central Greece, namely Kakavorema, Thermopiles and Sperhios, with each exhibiting different features with regard to water flow and quality. Specifically, Kakavorema is a stream, Sperhios is a river and Thermopyles a thermal spring). In total, 332 Odonata individuals were collected in the summer of 2014, which were then identified belonging to six different species. Based on the collected insects the Shannon-Wiener and Simpson biodiversity indices were estimated. In addition water samples were collected from the sites that insects were sampled and analyzed for pH, conductivity, sodium, potassium and calcium concentrations. The biodiversity indices (Shannon-Wiener and Simpson) revealed that Sperhios river was the less degraded habitat, something that was also verified by the calculated water quality parameters.

Keywords: *Odonata, Shannon-Wiener index, Simpson index, stream water quality, stream types*

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Improving Wildfire Management of Thasos Island: Combining Information Technology with Research Field Data

A. Vlachopoulou^{1*}, D. Emmanouloudis² and K. Ioannou²

¹Researcher Agriculturist M.Sc., Kavala, Greece,

² Eastern Macedonia and Thrace Institute of Technology (EmaTTECH), Department of Forestry and Natural Environment Management, Kavala, Greece

*Corresponding author: E-mail: Litsav8@gmail.com

Abstract

Wildfires have frequently impacted Thasos, in Greece, as with most Mediterranean regions. In the past, before the devastating fires that struck the island during the period 1984 – 2000, the coniferous forest covered 74% of the total area. In Thasos an average of 240,000 acres of forest burned in the region especially during the summer. Extensive wildfires can have serious consequences of these fires such as the loss of large quantities of wood, loss of habitat, intensive surface erosion that degrades soil quality and enhances the risk of desertification. So, it is necessary to establish a management plan of fire suppression in the most effective way. The method adopted in this study was derived from the combined use of information technology with the field research with the purpose to build a platform suitable for wildfire fighting in the most quickly and effective way management. The platform used was GIS and Multi-criteria Decision Analysis. The Multi-criteria Decision Analysis, a decision support system, is a multi-objective, hierarchical and network model that constructs and analyses various parameters (relevant with the final goal) - raster files, to a central data base, containing information layers. These layers used were: catchment basins, the hydrographical and road network, the digital terrain model, the allocation of existing reservoirs and the fire risk zones. The field data helped recognize the basin of the streams, that would allow to investigate the existence of continuous or minimal streamflow. The estimation of the flow of the streams is the main variable in choosing the positions of the small reservoirs. Overall this method had satisfactory results that improved the suppression of forest fires.

Keywords: Wildfires; Geographic Information Systems (G.I.S.); Multi – Criteria Decision Analysis, Streamflow Measurements

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Registering the changes in the hydrographic network of the city of Kavala during 20th century.

M. Margaritopoulos^{1*}, I. Dimitriads^{1*} and L. Kosmatopoulos¹

¹ Department of Forestry and Management of Natural Environment, Technological Institute of Eastern Macedonia and Thrace, 1st Km Dramas Microchoriou, 66100, Drama, Greece.

* Corresponding author: E-mail: dijomarine@hotmail.com

Abstract

The city of Kavala (in Eastern Macedonia and Thrace Region) is built at the foothills of the mountain “Symbolo”, which explains its amphitheatrical form. In the early 20th century, the city received a great wave of immigrant population. During this time, major suburban areas were established, which are currently incorporated in the city's urban fabric. In the mid-20th century the rapid urban sprawl has brought significant anthropogenic changes in the city's hydrologic network. Although Kavala has an amphitheatrical form, a few regions of the city are suffering by flood phenomena. Floods were usually observed after heavy rain events especially in the regions where low slopes and highly-modified streams are combined. The present study investigated the changes of the hydrologic network with the assistance of pre-existing available maps. The available maps were overlapped with the use of Geographic Information System (ArcGIS) in order to digitize the changes of streams in Kavala. The anthropogenic interventions were grouped by category with in situ inspections in order to be illustrated in a final contemporary map. Finally, a qualitative spatial representation of high flood risk zones was reported.

Keywords: Flood Risk Zones, Hydrographic Network, Urban Sprawl

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Precipitation and Temperature variability over Hellenic region and their future perspective

A. Kopasakis^{1*}, J. Luterbacher² and D. Emmanouloudis³

¹Dde Rodopis ,Greece

²University of Giessen, Germany

³Department of Forestry and Management of Natural Environment, Technological Institute of Eastern Macedonia and Thrace, , 1st Km Dramas Microchoriou, 66100, Drama, Greece.

* Corresponding author: E-mail: akopasakis@yahoo.gr

Abstract

The Hellenic region constitutes a large part of the Balkan Peninsula, known as Hellas (Greece), and part of South - Eastern Europe. As the focal point of three continents- Europe, Asia and Africa-it is of great interest because it contains a variety of climates. The country is surrounded by the Mediterranean, the Ionian, the Libyan and the Aegean Seas, the latter connecting with Asia and, therefore, the Black Sea. Following from all the above, an attempt to describe the basic particularities in the movement of precipitation and temperature in selected stations from the Hellenic region has been made. The results have been drawn from stations around the Hellenic region, and the average annual values of rainfall and temperature, as well as their maximum and minimum values have been placed on tables where seasonal separation (Winter -Spring -Summer- Autumn) has also been applied. An application of the Mann Kendall test with the final aim of producing negative or positive trends also appears in the paper. Finally, the paper compares the results of processed data to the flood and drought events, not as weather conditions, but rather as hydrological phenomena.

Keywords: *Precipitation, temperature, variability, Hellenic region, Mann-Kendall*

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Optimizing the management of urban water distribution networks using embedded microprocessor M68000 Motorola

H. Tsagkalidis^{1*} and D. Emmanouloudis¹

¹*Department of Forestry and Management of Natural Environment, Technological Institute of Eastern Macedonia and Thrace, 1st Km Dramas Microchoriou, 66100, Drama, Greece.*

* Corresponding author: E-mail: heliaseg@hotmail.com

Abstract

The efficient management of water resources is a growing necessity. In most cities, a large percentage of water is lost before it reaches consumers. A loss rate of 20% -30% is typical while in many cases it can reach 50%. In Greece where precautionary scan networks have been applied, many water and sanitation services consider a satisfactory rate of water loss from leaks, in the range of 30-40%. In developed European countries losses in water supply systems exceeding 15% are considered unacceptable. The failure to address the problem, particularly in areas with insufficient water resources in some mainland areas of Greece and, almost all of the Greek islands, leading to a significant waste of water with substantial consequences. The lack of incentives for the water management units, the lack of awareness of citizens-users of the water service and the lack of political willingness are the main causes for these excessive water losses in supply systems in Greece. This project presents a new way of detecting leaks in municipal water networks using an embedded system storage and processing data. A method used successive approximations of pressure values, calculates if there is water leakage. The results calculated by the program after the introduction of pressure values, showed that there is an increasing need for better diagnostic and monitoring tools to assess the condition of the water network. An extensive review is given of diagnostic and monitoring tests, that assess the condition of water network and provide an early warning of potential leakage

Keywords: *water losses, detecting leaks, embedded system, pressure values, potential leakage*

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A review on constructed wetlands (CWs) and their ability to remove wastewater pollutants.

Aik. N. Zarkada^{1*}, V. Iakovoglou², V. Kazana³ and T. Spanou⁴

¹MScStudent, Management in Water Resources of the Mediterranean, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

²Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

³Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

⁴Technological Educational Institute of Eastern Macedonia and Thrace, Department of Petroleum and Mechanical Engineering Sciences, St. Lucas Street, 65404 Kavala, Greece

*Corresponding author: E-mail: katerinazarkada@hotmail.com

Abstract

Constructed wetlands (CWs) are artificially created to simulate removal of pollutants from wastewater under processes that occur naturally in wetlands. This paper is aiming in reviewing work on different types of CWs according to the targeted removed pollutants, with emphasis on the removal of nitrogen and phosphorus. The studied removal factors were plants, microbes and the soil substrate. The suggested species for the CWs were the emergent macrophytes that are species that are able to adjust the redox potential by providing oxygen in the rhizosphere. They have also a relatively high capability of absorbing nutrients and they provide stable conditions for microbial community. Although the selection of emergent macrophytes is favorable for both nitrogen and phosphorus removal, each nutrient has different needs in oxygen levels, organic matter and substrate composition. Nitrogen removal is more dependent on microbial activity, while phosphorus removal is dependent on complexity and sedimentation of the soil substrate. Further, nitrogen removal is enhanced by a succession of an oxic and an anoxic environment with the second being preferably rich in organic matter. On the other hand, phosphorus removal is favored by a single oxic cell that retains metals such as Ca, Al and Fe which provide sites for adsorption, while organic matter should be absent since it blocks the adsorption sites. In an attempt to combine the different and interdependent needs, the suggested CW type is a hybrid system that consists of three communicating environments (cells): a vertical-flow, a horizontal-flow and a last vertical-flow cell, with the second cell being consisted with organic matter and the third cell with a limestone substrate.

Keywords: Cleaning water, ecosystems, plant responses, water pollutants, water quality

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SESSION VIII

Water Management in the Mediterranean 2

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Effects of geofluvial features on ground dwelling insects assemblages at two tributary watersheds of Nestos River in Greece

D. Syropoulos^{1*}, V. Iakovoglou², D. Petsopoulos², D. N. Avtzis² and G. N. Zaimes³

¹ Post graduate student, Management of water resources in the Mediterranean, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Drama, Greece

² Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

³ Professor of Technological Applications, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Drama, Greece

*Corresponding author: E-mail: dimsyrop@yahoo.gr, Tel: 6972268179

Abstract

Many studies have been conducted associating biotic and abiotic factors (understory vegetation, soil moisture, woody debris, canopy closure etc) with ground dwelling insects' communities, but only few have included geofluvial features. Three sampling plots were established at each one of two major tributaries of Nestos River, namely Vathirema (VTR) and Arkoudorema (ADR). Ground insects communities composition in respect with species richness and distribution have been compared not only between the two watersheds and with increasing elevations but also along trans-riparian (stream edge to upslope) transects. Biodiversity was quantified (both species richness and evenness). Furthermore, geofluvial measurements have been performed by using both GIS software and in situ measurements focusing on stream stability. Our findings suggest that ground dwelling insects' communities present increased values of diversity (Simpson and Shannon indices) at the VTR stream whereas the equitability index is slightly higher at the ADR stream. According to our geofluvial measurements VTR is a more mature and stable stream both in terms of relative stream power and sediment size. We suggest that in VTR sites the habitat is more suitable to host a greater number of species while in addition facilitates the emergence of dominating species. On the other hand, the ADR is less mature and species were not able to form large populations yet, thus they experience greater equitability. The hypothesis that riparian zones experience increased biodiversity levels was confirmed only at ADR whereas elevation was not correlated with diversity values. Increased riparian vegetation values also complied with the VTR improved biodiversity.

Keywords: Biodiversity indices, geofluvial measurements, ground dwelling insects, Nestos River.

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Review of climate change effect on crops and evaluation of irrigation systems on water use efficiency

M. P. Kasapi^{1*}, V. Iakovoglou² and V. Kazana³

¹MScStudent, Management in Water Resources of the Mediterranean, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

²Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

³Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

*Corresponding author: E-mail: marinakasapi@hotmail.com

Abstract

Climate change is one of the most questionable challenges that humanity faces and will continue to face. Abrupt and intense alterations in temperature and precipitation occur worldwide with an enormous variety of complex impacts. One of those impacts is the crop growth and production, since climate change affects factors such as photosynthetic rate and evapotranspiration that consequently alters their water use efficiency. This review targets primarily on the effect of climate change on crops, such as wheat, produced in the Mediterranean region. Based on the reviewed studies, in some areas wheat yields are expected to decrease up to 50% due to the increased temperatures that shorten the grain filling period, while in other areas, the increased rainfall is expected to increase the production. Temperature rise affects, also, cotton phenology with a positive or negative effect, while for maize the production indicated negative trends. Also, this review targets in evaluating the irrigation systems. Rational utilization of water resources in combination with water saving irrigation techniques are considered as the most efficient measures to enhance water productivity and sustain high yield production in the future. In particular, rainfall water utilization through catchment facilities, wells and reservoirs for water storage comprise the most usual and environmentally friendly measures improving rain fed conditions. Drip-, deficit- (surface and sub-surface) and sprinkler irrigation systems are outstanding examples of water saving irrigation techniques, since they may improve water use efficiency (up to 95-100%), yield quality and productivity. Finally, improving management system, concluding various economic and administrative measures, is considered essential for a water saving development.

Keywords: *Efficient cultivation, food production, morphological alterations, physiological responses, sustainable agriculture*

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On the sustainable management of water resources in the urban environment - Case study: A public school in Greece

I. Ikoniadou^{1*} and D. N. Kaziolas¹

¹Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

*Corresponding author: E-mail: iikonia@yahoo.gr

Abstract

In our days there are a lot of factors and complex reasons that affect the adequacy of water resources in Greece. Moreover, the contemporary way of life in the cities has accumulated even more trouble making it imperative for the rational use and conservation of natural resources. On the other hand technological developments have many solutions to propose for addressing related problems. The concept of sustainability in modern times should be evaluated in light of ancient public works and management practices. Technological developments when based on sound engineering principles can have extended useful lives. This paper examines the problems of water resources in urban areas as well as in areas with water shortages in Greece. Particular emphasis is given to the sustainable management of water resources by proposing construction techniques and technical works that can achieve the maximum saving or the reuse of water. The later is achieved by presenting a case study in which the technique of rainwater harvesting is applied to a public school in Greece (specifically the Vocational High School of Eleftheroupolis) with the expectation to help students become aware of the potential of water saving methods and comprehend that water management is everybody's business. Moreover, as inefficient infrastructures consume valuable water resources, material provided by this study can be used as benchmark to face the most wasteful facilities, and bring quantifiable savings while promoting conservation and sustainability in the cities.

Keywords: Construction techniques, sustainability, technical works, water resources.

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Using MaxEnt to predict the distribution of a typical riparian species: applications in environmental conservation and management

S. Triantafyllidis^{1*} and S. Tsiftsis²

¹Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMATTECH), Drama, Greece, ²Fire Department Kavala, Greece

* Corresponding author: E-mail: stetr86@hotmail.com ; 66100 DRAMA, Kazantzaki 6.

Abstract

Riparian vegetation provides valuable ecological services to the freshwater environment and the riparian ecosystem. Black alder (*Alnus glutinosa*) is a tree species occurring exclusively along watercourses and around lakes, offering benefits to soil, water and organisms. The main objectives of this study are to evaluate the performance of MaxEnt algorithm when predicting distribution of a species in a specialized, linear environment - as are riparian ecosystems - and to describe black alder's ecological niche. Such knowledge could be a useful tool for environmental and wildlife conservation efforts and management planning. The model was fitted by using a dataset of 200 occurrence points and 23 environmental variables. Two statistical methods were utilized in MaxEnt to generate distribution predictions in order to conduct comparisons and so, more precisely describe the black alder's niche. In all cases, models having AUC value above 0.75 were selected. An Outlying Mean Index (OMI) analysis was then performed in order to illustrate alder's niche differentiation for each method. The resulted information provides valuable knowledge on how alders could be exploited to ameliorate landscape's connectivity, protect riverbanks from erosion and preserve water quality.

Keywords: *Alnus glutinosa*, species distribution, conservation

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Renewable energy sources in desalination

E. Benazis^{1*}

^{1*} MCs Student, Management in Water Resources of the Mediterranean, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece; E-mail: ebenazis@gmail.com

Abstract

Nowadays the problem of water scarcity, along with that of energy, is a major socio-political issue. This study is an attempt to use of new technologies such as water desalination by reverse osmosis system together with the use of Renewable Energy to solve such problems and this thesis with a title “**Renewable energy sources in desalination**” is deal with that. The study involves two systems, a solar photovoltaic system and a reverse osmosis desalination system, to provide sustainable drinking water from sea water. These systems may be ideally for application in remote coastal areas that have a shortage of fresh water. The focus was on the reverse osmosis technique, effectiveness with a detailed on the description of the process and at the equipment needed for the reverse osmosis. Emphasis was given on the type R.O membranes. In regards to the Photovoltaic Solar Energy emphasis was to the advantages and disadvantages and the potential combinations in field of desalination. The ability to meet the energy needs of a desalination plant using renewable energy is a promising prospect for the Hellenic regions droughts, which have abundant renewable resources (high speed wind and solar radiation), whose peak needs coincides with season of the peak water demand. In addition energy and economic assessment process was conducted. Overall conclusions were drawn on the performance and the prospects of the combination of these two systems.

Keywords: *Water scarcity, Desalination, Renewable Energies, Reverse Osmosis*

Acknowledgement: I would like to thank Dr George Zaimis, Dr Dimitrios Kaziolas and Dr Dimitrios Emanouloudis, for knowledge and support they gave me especially at the difficulties.

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Fresh water demand minimization in residential urban buildings

Antonis Saragkas^{1*}

^{1*}Vizantiou 1 Str. Myrina-Lemnos, 81400, Greece, E-mail: asara494@gmail.com

Abstract

This thesis entitled “Fresh water demand minimization in residential urban buildings” was produced as part of the postgraduate program: “Management of Water Resources in the Mediterranean” of the Forestry and Management of Natural Environment department of Technological Educational Institute of Eastern Macedonia and Thrace during the academic year 2014 -2015. In the last decades, there is a lot of discussion in many scientific fields, about the high importance of water as a basic element for the existence and the maintenance of life, aiming to the right and proper usage of water in our everyday basic water-needs due to its limited resources and the growing demand. This master thesis deals with simple and technological ways applicable in urban residential buildings for the better management of domestic fresh water as far as its maintenance and sustainability, through the minimization of its usage with several applications. The report is consisted from two main parts. The first part focuses on a theoretical approach for the better understanding of why we should live only with the necessary water quantities aiming to the reduce of overconsumption, through the presentation of the priceless value of water, and its timeless problems which have resulted mainly from the human activities. The second part shows and describes how this can be implemented with several ways, devices and technological systems in any house . All the measures of water quantities have been estimated in the imperial gallon (1 gallon≈ 4.546 liter) which is used mainly in the United Kingdom, Canada and some Caribbean countries and in liter (1 liter≈ 0.2 gallon).

Keywords: *efficient urban water management, sustainable buildings, water resources sustainability*

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Small-scale Natural Wastewater Treatment Systems

I. Paschalidis-Gerostergiou^{1*} and E. Plevra¹

¹*Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMATECH), Kavala, Greece*

* Corresponding author: E-mail: sonpaschalidis@hotmail.com

Abstract

To show the necessity of reusing sewage water in small communities as a mean to maintain sustainability and to raise awareness on sustainability issues. To show how a, difficult to deal with, issue, such as sewage treatment, can become means to promote a sustainable well-being of small communities and to use a proposed paradigm as a teaching and learning resource for further information on local sustainability good practices. Material-methods: Research with questionnaires (Quantitative research) and research with interviews (Quality research), based on a sample of adults who live in a rural area. The research will take place in Ftelia's Stream in Drama, Greece. Important concepts of the study: Developing knowledge on water management in local communities, raising public awareness on a sustainable well-being of small communities, proving to local authorities the advantages of natural sewage water treatment systems and building a methodological tool on how to approach local communities in order to convince them into accepting a natural sewage water treatment in their area. Results: Data collection, analyzed by the statistical tool SPSS will show whether local community members will willingly accept the use of naturally treated wastewater for agricultural and recreational uses or not.

Keywords: *Natural, Treatment, Wastewater*

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Preschool teacher beliefs and attitudes towards teaching water science and sustainable management of water in the context of Environmental Education

E. Bourotzoglou^{1*}, D. Emmanouloudis² and A. Georgopoulos³

¹Preschool teacher, MSC, Management in Water Resources of the Mediterranean, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

²Management and Control of Mountainous Water, Dpt. of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

³Environmental Education, Dpt. of Preschool Education, Aristotle University, Thessaloniki, Greece

*Corresponding author: E-mail: ebourotzoglou@yahoo.gr

Abstract

It is necessary for future generations to become conscious of water environmental problems, since they will be forced to manage them in the future. Experiential environmental education is a tool for sustainable management of water resources. The key to this process is teachers and the factors that shape their readiness to fulfill their role. This study gives a pedagogical dimension to the technocratic problem of natural resources management. The aim of the study is to investigate preschool teacher beliefs and attitudes towards teaching water science and sustainable management of water, as they influence the quality of teaching and environmental awareness of children. Specifically, it investigates how preschool teachers perceive a) their willingness to improve their skills and knowledge on the scientific subject of water and its sustainable management, b) their comfort in teaching these subjects and c) their familiarity with the content knowledge, pedagogical teaching methods of preschool and environmental education and developmentally appropriate activities for these subjects according to Psychology. Besides, it explores preschool teachers beliefs and attitudes on d) whether water science and sustainable management of water achieve to keep child's interest and e) if it contributes to child benefit, raising his/her awareness of environmental issues and developing his/her language, art, math, technological and social skills. Correlation Analysis showed that preschool teachers beliefs and attitudes towards teaching this subject were positive but under certain preconditions. Limitations, future directions and implications for practice of these findings are also discussed.

Keywords: Beliefs and attitudes, preschool teachers, Environmental education, sustainable management, water

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Adult education on water management in the urban environment

E. Plevra^{1*} and I. Paschalidis-Gerostergiou¹

¹Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMATECH), Kavala, Greece

*Corresponding author: E-mail: eleniplevra@gmail.com

Abstract

Our objective is to increase awareness regarding the issue of water management, due to the pressures of climate change and overpopulation. We evaluate adult skills and competences through the use of ICT as a teaching and learning resource for further information in water management, and as part of lifelong learning for sustainable development. Our methodology involves the participation of adults, who live in an urban environment, by questionnaire (Quantitative research) relevant to the skills and competences used for water management. The research takes place in the urban environment of Thessaloniki, Greece. Adults who are familiar with the use of ICT obtain skills and competences in water management much more readily. Results are monitored through the statistical tool SPSS. Data collection will show if adults who are more educated and use ICT in everyday activities, are more flexible in adopting new skills in water management in the urban environment.

Keywords: *lifelong learning, water management*

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POSTER SESSION - I

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Geomorphological and vegetational differences of riparian areas of a torrent of Menoikio Mountain, Greece.

S. Astrantinis^{1*}, P. Koutalakis², G. N. Zaimis³ and K. Ioannou³

¹Student, Department of Forestry and Natural Environment, Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

²MSc Researcher Geologist, koutalakis_p@yahoo.gr, Proti, Serres, Greece 62047

³Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

*Corresponding author: E-mail: stastra252018@hotmail.gr

Abstract

Riparian zones have a special interest since they can provide many ecosystems services. These multiple services are the main reason why so many are protected by the European Union Natura 200 Network and internationally by the Ramsar Convention. This study took place during the summer of 2014 at the Menoikio Mountain (a Natura 2000 site), along the riparian areas of Gazoros torrent, near Palaia Zichni, Seres, Greece. This Euro-Mediterranean torrent has perennial flow. The geomorphological and vegetation characteristics of the reach, the bank and the riparian zone were studied. Riparian flora is of great importance because it helps the bank to withstand water pressure that can destabilize the torrent bank and lead to disequilibrium conditions in the stream and watershed. To evaluate the condition of torrent a 50 m section was selected and along it cross sections at 10 meters apart were taken. On each cross section the flora was identified on the left and right of the reach at a distance of 5 meters from the edge the torrent bank. The flora was separated into trees, shrubs and herbaceous vegetation while the species were also identified. Additionally the geomorphological parameters of width – depth ratio, the slope reach were estimated. Overall through this study the impact of the torrent geomorphology.

Keywords: riparian vegetation, Natura 2000, ephemeral flow, ecosystem services

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Assessing wildfire risk spatiotemporal changes in coppice and high Oak and Beech forest ecosystems of Greece

G. Mallinis¹, I. Mitsopoulos² and D. Karamanolis³

¹Department of Forestry & Management of the Environment and Natural Resources, Democritus University of Thrace, 68200 Orestiada, Greece

²The Global Fire Monitoring Center (GFMC) Fire Ecology Research Group, c/o Freiburg University, Georges-Köhler-Allee 75, 79110 Freiburg, Germany

³Aristotle University of Thessaloniki, School of Forestry and Natural Environment, 54124 Thessaloniki, Greece.

*Corresponding author: E-mail: gmallin@fmenr.duth.gr

Abstract

The objective of the current study is to assess past and future wildfire risk components to typical coppice and high Oak and Beech forest ecosystems in Northern Greece. We created site-specific fuel models by measuring the field fuel parameters in representative natural fuel complexes, and we determined the spatial extent of the different fuel types in the study areas by using very high resolution imagery and object based analysis. Fire risk was then analyzed using a sound modeling approach based on the MTT algorithm as it is embedded in FlamMap and ArcFuels fire behavior and risk tools. Wildfire simulations were run by using 10000 random ignitions in order to estimate major fire risk components such as Burn Probability (BP), Conditional Flame Length (CFL), Fire Size (FS) and Source to Sink Ratio (SSR), under two different time frames; 2000 and 2020. The results showed that conversion of coppice Oak and Beech forest into high forest woodlands resulted in slight increase of wildfire risk in terms of burn probability and the expected fire size. The proposed methodology will allow forest and fire managers to more accurately design fuel treatments across landscape for mitigating the expected forest loss in Oak and Beech forests as well as to design and better manage coppice to high forests conversion.

Keywords: *fire risk, coppice forests, high forests, very high resolution imagery, Greece.*

Acknowledgement: This study was partially supported by a STSM grant from the EU COST Action EUROCOPICE (FP 1301).

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Urbanization Impacts on the Riparian Vegetation of Kallifyto torrent in Drama, Greece.

A. Boga¹, V. Iakovoglou² and G.N. Zaimes^{3*}

¹Student, Department of Forestry and Natural Environment, Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

²Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

³Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

*Corresponding author: E-mail: : zaimesgeorge@gmail.com, Tel: +30 2521060416, Mobile: +306945124720

Abstract

Humans have always been attracted to riverine environments either as settlements or for recreational activities. In urban areas, the highly altered natural environment can significantly alter and degrade the water courses and the adjacent riparian area. Human anthropogenic alteration can be either instream such as channelization, narrowing and deepening of the channel stream bank reinforcement and/or along the riparian areas with its removal and replacement with human infrastructures. The objective of this study was to evaluate the impacts of urbanization in the riparian area of Kallifyto torrent and identifying these impacts due to anthropogenic interventions. To accomplish this three different reaches were selected: one upstream and one downstream from the urban settings and in the urban settings where there was still riparian vegetation. In each reach three plots were sample for a total of nine. In each plot the condition of the streambanks was evaluated in regards to erosion, the existence of running water and the riparian vegetation was surveyed. The vegetation survey was for the trees, shrubs and herbaceous where the species were recorded while additional measurements were taken (e.g. height). The results showed that the torrent channel and riparian area was influenced by anthropogenic activities. Substantial different among the urban and non-urban plots were recorded in regards to the riparian vegetation stream channel conditions.

Keywords: *degradation, anthropogenic activities, human interventions*

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***Pinus brutia* and its response under different irrigation frequencies**

Aik. Syropi^{1*}, V. Iakovoglou² and K. Radoglou³

¹MScStudent, Management in Water Resources of the Mediterranean, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), Drama, Greece

²Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

³Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace (DUTH), Orestiada, Greece

*Corresponding author: E-mail: aisyrop@gmail.com

Abstract

The Mediterranean forests are of high value mainly due to their increased biodiversity levels. Conifers are substantial part of those ecosystems with *Pinus brutia* being one of the dominant species. This pine manages to survive under the adverse semi-arid conditions of Greece. The scope of the study was to observe the responses of *Pinus brutia* under three different controlled water regimes based on irrigation frequencies. Containerized seedlings were grown up to three years under field nursery conditions with controlled irrigation. Continuously, the seedlings were placed in a controlled lab environment suitable for the root growth and let grown for one more month. Three were the observed irrigation frequencies; watering twice a week (control), once a week and once every second week. At the end of the month, seedlings were evaluated for characteristics such as height, leaf surface area and their dry weights. The Root Growth Potential (RGP) that is considered a very useful tool on the ability of the seedlings to produce new roots was also evaluated. Based on the results, the leaf area the root dry weight and the root accumulation of newly developed roots decreased with reduction in irrigation frequency. The results indicated that reduction of irrigation resulted in reduced growth and inability of the species to produce new roots. This suggests that the species of *Pinus brutia* has other defense mechanisms to tolerate water stressed conditions other than shifting its growth towards the development of new roots.

Keywords: Nursery practices, regeneration, restoration, tree physiology, watering

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Using GIS to find the suitable locations for drilling water: The case of Amfipolis Municipality.

P. Koutalakis^{1*}, C. Mertzanos² and G. N. Zaimes³

¹MSc Researcher Geologist, Proti, Serres, Greece 62047

²Chief of Technical & E/M Works & Transportation Department, Technical Services of the Municipality of Amfipolis, Rodolivos, Serres, Greece 62041

³Professor of Technological Applications, Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

*Corresponding author: E-mail: koutalakis_p@yahoo.gr

Abstract

Geographic Information Systems (GIS) have been extensively used in the field of environmental science and especially water resources management as they provide spatial analysis, modeling and simulation through the different produced layers-maps. This study is an attempt to find suitable sites for new drilling boreholes using GIS tools. The drilling boreholes would be used for drinking water supply. The study area is conducted in the municipality of Amfipolis, one of the seven municipalities of the prefecture of Serres. It covers an area of 414 km², it has 22 settlements and the total population is 9,182 people according to the last census of 2011. The municipality is located between Aggitis River and the west hills of Paggaios Mountain. The geology of the region favors the aquifers. For this reason, the drinking water supply of settlements originates from drilling boreholes and natural springs. The scope of this study is locating new drilling boreholes based on the Multi-Criteria Evaluation Analysis method. The criteria used were the prohibitive and restrictive measures of Serres Prefecture. Such measures are the minimum distances from other drilling boreholes, road network, protected areas, graveyards, ports, just to mention a few. Different maps of restrictive measures and the required parameters were created by using the buffer-tool in ArcGIS. All of these combined maps have indicated the most suitable sites for drilling holes. The results could be used by the Municipality to further investigate the sites and decide about the optimum implementation.

Keywords: water managers, Drilling boreholes, aquifers

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Evaluation of stream bank erosion of the torrent of Nea Zihni, Serres, Greece

E. Bournousouzi¹ and G. N. Zaimes^{2*}

¹Forester, Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama-Mikrohorion, Drama, Greece 66100

²Laboratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohorion, Drama, Greece 66100

*Corresponding author: E-mail: zaimesgeorge@gmail.com, Tel: +30 2521060416, Mobile: +306945124720

Abstract

Stream bank erosion is the movement of sediment and soil from the banks of a river or a stream. While this type of erosion is a natural phenomenon that occurs in the streams, it can intensify greatly and cause collapse of entire banks due to the changes that may be caused either naturally but especially after certain human interventions. Many different factors influence stream bank erosion. Some of the most important include the type and amount of vegetation present, soil type, the velocity of the flowing water, climatic conditions especially if heavy torrential rains, floods, topography, the stream slope, the riparian and watershed and land uses (e.g. agriculture, grazing). The purpose of this study is to show the potential differentiation in stream bank erosion with respect to the altitudinal gradient of the stream. Specifically we will compare rural areas with high altitudes with low land stream areas. The categorization of the erosion that was done with visual evaluations of the slopes. The categories were based on the Natural Resources Conservation Services (NRCS) and include the following categories: , light, moderate, severe and very severe. These visual measurements were taken on the Nea Zihni torrent. Based on these visual measurements the banks of the torrent located on the mountainous areas were very high due to steep slopes and the absence of vegetation along the stream (riparian area). In the lowland areas stream banks less intensive erosion was observed mainly due to the intense vegetation along the stream and the smaller slope.

Keywords: erosion, visual assessment, sediments

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Modeling and mapping wildfire suppression difficulty in a protected forest ecosystem of north-eastern Greece

G. Mallinis¹ and I. Mitsopoulos^{2*}

¹Department of Forestry & Management of the Environment and Natural Resources, Democritus University of Thrace, 68200 Orestiada, Greece,

²The Global Fire Monitoring Center (GFMC) Fire Ecology Research Group, c/o Freiburg University, Georges-Köhler-Allee 75, 79110 Freiburg, Germany,

*Corresponding author: E-mail: ioanmits@gmail.com

Abstract

Spatially explicit wildfire suppression can identify the areas where fires can potentially spread more quickly or have a high probability to turn into extreme behavior, and also to determine the locations in which it can overcome the extinguishing capability of aerial and ground fire fighting forces. The aim of this work is to model and map wildfire suppression difficulty by employing landscape fire behavior modeling and Very High Resolution (VHR) imagery in a protected forest ecosystem of north-eastern Greece. Custom fuel models have been created by extensive field sampling, while the fuel spatial extent was mapped by using RapidEye imagery. Expected fire rate of spread and fireline intensity was analyzed by using Rothermel's fire spread algorithm as it is embedded in FlamMap fire modeling system. Reclassification of the above layers was performed and categorized into four distinct fire suppression difficulty risk classes. From the combination of the four maps (e.g.; fire rate of spread and fireline intensity) and category rating of the factor values, the wildfire suppression difficulty map was obtained. The resulted wildfire suppression difficulty map can be useful both in pre-fire planning and during the fire response of the firefighting forces. The mapping approach presented here identifies those areas that are most prone to high intensity fire events and thus provides information necessary to prioritize fire suppression efforts.

Keywords: fire risk, fire suppression difficulty, fire behavior, very high resolution imagery, Greece.

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Water relations of *Lotus corniculatus* under limited and non-limited soil water

M. Karatassiou¹, P. Kostopoulou¹, A. Lazaridou² and M. Lazaridou²

¹Laboratory of Range Ecology, Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece,

²Department of Forestry, Faculty of Agriculture, TEI of East Macedonia and Thrace, 66100 Drama, Greece,

*Corresponding author: E-mail: mlazar@teikav.edu.gr

Abstract

The ability of the plant to control water uptake and/or water loss may be an adaptive mechanism to dry conditions. A pot experiment was performed in order to investigate the water status in the tissues of *Lotus corniculatus* plants under different water regimes. Plants from two semi-arid areas were collected (Drama and Theodosia Kilkis) and transplanted to pots. After a period of plant adjustment, two irrigation regimes were used: a) irrigation up to field capacity and b) limited irrigation in order to maintain water deficit conditions in the soil (stress). Measurements were performed during spring 2013 on early vegetative, vegetative, flowering and fruit formation stages. Water potential (ψ), relative water content (RWC), transpiration rate (E) and stomatal conductance (Gs) were measured. The results showed that the irrigation treatment affected the water relations of the two populations of *L. corniculatus*. Under water stress for the same value of Ψ , plants from both populations showed lower RWC and consequently higher water deficit. However, at the same value of Ψ population from Kilkis presented lower RWC and thus higher water deficit in relation to Drama population, suggesting that the population from Drama is more adapted to drought conditions. The transpiration rate was found not to be so closely related to stomatal conductance, suggesting a strong connection to environmental factors.

Key words: *birdsfoot trefoil, drought, stomata, transpiration*

Acknowledgments: This research has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF), Research Funding Program: ARCHIMEDES III. Investing in knowledge society through the ESF.

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DESIGNING WITHIN RIVERINE ECO-SYSTEMS: Emerging case studies from landscape design studio projects and beyond–SPRINGS: Case study of Loutron, Crete

D. Zavraka^{1*}, I. Margaritaki¹ and C. Kouvela¹

¹*Department of Landscape Architecture, Eastern Macedonia & Thrace Institute of Technology 66100 Drama, Greece*

**Corresponding author: E-mail: ddzavraka@gmail.com*

Abstract:

Within series of investigations on correlations between natural and cultural procedures, student teams have been tracing the limits of intervention on small rest area by a natural spring in the mountainous area of Rethymnon in Crete. Within the greater eco-system of Laggos deep, cypresses, olive trees, medicinal plants and herbs cover a dense network of historic paths and monuments (cave temples, cisterns, etc). This project aims at restoring the old Loutron and small rest area hosted underneath the heavy shadow of walnut trees. The open public bath pool is defined by an old stonewall that is maturing in a symbiosis with dense planting.

Keywords: *landscape design, riverine ecosystems, springs*

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DESIGNING WITHIN RIVERINE ECO-SYSTEMS: Emerging case studies from landscape design studio projects and beyond-STREAMS: Case study of Agia Varvara, Drama, Greece

D. Zavraka^{1*}, M. Konstantinou¹ and M. Kyvrakidou¹

Department of Landscape Architecture, Eastern Macedonia & Thrace Institute of Technology 66100 Drama, Greece

**Corresponding author: E-mail: ddzavraka@gmail.com*

Abstract

Within series of investigations on correlations between natural and cultural procedures, student teams have been tracing the limits of intervention on small rest area by a natural spring in the mountainous area of Rethymnon in Crete. Within the greater eco-system of Laggos deep, cypresses, olive trees, medicinal plants and herbs cover a dense network of historic paths and monuments (cave temples, cisterns, etc). This project aims at restoring the old Loutron and small rest area hosted underneath the heavy shadow of walnut trees. The open public bath pool is defined by an old stonewall that is maturing in a symbiosis with dense planting.

Keywords: *landscape design, riverine ecosystems, springs*

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DESIGNING WITHIN RIVERINE ECO-SYSTEMS: Emerging case studies from landscape design studio projects and beyond-RIVERS: Case study of Portitsa, Epirus, Greece

D. Zavraka^{1*} and E. Chatzis¹

¹*Department of Landscape Architecture, Eastern Macedonia & Thrace Institute of Technology 66100 Drama, Greece*

**Corresponding author: E-mail: ddzavraka@gmail.com*

Abstract:

This project aims at tracing a sustainable identity for riverine ecosystems and their development possibilities as combination of leisure and education activities significant for local economies. The particular case study refers to the greater area of Venetikos river and more specifically to its narrow passing from Portitsa. The project suggests a light and linear intervention, able to provide access along the river's banksides. This intervention becomes the starting point for a series of adventure projects establishing new modes of safe proximity to the ecosystem, without interrupting pre-existing natural balance.

Keywords: *landscape design, riverine ecosystems, identity*

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POSTER SESSION - II

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Spatial and temporal assessment of soil erosion using deterministic models

I. Șandric^{1*} and Z. Chitu²

¹University of Bucharest, Faculty of Geography

²National Institute of Hydrology and Water Management

*Corresponding author: E-mail: ionut.sandric@geo.unibuc.ro

Abstract

Soil erosion in the Subcarpathian Area has resulted to significant land degradation. Mitigation of soil erosion by conservation practices requires definition of a quantitative soil erosion assessment. Soil profile description, soil texture and soil water retention curves were used to infer the main soil hydraulic parameters. Our study was focused on developing a deterministic spatial-temporal model for soil erosion and to assess the temporal and spatial variation of this. The spatial variation is modelled based on interpolation of the physical properties of soils and the temporal variation is modelled based on the rainfall measurements. The model calculates the effective rainfall and thus temporal variation of interception is calculated allowing for seasonal changes to be taken into consideration. Changes in interception are modelled based on leaf area index obtained satellite times series. The results present estimates of soil loss for monthly, seasonal and yearly time steps

Keywords: *deterministic analysis, soil erosion, spatial and temporal analysis, Romania*

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Sediment transport on lower Danube river during a flood event

G. M. Pătru ¹, D. Nistoran ² and Ș. Grigorie ³

¹National Institute of Hydrology and Water Management, Romania

²University Politehnica of Bucharest, Department of Hydraulics, Hydraulic Machines and Environmental Engineering, Romania

³University of Bucharest, Faculty of Geography

*Corresponding author: E-mail: georgianapatru89@yahoo.com

Abstract

Knowledge of sediment erosion, transport and deposition in rivers is crucial to different fields such as navigation, power production, flood risk, ecology, water supply, agriculture. Like other rivers in the world, the Romanian reach of the Danube River has been affected by changes in the sediment transport regime, especially over the last decades. The objective of this study is to assess channel morphological changes after a typical flood event, appeared along the Danube River reach situated between Oltenița and Călărași gauging stations. HEC-GeoRAS is used to extract the cross-sections from topobathymetric digital terrain model. These are exported to HEC-RAS in order to build and calibrate and validate the hydraulic model with the help of the hydrologic data from the gauging stations, over an entire year period. Then, sediment data is used to perform and run a sediment transport model over a three months period of time. Sediment transport is computed using the following functions: Laursen for transport function, Exener 5 for sorting method and Ruby for fall velocity method. Each of the transport functions has a variable that quantifies the force or energy required to mobilize the sediment particles. Mobility of the channel bed by aggradation or degradation is then quantitatively assessed in all cross-sections and an overall important erosion rate is observed along the study reach. Even though the data used to predict bed change is uncertain and the theory employed is empirical and sensitive to a wide array of physical variables, numerical results can help understand and predict the fluvial processes found in natural rivers and streams.

Keywords: *erosion, morphological changes, sediment transport*

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Impact of large wildfire of 2009 in Poleskiy natural reserve on forest health and biodiversity

S. Zibtsev^{1*} and V. Gumeniuk¹

¹Regional Eastern European Fire Monitoring Center (REEFMC), National University of Life and Environmental Sciences of Ukraine (NULESU), Kiev, Ukraine

*Corresponding author: E-mail: sergiy.zibtsev@nubip.edu.ua, 03041, Geroiv Oborony str. 15, Kyiv, Ukraine

Abstract

The research devoted to post-fire succession of Scotch pine forests in Northern Ukraine after large wildfire with area around 1000 ha. Most of forests (90%) were burned by crown fire, other - by ground fire. The fire occurred in the Poleskiy Natural Reserve and so impact on forest health and distribution of endangers species was assessed as well. Poleskiy Natural Reserve (<http://polesye-reserve.org.ua/>) is most important territory for biodiversity protection in the Central-Northern of Ukraine. Forests of Scotch pine mixed with birch are the main types of ecosystem. Wildfires regularly occur in the area mostly due to human activity. Post-fire succession depends of intensity and type of fire. Complete dieback of pine stands and all grasses during 2-3 month occurred after the impact of crown fire. After 3 years non-forest grass species (*Erigeron canadensis* L., *Solidago virgaurea* L., *Gnaphalium sylvaticum* L., *Chamaerion angustifolium* L. – Sp; *Hieracium villosum* Jacq., *Rumex acetosella* L., *Taraxacum officinale* Webb. ex Wigg., *Deschampsia caespitosa* (L.) Beauv. – Sol; *Helichrysum arenarium* (L.) Moench., *Hieracium umbellatum* L. – Un.) and seedlings of birch, aspen and alder mostly occupies burned territories. On sites with more fertile soils some regeneration of pine were observed as well. On sites with ground fires (height of burned parts of tree barks not more 0.25–1.10 m) there is no massive dieback of trees observed. In three years from 17 to 25% of thinnest trees damaged by ground fire died while other 62–64% of trees are healthy and has no indication of defoliation or discoloration.

Keywords: wildfire, forest health, crown fire, post-fire succession, biodiversity

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Determination of land uses and areas at risk of soil erosion using LANDSAT images in the Jarama River (Guadalajara, Spain) –

V. Bernabe¹, M. C. Giménez¹ and J. L. García^{1*}

¹Universidad Politécnica de Madrid (UPM), Madrid, Spain

*Corresponding author: E-mail: josel.garcia@upm.es

Abstract:

The change in land use has become an important factor in regional and global climate change is considered the main cause of soil disturbance; and affects strongly the capacity to support biological systems and human needs. Such changes increase, in turn, the vulnerability of ecosystems and people in natural disasters. However, biodiversity loss is the most obvious and direct impact generated by the transformation of the main natural hedges. The area of study is the middle reach of Jarama river in the basin of Tagus River, a main Spanish watershed running along the Iberian Peninsula and pouring its waters into the Atlantic Ocean through Lisbon. Due to this reach of river has a small size, differential influences of climate are not significant, and the evolution of soils being conditional on lithological and topographical terrain factors. Two LANDSAT satellite images of the middle reach of Jarama river were treated to a visual interpretation process and digital treatments, aimed at obtaining a mapping of land uses and areas at risk of soil erosion. After the digital terrain model, the classified image is combined with the slope image and other maps in order to delineate homogeneous units based on areas at risk of soil erosion and gullies, as the key factor of the area study landscape.

Keywords: Remote sensing, gullies, land use

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Climate change and biodiversity conservation issues in southern Armenia

A. Ghulijanyan^{1*}, H. Ghulijanyan² and L. Gevorgyan³

¹ Head at ZEC, Ministry of Nature Protection, Republic of Armenia

² Director of ZEC Head at ZEC, Ministry of Nature Protection, Republic of Armenia

³ Chief Specialist at ZEC, Water Ecologist, Ministry of Nature Protection, Republic of Armenia

*Corresponding author: E-mail: zikatar_center@yahoo.com

Abstract

The area of Southern Armenia where “Arevik” National Park is located is considered to be one of most vulnerable areas towards climate change. The area is also considered to be very rich in biodiversity. During 1961-1990 the average annual temperature in the territory of Armenia increased by 0.85 °C, while the annual quantity of precipitations decreased by almost 6 percent. In addition, according to A2 and B2 scenarios of Intergovernmental Panel on Climate Change concerning greenhouse gas emissions, it is forecasted that before 2100 the temperature will increase by 4.8–5.7°C, while the quantity of precipitations will decrease by 8-28 percent. The total area of the park is 34402 ha. The mean elevation above the sea level of the area is 2200m. The highest peak is Baghats mount (3256m) and the lowest depression is Arax riverside (375 m). The climate of the area is diverse which is conditioned by mountainous relief and high level of ruggedness. The climate is seriously affected by elevation gradient, location of mountain ridges and isolated nature of inter-mountain valleys and depressions. The area of “Arevik” National Park is situated within 4 agro-climatic zones. One thousand sixty two species of higher plants belonging to 530 genera and 97 families grow on the territory of the park. It means that 40% of the whole number of the species of Armenian flora is represented here. There is a very high level of endemism here. Eighteen endemic species of Armenia from 11 genera and 7 families grow in "Arevik" National Park. Ninety two species from 67 genera and 33 families are included in the Red Data book of Armenia (2010), of which 19 Critically Endangered, 60 Endangered, and 13 Vulnerable species.

Keywords: Arevik National Park, biodiversity, Climate change, flora and fauna, wildfires

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SWAT model in Moldova – the first experience

R. Corobov^{1*} and G. Syrodoev²

¹*Eco-Tiras International Association of River Keepers, Chisinau, Moldova, MD2060,*

²*Academy of Sciences of Moldova, Institute Ecology and Geography, MD-2028, Chisinau, Moldova*

*Corresponding author: E-mail: rcorobov@gmail.com

Abstract

Soil and Water Assessment Tool (SWAT) model has proven to be effective software for assessing water resource for a range of scales and environmental conditions, and as such it has gained wide international acceptance. In 2014 the SWAT was first used in Moldova as a basis for the follow-up investigation whether the total runoff in the Codrii Forest Reserve is adequate to maintain water bodies necessary for water supply in suppressing possible forest fires in this area where water resources are presented mainly as small ponds. The assessment procedure included two main steps: (1) validation and modification of SWAT for local conditions and (2) its practical application for the reservoirs' properties and location identification. Interim steps included watersheds delineation aimed to identify sub-watersheds and Hydrological Response Units (HRUs)– small entities with the same characteristics of hydrologic soil type, land use and slopes. Addressing these tasks was followed by the creation of a targeted Digital Elevation Model integrated in the SWAT environment. Subdividing the watershed into HRUs, alongside with long-term information on local monthly temperature and precipitation, enabled to reflect differences in evapotranspiration and other hydrological conditions defining the runoff; it was predicted for each HRU and then routed to obtain its total quantity for the overall watershed. The study's results can be the base for similar assessments of water availability in other fire-prone forests of Moldova.

Keywords: *fire suppression, forest, Moldova, SWAT*

Acknowledgement: The authors thank the EU INTERREG IV “Black Sea Basin Joint Operational Programme 2007-2013” responsible for the funding of the project “*Utilizing Stream Waters in the Suppression of Forest Fires with the Help of New Technologies*” in which framework this research was carried out. This Programme is also co-financed by the EU through the European Neighborhood and Partnership and Pre-Accession Assistance Instruments.

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Analysis of Precipitation and Soil Moisture Conditions for landslide occurrence in the Ialomita Subcarpathians

Z. Chitu ^{1*}, A. Busuioc ¹, M.J. Adler ¹ and I. Sandric ²

¹National Institute of Hydrology and Water Management, Romania

²Faculty of Geography, University of Bucharest, Romania

*Corresponding author: E-mail: zenaida.chitu@hidro.ro

Abstract

Like in many parts of the world, in Romania landslides represent recurrent phenomena that produce numerous damages to infrastructure every few years. In Romania in particular, recent studies exploring the temporal occurrence of landslides have revealed that rainfall represents the most important triggering factor for landslides. The presence of low permeability soils and gentle slope degrees in the Subcarpathian area between Prahova and Ialomita Valleys makes that cumulated precipitation over variable time interval plays a key role in landslides occurrence. This study aims to investigate the hydro-meteorological conditions which triggered landslides during April 2014 - January 2015 by analyzing the spatial and temporal patterns of precipitation and antecedent soil moisture conditions in the Ialomita Subcarpathians. Hourly data from six soil moisture stations that are fitted with volumetric soil moisture sensors and rain gauges were used to analysis the relationship between landslides, precipitation and soil moisture conditions.

Keywords: *Ialomita Subcarpathians, landslides, precipitation, soil moisture, triggering factor.*

Acknowledgement: This work was supported by a grant of the Romanian Ministry of Education, CNCS –UEFISCDI, project number PN II –RU-PD-2013-3-0624.

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The Riparian Forest of Nestos Delta. Management under changing climatic conditions

D. Filiadis^{1*}, V. Iakovoglou² and I. Dimitriadis¹

¹ Department of Forestry and Management of Natural Environment, Technological Institute of Eastern Macedonia and Thrace, 1st Km Dramas Microchoriou, 66100, Drama, Greece.

² Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

*Corresponding author: E-mail: dimf8@hotmail.com

Abstract:

The Riparian Forest of Nestos Delta has a 100-year history of anthropogenic disturbances. Land use alterations (mainly conversion to agricultural land) resulted in the demise of the once known “Great Forest”, while changes in the river’s hydrologic regime such as construction of dams and floodplain embankments had a more subtle effect on the natural vegetation. Water management issues at a regional scale also pose significant environmental challenges for the ecosystems located along the rivers course. Rich biodiversity status and fragile landscape characteristics necessitate the allocation of resources and time commitment from local stakeholders. Recent efforts to enhance the ecological balance in the floodplain riparian area, required the commitment of resources under a management plan focusing mainly on forest restoration. However, changes in climatic conditions and water consumption could increase potential hazards and threaten the ecologic stability of riparian forest and wetland areas. Evaluating the near future regional climatic scenarios as well as past climatic and anthropogenic impacts could assist in acknowledging future management priorities. Dendrochronological studies can attribute both in studying the climate reconstruction and understanding the evolution of hydrological regimes. Thus, the Riparian Forest on Nestos Delta provide a case study investigation of climate change impacts on riparian vegetation as well as climate reconstruction.

Keywords: *Climate reconstruction, Dendrochronology, Management, Nestos Delta, Riparian Forest*

Acknowledgement: This work was partially supported by a grant for the programme for the promotion of the exchange and scientific cooperation between Greece and Germany programme IKYDA 2014, titled: Climate change and anthropogenic impacts on the surface water resources and the riparian ecosystem of the Nestos Delta (Acronym: NESTOS-Water).

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Seedling quality as affected by altitudinal seed sampling

V. Iakovoglou^{1*}, M. Neofotistoy², G. Pantazi² and Aik. Pipsou²

¹Forest Research Institute, Hellenic Agricultural Organization Demeter (DEMETER/FRI), Vasilika, Thessaloniki, Greece, 57006

²Eastern Macedonia and Thrace Institute of Technology (EMATTECH), Department of Forestry and Natural Environment Management, GR-66100 Drama, Greece

*Corresponding author: E-mail: viakovoglou@yahoo.com

Abstract

The quality of the produced seedlings by forest nurseries is of high importance since it redefines the seedlings' ability to tolerate adverse field conditions. Restoring sites in the Mediterranean region, like Greece, are a great challenge since hot dry summers combined with early frost growth conditions pose limitations to the establishment of the transplanted seedlings. Nowadays, those phenomena become more intense due to the adverse and intense climatic alterations. The aim of this study was to determine if seed collection based on an altitudinal gradient affects the quality of the produced seedlings. Seeds of *Quercus coccifera* were collected based on an altitudinal gradient of 200, 250 and 300 m. The produced seedlings were derived from seeds of consistent size (12-14 mm diameter) and grown for six months under greenhouse conditions with controlled irrigation. They were evaluated for their dry weights, leaf area and specific leaf area. The results indicated a strong altitudinal effect on the seedling characteristics. Specifically, from the studied variables it affected the dry weight of the root, the leaves and the total seedling with decreasing values as altitude increased. Our results suggest that altitude is a variable that should be taken into consideration when producing seed derived seedlings. By knowing if and how seed collection based on a specific altitude affects seedling quality this information can use for our benefit to produce seedlings with desired characteristics that could potentially affect positively seedling establishment after field transplant.

Keywords: *Climate change, nursery practices, regeneration, restoration, tree physiology*

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Evaluation of the status of the riparian habitat at two tributary watersheds of Nestos River in Greece.

D. Syropoulos¹* and G. Zaimes²

¹ Post graduate student, Management of water resources in the Mediterranean, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Drama, Greece

² Professor of Technological Applications, Eastern Macedonia and Thrace Institute of Technology, Dept. of Forestry and Natural Environment Management, Drama, Greece

*Corresponding author: E-mail: dimsyrop@yahoo.gr, Tel: 6972268179

Abstract

Two riparian habitat evaluation indices were utilized to assess the riparian quality status along two major tributaries of Nestos River. The recently introduced riparian forest evaluation (RFV) index along with the well known and already performed in Greece riparian forest quality index QBR were applied to determine the riparian ecological status of Arkoudorema (ADR) and Vathirema (VTR) streams. Both indices were implemented at six sampling stations at each watershed, at increasing elevations and within different forest habitat types as distinguished by Natura 2000. Comparisons of the riparian quality conditions according to scores obtained by each index between the two streams were conducted. Furthermore, the same comparisons were conducted for each component of the two indices in order to assess the impact of different riparian features upon habitat status. The QBR and RFV indices were also assessed and compared with each other in order to find how closely their results match. The VTR displayed better quality standards in relation to ADR only for two components (total riparian cover and cover structure) of QBR index. Improved riparian conditions were also found as the altitude of the sampling stations increased in both watersheds. Additionally riparian and adjacent terrestrial vegetation has been recorded as well as dominant and subdominant riparian tree and shrub species have been listed revealing not only the species diversity but also the increased number of distinguished forest habitat types.

Keywords: Nestos River, QBR index, RFV index, riparian habitat quality

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MSc Degree on Management of Sustainable and Ecological Tourism –

M. P. Arraiza^{1*}, M. C. Gimenez¹, C. Cordon¹, J. L. García¹ and J. V. Lopez¹

¹Universidad Politécnica de Madrid (UPM), Madrid, Spain

*Corresponding author: E-mail: paz.arraiza@upm.es

Abstract

Tourism is, nowadays, one of the most growing sectors worldwide, and a source of richness and job, especially in development countries. United Nations highlighted the importance of joint tourism development to sustainability, in order to guarantee future viability of tourism. Master on Management of Sustainable and Ecological Tourism, MEST, is designed as a specialized postgraduate degree, whose aim is to create future graduates able to carry out a comprehensive ecotourism management. It will be an official Master Programme, adapted to European Higher Education Area. Some learning institutions offer ecotourism specialized courses. However, MEST joint sustainability, ecology and tourism in an ambitious learning programme that groups people from different disciplines of university and economic environment. Master on management of Sustainable and Ecological Tourism accommodates a wide range of knowledge related to ecotourism, beginning to the definition of a general frame, to continue with the study of modules related to natural and cultural heritage, ecotourism products, green building, marketing and management, from the point of view of sustainability. Optional subjects will cover aspects related to sport tourism, rural tourism or nature tourism, offering a wide range of possibilities in tourism sector. The duration of the master will be one academic year (60 ECTS) and it will be implemented through virtual learning platform.

Keywords: *Tourism, Learning, Sustainable, Master, Ecology*

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Lack of genetic differentiation among populations of *Corythucha ciliata* (Hemiptera, Tingidae) on Epirus (Western Greece)

A.M. Farsakoglou^{1*}, A. Tzisiou¹, A. Bataka², N. Soulioti³, F. Aravanopoulos¹ and D. Avtzis²

¹School of Forestry, Faculty of Forestry, Agriculture and Natural Environment, Aristotle University of Thessaloniki, Greece

²Forest Research Institute, Hellenic Agricultural Organization Demeter, Vassilika, Thessaloniki, Greece

³Institute of Mediterranean Forest Ecosystems and Forest Products Technology, Hellenic Agricultural Organization Demeter, Athens, Greece

*Corresponding author: E-mail: annamariafa91@gmail.com

Abstract

The sycamore lace bug, *Corythucha ciliata* (Hemiptera, Tingidae) is one of the most abundant pests of *Platanus orientalis* in Central and Southern Europe. In this preliminary study, we investigated the genetic differentiation among four populations of the sycamore lace bug, which were located on the Pindos mountain range (Epirus, Western Greece). For that, 646 nucleotides of the mtDNA Cytochrome Oxidase One (CO1) gene were amplified and sequenced for 40 individuals (10 individuals from each population). Despite the fact that Pindos mountain range has been considered a barrier to gene flow that often promotes differentiation, analysis of the obtained sequences did not reveal any differentiation at all, a likely result of extensive gene flow among them. However, this preliminary result will be enhanced in the near future with more populations and individuals analyzed, in order to extract a more robust conclusion regarding the influence of this mountain range on shaping the genetic pattern of *C. ciliata* in the region.

Keywords: genetic differentiation, *Corythucha ciliata*, *Platanus orientalis* L., Pindos mountain range

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