

# Open GIS Symposium and Summer School 2015

## «Building up Open Source for OPENCOAST»

CHANIA GREECE, 20-24 JULY 2015

## Proceedings

Organized by:

University of the Aegean

The “OPENGIS” Symposium and the Summer School is taking place under the umbrella of MEDFRIEND PROGRAM (UNESCO-IHP). The event is organized by the University of the Aegean (UoAeg) and the Mediterranean Agronomic Institute of Chania (MAICh) and it takes place at the facilities of MAICh in Chania, Crete, Greece.

**Editor:**

Ntouzgos- Mourtzos Dimitrios

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## **Editor:**

Ntouzgos- Mourtzos Dimitrios,



# Foreword MEDFRIEND program (UNESCO-IHP)

MEDFRIEND program (UNESCO-IHP) supports “OPENGIS” Symposium and Summer School that is held between 20-24/07/2015 in Chania of Crete, Greece. The event is organized by the University of the Aegean (UoAeg) and the Mediterranean Agronomic Institute of Chania (MAICh) and it takes place at the facilities of MAICh in Chania, Crete, Greece.

The MEDFRIEND program (UNESCO-IHP) program aims at promoting collaborative research and training activities related to hydrology, between all country members around the Mediterranean. The choice of UNESCO to support this OPENGIS 2015 Symposium and Summer school is due of course to the high quality of the event, which aims as well at bringing regional specialists together as well as to teach young researchers some technical issues with an “open access” software. It is also due to the topic of the event, as the coastal areas in the Mediterranean are dangerously at risk following the sea level increase, and the international interest is rapidly increasing about this.

The organizers of this event are internationally recognized in their research field, and are willing to disseminate their experience and findings to other groups in the region of the East Mediterranean. This and other considerations as the place given to the training of students and young researchers, encouraged UNESCO to give a support.

In the name of UNESCO MEDFRIEND group, I thank the organizers for this very interesting event, and I hope that the participants and trainees will find a large interest for their knowledge and future collaborations.

Yours sincerely,

Gil Mahe

Research Director

Institut de Recherche pour le Développement

Hydro Sciences Montpellier Laboratory

Regional Coordinator of the MEDFRIEND program



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# Foreword UNESCO

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Freshwater is a key resource for human health, prosperity and security. It is essential for poverty eradication, gender equality, food security, and the preservation of ecosystems. Yet billions of people worldwide are confronted with serious freshwater challenges, from water scarcity, poor quality, lack of sanitation facilities, to water-related disasters such as floods and droughts. Almost half of the world's population will be living in areas with high water stress by 2030. The UN General Assembly declared access to clean water and sanitation a human right in July 2010. But lack of access to drinking water of adequate quality and quantity remains one of the largest human health problems globally. Although the Millennium Development Goal (MDG) target on water supply was met in 2010, more than 700 million people still lack access to safe drinking water, nearly half are living in sub-Saharan Africa. The MDG target on sanitation is unlikely to be met; if current trends continue, 2.4 billion people will not have access to improved sanitation facilities in 2015, a large majority of those from rural areas. Water resources are under increasingly severe pressure from climate change and other global drivers. Climate change alters rainfall patterns, soil moisture, humidity, glacier-mass balance and river flow, and also causes changes to underground water sources. At the same time, floods or droughts are rising in frequency and intensity. Over the next 40 years, approximately 800,000 new residents will move to cities around the world every week. Population growth and rapid urbanization will create further pressures on water resources and will have a tremendous impact on the natural environment. Deteriorating water infrastructure in many parts of the world will impact public health and the environment. Given these challenges, the need to manage freshwater properly is essential. Sustainable water management should be at the heart of the post-2015 development agenda, with water-specific goals explicitly linked to other goals and climate-related issues.

The International Hydrological Programme (IHP) is the only intergovernmental programme of the UN system devoted to the scientific, educational and capacity building aspects of hydrology. UNESCO has long recognized the importance of hydrology for the rational utilization of water resources. Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into a comprehensive programme to facilitate education and capacity building, and enhance water resources management and governance. The programme, implemented in six year phases and, from 2014 onwards, in eight-year phases, stimulates and encourages hydrological research, and assists Member States in research and training activities. IHP facilitates an interdisciplinary and integrated approach to watershed and aquifer management, which incorporates the social dimension of water resources, and promotes and develops international research in hydrological and freshwater sciences.

Our fate is intrinsically bound to the fate of our water resources. To build the future we want, we need to harness the contributions of science and innovation for water security. Based on the needs and priorities of Member States, IHP-VIII focuses on six knowledge areas: (i) mobilizing international cooperation to improve knowledge and innovation to address water security challenges, (ii) strengthening the science-policy interface to reach water security at local, national, regional, and global levels and (iii) on developing institutional and human capacities for water security and sustainability.



The role of human behavior, cultural beliefs and attitudes to water, and socioeconomic research to better understand and develop tools to adapt to changing water availability are some of the issues to be addressed. IHP-VIII will bring multidisciplinary, environmentally-sound, innovative methods, tools and approaches into play by capitalizing on advances in water sciences, as well as build competences to meet today's global water challenges. National Committees, UNESCO centers and chairs will play an important role in this process.

Kind regards

Demuth, Siegfried

Chief of Section, Hydrological Systems and Climate Change



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# Introduction & Objectives

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The sustainable management of the coastal zone is a crucial exercise, not only due to the critical socio-economic role of the coastal areas, but also because of their increasing vulnerability under the rapidly changing environmental, social and economic conditions. Integrated approaches are needed that could address (a) the challenges posed by the ever-increasing development and conflicting uses of the coastal zone and (b) the impacts of environmental change. The process should be driven by appropriately formulated/structured policies that contain efficient checks/balances and involve effective environmental regulation. With regard to the EU Member States, coastal environmental regulation consists of several tiers, i.e. international/regional, European and national regulation. There are international Conventions that regulate, amongst others, maritime zone delimitation and uses, marine conservation and pollution prevention, preparedness and response. There are regional Conventions (i.e. the Helsinki, OSPAR and Barcelona Conventions) that provide for the conservation of the European coastal regions, whereas there is also an increasing volume of pertinent environmental tools. All these regulatory instruments and management tools form a complex framework which, nevertheless, must be comprehended/mastered by coastal managers, scientists/engineers and stakeholders.

The general objective of the OPENGIS2015 summer school is to advance knowledge in coastal areas management by a comprehensive plan of lectures and practicals, where individual skills growth is supported by the use of an open access Geographical Information system.

The main objectives include:

- demonstration of various model, methodologies and tools for coastal areas assessment and management based on open access GIS;
- applications in relevant case studies in Europe;
- increase modeling capacities for coastal hazard mitigation/adaption;
- plan and conduct a field campaign demonstrating the current situation of Cretan coastal areas and management efforts;
- strengthen quality of European research by developing international collaborations.

The five days summer school will be realised by a multi-disciplinary team consisting of lecturers/scholars from the existing academic staff of Department of Marine Studies of the University of the Aegean (UoAg) and Mediterranean Agronomic Institute of Chania (MAICH) as well as selected invited Greek and foreign experts. Scientists from several organizations (Technical University of Crete, WWF, Institute of Applied and Computational Mathematics (IACM-CLR), FORTH, UoAg, Technological Educational Institute of Crete, MAICH) present in a joint effort focused research on specific scientific challenges in coastal science fields. Teaching will employ a classic as well as an e-learning approach (e-class) that will be available through the UoAg web. Knowledge delivery is through a series of lectures, computer-based work and coursework. The distance learning platform of the university ([www.eclass.aegean.gr](http://www.eclass.aegean.gr)) is used for files exchange such as files, data, tutorials, literature, grades and instructor announcements



The summer school OPENGIS2015 (3 ETCS) will introduce the concepts behind GIS, the spatial data analysis and projection, the characteristics and relevance of the international and European environmental regulatory framework for the ICZM, with special emphasis on the Mediterranean region. It will provide knowledge on the needs and emerging challenges to an integrated approach in the coastal zone management as well as on existing management tools. The course will follow a multidisciplinary approach which includes, amongst others, integrated workshops for the demonstration and training in user friendly (in GUI format), open source science-based tools to address specific issues related to the ICZM (e.g. the delimitation of set-back zones under a changing climate); these tools will be made available to all participants to the course. The final student assessment will be based on (a) a group practical exercises involving the use of demonstrated tools and (c) an individual study/presentation on a particular (European or international) environmental problem relevant to ICZM.

It is envisaged that the OPENGIS2015 will promote interest in the vital role that the modern tools such as OPENGIS, QSWAT, INVEST, XBEACH play on the environmental, social and economic development of the European coasts and demonstrate the significance/added value of the integrated approaches. The multidisciplinary nature of the OPENGIS2015 participants that are coming from Algeria, France, Slovakia, United Kingdom, Cyprus, Hungary, Greece, Nigeria, Somalia and Indonesia, as well as their professional and educational background should ensure the implementation and dissemination of the knowledge acquired during the Summer School and Symposium.

Tzoraki Ourania, Ass. Professor

Kalaitzidis Chariton

Velegrakis Adonis, Professor

Marine Science Department,  
University of the Aegean

Research and Studies coordinator of the  
Geoinformation in Environmental  
Management programme, International  
Centre for Advanced Mediterranean  
Agronomic Studies / Mediterranean  
Agronomic Institute of Chania



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# Topic of Speech

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## 1. Spatial consciousness... the missing link?

**Panayiotis Partsinevelos**

Asst. Professor, Technical University of Crete, Dept. of Mineral Resources Engineering

## 2. Monitoring the effects of climate change on treeline shift, through Remote Sensing and GIS

**Chariton Kalaitzidis**

Research and Studies coordinator of the Geoinformation in Environmental Management programme, International Centre for Advanced Mediterranean Agronomic Studies / Mediterranean Agronomic Institute of Chania

## 3. Mapping and change detection of NATURA 2000 habitat 2250\* (Coastal dunes with Juniperus spp.), within the framework of JUNICOAST project

**Panayiotis Nyktas, Dany Goshn**

Researchers at the International Centre for Advanced Mediterranean Agronomic Studies / Mediterranean Agronomic Institute of Chania

## 4. Anthropogenic impact on the seawater intrusion rate and the coastal water pollution

**Stavroulakis Giorgos**

Professor of Water & Soil Resources Quality Control at the Department of Environmental and Natural Resources Engineering, School of Applied Sciences, Technological Educational Institute of Crete

## 5. Marine Spatial Planning in Greece: Lesvos case study

**Ourania Tzoraki, Gerasimos Pavlogeorgatos**

Ass. Professors, University of the Aegean 81100 Mytilini, Greece

## 6. "An outline of WWF Greece's initiative for the conservation of island wetlands». An outline of WWF Greece's initiative for the conservation of island wetlands

**Kaloust Paragamian**

WWF Greece

<b>POSTER SESSION</b>
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## Presentation of Filoi toy bithou (Marine Depth Friends) actions and photographic archive

**Charis Karavarakis**

Filoi toy bithou (Marine Depth Friends)

# Program

## OPENGIS2015 SYMPOSIUM

Monday 20<sup>th</sup> July 2015

09.00	10.00	Registration
10.00	10.30	"Spatial consciousness... the missing link?", Panayiotis Partsinevelos Asst. Professor, Technical University of Crete, Dept. of Mineral Resources Engineering
10.30	11.00	"Monitoring the effects of climate change on treeline shift, through Remote Sensing and GIS", Chariton Kalaitzidis Research and Studies coordinator of the Geoinformation in Environmental Management programme, International Centre for Advanced Mediterranean Agronomic Studies / Mediterranean Agronomic Institute of Chania
11.00	11.30	"Mapping and change detection of NATURA 2000 habitat 2250* (Coastal dunes with Juniperus spp.), within the framework of JUNICOAST project", Panayiotis Nyktas, Dany Goshn Researchers at the International Centre for Advanced Mediterranean Agronomic Studies / Mediterranean Agronomic Institute of Chania
11.30	12.00	COFFEE BREAK
12.00	12.30	"Anthropogenic impact on the seawater intrusion rate and the coastal water pollution", Stavroulakis Giorgos Professor of Water & Soil Resources Quality Control at the Department of Environmental and Natural Resources Engineering, School of Applied Sciences, Technological Educational Institute of Crete
12.30	13.00	"Marine Spatial Planning in Greece- Lesvos Case study ", Ourania Tzoraki, Gerasimos Pavlogeorgatos Asst. Professors, University of the Aegean 81100 Mytilini, Greece
13.00	13.30	"An outline of WWF Greece's initiative for the conservation of island wetlands". An outline of WWF Greece's initiative for the conservation of island wetlands", Kaloust Paragamian WWF Greece
13.30	15.00	LUNCH
15.00	15.30	Presentation of Fili tou Vithou, Charis Karavarakis
15.30	18.00	Poster Session



**Tuesday 21<sup>st</sup> July 2015**

09.00	10.30	Introduction to GIS, Spatial data and databases (Kalaitzidis)
10.30	10.45	COFFEE BREAK
10.45	11.15	Coordinate systems – Projection and geographic coordinate systems (Kalaitzidis)
11.15	12.15	Elementary QGIS operations (Kalaitzidis)
12.15	12.30	COFFEE BREAK
12.30	13.30	GIS applications on Agriculture – Precision Agriculture (Kalaitzidis)
13.30	15.00	LUNCH
15.00	17.00	GIS applications on Forestry - Change Detection (Kalaitzidis)

**Wednesday 22<sup>nd</sup> July 2015**

09.00	10.30	Overview of river basin and coastal and hydrological models (Tzoraki)
10.30	10.45	COFFEE BREAK
10.45	12.15	Hands –on practical workshop on ARCSWAT (Tzoraki)
12.15	12.30	COFFEE BREAK
12.30	13.30	Hands –on practical workshop on ARCSWAT (Tzoraki)
13.30	15.00	LUNCH
15.00	15.45	Land based fluxes -Introduction to Invest model
15.45	17.00	Hands –on practical workshop for Land-based Pollution models (Tzoraki)

**Thursday 23<sup>rd</sup> July 2015**

<b>Excursion</b>	
9.00	Departure from MAICh
9:15	Technical University of Crete
10:00	Park for the Preservation of Flora & Fauna
11:00	Museum of Eleftherios Venizelos
12:00	City Hall Reception
13:30	Orthodox Academy of Crete
14:30	Lunch
16:00	Field data gathering
17:00	Return to MAICh

Friday 24<sup>th</sup> July 2015

09.00	10.30	Introduction to beach morphodynamic models (Monioudi/Kampanis)
10.30	10.45	COFFEE BREAK
10.45	12.15	Hands –on practical workshop for the analysis of cross-shore beach profiles (Monioudi/ Velegrakis)
12.15	12.30	COFFEE BREAK
12.30	13.30	Hands –on practical workshop for wind data analysis and wind wave predictions (Monioudi/Velegrakis)
13.30	15.00	LUNCH
15.00	17.00	Hands –on practical workshop for beach morphodynamic models (Monioudi/Velegrakis)
15.00	17.00	Evaluation- Roundtable



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# List of Instructors

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The topic leader **SHI SHAOZHONG** is a postdoctoral researcher at the National Centre of Geocomputation, National University of Ireland Maynooth. He was a postdoctoral researcher to carry out design and development of a novel type of Internet GIS, at Kingston University, UK. He worked as the Director of Human Resource Development at Shenzhen Centre of the State Key Laboratory of Information Engineering for GIS, Remote Sensing and Land Survey, Wuhan University China. He carried out research and teaching at Coventry University and did a substantial amount of teaching at Inverness College of the University of Highland and Islands and Liverpool Hope University, UK respectively. In his long academic career, he has taught a wide range of subjects including Research Methods, Database Design, Geography, Environmental Science, GIS, Remote Sensing. Dr. Shi led the design, development and implementation of ground breaking Web GIS system and software engineering showcase projects and industrial GIS engineering projects internationally. He held two postdoctoral fellowships with Kingston University and National University of Ireland. He obtained a PhD in geography with Coventry University, UK. He has authored and co-authored many internationally peer-reviewed papers.

Dr. **CHARITON KALAITZIDIS** holds a degree in Agriculture since 1999 and an MSc (2000) and a PhD (2005) on Environmental Remote Sensing. He is the Studies and Research Coordinator of the Geoinformation in Environmental Management Department of MAICh since 2012. His main research interests lie in the use of GIS with remote sensing data from field or airborne/ spaceborne platforms, on environmental, ecological and agricultural applications, and in particular, vegetation mapping, forest management and precision agriculture. He has participated in a number of relevant European research projects related to agriculture, forestry and biodiversity.

Dr. **OURANIA TZORAKI** is Assistant Professor, at the Department of Marine Sciences, University of the Aegean. She has more than 15 years research/teaching experience (Technical University of Crete (GR) (2000-2013), Cyprus University of Technology (CY) (2010-2013), Leibniz University of Hannover (09/2014) and University of the Aegean (2013-2015). She has participated as coordinator/principal researcher in several EU-funded or other international and national projects (e.g. temp Qsim, MIRAGE, ENVIFRIENDLY, THAL-CHOR). She has been a member of various international working groups (e.g. Water Directorate EU on RPB).

She is (co)author of >70 publications (20 in peer-reviewed international journals) and participated in the development of innovative modeling tools to facilitate river basin management (e.g. in-stream MONERIS and karstic models) and tested novel field technologies (Monitored Natural Attenuation, coastal aquifer recharge with reclaimed water, LSPIV) in various Mediterranean basins. Her research currently focuses on coastal zone management, climate change impact on agriculture and forestry, land based sources, coastal vulnerability, developing and applying methods for ungauged river basins water budget estimation and the impact of climate change. She is the coordinator of the OPENGIS Summer School.

The topic leader **ADONIS VELEGRAKIS** is Professor at the Department of Marine Sciences, University of the Aegean. He has more than 20-year research/teaching experience (National Oceanography Centre, Southampton (UK) and UoAeg. He has authored/co-authored more than 100 research papers and has led/taken part in numerous relevant national and international projects. He has been scientific expert/consultant for UNEP-Grid, UNEP-MAP, UNECE and WWF and a contributing author of the IPCC-SREX 2012 report.





Dr. **ISAVELLA MONIOUDI** Research fellow, DMS UoAeg. She holds a BSc in Marine Sciences, an MEng in Water Resources Science and Technology and a PhD in coastal morphodynamics. Her research focuses on coastal morphodynamics, estimation of coastal vulnerability due to climatic change, development/application of coastal morphodynamic models and tools. She has taken part in several relevant research projects and authored/co-authored more than 10 publications. She has more than 3 years teaching experience in coastal morphodynamics and engineering. Her contribution in the ICZPol project will be related to (a) teaching/training of software toolboxes concerning beach morphodynamics during workshops (b) organizing the e-courses and several events (conference, training schools) and (c) administrative support.

Dr **GEORGE STAVROULAKIS** is Professor of Water & Soil Resources Quality Control at the Department of Environmental and Natural Resources Engineering, School of Applied Sciences, Technological Educational Institute of Crete. His research interests focus on the qualitative parameters and pollution control of drinking, surface, underground and coastal waters. He is scientific coordinator in national and EU co-funded research projects on drinking water quality control of municipal networks, seawater intrusion rate and groundwater quality characteristics, urban runoff and marine water pollution. He is the academic coordinator of the Practical Training Office at the Department of Environmental and Natural Resources Engineering. He has coordinated 3 EU co- founded projects on Practical Training of the undergraduate students. He has organized a wide network with professional associates and agents from the private and public sector on renewable energy resources and environmental pollution control.

Dr. **PANAGIOTIS PARTSINEVELO**S is an Assistant Professor in the area of computational analysis in GIS and Remote Sensing. He received his PhD in Spatial Information Science & Engineering from the University of Maine, part of the National Center for Geographic Information and Analysis (NCGIA) in USA and NASA Center of Excellence in Remote Sensing Applications. He holds a Dipl. Eng. degree in Surveying Engineering from the National Technical University of Athens. He has worked as a postdoctoral researcher in the Academic and Research Computer Technology Institute, Greece and as a GIS expert in the public sector. He is currently an Assistant Professor in the School of Mineral Resources Engineering in the Technical University of Crete. His research interests include tangible GIS, gestural interfaces, spatial database querying, multi temporal satellite image processing, cognition, spatiotemporal data management, Unmanned Aerial Systems, spatial topology, visualization, photogrammetry, etc. His work has been published in several journals and conferences and he has received various scientific awards. He has served as a PI and participated as a researcher in national and international research projects (NSF, FP7, etc).

Dr. **PANAGIOTIS NYKTAS** has graduated from the Department of Environmental Sciences of University of Aegean and undertook postgraduate studies on Land Dynamics at the University of Wageningen. He was employed at the Mediterranean Agronomic Institute of Chania in EU-funded projects regarding management of protected areas and sustainable management of natural resources. He completed his PhD studies with a scholarship at the Department of Geography of the University of Reading on dynamic landscape processes, geomorphology and climatic parameters influencing species distribution in Lefka Ori of Crete. Since 2009 he has been an external expert on various project regarding the management of priority habitats, land use change, assessment of ecosystem services, modelling of landscape processes and others. He is also a member of the governing body of the Management Body of Samaria National Park.

Mr. **DANY GHOSN** Born in 1971 in Beirut, he studied Agricultural Engineering at the Lebanese University. In 1995, he was awarded a scholarship offered by the Mediterranean Agronomic Institute of Chania, Greece (MAICh) and followed a M.Sc. degree course in Environment and Renewable Resources. In 1998, he was awarded a scholarship offered by the Institut National de la Recherche Agronomique, (INRA, Avignon-France) and followed a post-graduate degree course in Biology of Evolution and Ecology at the Ecole Nationale Supérieure Agronomique de Montpellier (ENSAM). Since 1999 he has been working as a research fellow in Environmental Management at the Mediterranean Agronomic Institute of Chania.

Dr. **GIL MAHE** is a research Director at IRD (Institut de Recherche pour le Développement). He is an hydroclimatologist with a long experience of work in cooperation in foreign countries (15 years in Senegal, Mali, Burkina-Faso and Morocco). He has driven several international programs or work packages (FAO, Europe, AUF, UNESCO). He has a long experience in editorial work as associate editor of several Journal like Hydrological Sciences Journal, Journal of Water Sciences. He is the actual regional Coordinator of the UNESCO MEDFRIEND IHP program. He is also the Water team leader of the IGCP UNESCO geosciences program. He organized or co-organized numerous workshops and conferences in Africa and Europe in the frame of the FRIEND program (Montpellier, Paris, Istanbul, Rabat, Algiers, Bizerte).



# Visiting M.A.I.Ch.

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The Mediterranean Agronomic Institute of Chania. MAICh is located 3 km south-east of Chania city centre, 13 km from the airport and 2 km from the port of Souda.

The city center of Chania can be reached by bus No13. Buses leave every 20min and the bus stop is located outside the MAICh premises on the main street (Souda Avenue). Tickets cost 1.20€ one way and will be available for purchase at MAICh's Restaurant. Please take into consideration that when the ticket is purchased on the bus the price rises for 0,50€.

Taxis to the city centre cost about 7-10€. The port of Souda can also be reached by bus. Taxis to Souda cost approximately 3€. There is no direct bus service connecting the airport with MAICh. Taxi is the only means of transportation at an approximate cost of 17-20€.

## Travelling to Chania

- **By airplane**

Chania International Airport is the closest airport. Heraklion can be an alternative but a bus journey would take 3 hours. There are direct charter and scheduled flights connecting Chania with many European cities carried out by RYANAIR and Easyjet and others. Please contact your travel agent for details about charter flight schedules. Domestic flights from the Athens International Airport are also frequent and are carried out by Olympics and Aegean Airlines.

- **By ferry**

Ferries to Chania (Souda port) leave from Athens (Piraeus port) on a daily basis. The overnight/daytime trip with ANEK lines takes about 9 hours. Please check the web sites for ferry schedules. Also note that there is a direct bus service connecting Athens International Airport with Piraeus port. More information about public transport in Athens can be found here. Chania can be reached by coach from the city of Heraklion situated 145 km (90 miles) from Chania. The bus fare is about 9 Euros and takes about 2.5 hours. The taxi costs approximately 80 Euros. Heraklion, being the biggest city of Crete, is directly connected with charter/scheduled flights with many European cities. Flights to/from Athens are also frequent. Ferries from Piraeus travel to Heraklion every day. The overnight/daytime trip with MINOAN lines takes between 7-8 hours.

- **Weather / Climate**

The climate is relatively mild, Mediterranean. During the fall and winter months north and northwest winds dominate, while in the summer the ill winds make it enjoyable. But the divine gift of the eternal sunshine allows one to start their vacation from March and end it at the end of October. Chania has the largest amount of water in Crete (65%), and for this there is rich vegetation of plants and fruitful trees (citrus trees, olives, vines etc.) as well as semitropicals. The very clean beaches of Chania win always the "blue flags" of Europe and are accessible for all ages throughout the year.



# Abstracts

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## 1 Evaluating the use of open-source GIS Technologies for advancing SDI adoption as a precursor to improving environmental management practices in Nigeria

Warekuromor Tubolayefa<sup>1</sup>

<sup>1</sup>PhD in the Geography Environment and Disaster Management, Coventry University, United Kingdom

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**Abstract** Issues of pollution and environmental degradation are fundamental concerns to both developing and developed countries. Nigeria is an oil producing country with high rates of gas flares, indiscriminate waste disposal and oil spills. These events pose significant environmental impacts on the land, water, biodiversity, air as well as the socio-economic wellbeing of the people. A number of strategies like Environmental impact assessments (EIA) have been implemented to identify possible impacts of development projects on the environment and propose alternative as well as mitigation measures to improve environmental performance. However, little or no success has been recorded. Poor access to accurate data as well as the issues faced with data integration and analysis has been documented to impair the quality of impacts predicted as well as the quality environmental management decisions made.

The emergent Spatial Data Infrastructure (SDI) in Nigeria called the National Geographic Data Infrastructure (NGDI) has been insufficient to support the spatial data needs for these environmental management protocols. The NGDI clearinghouse which is meant to facilitate data access is not fully operational. This paper explores the prospects of open-source Geographical Information Systems (GIS) technologies in advancing SDI implementation and adoption as a precursor to improving environmental management protocols in Nigeria. It presents a standardized model for SDI-GIS integration using web services to improve spatial data access, integration, analysis, sharing and collaboration. Open source software was utilized for the design, implementation and evaluation of the model as it is cost effective and widely applicable.

Argo UML was used of the design and evaluation of the use-cases and conceptual framework. QGIS provided a sufficient platform for the development of the spatial database with ample links to Open Geospatial Consortium (OGC) standard Web Map Service (WMS), Web Features Service (WFS) and Web Catalogue Service (CS-W) as well as the postgres sever where the spatial data sets are stored using post gis for this study.



## 2 GIS-based hydrological modeling using the distributed model Arc SWAT – Limnatis river basin case study.

Papatheodoulou Athina<sup>1</sup>

<sup>1</sup>The Cyprus Conservation Foundation-Terra Cypria

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**Abstract** The European Commission released in November 2012 a “Blueprint” to safeguard Europe’s waters that outlines strategies for water resources management at European level. The Blueprint’s objectives stressed the importance of ensuring the quality of water resources based on the experience taken of the evaluation for the implementation progress of the Water Framework Directive. Progress towards the objective of good status by 2015 is expected, but it will not be achieved for a significant proportion of water bodies. In regards to Cyprus about 55% of the 216 river water bodies were classified in lower than good state. The use of models for addressing different dimensions in river water quality management starting from hydrological modeling to policy making has become widely established from a small catchment level to continental level.

As a contribution to the understanding of the role of various river water quality parameters, the role of hydrology was investigated within a distributed modeling approach. SWAT model was selected to predict the impact of hydrology in a watershed with varying soils, land use and management conditions. The river basin of Limnatis in Limassol district-Cyprus was used as a pilot basin for the application of the Soil Water Assessment Tool (SWAT).

The basin was monitored for a period of 19 months at a biweekly basis and the data retrieved in combination to historical data were used to predict and understand the fate of water using SWAT.

### 3 Monitoring of the most harmful pests in forests of Slovakia using Web GIS application

C. Nikolov<sup>1</sup>, M. Kajba, M. Dubec, A. Kunca, J. Vakula, A. Gubka, M. Zúbrik

<sup>1</sup>Inspector of Forest Protection Service (FPS), National Forest Centre, Forest Research Institute Zvolen, 22 T. G. Masaryka, 960 92 Zvolen, Slovakia

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**Abstract** Complex influence of insect pests affecting in parallel or subsequently is the most important problem in the forest protection. In the recent years the insect damage in forests of Slovakia rapidly increased and the current bark beetle outbreak is the largest and most severe in recorded history. The total damage caused by bark beetles in 2008 – 2014 exceeded wind damage, historically the most destructive agent in Slovakia. The most abundant species contributing on damages are *Ipstypographus* and *Pytiogeneschalcographus*.

Non-native tree-feeding insects are of great concern for forest ecosystems in Slovakia. In the last decade serious damages caused by non-native species *Ipsduplicatus*, *Xylosandrusgermanus* and *Dreyfusianordmannianae* were recorded. Many of the destructive forest pests introduced into Slovakia inhabit the region. There is a need for managing and displaying the distribution of the most harmful forest pests at both spatial and temporal scales. To collect the data on the presence, distribution and abundance of approximately twenty the most harmful species of forest pests, we are developing an online Web GIS application using ArcGIS API. Data on the incidence of harmful agents into the system will be recorded by specialists of Forest Protection Service, foresters and public users. Monitored pests will be described on the project website. This will simplify identification of monitored pests. We expect that the improved web-based data collection tools will result in increased data availability and thereby new opportunities for risk assessment. Based on spatially recorded data we may identify, understand and model patterns of insect pests spreading and so predict the future population increases and point the areas where the pest management should be carried out to prevent the mass outbreak of these pests.

Foresters and researchers will take great advantage of a variety information which provides critical implications for forest management and decisions making. Developed GIS application will enable using of advanced GIS functionalities to a broader user spectrum without need for specialized GIS software; only standard information infrastructure (basic hardware, software and Internet connection) will be required.

**Keywords:** web GIS application, forest insect pests, monitoring

## 4 Spatial consciousness... the missing link?

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**Abstract** Geographic information systems in terms of software, tools and usage have been around for the last decades without capitalizing on the significant technological investment. However, other geography related applications thrive in acceptance and application wealth, yet their spatial components remain discrete.

In terms of joining the gap between applications and spatial understanding, the challenge to stimulate spatial consciousness rises. Geography is usually taught as a static, map based classification of the world, yet location based analysis and association are essential to facilitate socially and historically aware people.

Location is of utmost importance in our identity, world perception and relations, as the Earth moves in terms of space and time. In the direction of broadening the applicability of spatial related prospective, three-dimensional interaction, gestural interfaces, tangible GIS, non traditional types of queries and spatial cognition experiments are demonstrated in an attempt to bridge the aforementioned gap.

## 5 Anthropogenic impact on the seawater intrusion rate and the coastal water pollution

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**Abstract** A 7 year survey based on the effect of pumping rate on both water quality and

Sea water intrusion was conducted in the hydrological basin of Kaina's well in the region of Chania, Crete. Water samples from the well in Kaina- Vamos were collected throughout the period from 2003 to 2010.

The measured values of certain chemical and microbiological qualitative parameters were below the limits of the current national regulations indicating the absence of human pollution or contamination agent in the hydrological basin. However, the concurrent increase of EC and  $Cl^-$ ,  $Na^+$ ,  $Ca^{2+}$ ,  $K^+$  concentration due to seawater intrusion was caused by the overexploitation of the aquifer. The study of the aquifer indicated a remarkable self regulatory capacity during the winter period which can be supported by further pumping reduction to less than 30.000 m<sup>3</sup> per month.

The central urban runoff pipe outlet of the city of Chania is located in the west side of the city, on the coastal area of Koum Kapi, close to a beach used for swimming by the public. Throughout the 2012-14 period, water samples were collected from the central urban runoff pipe outlet, in the framework of ARCHIMEDES III project. Seawater samples were also collected from the coastal area of Koum Kapi, 5m, 15m and 30m away from the urban runoff pipe outlet. The high level of the pollution load measured in the urban runoff pipe outlet, was reduced by 90-97% in a vertical distance of 5m from the pipe outlet and at 0.7m depth. A diffusion model - based on additional data obtained from pollution diffusion measurements at each side of the pipe - could support decision makers to prevent future coastal water pollution.

## 6 Case Study: Ecological status of Gallikos river basin

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**Abstract** The purpose of the present study was to assess the ecological status of Gallikos river basin, analyze the impacts of the human activities and evaluate the risk of failing to meet the European Water Framework Directive (WFD) 2000/60 environmental objectives.

Gallikos river is located at the northern part of Greece and is characterized by very low discharge. It originates from Kroussia Mountain and discharges into the Thermaikos Gulf (North Aegean Sea). The calculated total drainage area and the length of the main stream were 948.52 km<sup>2</sup> and 65.8 km respectively. Protected areas represent 5.3% of the river basin. The total population of the area is 44.475 residents and almost half of them live in the city of Kilkis (23.717 residents). The municipality of Kilkis covers 78.5% of the area. Considering altitude, slope and geology as descriptors almost ¾ of the basin is described as hilly being dominated by slightly to strongly inclinations, over the underlying siliceous geological formations. Considering the descriptor catchment area, almost half of Gallikos river basin (43.8%) is drained through medium size basins of small and medium tributaries. In the river basin, there are significant pressures from point (domestic wastewater, livestock breeding extracts) and non–point (agricultural uses) sources of pollution as well as from morphological alterations (landscape alterations).

The approximate hydrological balance for Gallikos river basin (1990-2000) was characterized as deficit since total water demands (36.8x10<sup>6</sup>m<sup>3</sup>) were greater than the estimated water potential (35.1x10<sup>6</sup>m<sup>3</sup>) mainly due to irrigation for agriculture use. Gallikos river drains major rural, agricultural, urban and industrial areas, carrying pollutant loads that come from domestic wastewaters, agricultural runoff, animal breeding and industrial activities. Kilkis and Kristoni are connected to sewage disposal system with secondary treatment. The rest of the settlements cover their needs by septic tanks bringing important pollution loads into the rivers of the basin. Livestock breeding activity was found as the most responsible for BOD immissions (89%); agriculture areas for TN (63.8%) and TP immissions (41.4%). In the latter case, domestic wastewater was responsible for 31.6% of TP immissions. Pressures caused by pollution sources (immissions loads of BOD, TN and TP) were compared to quality standards for drinking water and fish life and they were all identified as significant, since they exceeded the permitted levels of quality standards. Also, pressures from morphological alterations in surface and groundwater are significant as agricultural land use in Gallikos basin is 64.5% and 60% of Gallikos river runs through agricultural areas.

On the basis of evaluating water quality, samples of water, fish and benthic macro invertebrates were collected from 14 sites of Gallikos river basin during the high flow season (May 2013). The 14 sites covered the whole surface of the river basin. They belonged to the main channel and the tributaries from the upper parts of the river as well as the lowland. The lowland part of the river was found to have high percentage of silt and sand.

In some sampling stations BOD, NO<sub>2</sub>-N, TSS and NH<sub>4</sub> exceeded the permitted levels for fish life. In total 8 fish species were recorded. Benthic macroinvertebrates were used for monitoring the running water. According to Hellenic Evaluation System (HESY), the ecological quality was less than good at all sampling sites and according to the European multimetric index for Mediterranean countries (STARICMi), not so well adopted to the Greek rivers, the ecological quality was good only at two sites. Accordingly, the ecological status of Gallikos river basin was less than moderate based on HESY.

The impacts from morphological alterations by human interferences are present in all the study area and risk highly not to achieve the environmental objectives set by WFD 2000/60 if immediate programme of measures is not followed. Pollution pressures cause probable impacts to the ecological quality but the risk not to achieve the environmental objectives set by WFD 2000/60 is medium. Thus a long term programme of measures is needed. DPSIR analysis (Driving forces – Pressures – State – Impacts – Responses) highlights the negative impacts on both people and environment and the complexity of water management issues as to degradation of the surface and underground water quality (untreated sewage, agriculture and industrial wastes) and its quantitative status (from over pumping for anthropogenic activities). An irreversible problem is the salinization because of the extensive subsidence along the coastal zone. A SWOT - analysis applied to Kilkis municipality recognized internal Strengths and Weaknesses and external Opportunities and Threats that have to be met in order to achieve the environmental objectives of the WFD.



# 7 Ecological evaluation of estuarine ecosystems close to the Gulf of Patras with the use of Geographic Information Systems (GIS)

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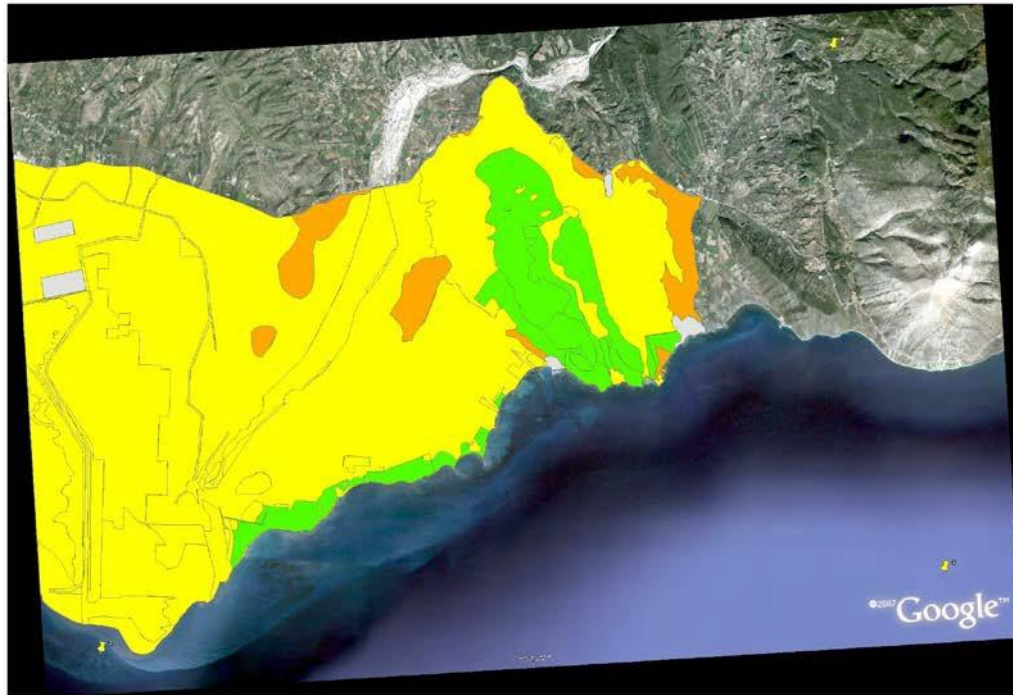
**Abstract** In the present study an ecological evaluation of the estuary ecosystems of the rivers Evinos and Piros flowing into the Gulf of Patras was carried out. They constitute a combination of terrestrial and wetland areas with significant ecological value and functions. Evinos forms a typical delta unlike Piros, in the estuarine region of which the conditions do not favor such a process. The objectives of the study were: the recording and mapping of habitat types in each area with the use of GIS, the study of human activities and their impact on the structure of habitats, the assessment of their state with the use of indicators of ecological value and finally, the development of an appropriate management plan. For the accomplishment of this study visits to both estuarine ecosystems, photography and collection and identification of the plant material from the main vegetation types was performed. For the identification of habitat types the Technical Guide for Mapping of the network NATURA 2000 was used. To assess the ecological status of the areas concerned the criteria of diversity, naturalness, rarity, threat and replace ability were applied, at the level of habitats and their combinations, according to the Directive 92/43/EEC.

Moreover, the DPSIR (Drivers - Pressures - State - Impacts - Response) analysis was applied at the basin level of the studied rivers, with emphasis on their estuarine systems. The habitat types, the evaluation based on the criteria and the pressures-impacts on each of the studied areas were visualized into digital maps using GIS. 322 taxa were recorded for the Evinos delta and 225 for the mouth of Piros, of which 112 are common among the study areas. Description and mapping of 22 natural and 3 anthropogenic habitat types was carried out. The main alterations that were recorded as a result of long-term human presence are: the intense erosion and retreat of the coastline, the expansion of cultivated land at the expense of natural one and the strong water pollution. Assessment revealed that the habitats in both regions are at a moderate to good conservation status, with the area of Evinos receiving the highest rating concerning the above criteria (**Figures 1 & 2**).

The DPSIR framework analyzed the present state and highlighted the serious degradation that occurs in estuaries. In conclusion, the GIS are an important management tool, as they allow the continuous recording of the diachronic changes and the evaluation of the degree of deterioration of both estuary ecosystems in order to conserve and protect them.



## CONSERVATION INTEREST Evinos delta



0 1.125 2.250 4.500 6.750 9.000  
Meters

**Figure 1:** Map presenting the total Conservation Interest of every habitat type of the Evinos delta. The bigger the total score for every habitat, the higher the CI [colours were used according to the Water Framework Directive 2000/60/EC, red:1-5 (bad), orange:6-10 (poor), yellow:11-15 (moderate), green:16-20 (good), blue:21-25 (high)].



## CONSERVATION INTEREST

### Piros estuary



0 270 540 1.080 1.620 2.160  
Meters

**Figure 2:** Map presenting the total Conservation Interest of every habitat type of the Piros estuary. The bigger the total score for every habitat, the higher the CI [colours were used according to the Water Framework Directive 2000/60/EC, red:1-5 (bad), orange:6-10 (poor), yellow:11-15 (moderate), green:16-20 (good), blue:21-25 (high)].

# 8 Risk Assessment of Cutaneous Leishmaniasis in an Endemic Area, Central Iran: A Model for Early Warning System in the Country

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## 1. Introduction and Objectives

Cutaneous leishmaniasis (CL) is one of the 10 infectious diseases priorities in the world, 5<sup>th</sup> priority diseases in Qom Province. Current study was conducted to assess the risk of CL and to study some epidemiological aspects of the disease in Qom Province.

## 2. Materials & Methods

This cross-sectional descriptive study was conducted during 2013-14. Different data layers, including spatial distribution of vector, reservoir, and human cases, environmental and climatologically variables which seem to affect on CL transmission were prepared and stored in a database created in ArcGIS9.3. MaxEnt 3.3.3 model was used to determine the suitable ecological niches for main vector and reservoir of CL in the province level. Finally, spatial analysis and clustering methods were applied in ArcGIS9.3 to find hot spots and susceptible areas for establishing new foci of CL Qom Province.

## 3. Results

During 2009-13 a total of 1767 CL cases were recorded in Qom Province, out of them 65% were male and 35% female. The most and the least cases were reported in 2010 and 2013, respectively. From these cases, 979 were living in Qom city and the remained in other parts of the province. Spatial distribution of CL cases across the province showed north-eastern and south-western quarters of Qom city were hot spots of the disease ( $P < 0.05$ ). Analyses showed hot spots of the province (excluding Qom city) gradually become closer to Qom city during 2009 to 2013. Overlaying vector and reservoir layers on the risk of CL incidence resulted to find high risk areas of the province.

## 4. Conclusion

Zoonotic cutaneous leishmaniasis due to *L. major* is endemic in Qom Province; *P. papatasi* and *M. libycus* are the main vector and reservoir, respectively. Most of recorded human cases in Qom city had a history of travel to the endemic areas of CL within the province or to the endemic areas of the disease in Iran. By the way, due to existing few cases without any travel history as well as finding hot spots ( $P < 0.05$ ) of CL in some quarters of Qom city, it seems to be transmitted in the city as well.

Therefore, it is necessary to do a comprehensive study on CL in hot spots to clear the situation of CL in Qom city. It should be noted that Qom city is reported as one of the suspected ACL foci of the country, but our findings show the opposite.

Hot spot and risk analysis across the province showed more than 40 villages are locating in the areas with high and very high levels of risk in the case of CL transmission. Therefore priority should be given to prevention and control programs in these areas. Results and methodology of this study can be used as a model for similar studies in other endemic areas of CL in Iran and establishing a national database on cutaneous leishmaniasis.

**Key Words:** Cutaneous leishmaniasis, Risk assessment, Geographical information systems, Qom

## 9 ecological Impacts evaluation of proposed road construction

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**Abstract** Our objective was to outline the different approaches of landscape ecological stability evaluation and to delineate important ecological parts and emphasize their importance and vulnerability for ecological impacts evaluation of proposed road construction within the Environmental Impact Assessment process. We have chosen a road construction proposed in the northern part of the Slovak republic as a model activity for this research. We created a buffer around this road for precise impact prediction and evaluation. We found out the current ecological state of model area using a calculation of different coefficients of ecological stability based on the exact areas of individual landscape structural elements. We delineated elements from the territorial system of ecological stability and protected areas. We tried to identify important landscape ecological parts based on previous information and with support of biotope mapping in the area we created various map layers (map of current landscape structure, map of ecological significance, map of nature conservation, map of biotopes, etc.) for better visibility of impact identification. We created a map of ecological impacts and a map of road ecological impact zone.

Then we valued the significance of ecological impacts we have identified by applying criteria –habitat quality, species occurrence, size, abundance, duration, reversibility and magnitude. For each criterion we proposed the multiple degree scale to evaluate the significance. Then we suggested mitigation measures of road ecological impacts and proposed main recommendation how to preserve and increase the ecological stability of the whole area.

**Key words:** ecological impacts, road constructions, ecological stability, ecological significance, impact evaluation

**Topic area:** identification and evaluation of road ecological impacts

# 10 Applications of GIS in Agriculture: Focusing Local, National and Global Issues

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**Abstract** Agriculture is an inherently geographical practice and it is not surprising that this, together with the extremely large sums of money involved make it a natural application for GIS. Many site-specific farming systems utilise GIS and several related technologies (global positioning system, receivers, continuous yield sensors, remote sensing instruments) to collect spatially referenced data, perform spatial analysis and decision making, and apply variable rate treatment (Usery et al 1995). Barnsley and Lange and Gilbert provide reviews of global positioning systems (GPS) and remote sensing technologies.

These advanced technologies offer numerous advantages at scales ranging from the farm field to the entire globe because they can be used to: generate and synthesise new information cheaply and quickly; document data sources and methods of integration; provide diagnostics for error detection and accuracy assessments; provide input data for a variety of crop yield and non-point source pollution models; and prepare maps and tables that meet specific needs.



# 11 Current Surface Water Supply and Beach Morphology at Pinios (Thessaly) River Delta

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**Abstract** In Mediterranean river deltas the socio-economic development is often based on conflicting human activities directly dependent on natural resources and changes in coastal zone. The delta of Pinios River (approximately 69 km<sup>2</sup>) is characterized by the extensive agricultural cultivation and expanding touristic exploitation of the coastline; deltaic plain is among the most productive agricultural lands of the broader area and there are many vacational settlements and small hotels built along the deltaic coastal zone. Agricultural and touristic activities depend on surface water supply for irrigation purposes and the stability of the ‘beach’ front for the improvement and the protection of any recreational facilities, respectively. The scope of this contribution is to examine the current conditions in relation to water supply and morphodynamic setting of Pinios River delta by recording river fluxes reaching deltaic plain and investigating the seasonal changes of the beach zone’s morphology.

Data collection, regarding surface water resources, included flow depth and velocity measurements made by current flow meters across Palaiopyrgos bridge (at the center of the plain) to determine the water discharge on monthly basis, during the hydrological year 2012/13. In order to investigate seasonal coastline morphology, beach zone was divided in two sections (South and North) and data collection comprised of 10 descriptive shore-normal profiles (South section: 1-7, North section 8-10) along the beach zone and recording of shoreline by DGPS.

Results show that monthly flows at Palaiopyrgos bridge during wet season range from 19.1 to 216.60 m<sup>3</sup>/s with the highest occurring in February (flood event) and March, while during the dry season varied from 5.6 to 47.7 m<sup>3</sup>/s with the lowest measured in July and August. The observed monthly/seasonal variation is similar to that referred to other Greek river systems, whose catchment area is located east to Pindos mountain chain, where water discharge levels have their maxima between November and April and their minima between May and September. The big reduction of water flow during summer period has been attributed to the intensive use of water in the agricultural plain of Thessaly (before the river enters deltaic plain) and could threaten crops growing in the deltaic plain.



Concerning beach zone seasonal evolution, the seasonal shoreline displacement (from swell to storm beach profile) suggests that beach at shore-normal profiles 1, 2, 3 and 10 retreats while at profiles 5, 7, 8 και 9 propagate. In profiles 4 and 6 shoreline displacement were within the limit of accuracy ( $\pm 1$  m) of DGPS and, therefore, they may be considered as rather stable. In North section, which is characterized by expanding touristic exploitation of the coastline, sand dunes are almost absent whilst they still exist in the South section. In some areas of the North section, coastline retreat is great and storm waves can reach vacation coastal residences and hotels. The latter could probably considered as a consequence of the sand dune destruction in the North section where there is some evidence that human interventions (e.g. seasonal beach nourishment) has alter the natural way the coast advances or retreats; certainly, these arguments to be proven require further research to be done. The results of this study show that local and regional authorities should take into consideration the potential threats regarding local agricultural and touristic income; reduced surface water supply during growing season of various crops in deltaic plain disturbs agricultural productivity and coastal retreat during winter exposes coastal vacation buildings to high wave energy which threatens their existence. A sophisticated coastal management tool is needed to be developed for the study area to ensure the sustainability of natural resources (surface water and beach front) and local economic development.

**Keywords** discharge, agricultural, touristic, income, reduction, retreat, management.

#### **ACKNOWLEDGEMENTS**

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## 12 Habitat suitability maps of bottlenose dolphin in the Greek Seas

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**Abstract** The aim of the present study was the assessment of the summertime suitable habitat of the coastal population of *Tursiops truncatus* (bottlenose dolphin) in the Aegean and Ionian Seas. For this purpose Generalized Additive Models were applied to identify potential areas of bottlenose dolphins' distribution using probability of sardine presence and environmental data as proxies to define species habitat preferences. Results indicated higher bottlenose dolphins' presence at areas presenting shorter distance from shore, high sardine probability of presence and high concentration of chlorophyll-a. Subsequently, Geographic Information Systems (GIS) were used to determine the persistent and occasional habitat of the species. Areas suggested as persistent habitat for the species include enclosed seas, continental shelf waters, and waters surrounding islands.

**Keywords** Habitat modelling; *Tursiops truncatus*; bottlenose dolphin; Geographic Information Systems; Generalized Additive Models; Eastern Mediterranean basin.

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### Introduction

Bottlenose dolphin (*Tursiops truncatus*, Gervais, 1855; hereafter referred as 'bottlenose dolphin') is one of the most common cetaceans in the Mediterranean Sea where the species is predominantly 'coastal' or 'inshore' animal (Bearzi *et al.*, 2008a). It is generally an opportunistic species that feeds on a wide range of prey species, mostly consisting of demersal prey (e.g. European hake, red mullet, European conger) (Bearzi *et al.*, 2008a; Frantzis, 2009) as well as pelagic species depending on fish availability and abundance (e.g. Bearzi *et al.*, 2006; Pirrodi *et al.*, 2011; Holcer, 2012). For example, in certain areas like the central Adriatic (Holcer, 2012), the Inner Ionian Sea Archipelago (Bearzi *et al.*, 2006; Pirrodi *et al.*, 2011) and Amvrakikos Gulf (Bearzi *et al.*, 2008a), small pelagic like European anchovy and European sardine are known to be an important part of its diet.

As a precautionary measure, in the Mediterranean Sea, due to a population decline of at least 30% over the last 60 years, the *International Union for the Conservation of Nature (IUCN)* has listed bottlenose dolphin as a Vulnerable species under the Red List of Threatened Species category (Bearzi & Fortuna, 2006). The need for identification and protection of special conservation areas are requested by the EU Habitats Directive, thus the identification of suitable areas for the species can be an important tool for conservation purposes. Existing work on habitat modeling focuses on the determination of factors related to species habitat instead of mapping (northern Adriatic: Bearzi *et al.*, 2008b using environmental variables and bottom depth / North Evoikos Gulf: Bonizzoni *et al.*, 2014 using mainly distance from fish farms and bottom depth). Here, we aim to assess and map the summertime suitable habitat for bottlenose dolphin using as proxies for its ecological preferences: sardine probability of presence, ecosystem productivity and distance from the coast. It should be clarified that we do not consider sardine as the only prey for bottlenose dolphins but along with productivity we assume it is a good proxy of potential prey availability within the coastal environment in the study area. Moreover, in the study area anthropogenic factors often related to the presence of the bottlenose dolphins, like fishing activity from most gears or the presence of fish farms, are carried out within the continental shelf, largely overlapping with sardine main distribution grounds.

## Materials & Methods

Bottlenose dolphins' sightings used (Table 1), were obtained from three different sources a) dedicated cetacean surveys of the Pelagos Cetacean Research Institute in the period 1994-2014 (Frantzis, 2009 unpublished data) and IFAW/MCR Song of the Whale Research Team in 2013 (Ryan *et al.*, 2014), b) opportunistic data during the MEDIAS surveys carried out on board R/V Philia (HCMR unpublished data) and c) published data (Zafiroopoulos & Merlini, 2001; Bearzi *et al.*, 2008c; Dede & Öztürk, 2007). Data covered the summertime period 1990-2014 and was split in early summer (May, June, July) and late summer (August, September) observations. This allowed us to take any seasonal effect into account. In all surveys, cetaceans were identified by experienced observers on board and questionable observations were discarded from the dataset.

Generalized additive models (Hastie & Tibshirani, 1990) were applied to define the set of environmental and biotic factors that best describe bottlenose dolphin spatial distribution in the study area, during early and late summer for the period 2000-2013. This methodology requires presence / absence data. Thus, for modeling purposes survey locations at depths >400 m (although marine mammals surveys are scarce at deep waters, bottlenose dolphin distribution in the Greek Seas is known not to exceed the 250 m isobaths) (Frantzis, 2009) where available sightings only referred to the striped dolphin (*Stenella coeruleoalba*; Meyen 1833), were considered as absence locations for the species.

**Table 1** Sightings of bottlenose dolphin used for analysis.

Source	Period covered	Month	Sightings
Surveys by Pelagos Cetacean Research Institute and IFAW/MCR	1990-1999	05-09	82
Song of the whale Research Team; Published references	2000-2014	05-09	163
MEDIAS research surveys (HCMR unpublished data)	2006-2013	05-09	31

Sardine probability of presence was available at an adequate spatial and temporal resolution for the entire Aegean and Ionian Seas from a published habitat suitability model (Tugores *et al.*, 2011) and thus retrieved at the geographical coordinates of the respective marine mammals' presence/absence records from the available annual maps of the entire Greek Seas. Similarly, we retrieved chlorophyll-a concentration (Chl-a in  $\text{mg}/\text{m}^{-3}$ ; <http://oceancolor.gsfc.nasa.gov>) as monthly averages and distance from the coast at the same grid resolution of 4x4 km as sardine probabilities.

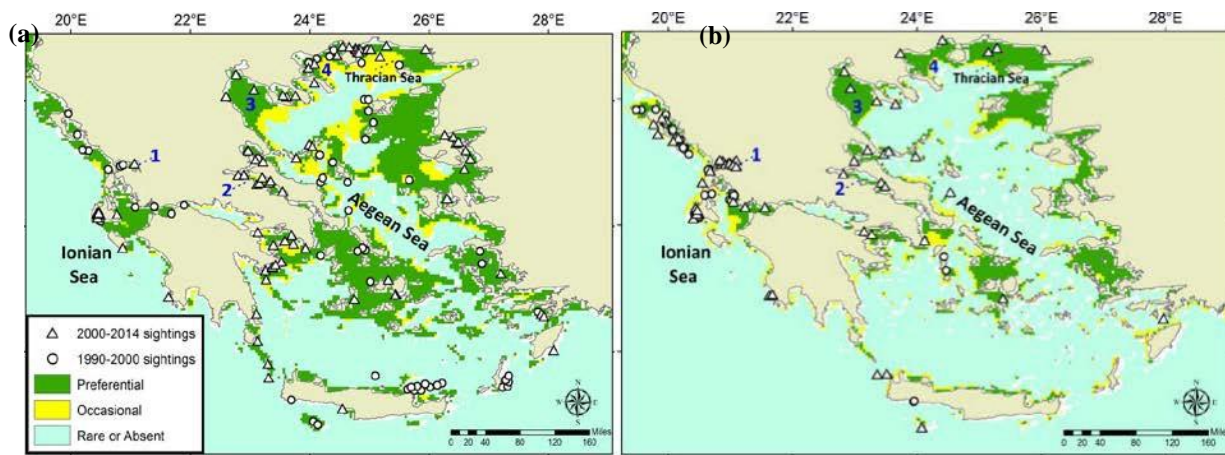
The final model was selected based on the minimization of the Akaike Information Criterion. The degree of smoothing was chosen based on the observed data and the restricted maximum likelihood estimation. The final model was evaluated for its predictive performance using the initial data (modeled dataset) in addition to records which were not included (non-modeled dataset) in model selection involving a) year 2014 and b) period 1990-1999. Due to lack of adequate satellite environmental data for the period 1990-1999, sardine probability of presence was estimated based on the respective available information for June and September 2003. For validation purposes, we estimated the receiver operating characteristic curve and the area under the curve (AUC). Sensitivity (proportion of observed positives that are correctly predicted) and specificity (proportion of observed negatives that are correctly predicted) indices were also used for model evaluation (Guisan & Zimmermann, 2000).

The final model was applied in a predictive mode to obtain annual habitat suitability maps over a grid at a GIS resolution of 4 km, covering the entire Aegean and Ionian Seas (i.e. practically indicating areas with suitable conditions to support dolphins' presence) for the period 2003-2008. Subsequently, the mean average probability estimates and the respective standard deviation were estimated by means of GIS techniques at each grid point, and were the basis for defining preferential and occasional dolphins'

habitat (limits used for occasional: mean  $>0.25$ , standard deviation  $>0.05$  and for preferential: mean  $>0.75$ , standard deviation  $<0.05$ ) (*sensu* Giannoulaki *et al.*, 2013).

## Results

Modeling results indicated higher bottlenose dolphins' presence at areas presenting shorter distance from the shore, high sardine probability of presence and high concentration of chlorophyll-a, explaining 72.6% of the total variation. Sardine probability of presence alone explained 61% of the total variation verifying that it operates as a good proxy for the habitat preferences of the species. The season effect was also found significant, while model validation generally showed good model fit (AUC values were  $\sim 0.98$  for modeled dataset and  $\sim 0.82$  for non-modeled dataset, sensitivity values were  $\sim 0.93$  for modeled data and  $\sim 0.84$  for non-modeled data). Habitat allocation maps of bottlenose dolphins' habitat showed summertime favorable areas that largely coincide with the areas of known records for the period 2000-2014, as well as past records for the period 1990-2000 (Fig. 1).



**Fig. 1** *Tursiops truncatus*: Habitat allocation maps for (a) early and (b) late summer in the period 2003-2008. Sightings for the periods 1990 - 2000 and 2000 – 2014 are also shown. 1: Amvrakikos Gulf, 2: North Evoikos Gulf, 3: Thermaikos Gulf, 4: Strymonikos Gulf.

## Conclusions / Discussion

Areas suggested as preferential habitat for the species are dominated by enclosed seas, continental shelf waters, and waters surrounding islands, in accordance to Bearzi *et al.*, (2008a and references there in) as well as closed basins like Amvrakikos Gulf and North Evoikos Gulf also in accordance to Bearzi *et al.*, 2008c and Bonizzoni *et al.*, 2014, respectively. Moreover, the seasonal effect was found significant and modeling results showed shrinkage of the preferential and occasional habitat from early to late summer towards more coastal areas. Bottlenose dolphins calving season (peak in July and August, Bearzi *et al.*, 1997) is known to coincide with the major use of coastal waters (Evans *et al.*, 2003) that assure the protection of the young ones.

This could explain the seasonal shift in species habitat. Although further research is needed, the knowledge of the suitable habitat of the species over extended areas can be very important for the development and management of conservation plans.

## Acknowledgements

We wish to thank all those who have contributed with visually documented opportunistic observations included in the national database of Pelagos Cetacean Research Institute and in the MEDIAS surveys. Finally, we wish to thank the Song of the Whale Research Team of Marine Conservation Research International and the International Fund for Animal Welfare (IFAW) for providing sighting data from a dedicated survey in the Aegean Sea in 2013.

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# 13 Marine pollution management in South Crete

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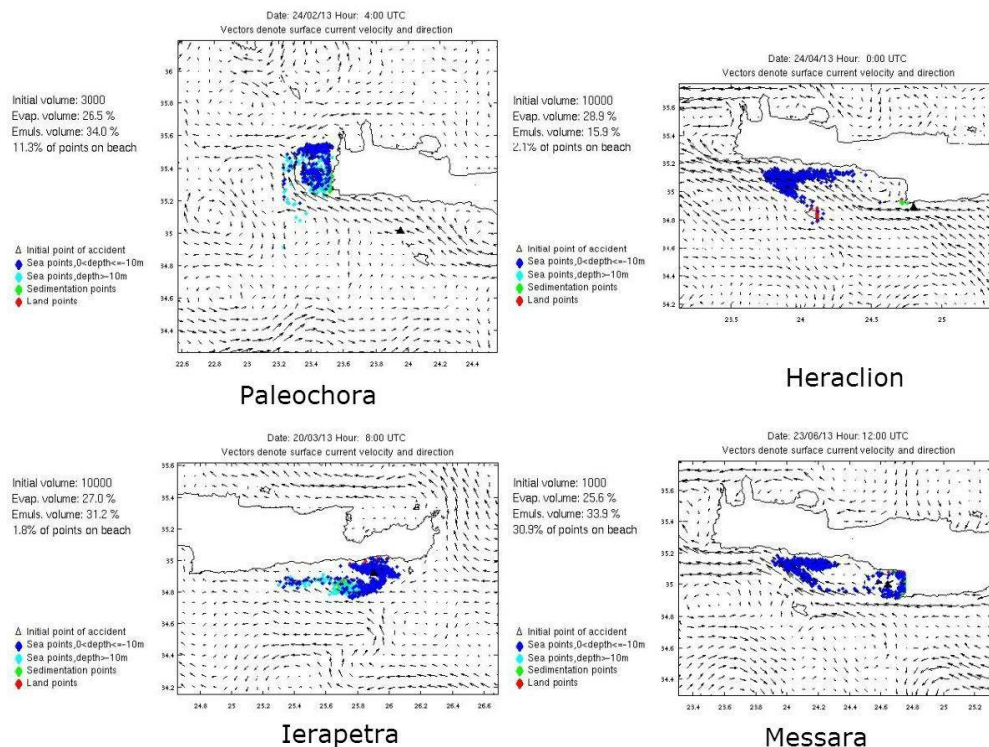
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**Abstract** This thesis is an introductory survey on marine pollution in the wide area of Crete. It is based on simulation models from HCMR Hellenic Centre for Marine Research and data from bibliographic research. It mainly deals with oil pollution in the offshore part of Crete, especially in the areas of Paleochora, Messara, south of Heraklion and Ierapetra. Part of this work has been implemented through the oil spill simulation system POSEIDON, developed by the Greek Centre for Marine Research (HCMR). Part of the data have been processed in ARCGIS.

## Modelling with POSEIDON OSM (Oil Spill Model)

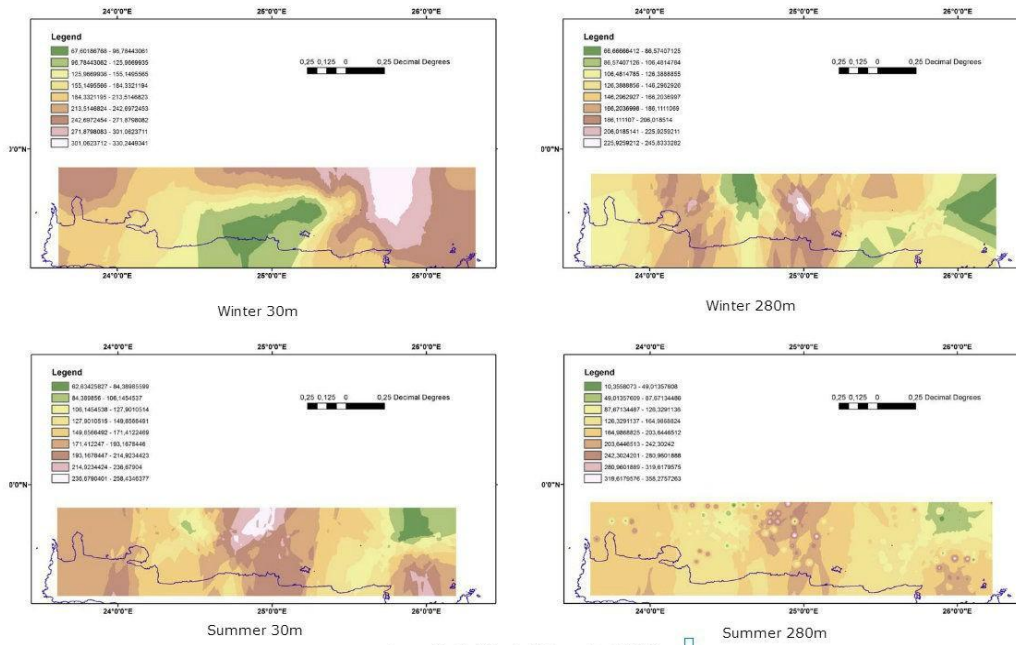
Initially, the data we had, we were full. We have longitude, latitude, time of the accident, oil leakage amount - in barrels (bls), leakage time period. The scenario was that the four regions of southern Crete, South Heraklion Messara, Ierapetra and Paleochora, there are platforms of oil extraction.

The hypothetical scenario provided, that the accident would happen the twentieth day of month, with an average duration of 96 hours. The hypothetical scenario, with the data sent in Online Oil Drift Forecasting System, asking every two hours to extract our results.



## GIS-Interpolation

We applied GIS to study the movement of currents in the Northern part of Crete. The following images with interpolation because we have not sufficient data



based in G. Triantafyllou, et.al 2002

## Conclusions/ Discussion

The modeling of the spread of oil is a key step to handling oil accidents in time. This thesis, showed the interest of the study of meteorological data and their adaptation in the Oceanography. We noticed that the responses of marine pollution from Oil, inextricably linked with the meteorological situation that exists in our study area, when we study the phenomenon.

# 14 Citizen - science : The practice of the Citizen's observatory for ocean and maritime optical monitoring

**Pavlakis Christoforos**

Christoforos Pavlakis is a Ph.D. candidate with research interest among others, geography data and citizen science. He is the research associate of very-large projects, such as the Citclops project, a 5 M€ European project about a citizens' observatory for coast and ocean optical monitoring. He is also a member of the Knowledge Engineering and Machine Learning group (KEMLg) at the Universitat Politècnica de Catalunya - BarcelonaTech (UPC). Christoforos was previously at Eurecat, where he coordinated the Personalized Computational Medicine research group. And was the coordinator of the Synergy-COPD project, a 5 M€ European project about modelling and simulation for systems medicine. He obtained a BSc degree in Environmental Sciences; an MSc degree in Information-Technology Languages and Systems; and is currently enrolled at the PhD course in Artificial Intelligence.

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**Abstract** Aquatic ecosystems are characterized by an extraordinary mix of human activities, e.g.: tourism, fishing and industry (petrochemical plants and aquaculture, etc.). Given the frequently conflicting interests between conservation and exploitation, the fate of aquatic ecosystems is often a hot political issue. The attitudes and values of stakeholders in environmental issues are an essential part of the stewardship of conflicting environments. New policies concerning environmental resources should have citizens' support and consider public attitudes from the beginning.

When managing complex ecosystems, the approach of seeking public support can present serious difficulties. It is unrealistic to expect everybody to understand the whole tangle of potential ecological problems, and therefore it is important to ask how much of an educational effort is necessary. In general, public attitudes show a strong preference for protecting aquatic ecosystems as well as returning already-damaged ecosystems to their original, natural status for a variety of reasons. Given the state of affairs that exists in aquatic ecosystems, the word "natural" is open to a variety of interpretations. Usually, scientists narrowly define "natural status" to mean "unaltered by human beings". Citizens usually define it to mean "natural appearing".

A great many people who value natural resources value them as something to look at. It will take generations of environmental education to create a general public understanding of the fact that the importance of nature and its processes goes far beyond scenery (e.g. not all colour-changes represent a risk). Part of this education and understanding can be realized through citizens' effective participation in environmental stewardship. This is especially true in the monitoring of coastal and ocean waters, which need extensive data measurements due to their highly complex dynamics with high variability in space and time.



# 15 New Spatiotemporal Risk Index for Heavy Metals; Application in Cyprus

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**Abstract** The main aim of this research was to improve risk mapping of heavy metals by accounting for erosion effects. A new spatiotemporal index, namely the G2met index, is introduced, by integrating pre-existing methodologies. The G2met index is expressed in terms of month-time series of risk maps for each heavy metal and totally. The rich in heavy metals and vulnerable to erosion, island of Cyprus, was selected as a study area, which though was limited to the southern part of the island, where all required data were available. Concentration of major heavy metals was extracted by sampling soil from a grid of 5350 sites. Rainfall, vegetation, soil, land use, topographic, and hydrologic data were collected or calculated from existing European or global databases (WorldClim, BioBar, ESDAC, CORINE, ASTER GDEM, and USGS).

A large number of regional-scale risk maps were produced (500-mell size), i.e. one for each heavy metal and totally per month and annually. Also, choropleth maps per heavy metal in terms of statistics per river basin were produced. The G2met maps resulted in different patterns in comparison to those depicted by the Hakanson index alone.

**Keywords:** PERI (Hakanson index); G2 model; EPM (Gavrilovic model); risk assessment

# 16 Mapping and change detection of NATURA 2000 habitat 2250\* (Coastal dunes with *Juniperus* spp.), within the framework of JUNICOAST project

Panayiotis Nyktas<sup>1</sup>, Danny Goshn<sup>2</sup>

<sup>1</sup> He was employed at the Mediterranean Agronomic Institute of Chania in EU-funded projects regarding management of protected areas and sustainable management of natural resources.

<sup>2</sup>Agricultural Engineering at the Lebanese University. In 1995, he was awarded a scholarship offered by the Mediterranean Agronomic Institute of Chania, Greece (MAICh) and followed a M.Sc. degree course in Environment and Renewable Resources

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**Abstract** The JUNICOAST project aimed to restrict the anthropogenic threats and implement actions to for the protection and long term restoration of the priority habitat of coastal dunes with *Juniperus* spp. (NATURA2000) in Crete. The four case studies that were selected, included the juniper forests in Gavdos island, Falasarna and Kedrodasos in Chania prefecture, as well as the Chrisi island in the Lasithi prefecture. In order to assess the current status of the habitats, it was necessary to map the habitats in their present status, as well as derive maps of the same locations from the past.

The mapping process employed historical aerial photographs (1945 and 1968), providing snapshots of the past, as well as recent satellite imagery (2007).

The data were processed and classified, in order to identify the land cover types present in the areas, and the resulting classification maps were compared using GIS, in order to assess the changes that have occurred over time. The results showed that an overall increase in vegetation cover was observed in all areas, with the greatest vegetation expansion being observed in Gavdos island. In contrast, the vegetation in Kedrodasos showed a marginal increase of 3%, due to the large area where vegetation loss was observed (10% decrease against 13% increase).

# 17 Monitoring the effects of climate change on treeline shift, through Remote Sensing and GIS

**Chariton Kalaitzidis**

Dr. CHARITON KALAITZIDIS, Studies and Research Coordinator of the Geoinformation in Environmental Management  
Department of MAICH since 2012

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**Abstract** Mountain ecosystems are characterised by the gradual succession of ecotones in accordance with elevation increase. The changes observed in the climate around the world in the recent years are disturbing the balances and are changing the boundaries of those ecotones.

As temperature increases, vegetation species previously confined to lower elevation are now finding habitable climatic conditions in higher elevations and are competing with the species currently occupying those areas. By using snapshots of the past through historical aerial photographs and current satellite imagery or aerial photographs, and identifying the different land cover and vegetation types present at each time, it is possible to monitor the changes that have occurred over the years.

High spatial resolution images are required in order to accurately identify vegetation types and observe subtle changes in vegetation cover. GIS is then employed to quantify the changes observed on the classified images and identify the spatial parameters that are most influential in bringing about those changes. Overall the most significant change observed involves the progression of coniferous tree species in higher elevations, replacing scrublands currently found there. Slope and aspect appear to play a role in this progression, due to their relation to the amount of incident solar radiation.

# 18 Marine Spatial Planning in Greece: the project THAL-CHOR

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**Abstract** Economic growth and new technological developments using marine resources require integrated spatial planning in the marine environment. Marine Spatial Planning (MSP) is absolutely necessary in vulnerable and sensitive areas like the Aegean Sea. The strategic project “Cross-border Cooperation for Maritime Spatial Planning Development- THAL-CHOR” was approved for funding under the Cross-border Cooperation Programme “Greece–Cyprus 2007–2013”, with main objective the development and evaluation of a number of scenarios regarding the marine environment as well as the coastal zone of three Greek regions in the Aegean Sea of Greece (Northern Aegean Region, the Southern Aegean Region and the Region of Crete).

Within the framework of the project, the following actions took place:

- A stock-taking of the current situation, by collecting available data and information related to human activities at sea and the marine environment;
- Enrichment/updating of data bases by collecting new data and information;
- Development of a WebGIS which display all the collected data;
- Overview of the current legal framework and suggestions for its improvement;
- Defining future priorities and objectives and performing future state analysis for both the further development of existing activities and development of new activities, in conjunction with ensuring good environmental status;
- Pilot implementation of MSP in Rhodos and Lesvos and drafting of maritime spatial plans;
- Evaluation of the process and methodology followed for implementing MSP and identification of good practices for the future.

The resolution of spatial conflicts between different uses of the sea, better coordination between stakeholders, strengthening cross-border cooperation, and creating conditions for achieving sustainable development in line with the strategy “Europe 2020”, are among the main objectives of the project.

Crucial role is playing the evaluation outcomes of the uncertainties (epistemic, stochastic, strategic and institutional) that infiltrate into the various phases of spatial planning approaches. Multi Criteria Analysis (MCA) methods are used as a quantitative approach for the evaluation of alternative scenarios in the area. Within THAL-CHOR activities a vast array of information, social, economic and environmental has already been compiled to be used for evaluation of different policies providing the decision maker with information and feedback with conclusions derived from the evaluation.

## **Acknowledgments**

The Action entitled: “Cross-Border Cooperation for the development of Marine Spatial Planning” referred as THAL-CHOR (in Greek ΘΑΛ-ΧΟΡ) is co-funded by the European Regional Development Fund (ERDF) by 80% and by national funds of Greece and Cyprus by 20%, under the Cross-Border Cooperation Programme “Greece-Cyprus 2007-2013”.

# 19 Georeferencing image

**Evangelos Koukouras**

Civil Engineering, National Technical University of Athens

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**Abstract** In the university, as part of the lesson of urban planning we were asked to georeference a part of the street plan of the urban complex of Athens (more specifically the area of Zografou). The georeferenced image was used as a background for the cartography of the age of the buildings. The process of the georeferenced had two steps. To begin with, through ArcCatalog we connected the ArcGIS to the server of “Κτηματολόγιο ΑΕ”. We opened ArcCatalog and went to the GISServer and finally chose Add WMS Server.

The URL we used is: [gis.ktimanet.gr/wms/wmsopen/wmsserver.aspx?](http://gis.ktimanet.gr/wms/wmsopen/wmsserver.aspx?) (Version: 1.1.0.). Moreover, we connected to folder of the geodatabase and we input the image of the street plan as a different layer. We reduced the transparency of the image to 38%, we executed the georeferencing command. We used five scattered points to align the image to the “Κτηματολόγιο”. Then, through the rectify command, we saved the georeferenced image as a new one. Furthermore, we went to the properties of the new image and we changed its coordinate system to ΕΓΣΑ87 (Coordinate System > Projected > National grids > Greek Grid).

**Keywords:** georeferenced, urban planning, Κτηματολόγιο ΑΕ, ΕΓΣΑ87

## 20 An outline of WWF Greece's initiative for the conservation of island wetlands

**Kaloust Paragamian**

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**Abstract** Since 2004 WWF Greece has been striving to document the importance and conservation needs of the islands' wetlands of Greece, to raise awareness regarding their value and to promote their effective protection. Our project "Conservation of the Islands Wetlands of Greece" (2004-2013) initially focused on the Aegean Islands and later extended to Crete and Ionian Islands, involving, in essence, the whole of maritime Greece. Following extensive field work and intensive efforts to prevent their degradation and ensure their legal protection, a significant progress has been achieved:

a) we have amassed precious knowledge regarding the status, importance and value of 806 wetlands larger than 0.1ha in 75 islands,

b) the issue of their conservation has been introduced into public dialogue after persistent presentation of results at conferences, workshops with stakeholders, events for the general public, announcements to the media and intense use of social media,

c) A large number of citizens and organizations have been mobilized within a network of wetlands monitoring for early detection of threats in 7 islands (Lemnos, Lesvos, Paros, Andros, Skyros, Kos, Crete) and more than 140 degradation cases across 13 islands were tackled by mobilizing the relevant authorities,

d) Site specific management proposals were promoted for a series of wetlands and some of them are either being or in the process of being implemented such as actions at Moronis estuary and Malia river marsh in Crete, Adamas marsh in Milos and the total of natural wetlands of Paros, and

e) Specific legal and management measures were promoted for their protection, both on a national and on a local scale, several of which were adopted for a large number of wetlands: establishment of a Wildlife Refuge in Lesvos (4 wetlands), inclusion of wetlands as protected areas in approved Open City Spatial Plans (47 wetlands on 6 islands), inclusion of wetlands in the Water Management Plans of Aegean and Crete water districts, provision for the protection of all island and mainland wetlands measuring up to 8 ha in surface area (Article 13) in the Biodiversity Law (3937/2011), and, following a successful public debate, the Presidential Decree "Approval of a list of small island wetlands, and provision of terms and conditions for the protection and conservation of small coastal wetlands included therein" was signed in June 2012 (Government Gazette AAP 229/19.06.2012), bringing 380 natural wetlands across 59 islands under a strict protection status. Furthermore, we brought to the spotlight the urgency to conserve the fragile island wetlands of the Mediterranean, through a resolution that was unanimously adopted on June 8th 2015 by the plenary of the 12th Conference of the Parties (COP12, Uruguay, 2-9 June) to the Convention on Wetlands of international significance (Ramsar, Iran, 1971).



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