

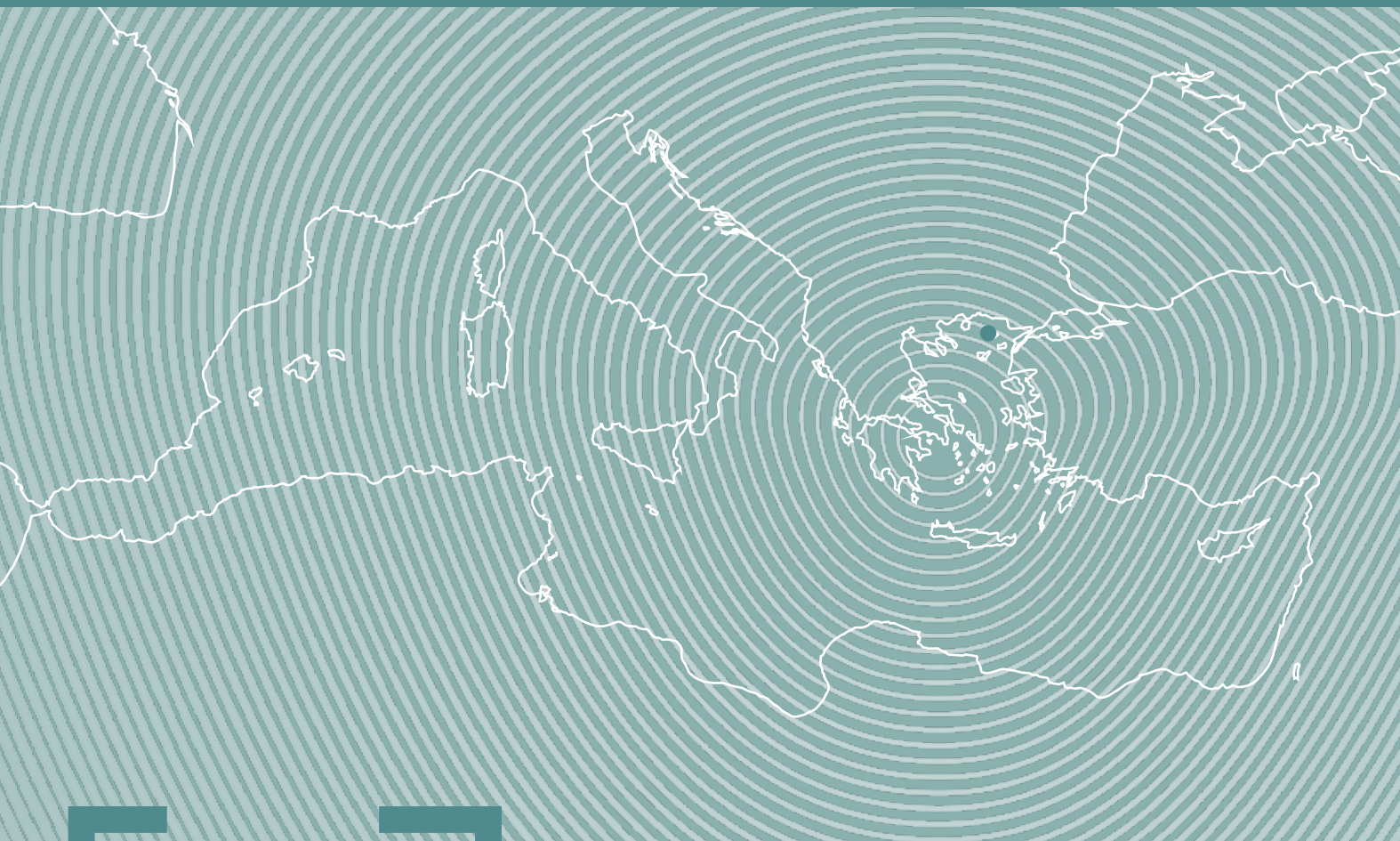
Sustainable Mediterranean

MEDITERRANEE DURABLE • ΒΙΩΣΙΜΗ ΜΕΣΟΓΕΙΟΣ • MEDITERRANEO SOSTENIBILE • المتوسطة المستدامة

SUMMER UNIVERSITY OF SAMOTHRAKI 2016 Integrated Management Approaches for Biosphere Reserves and other Designated Areas

9-22 July 2016

This issue of Sustainable Mediterranean is co-produced by the UNESCO Regional Bureau for Science and Culture in Europe, Venice (Italy); the Global Water Partnership (GWP); and the Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE) in collaboration with the Institute of Social Ecology (Vienna, Alpen Adria University) and the Hellenic Centre for Marine Research (HCMR, Athens).



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No 73,
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The views and opinions expressed in Sustainable Mediterranean by individual contributors do not necessarily reflect those of UNESCO, GWP, MIO-ECSDE nor those of any other sponsor of the summer University.

The unanimous conclusion of the Summer University was that Samothraki seems to combine all the necessary elements to become an ideal Biosphere Reserve.

This special issue of 'Sustainable Mediterranean' is devoted to the Summer University of Samothraki that took place in July 2016 with the participation, synergy and support of many International Organisations, Universities, Academic and Research Institutions and Networks, National and Local Authorities of Samothraki island, NGOs and other stakeholders.

The Summer University was organised as a support to the efforts of the Authorities of Samothraki to designate the island as a Biosphere Reserve under the Man and the Biosphere Programme (MAB/UNESCO). Its scope was to train post-graduate students, young scientists and professionals on the Integrated Management Approaches for Biosphere Reserves and other Designated Areas, having two complementary courses:

- Course A on "Aquatic and Social Ecology - Theory and Practice" and
- Course B on "Integrated Water and Coastal Management - Educational and Participatory Approaches".

The two courses ran jointly (with common plenary sessions) and in parallel (in the groups), providing high quality education to more than 70 trainees from 21 countries. For two weeks the trainees participated in fieldwork including taking measurements sampling, data collection, surveys of the views of the locals and visitors, interviews of staff of various administration services, farmers and businessmen. They examined the local social and enterprise initiatives and carried out various assignments and group work in order to obtain a clear idea about the island's ecological, social, and economic aspects and conditions, and reflect on its potential, as well as on the challenges of becoming a Biosphere Reserve. The preliminary results of their field work and group exercises are compiled in this issue.

In addition to the lectures, field visits and workshops, the Summer University participants enjoyed the rich natural and cultural diversity and heritage of the island through hiking around the island, tasting the island's great food and wine, snorkeling in the sea and swimming in its famous water pools ("vathres"), dancing and having fun interacting with youth and scientists from other countries.

The Summer University made clear that Biosphere Reserves could become drivers of local and regional development, particularly if the conditions of the natural socio-economic and cultural environment are appropriate. The unanimous conclusion of the Summer University was that Samothraki seems to combine all the necessary elements to become an ideal Biosphere Reserve. What is missing however is expertise and trained human capital to elaborate and set in action a Sustainable Development Plan to guide the local community and potential investors towards a truly sustainable future.

All the contributors to the Summer University and the Greek National Committee of the MAB/UNESCO programme expressed their willingness to support the Mayor, the local authorities and the community of Samothraki in their efforts for such a future and the accession of the island to the MAB/UNESCO World Network of Biosphere Reserves. The current issue is a tangible contribution in favour of this accession.

The current publication would not have been possible without the substantial support in funds and expertise on behalf of the UNESCO Regional Bureau for Science and Culture in Europe, Venice (Italy) and the Global Water Partnership (GWP). We wish to thank them for their support and their commitment to the "Samothraki cause".



Prof. Michael Scoullos,
Chairman, MIO-ECSDE
Chairman, Greek National Committee of MAB
Director, UNESCO Chair, UoA



Meeting the Mayor at the Municipality of Samothraki: From left to right N. Skoulikides (HCMR), V. Psallidas (MIO-ECSDE/MEdIES), M. Fischer-Kowalski (Alpen Adria University), M. Scoullos (University of Athens), A. Vitsas (Mayor), P. Pypaert (UNESCO, Venice Office)

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Contribution of the Mayor of Samothraki

The opening speech of the Mayor Mr. Athanasios Vitsas, at the public event held at the Cultural Centre of Chora on 19 July 2016, within the framework of the Summer University of Samothraki 2016

Ladies and Gentlemen we have all gathered here today because for the last 2 weeks, a group of people including Prof. Marina Fischer-Kowalski, Research Director, Nikolaos Skoulikidis and Prof. Michael Scoullas, representing the Greek National MAB Committee, as well as a lot of other professors and many post-graduate students (both Greeks and foreigners) are in Samothraki for the Summer University entitled 'Integrated Management Approaches for Biosphere Reserves and other Designated Areas'.

In 2011 Samothraki submitted an application to the MAB/UNESCO to become a Biosphere Reserve and be enlisted in the world MAB network.

Is this the right choice? This is a crucial question.

During the last decades we witnessed a situation of stagnation of development which followed the economic growth of the '80s and '90s. Therefore as a local community we frequently discuss DEVELOPMENT, the meaning of which, however, differs significantly from mind to mind.

Nevertheless, there are plenty of things that bother us and many of our problems are unsolved and so we are continually requesting State support, mainly State funding. This has both positive and negative aspects.

The positive aspect which I would like to concentrate on is that due to this economic shortfall, in conjunction with the significant identity of the island, a treasury of cultural and environmental heritage has been created on this island. This treasury is the capital of the place and this is the great advantage for the future.

There is no future if we waste everything today in the worst, anarchic way. Consequently this choice of "protection" is the only way forward.

These people gathered here and these organising institutions are joining their efforts in order to research the situation and to give answers to the questions and the problems raised by the procedure of submitting our candidacy for Samothraki as a MAB Reserve.

There is a second question:

Could this attempt be successful if we, as local community, do not embrace it? If we do not agree on this perspective? If we do not support it?

There is no future if we waste everything today in the worst, anarchic way. Consequently this choice of "protection" is the only way forward.

Addressing the local community I would like to clarify that I personally agree with the imposition of restrictions, because I am certain that an uncontrolled trajectory into the future without rules leads to dead ends: The development model of doing whatever one wants, wherever one wants, and however one wants is disastrous.

In order to avoid misinterpretation, I would like to clarify that MAB Reserves are regions which can live and act. People in these areas can make interventions and are economically active. There are two MAB Reserves in Greece, Olympus and Samaria Gorge, both of which are thriving.

Addressing the scientific team, my thoughts are not so technical but more political. I use the term political with its wide and positive context. Even the smallest initiative cannot be successful if the local community does not understand and adopt it. Even if it is accepted at the beginning it will be rejected and fall apart later. Strategic planning as well as long term and in depth public consultation are among our interests. The rules of the game should be clear from the beginning.

We clarify that we need your assistance on how to progress and how to manage our course towards the goal. Perhaps one or more master's thesis on the social aspects could shed light on these issues. I would like to propose that part of the research is focused on the social and behavioural implications that are specific to Samothraki in order to create scientific tools at the disposal of the consultants and advisors working within the community.

Without a doubt, the role and support of the local authority is fundamental in this procedure, so that we can be successful.



Shots from the public event held at Chora, 19 July 2016 © V. Psallidas.

Joint Statement of the tutors of the Samothraki Summer University, July 2016

1. The undersigned welcome and greatly appreciate that the island of Samothraki is considered a candidate for a Biosphere Reserve under UNESCO's Man and the Biosphere Programme. Upon seeing this island, surveying the research that documents its unique features and making contact with its inhabitants, we are convinced that Samothraki qualifies fully for such a nomination, which will benefit its inhabitants and natural resources alike. To this end we would like to support the appreciation of Samothraki to become a Biosphere Reserve (BR).
2. We appeal to the Greek Government to deal with one of the major obstacles completing the accession procedure, namely to fully legalize the status of the Natura 2000 areas on the island and provide the necessary resources for the sustainable management of the site.
3. We very much appreciate the momentum created by the mayor, the municipal council and other local actors of the civil society, in promoting clear visions and practices for the sustainable development of the island. A committed local community is prerequisite for the accession for the Biosphere Reserve.
4. A dedicated national and international scientific community, working for and at Samothraki, supports the relevant activities through its broad expertise.
5. We recommend developing an integrated management plan, with explicit targets and milestones for the next years, under the leadership of the Municipality. All achievements on initiatives undertaken or in the pipeline could reinforce trust in making change happen and motivate even broader civil participation toward achieving the goal of accession.

The undersigned welcome and greatly appreciate that the island of Samothraki is considered a candidate for a Biosphere Reserve under UNESCO's Man and the Biosphere Programme.

The organizers and trainers of the Samothraki Summer University 2016

- Iro Alampeï**, Education for Sustainable Development (ESD) officer, MIO-ECSDE / MEDIES
- Nuria Bonada**, Associate Professor, University of Barcelona
- Aristea Boulouxi**, Dr, Science Teacher, Anavryta Model Junior High School
- Panayotis Dimopoulos**, Professor in Botany and Ecology, Dpt, of Environmental and Natural Resources Management, University of Patras
- Tamara Fetzl**, Researcher, Alpen Adria University, Austria
- Marina Fischer-Kowalski**, Professor of Social Ecology, Alpen Adria University, Austria
- Antoni Grau**, Professor, Technical University of Catalonia
- Raffael Hickisch**, International Programme Director, Institute for Social Ecology Vienna, Austria
- Yiannis Issaris**, Researcher, Hellenic Centre of Marine Research
- Eleni Kytinou**, Hellenic Centre of Marine Research
- Anastasia Lampou**, Researcher, Hellenic Centre of Marine Research
- Steven Libbrecht**, Senior Consultant, Prospex, Belgium
- Elisabeth Lipiatou**, European Commission, DG Research & Innovation
- Gergana Majercakova**, Communications Officer, GWP CEE Regional Secretariat, Slovakia
- Vicky Malotidi**, Education for Sustainable Development (ESD) officer, MIO-ECSDE / MEDIES
- Marta Moren-Abat**, European Commission, DG Environment
- Tuncay Neyişçi**, Professor, Akdeniz University
- Momir Paunovic**, Researcher, University of Belgrade
- Panos Petridis**, Researcher, Institute of Social Ecology Vienna, Alpen Adria University, Austria
- Vassilis Psallidas**, Education for Sustainable Development (ESD) expert, MIO-ECSDE / MEDIES
- Maria Salomidi**, Researcher, Hellenic Centre of Marine Research
- Simron Singh**, Associate Professor, Faculty of Environment, University of Waterloo, Canada
- Nikos Skoulikidis**, Research Director, Institute of Marine Biological Resources and Inland Waters, Hellenic Centre of Marine Research
- Danka Thalmeinerova**, Senior Knowledge Management Officer, Global Water Partnership (GWP), Sweden
- Klement Tockner**, Professor for Aquatic Ecology at Freie Universität Berlin, Germany; Director of the Leibniz-Institute of Freshwater Ecology and Inland Fisheries.
- Aggelos Varvarousis**, Researcher, Autonomous University of Barcelona
- Vassiliki Vlami**, Researcher, University of Patras
- Ierotheos Zacharias**, Associate Professor in Environmental Geology and Water Resources, Department of Environmental and Natural Resources Management, University of Patras
- Stamatis Zogaris**, Researcher, Hellenic Centre of Marine Research

Aims, rationale and structure of the Summer University

The Summer University of Samothraki 2016 attempted to provide a high quality intensive two week long training to graduate students and young scientists from European and other countries, on Integrated Management practices of Biosphere Reserves and various other categories of protected areas (National Parks, Areas Natura 2000, etc.)

Its main aim was to deepen the understanding of the value of Biosphere Reserves as “laboratories” and “catalysts” of Sustainable Development. The Summer University specifically aimed to highlight the rich natural and cultural diversity and heritage of the island of Samothraki and support the proposal for its inclusion in the World Network of Biosphere Reserves (UNESCO Man and the Biosphere Programme, MAB/UNESCO).

The summer University of Samothraki 2016 has been supported by the UNESCO Regional Bureau for Science and Culture in Europe, Venice (Italy), the Global Water Partnership (GWP), the Austrian National Science Fund, the Alpen Adria University (Austria) and the Municipality of Samothraki, while a wide consortium of Research Institutions and Networks, Universities, National and Local Authorities, NGOs have participated in its rich program. Actually, the entire University has been structured around two parallel complementary courses (directions) that intersected on several occasions:

- Course A on “Aquatic and Social Ecology - Theory and Practice” and
- Course B on “Integrated Water and Coastal Management - Educational and Participatory Approaches”.

In total, more than 70 participants from 21 countries successfully completed the Summer University of Samothraki comprising a diverse group of postgraduate students, young scientists, researchers and junior and senior officers working in Biosphere Reserves and/or other designated areas, or in water management bodies. This diversity in nationalities, profiles and interests of the trainees certainly has contributed to the success of the Summer University, as the trainees were constantly exposed to one another’s working methods and realities.

The Summer University combined plenary presentations, group work and field research. Throughout its duration on a daily basis, a 2 hour long key speech given by an invited lecturer (jointly for Course A and B), was followed by dedicated workshops and field research (parallel for Course A and Course B). The main lectures, the data recorded by the trainees’ field research, as well as the results from their group work are presented in the following paragraphs.

Course A “Aquatic & Social Ecology: Theory and Practice”

Organized by the Hellenic Centre for Marine Research, the Vienna Institute of Social Ecology, Alpen Adria University and the University of Patras, Course A was designed with the aim to learn and apply aquatic ecology and social ecology approaches in a local setting while supporting current research and building synergy with the UNESCO Biosphere Reserve process. The course thus gave students the opportunity to engage in a real-life project and utilise their scientific training to support the process further, namely the creation of a management plan with a set of activities towards sustainability, and a science plan for further research on the island that would also meet local interests.

For the most part, students were split in small groups and conducted fieldwork in an array of social and natural science methods frequently used in socioecological and aquatic research. Each method was practically demonstrated by a tutor guiding the small student groups throughout the field work. In line with our applied, practical goals, we have again planned the modules of the excursion as small sub-projects in such a way that they contribute to current research directions, often directly responding to requests by the commune. In total 8 such modules were performed (refer to the Agenda, p10 for their description).

Course B “Integrated Water and Coastal Management - Educational and Participatory Approaches”

Led by MIO-ECSDE and with the support of GWP and UNESCO Regional Bureau for Science and Culture in Europe, Venice (Italy), Course B was of a different nature, based on presentations combined with workshops (both indoor and outdoor) and with all students participating in all activities. It focused on integrated management tools, on education as well as on participatory approaches.

The ultimate goal was to critically reflect on sustainable management and development of the island, having as a reference point two main documents i) the Samothraki Nomination folder to the World List of Biosphere reserves of MAB/UNESCO, and ii) the IMF methodology (see below). The trainees combined all their findings throughout the Course in targeted presentations during the last day. In a nutshell, the main topics of Course B were the following (refer to the Agenda, p10-11 for their description):

- The Integrative Methodological Framework for coastal river basin and aquifer management (IMF)
- The Integrative Water Resources Management Approaches (IWRM); as part of the GWP Toolbox

- The Biosphere Reserves (characteristics, function, governance, etc.)
- Public & Stakeholder Participation (stakeholder identification, mapping and analysis, surveys)
- Nature interpretation (on the field)
- Modeling and Simulation of dynamic systems
- Place-conscious learning & place-based educational pedagogy
- Marine litter collection & recording.

The key stakeholders and history behind the organization of the Summer University of 2016

The Institute of Marine Biological Resources & Inland Waters (IMBRIW) of the Hellenic Centre for Marine Research (HCMR) (<http://imbriw.hcmr.gr/>), has been studying the island's freshwaters for 15 years. From 2013 onwards, HCMR, in collaboration with the Municipality of Samothraki, initiated an inland waters research initiative, based on self-funding. In the frame of this effort, springs, streams, wetlands and lagoons have been investigated for their chemical-physicochemical and ecological quality. Thus, related data refer to hydromorphological and habitat features, physico-chemical results and biological characteristics. Finally, a Memorandum of Collaboration between HCMR and the Municipality of Samothraki has been signed to establish the Samothraki Nature Observatory (16-12-2013) on the island, aiming to research, promote, manage and protect its natural heritage.

The Vienna Institute of Social Ecology (SEC), Alpen Adria University (www.aau.at/sec) has been conducting research on the social metabolism of the island of Samothraki since 2007, acknowledged by the Sustainability Award 2010 received by the Austrian Ministry of Science and Research, and the Honorary Citizenship award Marina Fischer-Kowalski received from the Municipality of Samothraki in 2012 for her sustained efforts in promoting sustainability on the island. SEC has previously organized summer schools in social ecology in 2012, and 2014 as part of an Erasmus Intensive Programme with a range of European partners. This interdisciplinary research on energy, material flows, land use and the island economy, and the simultaneous networking with local civil society and stakeholders, prompted the communal administration, unanimously, to make an effort at turning the whole island into a UNESCO Biosphere Reserve. (Read more: www.sustainable-samothraki.net).

On the other hand, MIO-ECSDE; the UNESCO Chair & Network on Sustainable Development Management and Education in the Mediterranean of the University of Athens, and the Greek National Committee of MAB/UNESCO together with the UNESCO Regional Bureau for Science and Culture in Europe, Venice (Italy) have a long standing fruitful collaboration in projects and initiatives on topics relating to management as well as education within designated areas and especially Biosphere Reserves in the Mediterranean. Reference should be made to the production of a joint UNESCO and MIO-ECSDE publication, the first of the kind, in 2012 targeting BR managers educators and field-guides, entitled "Education for Sustainable Development (ESD) in Biospheres Reserves and other Designated Areas: A Resource Book for Educators in South-Eastern Europe and the Mediterranean" (<http://mio-ecsde.org/protarea/>); the organization of several train-the-trainers seminars including the 2012 Grundtvig Workshop entitled "Building Bridges - ESD for MAB BRs and other Designated Areas" in Greece; the 2014 Summer School entitled "ESD in Protected Areas and Biosphere Reserves" (<http://mio-ecsde.org/erasmus-IP-2014/>), and the 2016 experts meeting on "The role of Universities in Supporting UNESCO Designated Sites as Drivers for Sustainable Development at Local and Regional Levels". The above mentioned bodies are very supportive to the Samothraki nomination as a Biosphere Reserve, and they have been instrumental in co-organising the Summer University of 2016.

Another key stakeholder of the Summer University of 2016 was the Global Water Partnership (GWP), together with its Mediterranean "branch" (GWP-Med). Actually two whole days of the Summer University (Course B) were based on the GWP Toolbox on Integrated Water Resources Management (IWRM). The GWP Toolbox is a free and open online collection of cases (best practices) in water management, and has been used as a training material for water professionals in numerous trainings all around the world (www.gwp.org/en/Toolbox/).



SUMMER UNIVERSITY OF SAMOTHRAKI 2016

Integrated Management Approaches for Biosphere Reserves and other Designated Areas

9-22 July 2016

Course A: Aquatic & Social Ecology: Theory and Practice

Course B: Integrated Water and Coastal Management - Educational & Participatory Approaches

Organized by:



Institute of Marine Biological Resources and Inland Waters (IMBRIW),
Hellenic Centre for Marine Research (HCMR)

Alpen Adria University, Vienna Institute of Social Ecology

UNESCO Chair and Network on Sustainable Development Management and Education
in the Mediterranean of the National and Kapodistrian University of Athens (UoA)

Mediterranean Information Office for Environment, Culture and Sustainable
Development (MIO-ECSDE) and especially its Educational Initiative MEDIES

University of Patras



MedUnNET

Network of Mediterranean Universities for Sustainable Development
focusing on Education for Sustainable Development (ESD)



Global Water Partnership-Mediterranean



Chemistry Education and New Educational Technologies Post Graduate Program
(ΔιΧηNET)



Technical University of Catalonia



University of Antalya

Supported by:



Global Water Partnership (GWP)



UNESCO Regional Bureau for Science and Culture in Europe



Municipality of Samothraki

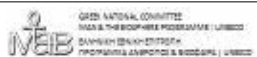


Region of Eastern Macedonia – Thrace



ScientAct SA

Under the auspices of:



Greek National Committee UNESCO-MAB



Hellenic National Commission for UNESCO



Special Secretariat for Water
of the Ministry of Environment & Energy of Greece

Agenda of Samothraki Summer University 2016

July 2016	Sat.	Sun.	Mon.	Tue.	Wed.	Thu.	Frid.	Sat.	Frid.	Sun.	Mon.	Tue.	Wed.	Thu.	Frid.
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
		Welcomes - Introduction: N. Skoulidakis, P. Petridis, M. Scoulios P1: Marina Fischer-Kowalski	P3: Michael Scoulios (IMF, ICZM, IWRM, PP)	P4: Philippe Pypaert (EWN-BR, ESD)	Trek (Springs and mouth of Fonia River) / prof. Tuncay on eco-inter-pretation and Dr. Zogaris on nature conservation	Trek (Fonia River) Course B: Field work: Interviews on SD	P5: D. Thamerleinerova: The GWP toolbox Course A: intro (ctnd): method 8 Course A: Groupwork Methods 2,4,7,8		P6: Klement Tockner Course A: Groupwork Methods 2,4,7,8 Course B: A. Boulouxi WS on place conscious education S. Libbrecht WS on stakeholder engagement	Boat tour (field activity on marine litter) P7: Nuria Bonada	Course A Course B: E. Lipiatou & Marta Moren			Final group reports Final reflections Evaluation	Departures
09.00-11.00															
11.30-13.30		P2: Philippe Pypaert 13.00 Logistics Course A: Introduction of Methods 1,3,5,6	Course A: intro (ctnd): method 6 Course A: Groupwork Methods 1,3,5,6	Course A: intro (ctnd): method 5 Course A: Groupwork Methods 1,3,5,6											
13.30-15.30 lunch break															
15.30-18.30		Course B: Aim, expect/ns, group forming & way of work - Q&A on BRs (P2)	Course B: M.Scoulios WS on the IMF	Course B: WS on IMF (ctnd) / Prep work on interviews		Course A: Introduction of Methods 2,4,7,8 Course B: A. Grau WS on modeling & simulation	Course B: WS on the GWP toolbox Course B: WS on the GWP toolbox (ctnd)					Preparation of final reports	Preparation of final reports		
20.00												Public event		Final Dinner	

Key

- Plenaries (A & B jointly)
- Work in groups (A & B parallel)
- Reports preparation
- Joint activities

Plenaries

intro Nikolaos Skoulikidis: Samothraki Island. Source of inspiration for the current summer school and for future research and conservation.

Panos Petridis: A summer school with both research and transdisciplinary goals.

Michael Scoullos: Background of making this joint summer school a reality.

- P1 Marina Fischer-Kowalski: Can socio-ecological research help to create a realistic perspective for a sustainable Samothraki?
- P2 Philippe Pypaert: Introduction to the Man and the Biosphere (MAB) programme and its World Network of Biosphere Reserves, their evolution and recent history, and in particular the provisions of the recently adopted 2015-2025 MAB Strategy and related Lima Action Plan, linked also to the 2030 Agenda (SDGs).
- P3 Michael Scoullos: The Integrative Methodological Framework (IMF) for Coastal river basin and Aquifer Management; the Integrated Coastal Zone Management (ICZM) and the Integrative Water Resources Management (IWRM) approaches as well as Public Participation (PP).
- P4 Philippe Pypaert: Session dedicated to Biosphere Reserves; participants will be introduced in more details to the functioning of these sites, from their nomination up to their governance, with a particular focus on their use as ideal places for Education for Sustainable Development.
- P5 Danka Thalmeinerova: An introduction to the GWP Toolbox, and key lessons learned from its application around the world.
- P6 Klement Tockner: Challenges in River Research and Management.
- P7 Nuria Bonada: Challenges and opportunities for research and management in Mediterranean-climate rivers.

Course A / Methods

1. Animal numbers and their drivers on the island: livestock counting and estimation of livestock densities on different habitat types by distance sampling. Analysing farmers' income by sources (utilization of animal products on markets, in subsistence, from state subsidies). Creating an empirically based estimate of current livestock numbers and putting it into perspective (tutor: Raffael Hickisch).
2. Problems of overgrazing and soil erosion: Analysing the impacts of agricultural land use and land-cover change on the vegetation cover. Mapping vegetation cover and erosion sites, discussing landscape change, its drivers and impacts. Exploring the outcomes of recent animal feed seeding experiments (tutor: Tamara Fetzl).
3. Exploring the current social metabolism of the island in terms of material and energy flow analysis by field observation and expert interviews, with a special focus on the fate of wastes. Exploring potential social tipping points (undersupply that might cause population decline) in the health and education

services. Structural legal and statistical analysis and stakeholder interviews (tutors: Simron Singh, Panos Petridis).

4. Local initiatives and their chances to drive socioecological change. Oral narratives and interviewing with local initiatives on whether cultural change toward collaboration may occur and widen the range of possible solutions even during a prolonged economic deadlock (tutors: Aggelos Varvarousis, Panos Petridis).
5. Aquatic chemistry and macroinvertebrate fauna of Mediterranean streams. Field protocols, field measurements and sampling campaigns in streams of Samothraki will be carried out in order to explore biodiversity issues, assess their ecological status and interpret the factors and processes that control it (tutors: Nikolaos Skoulikidis, Anastasia Lampou, Momir Paunović).
6. Stream riparian and landscape module. Visual survey techniques were utilized to collect floral, wildlife and anthropogenic degradation data to assess ecosystem integrity at the riparian corridor and landscape scale. Three survey methods were completed at a number of stream sites (tutors: Stamatias Zogaris, Vassiliki Vlami, Panayiotis Dimopoulos).
7. River hydrology, physical processes, stream hydrologic assessment, watershed assessment. Water resources management, watershed management. Survey to conceive the island's water resources management scheme, including an estimation of water uses and understanding of common irrigation practices (tutor: Ierotheos Zacharias).
8. Visual survey techniques, protocols and indicators for the ecological assessment of the Mediterranean sublittoral zone, with emphasis on benthic ecosystem structure and functions. Fieldwork to collect data within the island's marine Site of Community Importance (GR1110012). Analysis and report on identified status and trends (tutors: Maria Salomidi, Yiannis Issaris, Eleni Kytinou).

Course B / Workshops

- The "Integrative Management Framework" (IMF): The five stages required in the IMF are explored using case studies: (1) establishment (2) analysis and futures (3) setting the vision (4) designing the future (5) realising the vision. Another working document is the Submission folder of Samothraki to be a Biosphere Reserve (2013). During the entire course while collecting evidence from the lectures, workshops and the island itself, participants are challenged to critically reflect on it, and suggest ways to amend it / enrich it (tutor: Michael Scoullos).
- Public Participation: Experiential methods of how to enhance public participation based on the SUDECIR approach, through interviews with the locals. The end result (vision of the locals for the island) to be presented in the Greek Public event on Chora of Samothraki (tutors: Vicky Malotidi & Michael Scoullos).
- Field interpretation (in Paleochora archeological site and downstream of Fonias river): How can we interpret the marks left by the nature itself or

by man? We can draw information from almost everything around us, clouds, waters, rivers, soil, flies, rabbits, and birds, they all tell us something. Without seeing any bird on site, we can make estimations about the bird species and their population size just studying their droppings or nests. We can observe the fluctuation of the water level of a wetland, or we can clearly delineate its low and high water levels. Plants tell us about the water quality, the seasons of the year, the elevation or other aspects of the site (tutor: Tuncay Neyisci).

- Modeling and simulation of dynamic systems: System modeling is a tool to study behaviour (dynamics) and to properly act on it to obtain the desired behaviour. Mathematical models can be achieved in two ways: theoretical modeling (physical laws) and identification or experimental modeling (historical data). The theory session is complemented by a practical one with examples of ecological, educational, social, and natural resources models, integrating sustainability concepts (tutor: Antoni Grau).
- The GWP Toolbox: Water management education nowadays needs a better understanding of multi-disciplinary aspects of water governance such as legal issues, participatory approaches, and conflict resolution techniques. The integrated approach in water resources management (IWRM) is indispensable to address complex issues including climate change. The GWP Toolbox is an open online repository of case studies and references on water management at global, regional, national and local levels. The workshop provides a selection of more than 300 cases currently available at the GWP IWRM ToolBox (tutor: Danka Thalmeinerova).
- Place-conscious learning: The twin educational aims/ constructs of decolonization and reinhabitation are

introduced in a theoretical and a practical way. Key questions of place consciousness are addressed aiming at the participants' active engagement in the place-conscious learning process. The workshop is accompanied by a small scale research exploring the effects of place-based pedagogies of this summer school on its participants (tutor: Aristeia Boulouxi).

- The role of participatory processes in dealing with societal challenges, from the perspective of a practitioner. The topic of stakeholder engagement is explored, covering items such as stakeholder identification and selection, setting up the framework for stakeholder participation, and practical models (tools) for stakeholder management. Different models for setting up stakeholder participation will be discussed, including settings to deal with complex and technical challenges, that call for the integration of participatory and science based approaches (tutor: Steven Libbrecht).
- Marine Litter Monitoring (on the beach): Marine litter has become a hot environmental issue largely due to a) its increasing amounts and b) the threatening and largely unknown effects of microplastics. Even though beach cleanups alone cannot solve the problem, they can be a useful tool to raise awareness; especially when combined with an accurate recording, to generate data useful for scientists and policy makers. The activity records and collects marine litter on a voluntary basis on a deserted coast of Samothraki (tutors: Iro Alampegi & Michael Scoullou).
- Water, Social Sciences, European Research and Policy: The lecture gives an overview of priorities on research social sciences and an overview of water policy, legislation and implementation of the Water Framework Directive – Policy and research (tutors: Elisabeth Lipiatou & Marta Moren, European Commission).



Group photo of all participants of the Summer University 2016 in the Fideleio Cultural Centre, Samothraki.

Can socioecological research help to create a realistic perspective for a sustainable Samothraki?



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What is socioecological research? How is it performed? How did it come about that socioecological research is taking place on Samothraki? In the following lines we will try to give short answers to those questions, before focusing on some of our research findings and current priorities. We will then discuss lessons we learned regarding the relevance of scientific research in supporting a sustainable pathway for Samothraki, and more general, in guiding social transformations. But first a short historical overview:

Short notes on a long story

In 2007 members of the local initiative “Samothraki in action” approached frequent visitor Marina Fischer-Kowalski and requested scientific support regarding the ongoing environmental problems on the island – notably ineffective waste management. This, in the following year, led to the preparation of a feasibility study by the Institute of Social Ecology in Vienna (SEC), financed by the Austrian MAB committee, on whether a sustainable vision for Samothraki could be achieved via its inclusion in the World Network of UNESCO Biosphere Reserves. Regarding the nature conservation aspect, Samothraki was deemed clearly worthy of protection as it is host to a wide range of valuable species and ecosystems, a fact that is reflected in its extensive terrestrial and marine Natura 2000 areas. Moreover, according to an exploratory survey on future visions, a large majority of permanent residents and an even greater of visitors was in favour of a preservation,

rather than a modernization future for the island – and the trend is intensifying (see figure 1).

After preparatory work by SEC and an intensive two-way exchange with the local community, a formal application was submitted to UNESCO in 2011, with the unanimous support of the municipal council and supported by all relevant institutions (Greek UNESCO Committee, Ministries of Environment and Culture, Forestry, Archaeology, Chamber of Commerce). The process of those initial phases is described in detail in Fischer-Kowalski et al. (2011). The proposal was welcomed by UNESCO, which nevertheless noted the lack of a clear management plan. In response, a process of forming a community group “Sustainable Samothraki” to co-manage the future Biosphere Reserve (BR) was initiated.

Meanwhile, our research presence on the island was only just picking up, and in 2012 we organized the first summer school on social ecology, which included a series of focus discussions with local interest groups on their problems and visions (Petridis et al. 2013). The application to UNESCO was resubmitted two years later with amendments, and was again welcomed but deferred due to the fact that Natura 2000 areas (future BR core zones) are not legally protected. While trying to find ways to overcome this institutional constraint, our research activities on the island intensified, delving into diverse issues such as tourism, the livestock system and land degradation. We then organized a second summer school

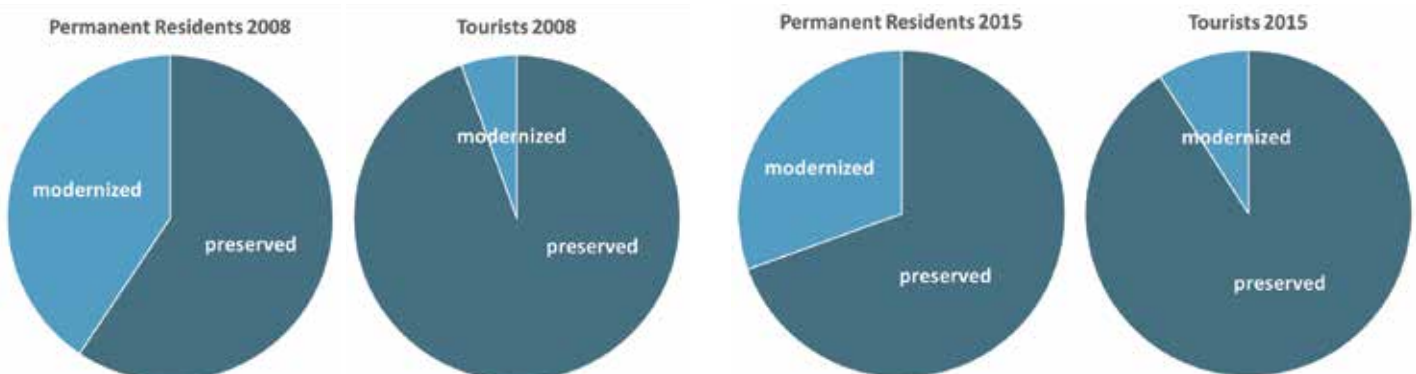


Figure 1. Who shares the vision of sustainability on Samothraki? Comparing the evolution of the preferences of permanent residents and island visitors for either a “preservation” or a “modernisation” future scenario for Samothraki, based on our extended surveys in 2008 (n=1511) and 2015 (n=1498).

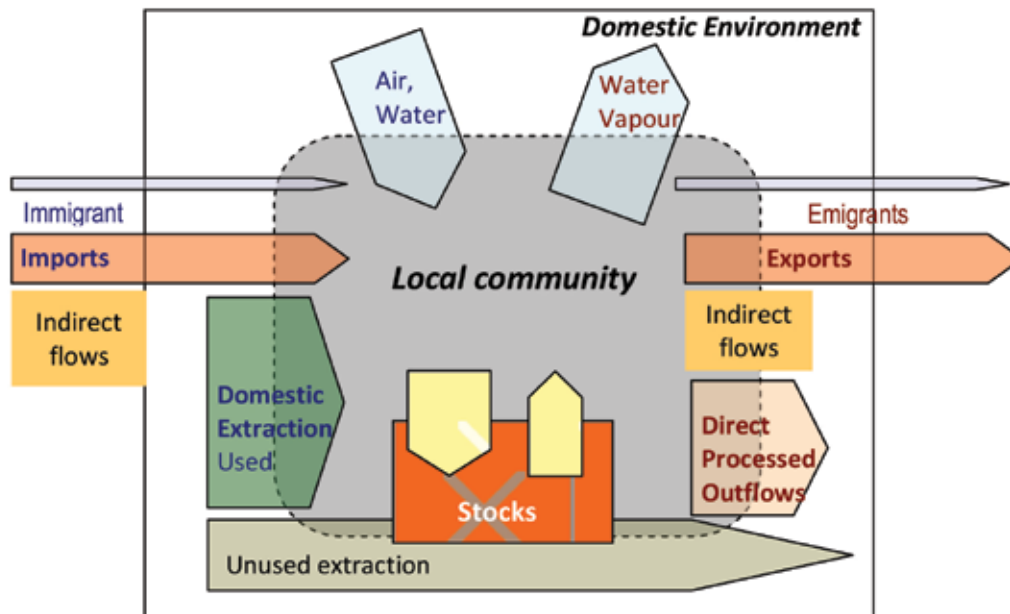


Figure 2. The sociometabolic input-output model (source: Matthews et al. 2000, modified).

on Samothraki in 2014, as part of an Erasmus Intensive Programme, with 5 partner Universities.

Moving closer to the present, our research activities now revolve around the ongoing project “SUSAKI” (Austrian National Science Fund 2015), which focuses on “socioecological transitions, sustainability and collapse of island communities”. The rationale behind this is that Samothraki has been undergoing a socioecological transition from a traditional agrarian society to a tourism destination and this presents new opportunities for the community, but also contains many risks: ecologically, culturally and demographically. We are interested in how Samothraki can deal with these risks towards a sustainable development, sustain its local population economically and maintain its natural and cultural heritage. This is supported by “CiSciSusaki” (Austrian National Science Fund 2016), a Citizen Science follow-up project that involves local citizens in scientific research, co-defining research questions, understanding the challenges ahead and finding a shared vision.

It is in this context that the third and significantly enlarged summer school on Samothraki took place in July 2016, summarised in this volume, planned in such a way as to achieve maximum synergistic effects between our research and policy goals (Petridis 2016).

The vision of “sustainable development” for Samothraki: what does it entail?

So, what does a sustainable future for Samothraki mean? Sustainable development, in this context, means to develop and maintain a *social metabolism* that serves the needs of the people without destroying the ecological balances of the natural environment (see figure 2), while being resilient to changing contexts. This means *not* to increase socio-economic stocks (such as people, houses,

roads and animal livestock) excessively, to use natural resources (land, water, biodiversity) carefully and efficiently and evolve towards a *circular economy*, to create effective synergies between the sectors of the economy (such as agriculture and tourism) and to develop a culture of social responsibility, collaboration and fairness (see figure 4)..

Revisiting the famous “sustainability triangle”, we can say it is at the same time magic and vicious. It is vicious, because there is a basic tendency of the three criteria (goals in the triangle) to succeed at the expense of one another. *Nature preservation* inhibits economic exploitation of resources; *economic success* tends to strengthen competitive pressure, produce social and political domination and exclusion of the unsuccessful; and emphasis on *local culture and social care* may conflict with economic growth and the preservation of natural resources. Yet, it is also magic, when one finds solutions that serve two goals simultaneously, while not harming the third. Those come up as a result of *careful systemic analysis, good networking* among local actors, *strategic imagination* ...and sometimes luck!

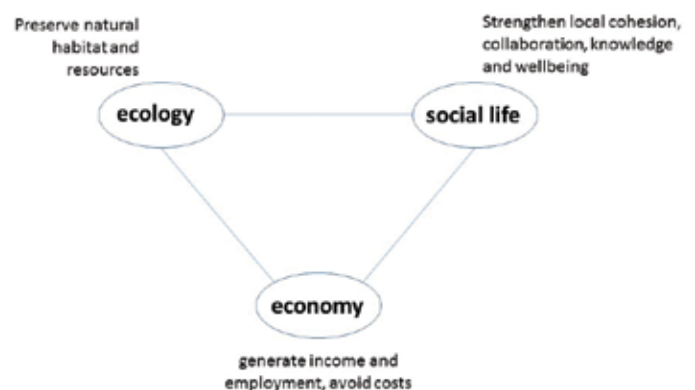


Figure 3. Sustainability triangle: magic and vicious.

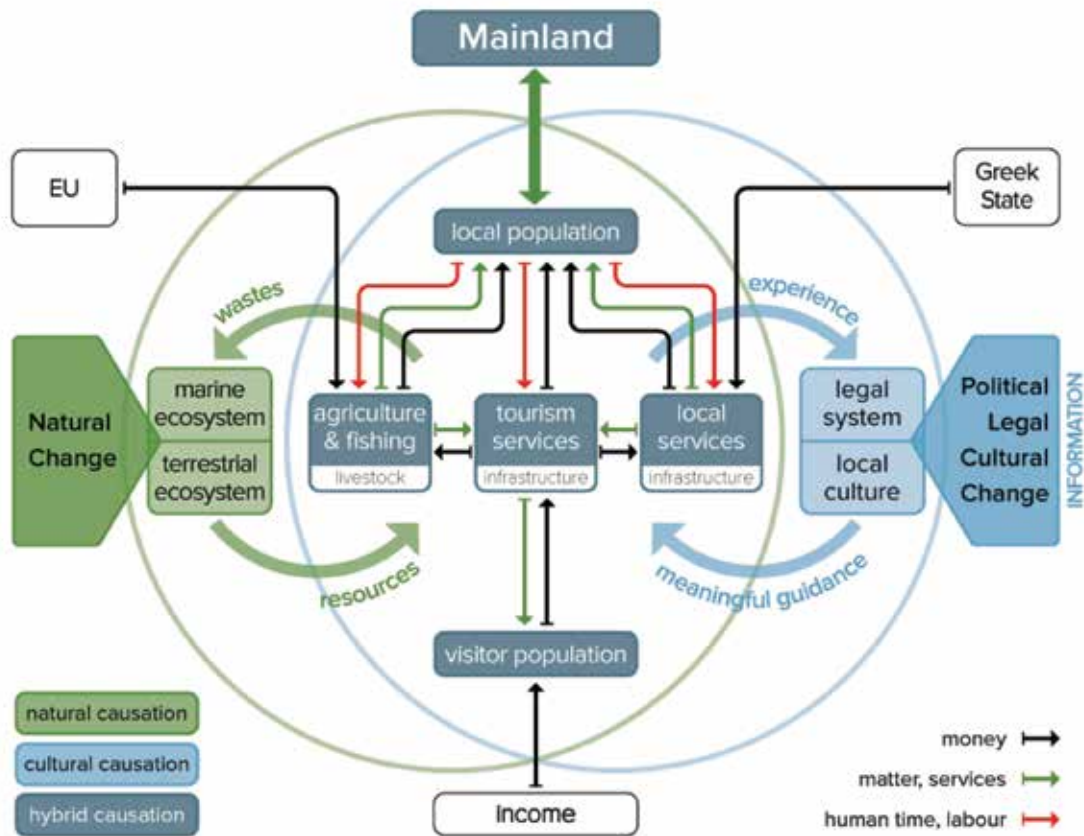


Figure 4. A model of the socioecological system of Samothraki (adapted from Petridis and Fischer-Kowalski, 2016).

Careful systemic analysis of a socioecological system implies an analysis of:

- sociometabolic stocks and flows, their dynamics, weaknesses and critical tipping points
- social actors, their interests, cultures and world views, and their action potential
- local ecological habitats, their vulnerability and interdependencies

In the following paragraphs some practical examples are given.

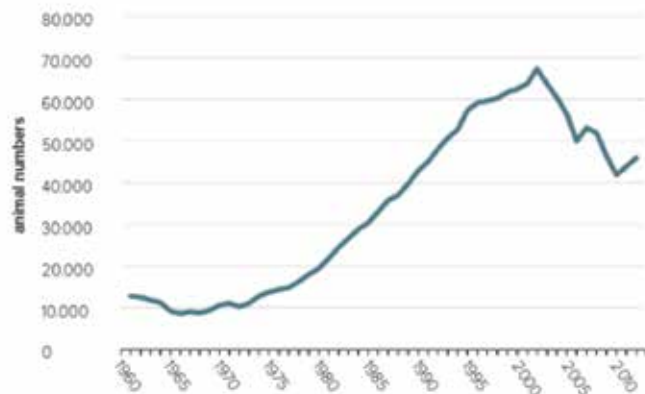


Figure 5. Small ruminant numbers 1960-2012. Note the likely grazing carrying capacity is ~15.000 animals [source: ELSTAT, Fuchs (2015) and estimates].

Efforts towards a more sustainable agriculture

In the agricultural system of Samothraki, livestock herding dominates. Goat and sheep populations are currently overgrazing the land (figure 5), and most of the grain grown is fed to the animals. Nevertheless, the island imports more meat (and possibly also more cheese) than it exports. Olive oil production is mainly for local use; wine production is increasing, but most wine consumed is imported; yoghurt and cheese production goes mostly for domestic use, with only one dairy exporting also to the mainland. In effect we are dealing with a rather inefficient traditional agriculture, when there could be a much better synergy with tourism, i.e. Samothraki as a supplier of high quality food.

Current efforts in the field of agriculture include the following:

- “Happy goats” app: In collaboration with IT firm Integrated ITDC, the Aristotle University of Thessaloniki, and the Leibniz Centre for Agricultural Landscape Research, we have been involved in the development of a decision support tool for farmers to better plan on their animal numbers and their use. The goal is to provide income planning in terms of management advice for sustainable small ruminant (sheep & goats) farming. To put it simply: show farmers that having fewer animals may cost less, be better for the land, reduce work and, most importantly, not affect profit.

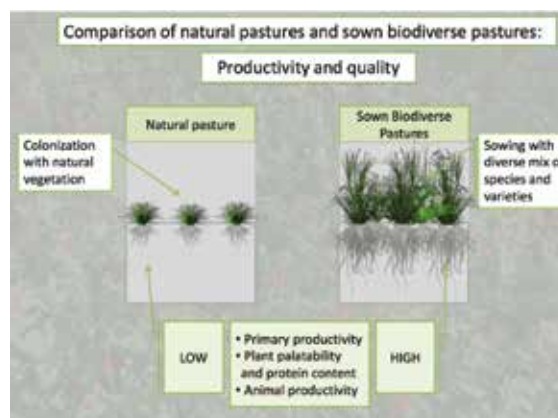
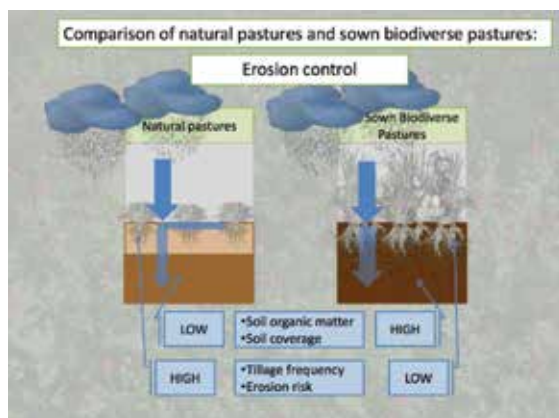


Figure 6. Comparison of natural pastures with sown biodiverse pastures [Source: Terraprima, Marjan Jongen].

- Sown Biodiverse Pastures: In order to increase plant productivity and grazing tolerance of overgrazed lands, Terraprima, a spin-off of Lisbon Technical University has developed special seed mixes. Sown Biodiverse Pastures (SBPs) are permanent, as they are self-maintained for at least 10 years and biodiverse, as up to 20 species or varieties are sown, many of which are legumes, a “natural factory” of nitrogen, avoiding the use of synthetic fertilizers (Teixeira et al. 2015, figure 6). A pilot project is currently underway on Samothraki, in collaboration with local farmers, in order to assess the effectiveness of SBPs.

How to make tourism more sustainable?

Of the 40.000 summer visitors to the island, about 27.000 are tourists, 3.500 are family visitors, 2.700 are second home owners and the rest are seasonal workers (own estimations, based on port statistics – figure 7). They spend 440 000 nights on the island – about 10 nights on average. Tourists are predominantly Greek (almost 90%), young, and two thirds of them have university education. Half of them have come repeatedly, and 90% want to come back. Half of them camp. More than half of them come in the peak season (July/August). Tourists from other countries stay a little longer and come more frequently also in the pre- and postseason (Fischer-Kowalski et al. 2011, and Schwaiger *in preparation*)

The current tourist population is, in principle, favourable

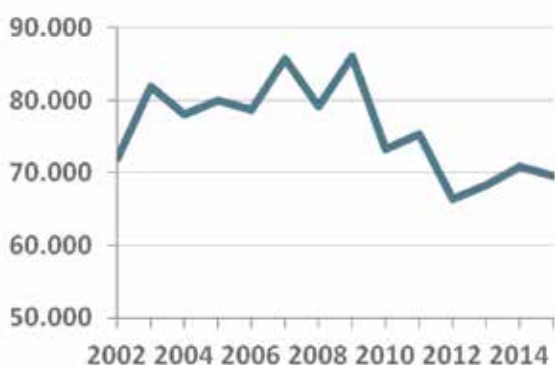


Figure 7. Annual ferry departures from the island 2002 – 2015 [Source: port statistics].

to a sustainable development of the island, and does meet many of its needs there. A certain increase in tourist numbers (and income from tourism) could be of little harm if (i) they spend a little more time on the island and (ii) they spread across a longer season. This possibly could be achieved by interesting ecological and cultural programs, a higher share of non-Greek tourists, better connectivity, increased international visibility of the island and improved local information.

Other priorities

Moreover, we are trying to find ways to improve the synergy between local agriculture and tourism. Our research has shown that, even though there is a trend away from healthy Mediterranean dietary patterns and towards “supermarketization”, there still remains a strong preference for high quality food from local sources. Maintaining and developing pride of high quality local food products would improve their branding and marketing (Petridis & Huber, forthcoming).

Other ongoing research revolves around how to make local services more sustainable. This includes: municipal services (e.g. water supply, sewage, waste removal), health services, as well as education and lifelong learning. Finally, we are trying to address several policy goals, such as the constitution and strengthening of local NGOs and the Sustainable Samothraki association, accelerating the Natura 2000 process for effective nature conservation, attracting international off season tourism and, last but not least, support a resubmission to UNESCO, for the inclusion of Samothraki to the World Network of Biosphere Reserves.

The strategic role of scientific inquiry to guide transformations

So, what does one need for doing research? A fascinating vision, funding, interested researchers, and supportive partners. We were lucky enough to secure seed money from the Austrian UNESCO-MAB committee, and then from the Austrian Science Fund, as well as the Erasmus program for the 2014 summer school and other side projects. We were also lucky to be able to attract many interested

Table 1. Crucial preconditions for success: a new style of collaboration between locals.

Traditional (agrarian society) collaboration patterns	Required collaboration patterns for a sustainability transition
Family centred (or extended family: clientelism)	Network of like-interested individuals
Hierarchical, little functional differentiation	Flat hierarchies, high functional differentiation
Low level of mutual trust. Punishment of deviants	High level of mutual trust. Exclusion of deviants from collaboration
Commons tend to be overused (unless strictly regulated)	Protecting commons as a mutually shared goal
Context: zero sum games: the gain of somebody outside the family system, even if a short-term co-benefit, tends to turn into a long-term disadvantage	Context: chance for mutually beneficial solutions, adaptability to rapidly changing environment

students mainly from SEC Vienna, as well as an increasing number of partners and collaborators, from the Hellenic Centre of Marine Research, the University of Patras, the University of Natural Resources and Life Sciences in Vienna, to name just a few. But the key for *transformative* socioecological research has been local support: Island mayors, civil society groups Samothraki in Action and Sustainable Samothraki, social cooperative Zathay, and many local citizens lending their support. What is more, a *sustainability transition*, should also entail a shift in local collaboration patterns (summarised in table 1).

Science controls neither money nor power; it only has some control over the consciousness of people (knowledge, beliefs), depending on communication and trustworthiness. A local community is not a hierarchical organization that can be “planned” or “managed” by some authority in charge. Instead, it has to be understood as a network of actors (internal as well as external) and forces (attractors) of variable strength that pull and push in diverse directions. For science to be able to guide successful interventions (from the parts of various actors), it must be able to plausibly communicate. Keys are the local availability of and access to communication media, and sometimes a window of opportunity for change (such as a socio-economic crisis), plus a long breath and patience!

Project website

<http://sustainable-samothraki.net/>

Acknowledgements

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References

- Fischer-Kowalski, M., L. Xenidis, S.J. Singh and I. Pallua. 2011. Transforming the Greek Island of Samothraki into a UNESCO Biosphere Reserve: An experience in Transdisciplinarity. *Gaia* 20(3): 181-190.
- Petridis, P. and M. Fischer-Kowalski, 2016. Island sustainability: the case of Samothraki. In: “*Social Ecology: Analyzing Society-Nature Interaction and Its History*”, H. Haberl, M. Fischer-Kowalski, F. Krausmann, V. Winiwarter (eds.), Springer International Publishing. pp. 543-557.
- Petridis, P. 2016. Establishing a Biosphere Reserve on the island of Samothraki, Greece: A transdisciplinary journey. *Sustainable Mediterranean*, Special Issue, No 72, 39-41.
- Teixeira, R.F., V. Proença, D. Crespo, T. Valada, and T. Domingos, 2015. A conceptual framework for the analysis of engineered biodiverse pastures. *Ecological Engineering*, 77, 85-97.
- Petridis P. & Huber, J. (forthcoming). A Sociometabolic and Dietary Transition on a Greek Island: Evidence of Quiet Sustainability. In: “*Sociometabolic Perspectives on Sustainability of Local Food Systems*”, E. Fraňková, W. Haas & S. J. Singh (eds.), under contract with Springer.
- Petridis P., R. Hickisch, M. Klimek, R. Fischer, N. Fuchs, G. Kostakiotis, M. Wendland, M. Zipperer & M. Fischer-Kowalski. (2013). Exploring Local Opportunities and Barriers for a Sustainability Transition on a Greek island. *Social Ecology Working Paper* 142, Vienna, Austria. Available at: http://www.uni-klu.ac.at/socec/downloads/WP142_WEB.pdf

The Preparation of a Management Plan for Samothraki applying the Integrative Methodological Framework (IMF)



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Introduction

In approaching the elaboration of a management plan for Samothraki and particularly in view of obtaining the nomination of the site as a Biosphere Reserve (BR) under the Man and the Biosphere Programme of UNESCO (MAB), one should be based on the recent, though comprehensive, experiences in managing its major resources in combination with its specific geomorphological, bioclimatic and cultural characteristics. Among them of principal importance are, obviously, its extended and diverse coastline and its unusually rich (for an Aegean Island) freshwater resources, closely related to the high mountain dominating the landscape, which together determine its main land uses.

It is therefore evident that in preparing such a plan the MAB principles and practices, as applied in other BRs, should ideally combine the consolidated Integrated Coastal Zone Management (ICZM) and Integrated Water Resources Management Planning (IWRM) approaches. Such effort could now be facilitated by the Integrative

Methodological Framework (IMF), recently jointly developed and introduced by GWP-Med, PAP/RAC of UNEP/MAP and UNESCO-IHE (2015).

The tendency to develop “integrated” management has its roots in the so-called “holistic” approaches of the 1970s and reached its peak with the introduction and promotion of the integrated approach within water resources management and coastal zone management in the 1990s and beyond. The need to introduce an integrated approach was a consequence of the increased conflicts over limited resources that are progressively more scarce compared to the demand. Integration was proposed in the first place as a solution to fragmentation at various governance levels; competing uses of natural resources and sectoral approaches; followed by the lack of coherence in policies, strategies and approaches related to the environment and development. Such incoherence often results in contradictory measures and reduced efficiency of proposed solutions while delaying and increasing the cost of their implementation. The need to combine integrated approaches has become evident and recognized at various expert meetings and international forums.

The Objectives of the IMF

1. Provide the rationale and the technical tools for a collective and coherent response to the multiple policy goals and directives that relate to the utilization, development and protection of coastal areas at national and local level and their natural and ecological resources.
2. Ensure that policy instrument mixes are consistent and mutually supportive.
3. Produce policy outcomes appropriate to specific coastal zone problem context.
4. Secure best knowledge base and support the interdisciplinary approach needed for the successful preparation of an integrated Plan.
5. Add value to individual approaches in order to obtain maximum synergy responding to the principle that ‘the whole is greater than the sum of the parts’.
6. Satisfy different legal requirements through a shared, efficient and effective use of often limited human and logistical resources available for such process, including reducing costs for planning and particularly for the setting and implementation of management options identified in the Plan.
7. Respond effectively to the more dynamic environment resulting from climate change and development impacts.
8. Achieve shared ownership by the involved sectors through better coordination and integration of them in the planning process.
9. Achieve sustainable coastal development in the Mediterranean estuaries and wetlands.
10. Simplify monitoring, evaluation and reporting.

More specifically the components of the proposed IMF are:

- The ICZM, which is a dynamic process for the sustainable management and use of coastal zones, taking into account at the same time the fragility of coastal ecosystems and landscapes, the diversity of activities and uses, their interactions, the maritime orientation of certain activities and uses and their impact on both the marine and land parts (ICZM Protocol of the Barcelona Convention, 2008).
- The IWRM, which, according to the widely accepted Global Water Partnership (GWP) definition (GWP, 2000), is a process that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment.
- The closely related Integrated River Basin Management (IRBM) and the EU Water Framework Directive (WFD) which provides also the formal legal framework according to the EU and Greek Legislation and, in the case of Samothraki, refers to the entire island, including also the so called Coastal Aquifer and Ground Water Management (CAGWM) and Planning, which aims to protect and restore the good status of all bodies of coastal groundwater.

Furthermore, there are few important notions directly linked to the Integrated Management and Planning, such as the Ecosystem Approach (EcAp) or Ecosystem Based Approach (EBA). The EcAp, or EBA, was adopted by the Conference of the Parties of the Convention on Biological Diversity (CBD) as the primary frame for action under the Convention. It is defined as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The vision behind the EcAp is that, through this approach, natural systems are planned and managed so as to provide their services and function at least sufficiently well. The EcAp does not refer to any particular resource but can refer to any functioning unit at any scale. This understanding is particularly important for river, aquifers, coasts and seas, where the nature of water keeps systems and functions interconnected.

An important emphasis of the EcAp is on the non-linearity and complexity of the ecosystem processes, for many of which we have still incomplete understanding and knowledge, and their outcomes are often characterized by time lags and surprises. Any management that takes into account the EcAp should be adaptive and apply the "precautionary principle" in responding.

The EcAp does not preclude other management and conservation approaches. It is recognized that "there is no single way to implement the ecosystem" but "it may be used as the framework to integrate the different approaches for delivering the objectives of the connection in practice" (CBD, COP 5, Decision V/6).

In fact, the EcAp further elaborates on and adds to standard ICZM and IWRM approaches the application of

appropriate scientific methodologies, focusing on levels of biological organization that encompass the essential processes, functions and interactions among organisms and their environment. Furthermore, it recognizes that humans, with their cultural diversity, are an integral component of ecosystems.

The UNESCO MAB Approach

The Man and the Biosphere (MAB) approach for the management of Biosphere Reserves (BRs) was first established by UNESCO in 1971 and has evolved since then. It shares many perspectives, objectives and tools with the EcAp (UNESCO, 2000) and for sure has an intrinsic integrative nature.

The BR management focuses on a multi-stakeholder system involving local communities, scientists, national and local government authorities and, increasingly, other stakeholder groups such as representatives of the private sector (food and tourism industry, etc.). BRs aim at promoting ecosystem management by protecting genetic resources, species, land and water, in combination with their sustainable use. Taking into account that each sector of society views ecosystems in terms of its own economic and societal needs, BRs seek to foster economic development compatible with conservation. They also "develop a continuum of scientific and educational activity to underpin sustainable resource management".

The MAB programme has developed a zoning system of "differentiated intensity" of management which is now widely used not only in BRs but also in many other types of designated areas where the needs and aspirations of the local population have to be considered. Ideally, each BR should contain three zones that have to be implemented in sites specific patterns to meet local needs and geographic conditions (Fig. 1). First, there must be one or more core areas where management is aimed exclusively at nature protection / biodiversity conservation. Originally, these were securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems and undertaking non-destructive research and other low-impact uses. Next to them are clearly identified buffer zones, which usually surround or adjoin the core areas, and can be used for cooperative activities compatible with sound ecological practices. Last, there is a flexible transition area, which may contain a variety of agricultural activities, settlements and other uses, in which local communities, management agencies, scientists, NGOs, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area's resources.

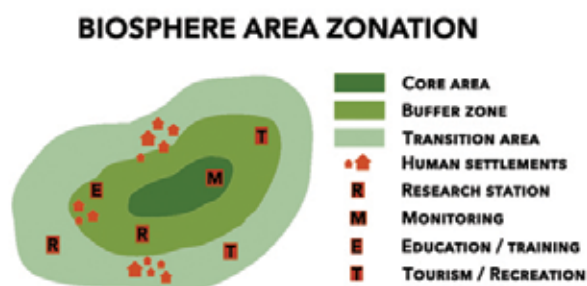


Figure 1. Typical biosphere reserve zonation.

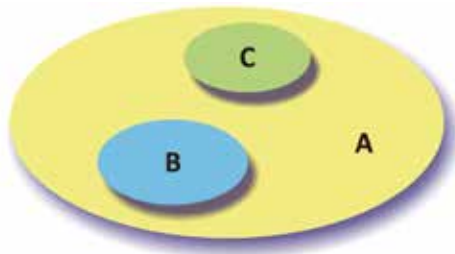


Figure 2. The concept of differentiated intensity of management: in $C >> B > A$

The whole concept of zoning in BRs integrates a dimension of flexibility and can be used creatively in order to facilitate the “mosaic” integration of specially designated areas into the wider bioregional landscape (Scoullos et al., 2013). The BRs zoning principle also leads to a differentiated intensity of management which can also be expanded to accommodate different biodiversity densities, geographical conditions, sociocultural settings, available legal protection measures (e.g. areas already characterized under Natura 2000, national parks, etc.) and local constraints and opportunities for development. Obviously, Core zones boarding to buffer and transition zones are expected to have differentiated management (fig. 2).

Countries apply this zonation scheme in different ways to accommodate their geographical conditions, sociocultural settings, available legal protection measures and local constraints:

- The core and buffer areas correspond usually to existing or newly established protected areas such as a nature reserve, national or regional parks: this implies that their management is based on the integration of existing legal provisions limiting human access to research and monitoring purposes.
- The transition areas usually involve municipalities surrounding the core and buffer zones, and their management is usually based on existing national/regional/local land use plans and territorial development policies, adequately supported by funding instruments.

The proper multi-sectoral governance of similar integrative systems requires the participation of all relevant stakeholders, from protected areas managers to regional and municipal authorities, as well as representatives of the civil society and economic interests. Their active participation in the coordination platform Biosphere Reserves are expected to facilitate and support, will allow for a better integration of their respective plans and actions and, in turn, represents a unique opportunity to concretize on the ground a more coherent and effective integration of policies in the view of achieving sustainable development.

How could all this apply to Samothraki island?

SD planning and management of an island such as Samothraki need to address major challenges inherent in the complex systems involved in the entire river flow and catchment area and at the land-freshwater-sea

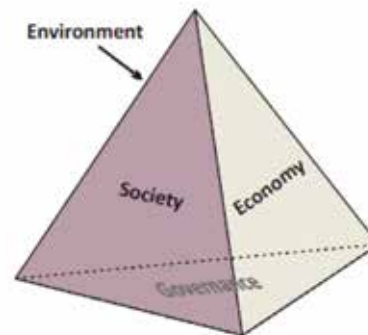


Figure 3. The tetrahedron, the new structure for sustainable development (Scoullos).

interface where integration of biogeochemical with socioeconomic factors is both essential and difficult. In SD planning and management all three aspects (economy, environment, society) are combined (fig. 3) to ensure that the development of an area like Samothraki is such that it fulfils the present needs and aspirations of its society without inhibiting future generations to obtain similar benefits from its natural and cultural resources, considering both the carrying capacity of the local systems involved and the ecological footprint of other regions on it and its input to other areas but also into the future. In the 1990s and 2000s, after Rio, a number of SD management plans were elaborated at the local level under “Local Agendas 21” with different degrees of ambition and success. Since the adoption of the 17 Sustainable Development Goals (SDGs) in 2015 a set of related tasks should also be taken into account.

To obtain sustainable development three groups of tools should be employed in the management plan as part of good governance, including:

- Institutions in their widest sense: international, regional, national, local and all legal and regulatory instruments (laws, etc.), as well as the enforcement mechanisms (administrations, monitoring, policing, justice, etc.).
- Scientific and technological tools, methods, infrastructures and constant inputs of innovation that allow the technical expansion of the carrying capacity of our systems and facilitation of the natural mechanisms to cope with anthropogenic pressures (e.g. sewage treatment, composting and recycling plants).
- A wide range of information/education, consultation and participation processes that deal with cultural-behavioural changes of individuals, groups and the society at large.

Introducing the tools, to the above scheme, we obtain a visualization of the directions to be followed by the management plan (fig4).

The management plan according to the IMF process in 5 steps

In order to achieve integration, a comprehensive planning process is suggested, to guide the step-by-step preparation of the plan. The guidelines that follow (fig. 5) are structured into sections representing the stages of a planning process within which the ingredients and principles of MAB/ UNESCO, ICZM, IWRM, coastal aquifer and groundwater management, the EcAp have been integrated.

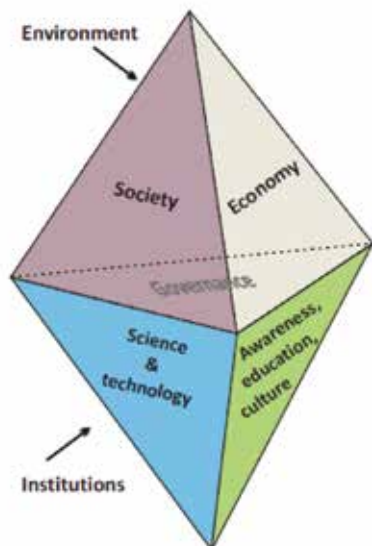


Figure 4. Sustainable development and tools to achieve it.

The “Establishment” includes the plan preparation and implementation process, namely: 1. Defining the initial territorial scope by identifying the boundaries of the specific plan area and the ecosystems involved; 2. Scoping of the major river basin issues; 3. Defining the governance context; 4. Engaging stakeholders and preparing communication strategy; 5. Proposing a potential vision for the plan area; 6. Deciding on strategic environmental assessment (SEA).

Then the second step of the “Analysis and Futures” includes: 1. Building the evidence: closer analysis of key issues where needed and undertaking the DPSIR policy cycle; 2. Identifying futures: building alternative scenarios and, if conditions allow, testing (including pilot actions and identifying potential future funding sources).

The third step of “Setting the Vision” asks for: 1. Building consensus reaching agreement among stakeholders and the wider community on the key problems, issues and priorities for the plan area; 2. Preparing the vision statement (setting the direction) i.e. observing the priorities and the consistency of the objectives of the plan; 3. Measuring success: selecting the necessary set of (at least preliminary “core”) indicators to measure the success of both the planning process and its outcomes.

The fourth step is about “Designing the Future/ Plan”: 1. Formulating the Management Plan and pilot actions that may constitute the basis of a workplan, simultaneously observing the planning process and programme formulation; 2. Establishing the inter-sectoral management/governance, facilitation and consultation structures for the long-term, post-plan period; 3. Embedding-obtaining formal approvals for funding/institutional support and legal adoption.

And going into practice with the fifth step of “Realizing the Vision” including: 1. To implement and coordinate legal, economic and spatial instruments & management processes/mechanisms; 2. To raise public awareness and enhance partnerships; 3. To secure financing & investment; 4. To monitor & review the implementation of



Figure 5. The five steps of a management plan according to the IMF process

the Plan providing constant feedback into the review of the plan and programme.

The methodological outlines for the management plan as described above have been presented to local authorities who have expressed their willingness to move fast and in a systematic way to the establishment of the BR of Samothraki and, further on, to work hard for the implementation of its management. A second step of analysis could quite easily be completed by combining all the available knowledge in order to address the existing gaps, and during the 2016 Summer University, we have also worked at various levels towards setting the common vision. Next steps should now include the careful design of the measures to be undertaken and their gradual implementation for the protection and sustainable development of this unique Island. The designation of the area as a BR will undoubtedly further contribute to the safeguarding of its unique characteristics and help the local community to address with more hope and pride their sustainable future.

References

UNEP/MAP-PAP/RAC, GWP-Med and UNESCO IHP (2015). An integrative Methodological Framework (IMF) for coastal, river basin and aquifer management. M Scoullas (ed.), Strategic Partnership for the Mediterranean Sea Large Ecosystems (MedPartnership), Split, Croatia www.pap-thecoastcentre.org/pdfs/IMF%20Guidelines.pdf

Convention on Biological Diversity, COP 5 Decision V/6 www.cbd.int/decision/cop/?id=7148

UNESCO, 2000 Solving the Puzzle: The Ecosystem Approach and Biosphere Reserves <http://unesdoc.unesco.org/images/0011/001197/119790eb.pdf>

Scoullas M., Kouroutos V., Mantzara B., Alampegi I., Malotidi V., Psallidas V., (2013). Education for Sustainable Development in Biosphere Reserves and other Designated Areas. A Resource Book for Educators in South-Eastern Europe and the Mediterranean. UNESCO & MIO-ECSDE, 2013

The uniqueness of Samothraki Island's environment



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Introduction

Samothraki, a small island (178 km²) with a steep relief (15°-30°) reaching 1,611 m (the highest mountain in the Aegean, after the much larger islands of Crete and Evoia), is a mountain emerging in the northeastern Aegean Sea. The island hosts impressive geomorphic structures, pristine vegetation with massive oak and plane forests, abundance of fresh water in the form of springs, temporary and perennial streams with waterfalls which plunge into deep glassy pools, thermal waters, small coastal wetlands and lagoons, rocky beaches and crystal clear sea. With a low population density (15 persons/km²), and its main economic activities being livestock breeding, fishing and tourism, Samothraki is relatively undisturbed by the modern world and remains one of the last truly virgin islands in the Mediterranean. Thus, the main portion of this unique island with unspoiled beauty and deep history is part of the NATURA 2000 Network and is a UNESCO Man & Biosphere Reserve candidate.

Geological evolution drives geomorphic features

The island is marked by dynamic geological, tectonic and geomorphological features. About 155 Ma BP an 'ophiolitic complex' (which cover today 31% of the island's



Photos 1 and 2. The upstream area of Fonias River.

surface area) intruded the Jurassic – Upper Cretaceous basement. A more recent intrusion, a granite one (that covers today 26% of the island), occurred in the Miocene (ca. 18 Ma BP). The granite intrusion initiated the uplift of the island which is still continuing (Vouvalidis et al., 2005; Syridis et al., 2005). Tectonic uplift movements created a rough relief with steep slopes (ranging between 15° and 30°). Particularly at the southeastern part of the island, the Island's and underwater relief becomes very steep as approaching towards the North Aegean Graben where depths reach 1600 m (Pavlidis et al., 2005). Furthermore, uplift movements formed a radial hydrographic network with V-shaped valleys and stream terraces and cause high denudation rates and linear, deep erosion (Vouvalidis et al., 2005).

Anthropogenic pressures enhance natural erosion

Erosion is enhanced by deforestation from woodcutting, wild fires, and overgrazing by excessive numbers of free grazing goats. Hence, despite the existence of impressive terrestrial and riparian (e.g. Photos 1 and 2) forests, there are several extensive highland areas with sparse or nearly no vegetation (bare soil and rock), and these bare areas dominate the mountain peaks (Photo 3 and 4) and the drier eroded valleys of the southwest.





Photos 3 and 4. Bare mountain peaks due to natural erosion, woodcutting, wild fires, and overgrazing.

Surface waters

The island is rich in springs and streams. Springs are fed by low potential aquifers that are developed within faults or weathering zones in magmatic or volcanic



Photo 5. Spring formed within granite weathering zone.

rocks and in quaternary sediments (Vergis, 1984). Snowmelt, precipitation, and spring water inputs create perennial or temporary streams. They present substantial flow considering the dimension of the island and the prevalence of highly impermeable rock formations. Rivers and streams form impressive waterfalls, commonly followed by small plateaus with long pooling waters (locally known as “vathres” = deep pools), and flowing rather abruptly to the sea. In several lowland areas wetland habitats are also formed (Skoulikidis et al., 2014).

Surface water quality

As a result of weathering resistant bedrock and high flowing velocity, stream waters present low mineralization marked by high marine aerosol and precipitation inputs. Spring waters also present low solute concentrations due to low residence times of subsurface water. Spring and upland stream waters are excellent potable water sources.

Considering dissolved oxygen and nutrient concentrations, the majority of Samothraki streams present a good to high chemical-physicochemical quality. An exception make two streams (Katsambas and Lakoma) that receive untreated domestic wastewaters and show a moderate to poor quality. Despite the absence of significant pressures, Samothraki streams present relative high levels of N-compounds, compared to other undisturbed areas in Greece. Even “pristine” mountainous streams and springs reveal relatively high nitrate and ammonium (Fig. 1) and relatively low oxygen concentrations. This may be attributed to a combination of leaf litter decay within interfering pools, goat excrements and/or precipitation inputs that are laden with significant nutrient concentrations. Further research is needed to clarify this unusual situation.

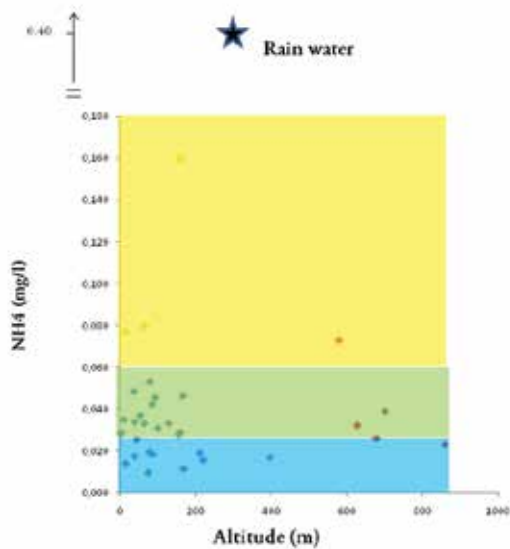


Figure 1. Ammonium levels in streams, related to altitude, and in rainwater. Colours present quality classes according to Skoulikidis et al. (2006), where blue = high, green = good and yellow = moderate quality.

Considering aquatic macroinvertebrates, the good biological quality prevails, except of the two aforementioned streams that present moderate to poor quality. However, as in the case of N-compounds, the biological quality is less than expected, possibly due to high stream velocity with cascades and waterfalls and the poor habitat due to the prevalence of bedrock and boulders within riverbeds. Thus, island specific reference conditions and EQRs to better classify nutrients and macroinvertebrate assemblages are under development.

Water and waste management

Despite the richness in water resources, the island suffers from poor management leading to shortages in irrigation and potable water during the summer period. In addition, untreated domestic wastewaters enter directly the stream ecosystems and deteriorate their quality. There is a lack in data regarding the available quantities of both surface runoff and groundwater aquifers. There is also insufficient information on water demand and consumption. Thus, a water resources and waste management plan is needed to be elaborated and applied.

References

- Pavlidis, S., Valkaniotis, S., Kurcel, A., Papathanasiou, Y., Xatzipetrou, A. "Neotectonic structure of Samothraki Island in relation to the North Anatolia fault." *Bulletin of the Greek Geological Society* 37 (2005): 19-28.
- Skoulikidis N., Amaxidis, Y., Bertahas I., Laschou, S., Gritzalis, K. "Analysis of factors driving stream water composition and synthesis of management tools – A case study on small/medium Greek catchments." *The Science of the Total Environment* 362 (2006): 205-241.
- Skoulikidis, N., Lampou, A., Karaouzas, I., Gritzalis, K., Lazaridou, M., Zogaris, S. "Stream ecological assessment on an Aegean island: insights from an exploratory application on Samothraki (Greece)." *Fresenius Environmental Bulletin* 23(5) (2014): 1173-1182.
- Syridis, G., Tsourlos, P., Vouvalidis, K., Albanakis, K. "Holocene stratigraphy and morphological evolution of the western low part of the Samothraki island." *Bulletin of the Greek Geological Society* 37 (2005): 38-50.
- Vergis, S. "Hydrogeological research of Samothraki Island", Technical Report, Inst. of Geol. & Mineral. Research, Xanthi (1984) 13 pp. (in Greek)
- Vouvalidis, K., Syridis, G., Albanakis, K. "Geomorphological surveys on Samothraki Island. The evolution of the hydrographic network." *Bulletin of the Greek Geological Society* 37 (2005): 29-37.

Education for Sustainable Development: an important tool to improve the management of a Biosphere Reserve



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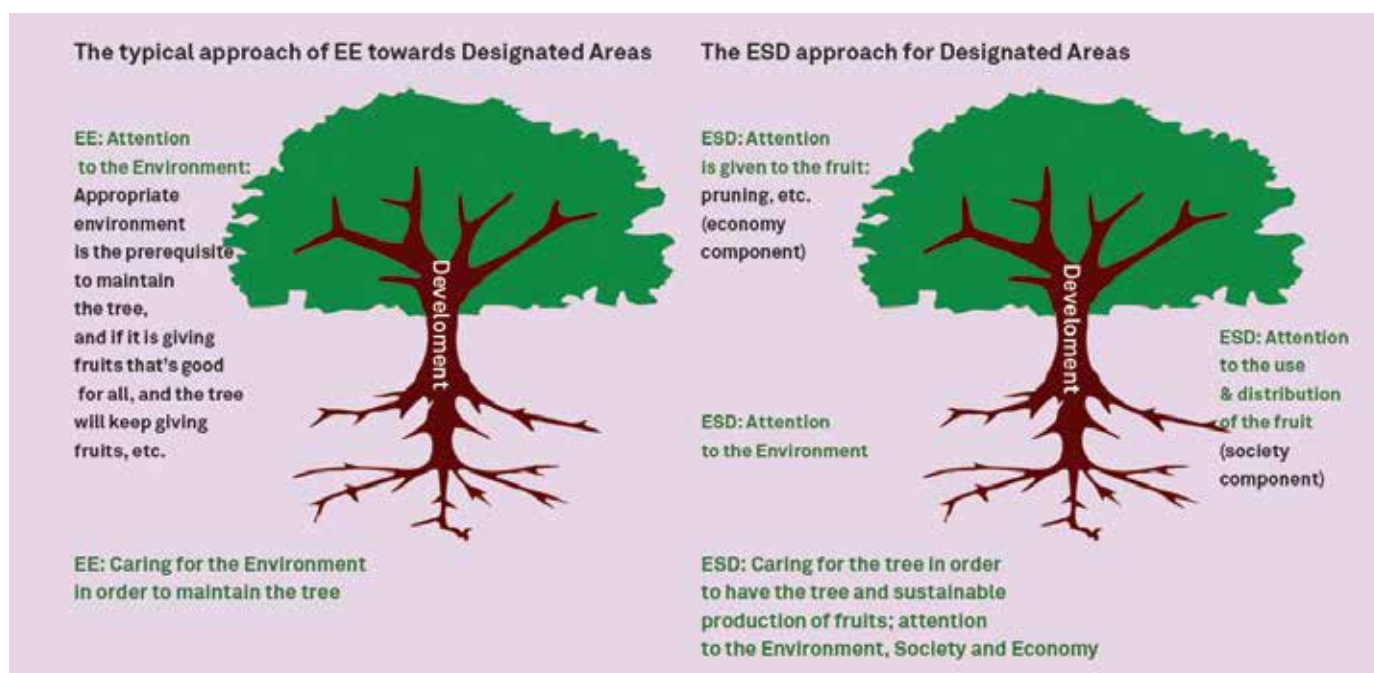
When a site is selected and proposed to become a Biosphere Reserve (BR), a management scheme is proposed and a management plan is designed. It is extremely important to include in all stages of planning and implementation the appropriate educational activities addressing formal, non-formal and informal educational interventions.

We have elaborated in detail the theoretical background of Education for Sustainable Development (ESD) in Biosphere Reserves or other Designated Areas in a book co-produced by UNESCO Venice Office, MIO-ECSDE and the relevant UNESCO Chair of the University of Athens (Scoullos et al., 2013).

What is important to cite from this book is the message that since BRs are not only for the protection of the environment and biodiversity but also for the development of human activities in 'symbiosis' with the natural environment, the original Environmental Education (EE) approach that was common in such areas,

needs to be shifted to ESD, where the socio-economic and cultural aspects are equally well developed and addressed as are the ecological / environmental ones. In an earlier publication we have attempted to provide a visualization of the transformation (see diagram).

In view of the establishment of a new BR, such as the one of Samothraki, it is fundamental to introduce among the key preparatory actions, from the first stages of drafting of the management plan, provisions for systematic, non-formal and informal education and awareness raising campaigns for the inhabitants and tourists. Such campaigns should focus not only on the obvious important, natural / environmental characteristics of the area, but also on the needs and the opportunities for educational programmes, green employment, and options connected with the human and economic development of the area, its history and cultural identity. Such educational approaches will enhance the ownership of the local community for a BR in the area, and, will mobilize support. Furthermore, all the initiatives should



support the stabilization, and if possible the increase of the local population.

In an earlier issue of 'Sustainable Mediterranean' (No 68-69), we have elaborated more on how ESD and the management of a BR could become mutually supportive and how "bridges" need to be created in order to expand and enhance 'communication' and foster better understanding, not only among inhabitants but also between the various communities of educators and managers of specially designated areas followed by "joint and complementary action". Such intersectoral and interdisciplinary understanding, though necessary, is not always evident and present at the appropriate relevant levels. Therefore, particular efforts are needed to bring together in a smooth and productive way, the competent stakeholders especially at sub-national and local level.

The type of interventions when an area is well established as a BR might be different from those at the establishment stages. Since ESD integrates the principles of 'quality education' and Education For All (EFA) and introduces the aspirations, objectives and methodologies for the promotion of Sustainable Development through learning, it may become the key educational approach for the schools of the BR, which should aim to fully endorse and implement the Whole Institute Approach (WIA) transforming their schools in exemplary laboratories of creativity and inspiration for their students, their parents and the overall local community.

On the other hand, BRs, Natura 2000 sites and other types of designated areas, have a status that allows them to be managed in a comprehensive, monitored way, and at the same time receive considerable numbers of visitors, individuals and organized groups, (among which schools from other areas), who are psychologically prepared to learn directly and indirectly, while simultaneously enjoying the natural, cultural, tangible and intangible values of these areas.

In this way, the educational contribution of a BR goes far beyond the borders of the site and the time of the visit. What is also important to be developed in a newly established BR is the national and international cooperation and networking around ESD and management, with other BRs and compatible areas. Such collaborations could also generate additional resources for the school and the BR from international organisations, the EU and various types of stakeholders (NGOs, enterprises, etc). The exchange of experiences by people of different, but not entirely uncommon

backgrounds, could lead to stimulation of international collaborations, enhancement of the educational caliber of projects and studies, the implementation of piloting innovative methodologies, the transfer of expertise and technologies and amelioration of legal, institutional and operational frameworks for the better management of BRs.

It should be clear that at the local level, site and time specific problems within narrowly defined socio-political, economic and cultural conditions, which may or may not be transferable elsewhere as such, could be addressed by the educators of the area in question in close cooperation with the local authorities and other competent stakeholders such as NGOs, professional unions and economic sectors (tourism, industry), etc.

Improved communication of these issues could undoubtedly contribute to inspire, compare and understand activities in other schools of the country and beyond and stimulate the generation of new proposals and projects. This is why the development of supportive strategies and policies, the networking of BRs in cooperation with local public authorities and the experiences on utilization of specially designated areas as laboratories for social participation and cooperation on ESD, are given particular emphasis in international fora and documents. This is also reflected in the Mediterranean Strategy on ESD (MSESD) and its Action Plan (recently adopted in Nicosia, Dec 2016, www.esdmedcyprus.pi.ac.cy)

In conclusion, there is a need for educators, academics and local authority managers as well as for national administrations, to utilize in a more systematic, comprehensive and synergetic way BRs and other types of designated areas in the application of ESD. BR could help in making ESD more interesting and meaningful with "hands on" work on the ground for learners of all ages and backgrounds. By doing so, the efficiency of management and the valuable ownership by the local and in some cases national or international society are enhanced.

References

MIO-ECSDE (2012), Sustainable Mediterranean, Issue No 68-69, "Biodiversity Management and Education for Sustainable Development in protected areas"

Scoullou M., Kouroutos V., Mantzara B., Alamepi I., Malotidi V., Psallidas V., (2013). Education for Sustainable Development in Biosphere Reserves and other Designated Areas. A Resource Book for Educators in South-Eastern Europe and the Mediterranean. UNESCO & MIO-ECSDE, 2013



One of the thousands of goats grazing freely: Livestock is a primal income for the locals, however overgrazing has created a number of problems on the island in the last decades. © V. Psallidas.



FINDINGS FROM SUMMER UNIVERSITY COURSE WORK
& WORKSHOP COORDINATORS

Course A

"Aquatic & Social Ecology: Theory and Practice"

The current livestock situation on Samothraki: An attempt of analysing pressures and developments

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Introduction

Located in the north Aegean Sea, Samothraki island is a Biosphere Reserve candidate of its own kind. Dominated by the Fengari Mountain rising 1662m above sea level, this small island shows unique ecotone features – with the mountain and riparian forests being particularly remarkable.

Over the past decades, however, there has been an apparent change in forest rejuvenation and indications of land cover change. Unmonitored and uncontrolled livestock grazing is probably an important driver of degradation – particularly in the remote parts of the island, which are denominated as Natura 2000 reserves (covering approximately 80% of the island terrestrial surface).



Photo 1. A traffic sign warning about crossing goats.

This study is to (1) show current livestock pressure and developments and (2) present a possibility to trigger and support local initiative in developing a sustainable management plan that will allow the island to successfully embark upon the trajectory towards a well-managed UNESCO Biosphere Reserve.

During the Summer School 2016 we made an exercise on calculating the current number of livestock on the island by using the method of distance sampling. Furthermore, an interview with the town official of the slaughterhouse gave us more insights on the meat production patterns of Samothraki. Besides this attempt to analyse the current livestock pressure and development, camera traps were used as a tool to raise awareness amongst citizens by being an incentive to observe the environment and providing pictures of the wildlife of Samothraki to the local community.

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Distance Sampling - an attempt of a livestock census

As a part of the Summer University our research team used Distance Sampling as a method to conduct a livestock census for the island. Making use of a map, seven random line transects were selected in advance. After arriving at each site, the team walked the sampling line of approximately 1 kilometre in a diamond formation of five people. This formation makes sure that every animal of interest (goats, sheep and horses), which is visible in the landscape, can be counted. We were equipped with 3 binoculars, 1 distance metre, and a smartphone with the GPS application Locus Pro. Different tasks were assigned amongst the members of the team. Three people in the front were responsible for spotting the animals, while the two remaining team members had to measure the distance to a sighted animal, keep records of the transect and note down animal number, angle to the object and place of sighting by using the GPS application.



Photo 2. Walking a line transect.

In a total of 7 transects we documented 28 observations of goats, 4 of sheep and one horse. The size of the animal groups varied between 1 and 62 individuals. The total amount of sighted animals of interest was 298. The walking speed for each transect was about 2.5 +/- 1 km/h.

The data sampled, was used to construct a population density model, using an appropriate computer software (Distance 6.3). The regression provides an estimate of the number of animals in the specified area of 14,454 goats, whereas the 95% confidence interval has a huge range from [6,683;31,265]. Due to this wide interval, the data cannot be used for a proper analysis.

Our approach was limited (1) because of time constraints, we conducted 7 transects in two days, which is not a representative sample over the entire study area; (2) we faced the risk of double counting due to large groups of moving animals; (3) one transect was in a steep area with fences and we had to stop without concluding the

transect; (4) the detection rate was influenced by the terrain type.

For a reliable monitoring exercise, more time and human resources would be required to provide representative results. This has to be considered in future studies. A proper livestock census can give insights on the current pressures put on ecosystems due to the grazing of (mainly) goats roaming free in the denominated Natura 2000 area.

Interview

In the course of the Summer University we conducted an interview with a town official to get deeper insights about the livestock situation on Samothraki. The interviewee has a widespread knowledge about the current meat production patterns due to his work at the local slaughterhouse.

The following claims were made: Approximately 60,000 animals (sheep and goats) are grazing all over the island. About 10,000 animals are slaughtered annually to supply locals and tourists; 60% of them within eight days around Easter. Up to 1,500 animals can be processed per day by 15 workers; that is the maximum capacity of the slaughterhouse. Animals are slaughtered or sold up to an age of 3-3,5 months. A large number of livestock is sold alive to a stakeholder from Athens, visiting the island once or twice a year to buy goats and sheep for a fixed price, which is not negotiable for local sellers. There is only one purchaser (in some years two). Goats without earmarks, grazing on common land, are private property. Local farmers "just do not care" and leave their animals unmarked, although they know exactly which individual belongs to whom.

The interview allows an interpretation of the current livestock situation on Samothraki, an island with limited technological means, traditional animal farming and a lack of law enforcement. Slaughtering takes place only for local use, whereas the sale of living animals is an important income source for locals. The fact that there is a monopolistic purchaser of living animals combined with the absence of facilities to freeze meat for later supply leads to a weak market position of local farmers. To improve the individual economic situation, locals may use strategies like grazing on common land. To avoid legal consequences, the animals are left unmarked. Saving costs for fodder can be one of the main incentives for this development.

Camera Trapping as a Citizen Science Project

Besides other things, camera traps are used to detect wild animals in tropical forests. On Samothraki they can be used as a tool to raise awareness for sustainable issues amongst members of the local community.

During the Summer School we learned how to install camera traps, using the model Nushnell Trophycam. The camera sensor reacts to movement and temperature, so

that pictures are taken whenever something/somebody moves in front. We checked the settings and set the time and date to ensure the auditability. Attention should be given while fixing the equipment to ensure a right angle and appropriate – target related – height. One of the camera traps was fixed on a tree for 3 days. Beside pictures of sheep we detected a farmer taking branches from a tree to feed his animals.

As a citizen science project, camera traps were handed out to local people. Two young scholars, hunters, hikers and town hall employees got camera traps and therefore now have the possibility to observe their environment with the eyes of a scientific researcher. The aim of the project is to give local community members a tool to discover their island. Yet, we do not know which observations they may make but it would be a desirable outcome to see them exploring the landscape, detecting animals (maybe lots of goats) and to give an incentive to observe and document ongoing changes and developments.



Photo 3. A goat climbing a car.

General Conclusions

Our attempt to use three different approaches to consider the livestock situation on Samothraki gave us a lot of insights on the current situation. The hypothesis of occurring soil erosion due to overgrazing on common land (including Natura 2000 area) can be supported by our experiences although the results lack in significance due to time and resource limitations.

A proper livestock census combined with an analysis of land cover changes over time could help to reveal the relation between overgrazing and the increasing degradation. In connection with a deeper understanding of strategies chosen by locals to maintain their living, this can enable a development towards a sustainable Samothraki. A key factor for the success of this process is the initiative taken by local inhabitants. Distributing camera traps to locals is an attempt to trigger and support local initiative due to the created possibility of exploring their own environment and sharing their experiences.

Ground cover and overgrazing on the Greek Island of Samothraki

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Keywords: Grazing management, overgrazing, Soil Erosion, Sustainable Samothraki

Introduction

Grasslands are an important natural resource and grazing is an essential risk management strategy that contributes substantially to people's livelihoods in many parts of the world by providing food and income (FAO 2012, Herrero et al. 2013). In Greece and the Mediterranean basin, livestock grazing is a traditional form of land-use (Papanastasis 1998) and the present ecosystem historically evolved to its current state under high grazing pressures over thousands of years (Perevolotsky and Seligman 1998; Noy-Meir and Seligman 1979). This is also true for Samothraki, where grazing by small ruminants was and still is the major type of land-use. Grazing provides an essential source of income for up to two third of the Samothrakian people. Yet today, soil degradation is a reportedly widespread phenomenon and can be observed in many places on the island (Fischer-Kowalski et al. 2011, Biel and Tan 2013, Fuchs 2014) and across Greece and the Mediterranean world (Hill et al. 1998; Lorent et al. 2008; Kizos et al. 2013). Soil erosion through overgrazing is a particular problem in mountainous regions (Zervas 1998) like Samothraki, where steep slopes make soils highly vulnerable to water and wind erosion and overgrazing can result in a declining productivity.

Protecting the available land resources from degradation is an essential precondition to achieve a sustainable development path in the future. Yet, knowledge about the actual extent and severity of the problem is still scarce and calls for an integrated approach to assess and improve the status of current grasslands by focusing on the implementation of proper management by farmers. To narrow the current knowledge gap, we introduced a Step-Point Intercept method for assessing ground cover (Evans and Love 1957) to students and interested locals on 12 selected sites on the island. Additionally, we documented and assessed visible signs of soil erosion across the island. Ground cover is an important indicator for assessing the health of plant communities (Hill et al. 1998) because it is linked to degradation and soil erosion (FAO 2002). This easy to apply and cheap method could encourage farmers to act as citizen scientists, monitoring their land and support informed decisions about the applied management method. We discuss potential factors, drivers and pitfalls and highlight the severity of soil erosion on some hotspots on the island and aim to underpin the urgency for the implementation of proper management measures.

Methods

We apply a Step-Point Intercept method broadly following the theoretical considerations introduced by Evans and Love in 1957. This is an easy, rapid and straightforward method for assessing ground cover (Evans and Love 1957; Elzinga et al. 1998; MLA 2014) based on a point as sampling unit. The method is best suited for grasses, forbs and shrubs (BLM 1999) and is considered the most objective and least biased because it does not involve mere visual interpretations (Bonham 1989; Elzinga et al. 1998). In general, it is recommended to sample between 300 and 500 sampling points per site in homogeneous vegetation types to provide a representative sample (Muir and McClaran 1997). Tool requirements amount to a simple measuring tape, pen and paper, a clipboard and a GPS enabled camera or separate GPS tool. The sites were chosen randomly based on the type of land cover (e.g., grasslands or meadows), the homogeneity of the present vegetation type and their current land-use (e.g., grazed sites). We applied approximately 12 parallel transects each 30 meters in length (Wilson 2011) and collected sampling points along each transect. The first transect is placed randomly (BLM 1999; US-Bureau of Land Management 1999) on the site after visual interpretation. Following transects were conducted every five meters parallel to the first one until the desired number of points was reached. The position and the direction of every starting point was recorded with GPS. Ground cover was documented at each step along the transect at the tip of the examiners boot. The ground cover of a site is determined by dividing the number of cover hits from all transects with the total number of observation points. Additionally, visible signs of soil erosion or overgrazing like water flow patterns, sheet erosion, gully erosion or weed invasion and signs of land abandonment like bush encroachment were documented with a GPS Camera.

Results and Discussion

The results of our field-work allow us to gain essential insights about the impacts of grazing on the island. The ground cover measurements (see Table 1 and Figure 1) at selected sites confirm the hypothesis of the rather devastating condition. Low ground cover is widespread and regularly accompanied by visible signs of soil erosion (Figure 1) like erosion gullies, because low cover leaves the soil unprotected from wind and weather. The spatial analysis of our results reveals that highest ground-cover values are maintained in the eastern part of the island (e.g., sites 10, 7, 2 see Table 1), where the bulk of the population lives (e.g., around Kamoriotissa), cropland is the most dominant land-cover and slopes are gentle. Fields in this part of the island seem to be well-managed. Low to very low values dominate the picture in hilly areas in the south (e.g., Profitis Ilias) and along the northern shore of the island (e.g., sites 1,8,9; see Table 1 and Figure

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1), where precipitation is higher due to a sharp north-south gradient. On site 11 and 12 a seeding experiment was undertaken by a Portuguese University (Teixeira et al. 2015) in cooperation with local farmers. While site 12 shows relatively good cover values, the low value obtained at site 11 is the result of problems during the establishment of the seeding experiment.

The visual interpretation of erosion hotspots (Figure 1) reveals, that these are mostly located in the heavily grazed sites along the north shore and in the hilly areas of the south (e.g., around Profitis Ilias) where ground-cover is low. On many heavily grazed and less steep sites along the northern shore of the island, the widespread occurrence of soil erosion is likely the consequence of inadequate pasture management during the past years/decades. Yet, caution must be taken because the mountainous character of the island makes it sometimes difficult to distinguish between natural and human induced degradation features, in particular where slopes are steep. Yet, an accumulation of heavily eroded sites around the breeder's village "Profitis Ilias" (see site 11; Figure 1) is likely due to human activity, in particular the construction of roads on relatively steep slopes, which is a good contact point for the establishment of gullies.

Table 1. Ground cover measurement results of 12 sites (see also Figure 1).

Site number	Number of Transects	Number of Steps	Ground Cover in %
1	12	494	33%
2	12	487	68%
3	12	504	51%
4	12	481	71%
5	12	492	59%
6	12	527	53%
7	12	480	74%
8	12	489	49%
9	12	451	37%
10	11	366	93%
11	12	500	26%
12	10	492	69%

The degradation of ecosystems on the island is dominated by two distinct processes, overgrazing and the abandonment of management practices (Kizos et al. 2013), both resulting in a declining grazing capacity. First, widespread overgrazing causes the overall productivity and hence grazing capacity to decline and a reduced ground cover on many sites triggered widespread soil erosion (Figure 1). In some places in the south-western part of the island we observed early signs of overgrazing manifested in the invasion of weeds (e.g., unpalatable plants; see Figure 1). Similarly, fields of bracken fern are widespread in particular on the humid northern slopes where grazing goats prevented the recovery of natural forests by feeding on seedlings (Biel and Tan 2014). Second, the abandonment of management practices has triggered successional growth of the natural vegetation in some parts of the island. This results in a dominance of woody or thorny plants (called shrub encroachment; see Figure 1),

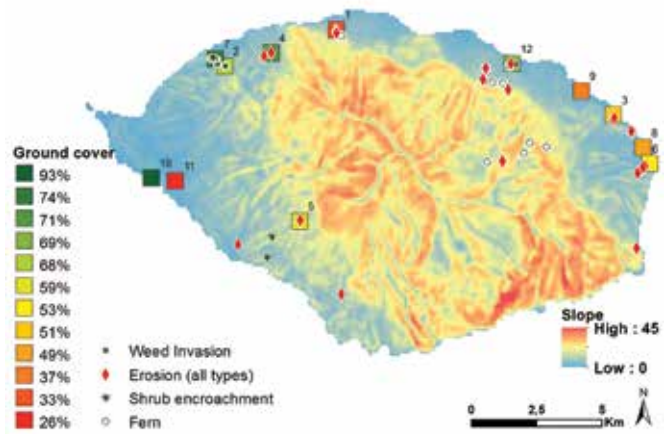


Figure 1. Overview on the results of the ground-cover measurements (ground cover in %), observed erosion features (erosion gullies, sheet erosion) and signs of changes in management (e.g. bush encroachment, weed invasion, fern establishment). Please note that this map does not represent a comprehensive assessment but rather shows the hotspots we visited during our 3-day's field-work.

reduces the fraction of palatable plant species and hence grazing capacity. On most sites with shrub encroachment, we identified *Sarcopoterium spinosum*, a classical phrygana (a Mediterranean dwarf shrub community; Seligman & Henkin 2002) as the dominant species in this process.

Overgrazing, abandonment of management practices and accelerated soil erosion likely emerged alongside the dramatic growth in animal numbers (almost twofold to approximately 46.000 in 2012; Fuchs 2014) since Greece joined the European Union in the early 1980s. Independent estimates even suggest that actual animal numbers were much higher in 2012, up to 70.000 (Fuchs 2014), which could be an explanation for the widespread signs of overgrazing. This has to be seen in the light of the complex interaction of socio-economic variables, like subsidies from the European Common Agricultural Policies (CAP), which were targeted on animal numbers (Lorent et al. 2009) up to approximately 2003, and the local socio-economic situation of farmers on a remote island. Increasing the number of animals certainly was an easy way to improve farm income in the past decades (Lorent et al. 2009; Kizos et al. 2013) but came at the cost of increasing grazing pressure and accelerated soil erosion.

Conclusion & perspectives

Heavy grazing and soil erosion through overgrazing is a widespread phenomenon on Samothraki and constitutes a serious threat to the achievement of a sustainable development path in the future. Our work revealed that overgrazing on the one hand and abandonment of management practices on the other hand occur on the island. The result is a declining grazing capacity due to a loss of top soil and accelerating bush encroachment. The latter could make it economically unattractive to put the land back into production due to high labour cost. Our results highlight the importance of proper management of the island's grassland resources, yet here it is the local community that should adapt to the situation and focus

Our work revealed that overgrazing on the one hand and abandonment of management practices on the other hand occur on the island. The result is a declining grazing capacity due to a loss of top soil and accelerating bush encroachment.

on the implementation of proper management methods. The cheap and easy to apply step-point method is a handsome tool and the monitoring process provides essential information to avoid further degradation. A combination of management of stocking density (e.g., grazing time or duration, fencing off areas, or weed management through burning; Kizos et al. 2013; Papanastasis 1976) and other methods to sustainably increase productivity (e.g., the experiments with grass-seeds adapted to climate and soil conditions, which already show promising results) could help to reducing soil erosion, increasing productivity and to sustain the island's valuable natural resources.

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References

- Biel, B. & Tan, K.I.T., 2014. The Flora of Samothraki, The Goulandris Natural History Museum, Kifissia – Greece.
- BLM, 1999. Sampling Vegetation Attributes. Available at: <http://www.blm.gov/nstc/library/pdf/samplveg.pdf>.
- Bonham, C.D., 2013. Measurements for Terrestrial Vegetation 2nd ed., Wiley-Blackwell.
- Elzinga, C.L., Salzer, D.W. & Willoughby, J.W., 1998. Measuring and monitoring Plant Populations. Bureau of Land Management Technical Reference,.
- Evans, R.A. & Love, M., 1957. The step point method of sampling: A practical tool in range research. *Journal of Range Management Archives*, 10(5).
- FAO, 2002. Excessive Grazing and Browsing. Available at: <http://www.fao.org/ag/againfo/programmes/-en/lead/toolbox/grazing/overgraz.htm>.
- FAO, 2012. Livestock sector development for poverty reduction: an economic and policy perspective. Livestock's many virtues. Food and Agricultural Organization of the United Nations.
- Fischer-Kowalski, M. et al., 2011. Transforming the Greek Island of Samothraki into a Man and Biosphere reserve: A feasibility study. *GAIA*, 20(3), pp.181–190.
- Fuchs, N.A., 2014. Effekte der EU-Agrarsubventionen auf das extensive Weidehaltungssystem der griechischen Insel Samothraki - sozialökologische Fallstudie im Hinblick auf umweltrelevante Veränderungen - Master Thesis. AAU Klagenfurt-Graz-Vienna.
- Herrero, M., et al. 2013. The roles of livestock in developing countries. *Animal*, doi: 10.1017/S1751731112001954.
- Hill, J. et al. 1998. Monitoring 20 years of increased grazing impact on the Greek island of Crete with earth observation satellites. *Journal of Arid Environments*, 39. 165–178.
- Kizos, T., Plieninger, T. & Schaich, H., 2013. "Instead of 40 Sheep there are 400": Traditional Grazing Practices and Landscape Change in Western Lesvos, Greece. *Landscape Research*, 38(4), pp.476–498.
- Lorent, H. et al., 2008. Land degradation and economic conditions of agricultural households in a marginal region of northern Greece. *Global and Planetary Change*, 64(3–4), pp.198–209.
- Lorent, H. et al., 2009. Livestock Subsidies and Rangeland Degradation in Central Crete. *Ecology and Society*, 14(2/41). Available at: <http://www.ecologyandsociety.org/vol14/iss2/art41/>.
- MLA, 2014. Assessing groundcover. Available at: www.mla.com.au/mbfp/Pasture-growth/Tool-22-Assessing-ground-cover.
- Muir, S. & McClaran, M.P., 1997. Step Point Method. Rangeland Inventory, Monitoring, and Evaluation. *Global Rangelands*. Available at: <http://globalrangelands.org/inventorymonitoring> [Accessed September 4, 2016].
- Papanastasis, P., 1976. Effects of Season and Frequency of Burning on a Phrygic Rangeland in Greece.
- Perevolotsky, A. & Seligman, N.G., 1998. Role of Grazing in Mediterranean Rangeland Ecosystem. Inversion of a paradigm. *BioScience*, 48(12), pp.1007–1017.
- Ruiz, F. et al., 2009. Dairy goat grazing systems in Mediterranean regions : A comparative analysis in Spain , France and Italy. *Small Ruminant Research*, 85, pp.42–49.
- Seligman, N.G. & Henkin, Z., 2002. Persistence in Sarcopoterium spinosum dwarf-shrub communities. *Plant Ecology*, 164, pp.95–107.
- Skapetas, B. et al., 2004. A study on the herbage mass production and quality for organic grazing sheep in a mountain pasture of northern Greece. *Livestock Production Science*, 87(2–3), pp.277–281.
- Teixeira, R.F.M. et al., 2015. A conceptual framework for the analysis of engineered biodiverse pastures. *Ecological Engineering*, 77, pp. 85-97.
- US-Bureau of Land Management, 1999. Sampling vegetation attributes,
- Wilson, B.J., 2011. Cover plus: ways of measuring plant canopies and the terms used for them. *Journal of Vegetation Science*, 22(2), pp.197–206.
- Zervas, G., 1998. Quantifying and optimizing grazing regimes in Greek mountain systems. *Journal of Applied Ecology*, 35, pp. 983-986.

Waste management on small islands: A case study from Samothraki, Greece

Preliminary Publication

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Introduction

It all began with waste. Members of the local civil society group “*Samothraki in Action*” were concerned about effects on human health as well as environmental degradation caused by the lack of sufficient waste management on Samothraki. Waste was then deposited in open dumps or incinerated without control. In 2007, the concerned citizens approached a long term visitor of the island, who happened to be an environmental scientist, and asked for her support in finding more sustainable solutions. After nine years of collaborative research and local initiatives the island community embarked on a transformative journey towards engaging in more sustainable practices, in which the open burning of waste admittedly came to an end. Yet, the management of waste still poses a major challenge.

The north-aegean island of Samothraki has an area of 178 km² and is inhabited by 2.840 people (census 2011) of which the majority is occupied in the primary and tourism sector. Due to Samothraki’s mountainous morphology (most of it included in the EU Natura 2000 network), the numerous water streams and the plethora of archaeological sites, it is not possible to establish a landfill site on the island that would comply with national environmental and cultural regulations and would also have sufficient distance from settlements. Consequently, the approximately 1.100 t of annually generated waste, including 8% recyclable waste, need to be shipped to landfills and recycling facilities on the mainland at high cost (Municipality of Samothraki 2015). Treating waste on site as much as possible would relieve the budget of the municipality but solid waste management on islands often faces various challenges. Financing options are often limited, since the local tax base is low, and the small market size and the relatively low amounts of waste are additional barriers for businesses to recycle profitably. Moreover, businesses on islands face higher costs (e.g. transport to and from the mainland), have to deal with seasonal fluctuations (e.g. tourism) and cannot compensate demand or supply shortfalls easily, which makes them less competitive (Skordilis 2003; Chen et al. 2004; Eckelman et al. 2014). Due to a lack of income opportunities, the local population has been declining since the 1960s and the persistent Greek financial crisis impedes both maintaining and investing in local infrastructure (Fischer-Kowalski et al. 2011; Petridis and

Fischer-Kowalski 2016). Like most insular and coastal areas, Samothraki is also receiving marine litter and is affected by coastal pollution. In addition, waste containers get frequently destroyed by strong winds, which further disperse waste across the island, into water streams or into the sea.

The aim of this study was to acquire a better understanding of the waste system on Samothraki in order to assist the municipality in implementing the new waste management plan (Municipality of Samothraki 2015), as a basis for steering the local economy towards resource circularity (Haas et al. 2016).

Methods

In July 2016, the authors conducted five expert interviews in order to obtain a thorough understanding of the local waste management system, and to identify legal and illegal waste disposal sites and practices. Persons interviewed included (1) the vice Mayor, (2) a senior employee of the municipality responsible of waste collection, (3) a member of the local initiative *Samothraki in Action*, (4) a member of the social cooperative *Zathay* that manages the café at the municipal camping site, and (5) an expert in the field of Industrial Ecology from Yale University, USA. Moreover, we visited the central municipal waste treatment facility of the island, as well as eight legal and illegal waste disposal sites, and documented their use via GPS and photos. On top, we surveyed five municipal waste bins using composition analysis (Gidarakos 2005), by measuring the share of organic, plastic, paper, metal, glass and other waste in bins for mixed and recyclable waste. Finally, five shops were investigated to assess if there is a deposit system for glass bottles in place on the island and to which extent it is used by the local and visitor population.

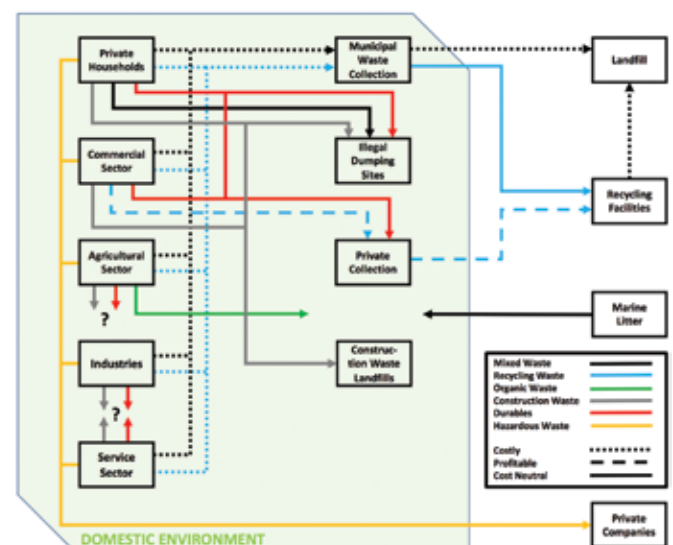


Figure 1. Qualitative waste flow chart of Samothraki.

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Findings

Figure 1 shows a first effort in producing a qualitative waste flow map for Samothraki. We identify five main sectors producing waste: household, commercial, agricultural, industrial and service. The municipality provides blue bins (blue dotted lines) for recycling (glass, metals, plastic, paper) and green and/or black bins (black dotted lines) for mixed waste. The composition analysis revealed that the municipal waste bins contain a relatively high share (mixed 59%; recycling 35%) of organic waste and confirmed indications that the system is not used efficiently (*expert interview 1 & 2*). On average, one mixed waste bin with a volume of 1.100 lt is provided per 6 inhabitants by a government regulation (*expert interview 2*). These are collected by one of 6 garbage trucks and delivered to the municipal waste collection site, from where waste gets transported by ferry to the mainland to recycling facilities or landfills. The dotted lines indicate that these flows pose costs to the municipality. The local waste management system is financed only through waste taxes per m² of living/working space and, as those are fixed, this provides no incentive for waste separation (*expert interview 1*). As a side effect of the high cost of transporting the waste to the mainland, there is a lack of budget to hire sufficient personnel to manage the waste infrastructure on the island.

Solid lines represent cost-neutral flows, while dashed lines denote financial revenues from waste. The solid blue line from the municipal waste collection to recycling facilities on the mainland indicate that the cost of transport is leveled out by the revenues from recycling. The dashed blue lines from the commercial sector to private collectors indicate that private collectors buy recyclable waste from commercial enterprises (for example plastic bottles and aluminum cans collected at the municipal camping) and sell them for revenue (dashed blue line) to recycling facilities (*expert interview 4*).



Photo 1. Municipal waste collection site between Alonia and Kamariotissa.

Red solid lines from private households and the commercial sector to either illegal dumping sites or private collectors indicate flows of refurbishing materials or durables, which are cost neutrally disposed by these sectors. All four local interviewees confirmed that illegal dumping is a big problem on the island. Waste on illegal dumping sites consists of mainly construction waste (grey lines) but also plastics and durables such as TVs, bicycles, furniture and other household electronics. Dead animals and slaughtering wastes were also found, which pose not only aesthetic but also hygienic problems. As observed on two locations, construction waste is also used as rubble to level uneven landscapes. Red and grey solid lines from the agricultural, industrial and service sectors could not be traced during our fieldwork and need to be assessed in the future. The agricultural sector also produces a large amount of organic waste that is assumed to be reintroduced into the system as indicated by a solid green arrow into the domestic environment. An additional waste inflow on Samothraki are “floating imports of waste” brought by the sea, indicated by a black solid arrow from marine litter to the domestic environment. There is also waste dumping from fisheries and tourists on the islands’ coasts, which can be considered as illegal dumping. Finally, hazardous waste from all sectors like old batteries, oil, or hospital waste are collected by private companies from the mainland and are depicted by an orange line. Finally, our investigation from five supermarkets revealed that there is a functioning deposit system for bottles in place.

Conclusion

The systemic assessment of local waste flows shows that waste management on Samothraki is currently handled by a combination of municipal services and formal or informal business operators, often acting out of economic needs to reuse products as long as humanly possible. Some of the main challenges are to reduce the large share of organic waste in the municipal waste



Photo 2. Illegal dumping site between Kamariotissa and Chora.

containers, increase the share and “purity” of recyclable waste, and control illegal dumping sites – all reflected in the municipal waste management plan (Municipality of Samothraki 2015). In order to be able to assist the municipality in developing an action plan for a more efficient waste management system we identify four issues that warrant further investigation:

- Waste flows need to be analyzed in greater detail to identify opportunities for the use of secondary resources to “substitute for imports and simultaneously reduce waste generation” (Eckelman and Chertow 2009).
- The reasons behind the non-functioning recycling system need to be assessed via a qualitative survey of private households and local businesses.
- The economics of waste, not the least of which agricultural by-products, must be assessed through an in-depth analysis of all monetary flows linked to waste flows.
- The separation and minimization of organic waste may be reinforced by joint initiatives in collaboration with the local population, e.g. by establishing central composting sites in villages or schools. Citizen Science, a recent initiative to include citizens in the research process, can be a helpful tool in implementing such strategies (Fischer-Kowalski et al. 2016).

References

Chen, M. C., A. Ruijs, and J. Wesseler. 2005. “Solid Waste Management on Small Islands: The Case of Green Island, Taiwan.” *Resources, Conservation and Recycling* 45 (1): 31–47. doi:10.1016/j.resconrec.2004.12.005.

Eckelman, M.J., W. Ashton, Y. Arakaki, K. Hanaki, S. Nagashima, and L. C. Malone-Lee. 2014. “Island Waste Management Systems.” *Journal of Industrial Ecology* 18 (2): 306–17. doi:10.1111/jiec.12113.



Photo 3. Informal waste collection site contains mainly durables.

Eckelman, M.J., and M.R. Chertow. 2009. “Using Material Flow Analysis to Illuminate Long-Term Waste Management Solutions in Oahu, Hawaii.” *Journal of Industrial Ecology* 13 (5): 758–74. doi:10.1111/j.1530-9290.2009.00159.x.

Fischer-Kowalski, M., L. Xenidis, S.J. Singh, and I. Pallua. 2011. “Transforming the Greek Island of Samothraki into a UNESCO Biosphere Reserve. An Experience in Transdisciplinarity.” *GAIA - Ecological Perspectives for Science and Society* 20 (3): 181–90.

Fischer-Kowalski, M., P. Petridis, D. Noll, G. Gratzer, M. Jongen, Y. Skourtis. 2016. “Citizen science as a key pathway to achieve effective nature conservation and a sustainability transition on the island of Samothraki – CiSciSusaki. Research Proposal to FWF. Link accessed 3.10.2016: <http://sustainable-samothraki.net/wp-content/uploads/2016/06/Proposal.pdf>

Gidararakos, E., G. Havas, and P. Ntzamilis. 2006. “Municipal Solid Waste Composition Determination Supporting the Integrated Solid Waste Management System in the Island of Crete.” *Waste Management* 26 (6): 668–79. doi:10.1016/j.wasman.2005.07.018.

Haas, W., F. Krausmann, D. Wiedenhofer, and M. Heinz. 2016. “How Circular Is the Global Economy? A Socio-Metabolic Analysis.” In *Social Ecology: Society-Nature Relations across Time and Space*. Springer.

Municipality of Samothraki. 2015. Local waste management plan of the Municipality of Samothraki, Samothraki, November 2015

Petridis, P., and M. Fischer-Kowalski. 2016. “Island Sustainability: The Case of Samothraki.” In *Social Ecology: Analyzing Society-Nature Interaction and Its History*, 1st ed. Berlin: Springer.

Skordilis, A. 2004. “Modelling of Integrated Solid Waste Management Systems in an Island.” *Resources, Conservation and Recycling* 41 (3): 243–54. doi:10.1016/j.resconrec.2003.10.007.



Photo 4. Transport of waste containers to the mainland by ferry.

Local initiatives and their chances to drive socioecological change

Social cooperatives on the Greek island of Samothraki

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Introduction

The Greek financial crisis of 2009 rendered many people unemployed, and the subsequent state downsizing left them vulnerable and socially and financially insecure. In the wake of this crisis, the Greek society saw a rapid increase in social cooperatives, a legal gateway to potentially ensure higher financial and social security and stability for its members, when the state and the market failed to do so (Varvarousis 2016). Social cooperatives are platforms for members to earn an income and be in charge of their own labour. Through a horizontal structure and an inclusive decision-making process, they strive to change the way that traditional business is made. While not all cooperatives are necessarily directly aimed at and focused on increasing sustainability, this is often at least a secondary outcome (Varvarousis & Kallis 2016).

Following earlier efforts in exploring the challenges of insularity (Petridis et al. 2013), and discussing collaborative future visions (Rau et al. 2014), the aim of

the research group on social cooperatives on Samothraki was to investigate the fate of initiatives that intend to find collaborative solutions on the island and try to understand what makes cooperatives there fail *vis-a-vis* succeed. We performed an exploratory study to make way for future research to delve into cooperation and processes of commoning on the island and whether or not these can increase social, ecological and economic sustainability on Samothraki.

Methodology

We conducted two focus group interviews and three individual semi-structured interviews, with members of different collaborative initiatives on the island, with varying degree of formalization. The method of interviewing was determined to be the best option for an exploratory study, as we had little knowledge in advance and thus needed to probe our way forward. The interview questions were jointly prepared by the research group beforehand, but were kept open to alteration and follow-up questions, depending on the respondent(s). Each interview provided us with information on the cooperative in question and a piece of the puzzle of the history and current status of island cooperation.



Photo 1. Focus group interview with the cooperative Zathay. Photo: Local initiatives group.

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Five cases of collaboration

We set up interviews with four cooperatives on the island – three active and one inactive – plus an emergent civil society association. The first focus group interview was conducted with three members of a social cooperative called “Zathay”, which runs a café and a small shop at a municipal campsite on the island, and in the future also hopes to run the campsite as well. The cooperative is further involved in a three-year educational program for young people in Greece, Germany and France. It was established in July 2014 by two of the interviewees. Zathay currently has nine members and apply an inclusive and flat decision-making strategy in annual meetings.

The second cooperative our group interviewed was a newly established olive producer cooperative. This was the second cooperative for olive producers on the island, which had been started in 2012, after an exceptionally large olive yield and after the old cooperative had gone bankrupt due to debts and corruption. The interviewee was himself not an olive grower, but hoped to help the farmers on the island, by changing the production to organic, giving the growers the ownership over the olive oil factory, and finding a niche market for high-quality olive oil. The cooperative is partly financed through a start-up fee paid by the farmers, and partly by the EU project LEADER.

The third interview was performed with a women’s cooperative called “Niki”. This was established in 2010, as a spin-off of a similar, earlier group called “Aksiokersa”, by the, now, only active member. She had been part of the previous cooperative, but left it in 2007. This cooperative produces a range of handmade products, such as marmalade, pasta, soaps, juices, dried fruits, etc. The reason the cooperative is only for women is a legal matter - this is a type of association, which is promoted by the municipality and the state to activate women in the productive sector. Our respondent was not actively searching for more members, but hoped that “the right people” would come along soon. Niki is also funded by LEADER.

Another interview was performed with a member of a failed collaborative initiative regarding a potential dairy cooperative, started by a young and ambitious new farmer and a long-standing herder. The idea was to create a creamery in the north part of the island, as an alternative to the already existing one in the south, which paid low prices for the milk and involved long driving distance for the farmers. This way, the many sheep and goats on the north side of island could be utilized for something other than just meat production. However, within the second year of production, the collaboration ceased, due to differences between the two members, regarding the use of technology and herd size.

Finally, a focus group was organised with five members of the planned civil society association “Sustainable Samothraki” that consists of relatively young permanent residents of Samothraki who want to promote a sustainable vision for the island. While the group is informally collaborating with visiting scientists, notably

from Alpen-Adria University, regarding the future designation of the island as a Biosphere Reserve, they are about to obtain the legal status of an association within the next months. While this is not a cooperative in the traditional sense, it is closer to a type of commoning project, trying to promote social and environmental sustainability within the local population.

Successes, failures, and impacts

Through these interviews we could begin to discern a number of themes, and the “cooperation situation” on Samothraki slowly emerged to us. As reasons for starting a cooperative in the first place, our respondents gave various answers. Some said that the reason for starting a cooperative was political or ideological, meaning that it was important for them that it was not a profit-oriented enterprise and that it had a flat organizational structure. For others it was a sustainability vision for the island. Many said that it was a matter of practicality and financial security. Some also genuinely believed in social cooperation as strengthening social bonds, etc.

From the interviews we could also identify factors for what makes social cooperation succeed and what makes it fail, both generally and more specifically on the island. For success, a horizontal decision-making process was stated as important, with a plan, and an intentional and pre-determined way of holding meetings, assemblies and solving conflicts. Trust between members was also identified as central for a functional cooperation. Finally, a sense of process ownership, as opposed to former cases of state bureaucracies, was also considered as a very important factor, for the members to feel independent and empowered.

Regarding reasons that cause cooperation to fail, almost all of our respondents said that there is lack of *cooperation culture* in general on the island. This can be both the cause and the result of how island politics (for Samothraki) works – there are internal feuds or issues that hinder these processes; the same issues can be interpreted as a result of the general non-cooperation, all in a vicious circle. For example, the lack of examples of good practices has been repeatedly mentioned as a reason why, culturally, cooperativism is relatively weak on the island. The slowness and inertia of the island was also mentioned by many respondents – many people are set in their ways and simply do not want to change.

When asked about perceived impacts of the existing cooperatives on the island, some of our respondents said that locals have slowly started trusting them more. The reason for the previous (and, still, current) mistrust is grounded in the fact that the old cooperatives that were active on the island were corrupt and riddled with nepotism. Zathay and the olive cooperative also said that multiple people had approached them and wanted advice for how to start similar projects – this can be interpreted as a positive sign that the cooperatives are successful in spreading the ideas and practices further. In the case of Zathay, their cooperative has also increased the financial security and stability for its members.

Discussion

After having probed the field and spoken to these groups, some common threads emerged to us. First, the initiatives could greatly benefit from cooperating between themselves, and showing the public even more that cooperatives are possible and even preferable over other more insecure forms of employment. The second key point we could identify was the lack of cooperation culture on the island. While this seems to slowly be dissolved by these “pioneers”, as well as increasing trust, there is still a long way to go. Overcoming this lack, would potentially be for everyone’s benefit, not only the cooperatives themselves, as a step towards social sustainability.

In terms of further impacts that the cooperatives can have on the island, we want to bring forth the potential of the cooperatives to facilitate a sustainability transition by shifting local collaboration patterns (see: Fischer-Kowalski & Petridis 2016). Old, traditional patterns of societal organization, family structure, production and consumption, etc., that are hierarchical and patriarchal need to be changed in order to facilitate a sustainability transition. In this regard, social cooperatives can play an important role, by paving the way for alternative modes of structuring and organizing family, business, and society.

Conclusion

In this exploratory study on social cooperatives and cooperation on the Greek island of Samothraki, we have identified, through interviews with representatives of the existing cooperatives on the island, some factors that have the potential to safeguard or hinder successful collaboration. Respondents named factors such as inclusive decision-making processes, and internal trust for success, and external mistrust and island inertia for failure. Even though there is pessimism among the “cooperators” about the future of the island or islanders’ willingness to change, steps in this direction are discernable. Our interviewees reported that they had been approached about tips and know-how’s to start other cooperatives,

and with the increasing success of some of the initiatives, perceptions about them seem to change.

For future research, our team wants to propose that cooperation on Samothraki is scrutinized through theoretical lenses such as transition theory, and commoning; the latter can be defined as describing the various and multifaceted approaches and processes by which individuals and groups cooperate to meet a shared goal (Bollier & Helfrich 2015), with the intentional or unintentional goal to achieve sustainability. We believe that among all the efforts, including both successes and failures, to increase the sustainability on the island of Samothraki, we have found a nugget of gold in these social cooperatives. A nugget out of which beautiful, yet useful, things can emerge. The challenge that lies ahead is knowing how to craft this gold into something more than a pretty-to-look-at trinket; into something that lasts; into something sustainable.

References

- Bollier, D. and Helfrich, S. eds., 2015. *Patterns of commoning*. Commons Strategy Group and Off the Common Press.
- Fischer-Kowalski, M. and P. Petridis., 2016. Can socioecological research help to create a realistic perspective for a sustainable Samothraki? *Sustainable Mediterranean*, 73 (this issue).
- Petridis P., R. Hickisch, M. Klimek, R. Fischer, N. Fuchs, G. Kostakiotis, M. Wendland, M. Zipperer and M. Fischer-Kowalski., 2013. Exploring local opportunities and barriers for a sustainability transition on a Greek island. *Social Ecology Working Paper 142*, Vienna, Austria.
- Rau, H., P. Gooch, A. Cardoso, A. Ruether, M.T. Wandel, P. Petridis., 2013. *Focus Groups – A Vision for Samothraki in 2030*. Samothraki Summer School 2014, Final Report.
- Varvarousis, A., 2016. Solidarity Economy. In D’alisa, G., Kallis, G., Demaria, F., eds. *Degrowth: A Vocabulary for a New Era*. Athens, Ekdoseis ton sinadelfon (in Greek).
- Varvarousis, A. And G. Kallis, 2017. Commoning against the crisis. In: Manuel Castells et al. (eds). *Another Economy Is Possible. Culture and Economy in a Time of Crisis*. Cambridge. Polity Press. (forthcoming).

Insights from stream ecological assessment on the Aegean island of Samothraki: aquatic chemistry and macroinvertebrate community

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Introduction

Streams and rivers are among the most threatened habitats in the world (Malmqvist & Rundle, 2002). Since they provide important ecosystem services (Thorp et al., 2010), it is crucial to understand the consequences of human perturbations on these ecosystems to preserve or restore their integrity (Meybeck, 2003). Therefore, assessment and biomonitoring programs are carried out widely by public authorities. In river biomonitoring, aquatic macroinvertebrates is the most commonly studied group (Bonada et al., 2006) since they are sensitive to multiple ecological alterations (Johnson & Ringler, 2014). In particular, taxa richness has been widely used because it is a key measurement to assess the structure of biological assemblages (Gotelli & Cowell, 2001).

Samothraki Island is known for the abundance of fresh water in the form of springs, temporary streams and perennial rivers with waterfalls which plunge into deep glassy pools, the majority of which present a high – good chemical-physicochemical and biological quality. Domestic solid wastes, domestic wastewaters from 16 small settlements with a total of 2,840 residents and livestock farming are the main human pressures on the island but they have only local impact. The most widespread pressure is considered to be free grazing goats (Skoulikidis et al., 2014).

The aim, in the context of the Lecture “Aquatic chemistry and macroinvertebrate fauna of Mediterranean streams”, was to learn and apply aquatic ecology approaches in a local setting. Specifically, field protocols/measurements and sampling campaigns in streams of Samothraki were carried out in order to explore biodiversity issues, assess their biological and chemical-physicochemical quality and investigate if these are affected by anthropogenic pressures.

Specific research questions were: “Do geological formations affect the chemical - physicochemical quality of Samothraki streams?” and “To which extent streams such as Fonias and Katsambas, that are affected by municipal wastewaters, differ in terms of hydrochemistry and macroinvertebrate assemblages from non impacted streams?”

Material and Methods

Samplings and Data sets

Field samplings were carried out during the course in order to display sampling methods. Two small river basins were investigated; Fonias (9.5 km²), which is located in the northeastern part of the island, and Katsambas (5.2 km²) situated in the west part of the island (Figure 1). While Fonias basin is free of settlements, the town of Chora and small settlements are found in Katsambas basin. Regarding geology, Katsambas basin is dominated by ophiolites (56.8%). On the contrary, the Fonias river basin consists mainly of granites (81.7%). Two samplings sites were selected along Fonias (F2 and Fonias Spring) and two along Katsambas (Chora and Kastro) rivers.

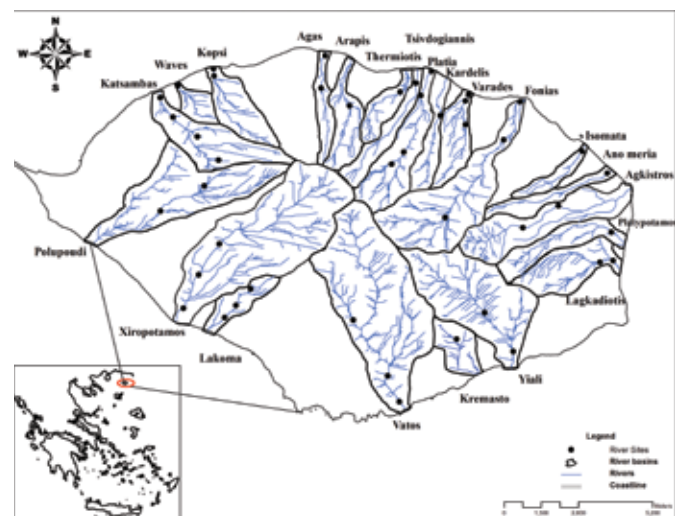


Figure 1. Map of study area that presents the river basins with their hydrographic network and the river sites for which data was produced.

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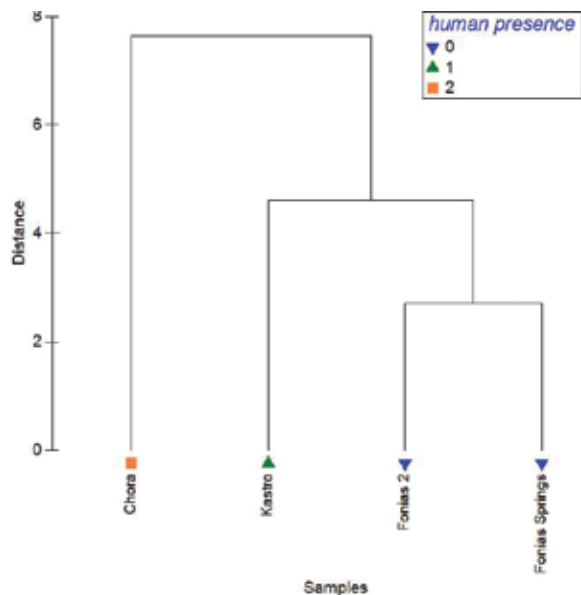


Figure 2. Cluster analysis regarding abiotic components of the two selected streams Fonias and Katsambas. (Human presence: 0=no human presence, 1= close to a settlement, 2=down of a settlement).

Additionally, data from the IMBRIW's data base were used. This data base includes hydrochemical and biological data from 22 river basins (Figure 1). Data were collected within the EU R&D projects AQEM and STAR (Skoulikidis et al., 2014), a Master Thesis (Lampou, 2012), and self funding in the framework of Samothraki Nature Observatory monitoring activities (Lampou et al., 2015).

The collection of benthic macroinvertebrates was performed by 3-minute kick and sweep (Armitage & Hogger, 1994) plus one minute of scanning the riparian vegetation where it was present and by the STAR-AQEM methodology. Macroinvertebrate identification was conducted to the family level. Environmental variables such as altitude, and hydro-morphological variables such as channel width, channel depth, velocity of the flow, as well as riparian vegetation and river's substrate for each site were also recorded. Water samples were collected for laboratory analyses, along with *in situ* measurements of physicochemical parameters (water temperature, dissolved oxygen, pH and conductivity).

Data analysis

For the selected river basins (Fonias and Katsambas), CLUSTER analysis with Euclidean distance was carried out to explore similarities/ differences based on chemical - physicochemical parameters. The factor of the human presence was used in order to investigate if human presence affects the groups of sites. To detect if there are significant differences in chemical - physicochemical parameters based on the above mentioned factor, the analysis of similarities (ANOSIM) was used. When R is near 0, there are spatial or temporal differences between sites, whereas when R is near 1, then sites have significant differences. To identify similarities in macroinvertebrate samples between the sites, a SIMPER analysis (Bray-

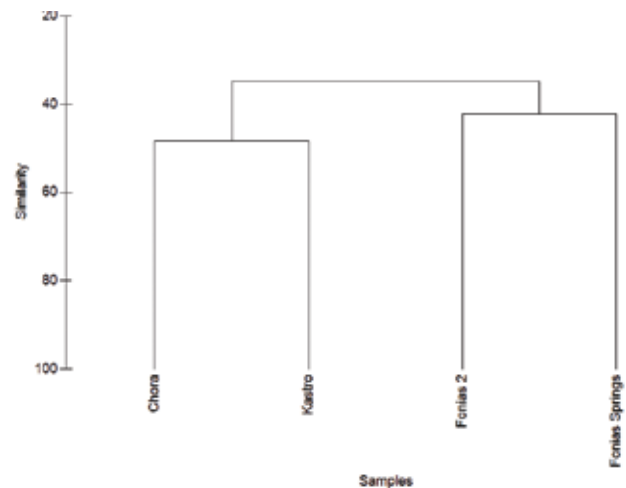


Figure 3. Cluster analysis showing groups regarding biotic components of the two selected streams Fonias and Katsambas.

Curtis) was performed with complete linkage clustering. Furthermore, the RIU.net application was applied in order to assess the biological quality of each sampling site.

For the IMBRIW's data base, hierarchical clustering with Euclidean distance was applied in order to identify groups of sites with similar or different chemical - physicochemical characteristics. In addition, a non-metric multidimensional scaling (NMDS) analysis was used to highlight differences among sites in relation to the geology of the respective river basins. To test any differences in chemical - physicochemical parameters (T, C, pH, DO, major ions and nutrients) among the sites with same geology, analysis of similarities (ANOSIM) was used.

All the analysis was carried out by using the Primer v.6.1.13+ program.

Results

Biotic and abiotic components of the selected river basins

According to the CLUSTER analysis, similarities in chemical - physicochemical parameters were found between the two Fonias' sampling sites. In addition, differences were detected between the two Katsambas' sampling sites and among them and Fonias' sampling sites (Figure 2). Based on the SIMPER analysis' results, the concentrations of PO_4 , NO_2 and Total P, were responsible for the differences between the sampling site groups. The ANOSIM test showed that regarding physicochemical parameters there are statistically significant differences between the sites which aren't affected by the human presence (Fonias' sampling sites) and the sites affected by human presence (Katsambas's samplings) ($R=1$).

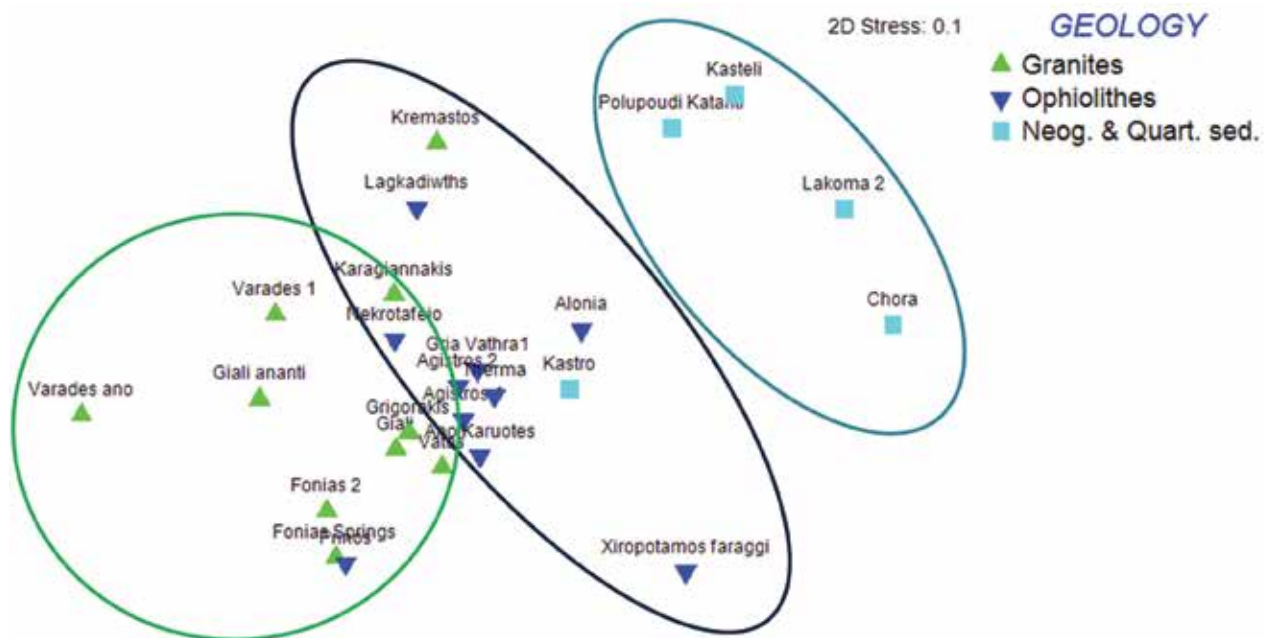


Figure 4. NMDS analysis presenting the relationship between geology and physicochemical parameters

A total of 14 and 10 families of macroinvertebrates were recorded in the Fonias bridge and Chora sampling sites, respectively. Differences in macroinvertebrate assemblages were detected between Katsambas' and Fonias' sampling sites (Figure 3). The average dissimilarity was estimated at approximately 65%, according to the SIMPER analysis. Species of the Gammaridae family dominated in Katsambas' sampling sites (with 42.1% relative contribution to the assemblages composition), followed by Baetidae (14%) and Chironomidae (7%). In Fonias' sampling sites, the fauna was mainly represented by Baetidae and Hydropsychidae with 24.77% and 24% contribution, respectively. According to the RIU.net application, the biological quality of Fonia's bridge and Chora sites was high and moderate, respectively.

Geological impact on abiotic components of Samothraki's river basins

NMDS analysis showed that the sites with similar geology in their sub-basins had a relatively similar variation in hydrochemical parameters (Figure 4). According to the ANOSIM test, sites with predominance of ophiolithes in their sub-basins were statistically significantly different from sites with predominance of neogene & quaternary sediments ($R=0.671$, $p=0.004$). Similarly, statistically significant differences were found when comparing sites with predominance of granites in their sub-basins with all other sites ($R=0.817$, $p=0.002$).

Discussion

Macroinvertebrate structure and composition

Macroinvertebrate taxa in Chora and Fonia's sites are indicators of an impacted (e.g. Gammaridae, Chironomidae) and high (e.g. Hydropsychidae, Philopotamidae) biological quality, respectively.

This is consistent with the result of the application RIU.net. The structure of invertebrate communities in streams results from a combination of different environmental parameters. At undisturbed sites, stream characteristics such as morphology, stream chemistry and riparian vegetation may determine the occurrence and abundance of species and can provide suitable predictors of community composition. Additionally, a range of anthropogenic pollutants may influence community structure, and also the effects of organic pollution (Kolkwitz R., 1950) and pesticides (Ganzelmeier et al., 1995) have been reported, as chemicals affecting community composition. In our study, we can observe the effect of anthropogenic stressors under the town of Chora on Katsambas stream (which is subject to the impact of untreated domestic wastewaters and agricultural activities), which affects stream nutrient and oxygen levels. Elevated nutrient concentrations close to Chora result in a moderate biological water quality. In addition, macroinvertebrate communities are very different between the two streams. While the Fonia's river shows a high biological quality, the Katsambas close to Chora presents a degraded stream macroinvertebrate community and the biological quality scores moderate. Changes in the macroinvertebrate community can affect the whole ecosystem functioning leading to a degradation of ecosystem services.

Human and geological impacts

According to the CLUSTER analysis based on hydrochemical parameters only for the selected river basins (Figure 2), Fonia's sites are grouped together and remote from Katsambas' sites. The concentrations of ammonia, phosphate and total phosphate determined the above clustering. Fonia's sites are natural with no human presence. The two sites of Katsambas river, Kastro

Our results at sites affected by human pressures suggest that actions should be taken to mitigate their effect on the ecological status of these streams.

and Chora, are natural and urbanized (located downward of a settlement), respectively. However, it is important to mention that Kastro is located close to the settlement of Chora. As a result, it was not grouped with the other natural sites. Also, Kastro was not so impacted in order to be grouped together with the other site of Katsambas river (Chora). The main source of ammonia, phosphate and total phosphate are municipal wastewaters (Skoulikidis et al. 2006). Thus, human influence affects the hydrochemical quality of Samothraki's streams.

Conclusions

Hydrochemical parameters in Samothraki stream basins are determined by geology and human activities. Another factor that may affect stream hydrochemical composition is the habitat diversity of the different sites, determined by the hydromorphology of the streams, the sediment/streambed characteristics and the presence (or not) of riparian and aquatic vegetation. The resulting combination of water quality and habitat diversity is reflected in the macroinvertebrate community through clear differences in species richness and abundance and community structure as well. Our results at sites affected by human pressures suggest that actions should be taken to mitigate their effect on the ecological status of these streams.

Acknowledgements

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References

- Armitage P. D. and Hogger J. (1994). *Invertebrates Ecology and Methods of Survey*. Sandy RSPB, Bedfordshire.
- Bonada N., Prat N., Resh V.H. and Statzner B. (2006). Developments in aquatic insect biomonitoring: a comparative analysis of recent approaches. *Annu. Rev. Entomol.*, 51, 495–523.
- Ganzelmeier H., Rautmann D., Spangenberg R., Streloke M., Herrmann M., Wenzelburger H-J., Walter H-F. (1995). *Studies of the Spray Drift of Plant Protection Products: Results of a Test Program Carried Out Throughout the Federal Republic of Germany*. Mitteilungen aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft Berlin-Dahlem. Blackwell Scientific, Berlin, Germany.
- Gotelli N.J. and Cowell R.K. (2001). Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. *Ecol. Lett.*, 4, 379–391.
- Johnson S.L. and Ringler N.H. (2014). The response of fish and macroinvertebrate assemblages to multiple stressors: A comparative analysis of aquatic communities in a perturbed watershed (Onondaga Lake, NY). *Ecol. Indic.*, 41, 198–208.
- Kolkwitz R. (1950). *Ökologie der Saprobien. Über die Beziehungen der Wasserorganismen zur Umwelt*. Schriftenreihe des Verbandes für Wasser-, Boden- und Lufthygiene 4, 1–64.
- Lampou A. (2012). *Assessment of the ecological water quality, according to the Directive 2000/60/EC, in rivers of Samothraki island in 2011*. Master Dissertation Thesis, Aristotle University of Thessaloniki, Thessaloniki, pp.158.
- Lampou A., Zogaris S., Karaouzas I., Gritzalis K. and Skoulikidis N. (2015). Samothraki Nature Observatory: Research and monitoring that supports the conservation and sustainability of a unique Aegean island. 11th Panhellenic Symposium on Oceanography and Fisheries, 13 - 17 May 2015, Mytilini Island, Greece.
- Malmqvist B. and Rundle S. (2002). Threats to the running water ecosystems of the world. *Environ. Conserv.*, 29, 134–153.
- Meybeck M., 2003. Global analysis of river systems: from Earth system controls to Anthropocene syndromes. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.*, 358, 1935–1955.
- Skoulikidis N. Th., Amaxidis Y., Bertahas I., Laschou S. and Gritzalis K. (2006). Analysis of factors driving stream water composition and synthesis of management tools - A case study on small/medium Greek catchments. *Science of the Total Environment*, 362, 205-241.
- Thorp J.H., Flotemersch J.E., Delong M.D., Casper A.F., Thoms M.C., Ballantyne F., Williams B.S., O'Neill B.J. and Haase C.S. (2010). Linking ecosystem services, rehabilitation, and river hydrogeomorphology. *Bioscience*, 60, 67–74.

Landscape assessment on Samothraki: Preliminary steps with a site-based protocol

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The European Landscape Convention (ELC 2000) defines landscape as “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.” The Convention promotes raising awareness of the value of so-called living landscapes, yet there are very few tools for assessing the conditions or quality of landscapes on the ground. A more participatory approach for appreciating and protecting landscapes is needed to provide support to communities in dealing with landscape change and associated threats and challenges.

This work aims to introduce and apply a simple site-based assessment tool which guides evaluators such as students, public bodies and scientists. This visual assessment protocol is similar to rapid visual assessment protocols such as SVAP and QBR (Bjorkland et al. 2001; Chatzinikolaou et al. 2011) which are now used for monitoring streams and river riparian areas worldwide. Mediterranean insular cultural landscapes such as on Samothraki are especially difficult to assess with precision and accuracy due to the diverse natural history

fabric and the influence of humans on the landscape for many centuries (Terkenli 2001). Our effort combines a qualitative and semi-quantitative assessment for landscape assessment and explores ways to validate the field protocol application.

Methods

The landscape assessment protocol (hereafter LAP) is still at the prototype stage while it is being developed in the process of a PhD at the Department of Natural and Environmental Resources Management of the University of Patras. The protocol is based largely on the Stream Visual Assessment Protocol (SVAP) framework which expands to assess landscapes instead of streams (for a similar venture see Schlee et al. 2012). The new protocol has 15 metrics and each is assessed on-site, visually and acoustically (Fig 1). Each metric, which is an element or feature that is known to be influenced negatively by human-induced changes in the landscape, is scored by the assessor. The trained assessor is guided by a field form that provides a narrative describing and guiding evaluation of a descending score from high (10) to low (1) quality. If an assessor is unable or uncertain in assessing a particular metric it is left unassessed. The overall score of

Original landforms, vegetation and cultural landscape features and elements with or without traditional land-use. Traditional elements and features intact (traditional village architecture, varied landscape features, etc).	Original landforms and vegetation and traditional cultural use dominate. Slight modern changes exist. Break in patterns of traditional land uses.	Natural areas covering >30% of landscape but signs of degradation present. Cultural features and elements moderately degraded.	Natural areas covering <30% of landscape with notable signs of degradation present throughout view. Cultural features and elements degraded.	No or minimal natural and cultural features. Modern elements dominate. Residential or mixed use (including modern industrial and urban sprawl) without order or organized infrastructure.					
10	9	8	7	6	5	4	3	2	1

Figure 1. The LAP field form's scoring card (Left) with the 15 potential metrics. And an example of the guidance narrative that assists assessors in scoring each metric; in this case the “land use pattern” metric (Right).

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Figure 2. The 35 sampled landscape areas and their scores (by one expert) on Samothraki.

the index is gained by dividing the sum of metric scores by the number that was scored.

In this application five assessors visited 35 different landscape areas on Samothraki and independently assessed each using LAP between the 10th to the 19th July 2016. Effort was made to visit as many and the most representative areas in terms of the diversity of landscape areas. Each of the five assessors was trained briefly in the beginning by the tutors (i.e. V. Vlami, S. Zogaris, P. Dimopoulos, Fig. 4). One of the tutors was chosen as “expert” in order to have a standard baseline to describe the variation among each person’s assessment scores.

Results and discussion

Figure 2 maps the results from 35 sites where landscape vistas were assessed (numbers are for future reference), as assessed by one expert assessor. The four-class scale ranges as follows: high (blue), good (green), moderate (yellow), to poor (orange) condition. Figure 3 shows the expert’s results and the cumulated results of the five person team. It is deemed improper to combine the assessments together since there is artificial eclipsing and differential moderating of the individual scores; this dampens the spread of assessment results (Andreason et al. 2001). Finally, only seven out of 35 sites fell below good in this assessment. All seven degraded sites are in the eastern part of the island (one is in the southeastern part). In this part of the island there are signs of building construction and some modern changes, otherwise much of the rest of the island is in good and very good landscape condition based on this assessment.

Some metrics in the protocol showed significant inconsistency in scoring (i.e. grazing, wildlife, vegetation, abandonment and landscape attractiveness) others were remarkably consistent. Table 1 ranks each metric with respect to the standard deviation for the assessments of the five-member team. Overall, the correlation among the five-person team results and the single expert scores for each site were positive and statistically significant (Fig. 5). This preliminary work shows that LAP is potentially a very useful tool for site-based assessments from on-site vistas. Lastly it also shows that the island’s landscapes are still in good condition.

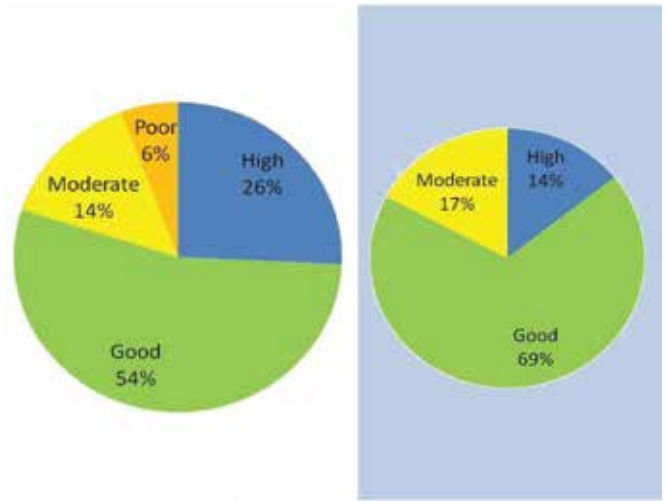


Figure 3. Pie charts above: Results of final index evaluation of all assessed landscape sites on Samothraki, as assessed by a single expert (left) and the summed scores of the five person team (right).



Figure 4. A photo depicting aspects of the training session at the beginning of the project.

Table 1. Validation of consistency among metric scoring in 5-person team scores: vegetation, wildlife, grazing effects had least consistent scores i.e. most difficult to assess consistently (utilizing standard deviation as a measure of variability among scores).

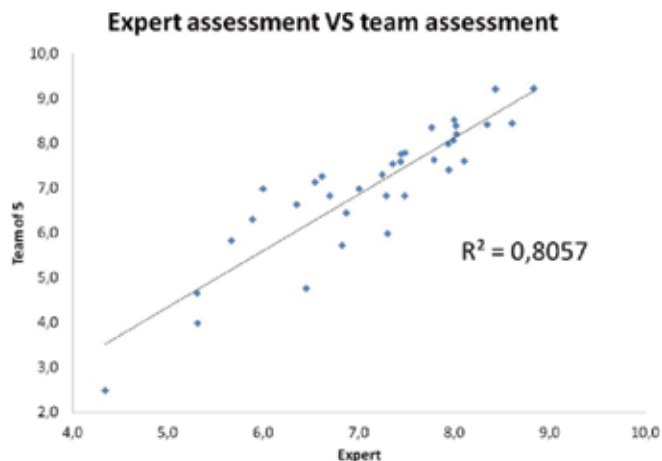
Metric	Number of sites with std>2
Road Network	0
Flora	1
Agriculture	1
Soundscape Quality	1
Garbage & Debris	2
Buildings	2
Land Use Pattern	3
Modern Antropogenic Interference	3
Hydorological Alternation	3
Shorelines &/or Riparian Condition	3
Landscape Attractiveness	3
Abandonment	3
Vegetation	4
Wildlife	4
Grazing	8

This work provides an operational protocol to assessment and monitoring of landscape quality at the site-scale, something that seems to be an important unmet need for landscape appreciation, planning and conservation in Europe (Jones, 2007). Further refinement and validation of this developing tool is needed since its simplicity and rapidity of use may also help members of the public appreciate and promote landscape conservation.

References

Bjorkland, Ronald, Catherine M. Pringle, and Bruce Newton. "A stream visual assessment protocol (SVAP) for riparian landowners." *Environmental Monitoring and Assessment* 68.2 (2001): 99-125

Chatzinikolaou, Yorgos, Konstantina Ntemiri, and Stamatis Zogaris. "River riparian zone assessment using a rapid site-based index in Greece." *Fresenius Environmental Bulletin* 20.2 (2011): 296-302.



Correlation among team and single expert assessment scores for each site.

Figure 5. Correlation among the five-person team results and the single expert scores for each site (N=35).

Jones, Michael. "The European Landscape Convention and the question of public participation." *Landscape Research* 32.5 (2007): 613-633.

Schlee, Mônica Bahia, Kenneth R. Tamminga, and Vera Regina Tangari. "A method for gauging landscape change as a prelude to urban watershed regeneration: The case of the Carioca River, Rio de Janeiro." *Sustainability* 4.9 (2012): 2054-2098.

Terkenli, Theano S. "Towards a theory of the landscape: the Aegean landscape as a cultural image." *Landscape and urban planning* 57.3 (2001): 197-208.

Andreasen, J.K., O'Neill, R.V., Noss, R. and Slosser, N.C., (2001). Considerations for the development of a terrestrial index of ecological integrity. *Ecological Indicators* 1(1), pp. 21-35.

Water management on the island of Samothraki

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Introduction

This report, dealing with the topic of water management and local water supply problems, contributes to the outcome of several summer universities held on the Greek island of Samothraki in the Mediterranean Sea. Samothraki is rich in ecological and cultural assets and applied to become a UNESCO Biosphere Reserve (Petridis, 2012). The island has several freshwater streams; thereof many periodically run dry in summer (Lampou et al., 2015). Additionally, the island has abundant groundwater resources with numerous springs and wells to provide water for people and ecosystems, but also many unregulated water withdrawals exist. Thus, water management is a significant topic for a sustainable future and to avoid deterioration of water resources that might occur in spite of their quantity and quality - exceptional for a Mediterranean island. This study aims at contributing to a better understanding of the island's water supply and demand, at determining its water balance, and at both short- and long-term recommendations for water management.

Methods

Our research started with a thorough study of the island's existing Water Management Plan (WMP). This was complemented by informal interviews with the mayor and some local inhabitants (mainly farmers). Site visits to the municipal water supply and distribution system, irrigation spots, and a planned reservoir location fulfilled the aim to get a better insight into the management issues on the island. No primary data was gathered in the frame of this study, but a wide range of existing literature was reviewed and used for calculations, including official Greek statistics, results from SUSAKI project, and existing hydrological studies of the island.

Results and Discussion

1 Status quo of water management on the island

To comply with the EU Water Framework Directive (2000/60/EC), the Greek government commissioned a consortium of consulting companies to write a Water Management Plan for Eastern Macedonia and Thrace. This management plan (ENM for the Ministry of Development, 2007) divides

the island into five river basins. Needs for water supply are concentrated mainly in the western basin, where touristic facilities exist around the harbor town of Kamariotissa and where most of the agricultural land is located. Few water needs – mainly for domestic supply – exist in the other basins. In order to expand irrigation, a small reservoir shall be constructed at Xeropotamos River, storing the flow of this intermittently dry watercourse behind a 15 m high dam shortly upstream of Xeropotamos village. The reservoir with a storage capacity of 315,000 m³ was designed to irrigate 70 to 100 ha of land and will be funded by the Greek state (Vardoulakis, 2011). Construction has not yet started, but the irrigation network has already been built, supplying e.g. olive groves. Apart from the unrealized irrigation potential and lacking treatment plants for municipal wastewater in certain villages, the WMP does not see a need for quantity measures and concludes that the waters of Samothraki are in a good quantitative and qualitative state (Water Management Plan Venture of Eastern Macedonia-Thrace, 2013).

The present system of water supply on Samothraki is based on groundwater sources. 21 cold springs sampled by HCMR showed good drinking water quality (Lampou et al., 2015; Skoulikidis et al., 2014). 35 springs fulfill domestic needs (municipal system), and 25 drilling wells are used for irrigation (16 public and 7 private wells) as well as drinking water supply (pers. comm. mayor). After an incident of contaminated drinking water, small independent chlorination facilities have been added to the supply reservoirs (pers. comm. mayor and local farmers). An unknown number of open livestock watering stations provide water for goats and sheep. Site visits have shown that in addition to this "official" water supply, irrigation is achieved by illegal abstractions from the municipal system, from springs and surface water bodies, and by maintenance of an older system of open ditches.

The challenges for each of the sectors of water supply, identified in the course of fieldwork, can be summarized as the following:

- *Domestic (municipal system)*. Distribution infrastructure is in a bad condition (leakages) and protection of sources, tanks, and pumping stations is missing. Thus, in spite of good water quality of the springs, there might be risk of contamination. Illegal abstractions for irrigation exist, but cannot be quantified due to a lack of monitoring. Overuse leads to low water levels in tanks and pumping stations, and sometimes to failure of the system (e.g. breakage of pumps).
- *Irrigation*. In some places, inefficient irrigation technologies are used (e.g. travelling guns involving

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high evaporation). Failure of the public system to supply sufficient amount of water to all users leads to illegal water abstractions or to maintenance of improvised and outdated irrigation structures. Pressures on surface and groundwater bodies cannot be quantified due to unregulated abstraction, but could increase in the future due to expansion of irrigation, e.g. for watering olive trees. The planned reservoir would solve this problem only for part of the island, and is moreover associated with high construction and operational costs. Moreover, some people are opposed to it due to its environmental and social impact.

- *Livestock.* Unclear numbers of goats and sheep do not allow an estimation of actual needs. Open watering stations might be questionable.

Local challenges, like the total breakdown of water supply in Kamariotissa for three days in the early touristic season, suggest that quantitative bottlenecks in the system do exist; however, neither municipality data nor the WMP allow conclusions about whether there is a balance of water supply and demand on the island. Therefore, data from Hellenic Statistical Authority are used to complement those in the next section.

2 Water demand and supply

Domestic demand. From our estimates the total demand for water for domestic purposes (e.g. drinking, bathing, washing, cooking) is 178,523 m³/yr. Apart from permanent residents, also tourists, seasonal workers, and other visitors who do not permanently stay on the island are included in this estimation (using data from the SUSAKI project, published in Fischer-Kowalski et al., 2011). How much each of these groups would use was estimated based on published data (ENM for the Ministry of Development, 2007) and personal experience; these figures still need to be verified. According to the municipality's water bills, domestic water supply from the public system amounted to 231,000 m³/yr (for 2014). The difference between demand and supply of 23 % can be explained with losses in the system, which is from our experience, for Greek pipe networks, a realistic value. It must be noted that illegal abstractions are not included in this figure, because they are not measured.

Irrigation demand. Total water demand for different crops which are grown on Samothraki is 7,215,000 m³/yr. This is the *potential* amount of irrigation; i.e., it is assumed that the entire agricultural land is irrigated according to the recommendations by the Greek Ministry of Agriculture (which is currently not the case). As olive trees do not have to be irrigated at all when focusing on quality and not quantity of the harvest, it is henceforward calculated with a *reduced* total irrigation demand of 2,310,000 m³/yr. Furthermore, it should be noted that legumes used as fodder for livestock contribute to almost 1 million cubic meters (MCM) of potential irrigation per year.

Livestock demand. According to Samothraki's WMP, the water demand of livestock on the island amounts to 360,000 m³/yr. However, it is calculated that 50,000 animals, consuming max. 10 L/day (ENM for the Ministry

of Development, 2007) would only need 182,500 m³/yr, which is the figure used in determination of total demand.

Total demand. Adding figures for domestic, irrigation, and livestock demand results in a total figure of 2,671,023 m³, or 2.7 MCM, of potential annual water demand on the island (Table 1). Irrigation has by far the largest share of this value (86 %), which is also typical for Greece. Demand of livestock and domestic water users have nearly equal shares (7 %), but it is important to note that livestock consumes the largest amount of water (1 MCM) indirectly, in the form of fodder which has been irrigated.

Table 1. Water demand of Samothraki.

Sectors	Water demand [MCM/yr]	%
Domestic	0.179	7
Irrigation	2.310	86
Livestock	0.182	7
Total	2.671	100

3 Water balance

Precipitation is the starting point for calculating Samothraki's water balance. The WMP and Xeropotamos reservoir study provide diverging figures in this regard (Table 2), which probably results from different locations of gauges (measurement on the mountain might lead to the higher values of the WMP). Also data for evapotranspiration, infiltration, and runoff is provided in the WMP; these figures were used as a basis for calculating percentage share and the distribution of the lower precipitation value. The lower figures are considered as a safer value to determine sustainable annual abstraction. Infiltration includes all the water which enters the ground; this does not mean that all of it reaches the saturated zone (i.e. recharges the groundwater aquifer). However, it can be assumed that with an annual infiltration of 19 MCM, a careful abstraction of 2.7 MCM from the aquifer is possible. Thus, it might be possible to fulfill all water demand on the island without using surface waters, i.e. building the dam. However, more reliable hydrological data and a detailed hydrogeological survey are needed to avoid over-exploitation of the aquifer, and ensuing problems like saltwater intrusion, which would irreparably damage it.

Table 2. Water balance of Samothraki. Known data (ENM, 2007; Vardoulakis, 2011) in bold print.

	WMP [mm/yr]	WMP [MCM/yr] ^a	Reservoir study [mm/yr]	Reservoir study [MCM/yr]	%
Precipitation	928	165	738	131	100
Evapotranspiration	416	74	331	59	45
Infiltration	143	24	107	19	14
Runoff	366	65	291	52	39

^a To determine annual values for the whole island (in million cubic meters, MCM), figures in mm/yr were multiplied with its total area (178 km²).

Conclusions – Measures

The preliminary water balance confirms that, untypically for a Mediterranean island, Samothraki has very rich water resources. Nevertheless, lack of monitoring and coordination might lead to local and seasonal overuse, and the WMP needs to identify and address the existing management problems. Site visits and interviews which have been carried out in the frame of this study have shown that threats to drinking water quality and quantity exist, that plans to expand irrigation might not be sustainable, and that in general, available data about the island's hydrology and water use is insufficient.

Preserving a good quantitative and qualitative state of Samothraki's water resources is integral to various goals of the ongoing efforts to turn it into a UNESCO Biosphere Reserve: protect the island's ecology, attract tourists who value intact nature, and enhance the livelihoods of locals. Therefore, to conclude this report, measures to improve the water management system on Samothraki are presented, for each sector:

Domestic water supply. As short-term measure, adequate pricing of the water and penalties for illegal abstractions from the municipal pipe network would be effective. In order to establish a high quality water supply with minimized costs and risks, the following long-term measures are recommended:

- Replacement of the existing old pipe network;
- Installation of a monitoring (metering) system for the water tanks and the water users;
- Protection and security of springs, wells, tanks and pumping stations.

Agricultural (irrigation and livestock) water supply. Measures concerning animal numbers and irrigation practices can help to improve freshwater management on the island.

- The most important measure would be to decrease the number of animals from around 50,000 to 20,000. This would lower on the one hand the water demand for the animals themselves and also for their food grown on the island.
- Plans to expand irrigation include the watering of olive trees, which is not necessary when focusing not on quantity, but on quality of the harvest.

The preliminary water balance confirms that, untypically for a Mediterranean island, Samothraki has very rich water resources. Nevertheless, lack of monitoring and coordination might lead to local and seasonal overuse.

- The need for Xeropotamos reservoir is questionable due to high construction and operational costs. In addition, the social and ecological impact has to be considered.
- The aquifer has a high potential and with an improved well system, distributed reasonably over the island and constructed for the total irrigation demand, several advantages can be expected, including easier coordination, better spatial distribution (shorter pipe network), as well as minimal evaporation losses and impact on stream flows. However, the positioning of wells has to be considered very carefully, and further research including hydrological monitoring and a hydrogeological study (mapping the aquifer to describe its properties) should be carried out, in order to protect the aquifer from salinisation.

Additionally, education and awareness raising for all water users (e.g. farmers, tourists, school children) would be a step towards more efficient water usage, and institutional improvements such as the implementation of a local water management agency, improved maintenance, and better coordination of communication would ensure a high quality water supply.

References

ENM for the Ministry of Development. Water Management Plan of Western, Central, Eastern Macedonia & Thrace (2007).

European Union. "Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy." Official Journal of the European Communities L327 (2000).

Fischer-Kowalski, Marina, Lazaros Xenidis, Simron Jit Singh and Irene Pallua. "Transforming the Greek Island of Samothraki into a UNESCO Biosphere Reserve. An Experience in Transdisciplinarity." Gaia 20 (2011): 181–190.

Lampou, Anastasia, Stamatis Zogaris, Ioannis Karaouzas, Konstantinos Gritzalis and Nikolaos Skoulikidis. "Samothraki Nature Observatory: Research and monitoring that supports the conservation and sustainability of a unique Aegean island." Greece, 11th Panhellenic Symposium on Oceanography and Fisheries on Mytilene Lesvos island (2015).

Petridis, Panos "Establishing a Biosphere Reserve on the island of Samothraki, Greece: A transdisciplinary journey." Sustainable Mediterranean 72 (2012): 9–41.

Skoulikidis, Nikolaos, Anastasia Lampou, Ioannis Karaouzas, Konstantinos Gritzalis, Maria Lazaridou and Stamatis Zogaris. "Stream ecological assessment on an Aegean island: insights from an exploratory application on Samothraki (Greece)." Fresenius Environmental Bulletin 23 (2014): 1173–1182.

Vardoulakis M. "Environmental Impact Assessment for the Xeropotamos reservoir, in Samothaki island." Official Journal of the European Communities (2011).

Water Management Plan Venture of Eastern Macedonia-Thrace, for the Ministry of Environment. Establishment of water management plans of Eastern Macedonia and Thrace as specifications of directive 60/2000/EC (2013).

First Integrated Marine Ecological Assessment of Samothraki

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Introduction

Natural resource management plans provide fundamental guidance to advance sustainable development in natural protected areas. Samothraki island, situated in the north-eastern border of the Aegean Sea, is no exception. Declared a NATURA 2000 Site in 2001 (Fischer-Kowalski et al., 2011) to protect its rich terrestrial and marine species and habitats, Samothraki currently lacks the scientific inputs to produce a marine management plan. With the purpose to establish a scientific baseline and direct future marine conservation efforts in the island, this study presents the first evaluation of the ecological status of the Samothrakian marine coastal zone and its biodiversity. For millennia the plateau between Samothraki and northern Greece has been known to be one of the most productive fishing grounds in the Mediterranean (Theocharis & Georgopoulos, 1993). We argue that the future economic and biological richness of this region will depend on the actions we take to protect it now.

Methodology

Theoretical Background

Marine benthic macrophytic species are excellent indicators for evaluating the ecological status of coastal areas because they respond to biotic and abiotic changes in the environment (Orfanidis et al., 2001; WFD, 2000/60/EC; Harlin, 1995; Schram & Nienhuis, 1996; Schramm, 1999). The application of the Ecological Evaluation Index (EEI) (Orfanidis et al., 2001) on photoquadrats of the macroalgae of upper infralittoral zone. i.e. the Rapid Assessment of Coastal Ecological Status (RACES) methodology (Salomidi, 2009) has been successfully used in a large scale monitoring project across Greece to assess the state of shallow rocky shores within several NATURA 2000 marine sites; results revealed a severe decline of the large canopy algae and their associated communities, once thriving in the Aegean and Ionian Seas, due to: (i) sea-urchin overgrazing for latitudes north of about the 37th parallel, and (ii) invasive siganids overgrazing for latitudes south of that (Salomidi et al., 2015). The same methodological

tools are hereby applied to assess the ecological status of Samothrakian coastal waters and determine whether local conditions also corroborate this trend.

Ecological Assessment

To assess the ecological quality of each site, we used the EEI, which is based upon the classification of macroalgae into two main categories: Ecological State Group I and Ecological State Group II (Littler & Littler, 1980). Each group includes species with similar morphologies, functional characteristics, and reproduction strategies: i.e. species which play a similar role in the ecosystem under the same set of ecological conditions. The Ecological State Group I (hereafter ESGI) is mostly composed of perennial species characterized by thick, upright or calcareous bodies, i.e. the canopy-forming algae of *Cystoseira* spp. and *Sargassum* spp., which provide habitat and otherwise support several other species of marine flora and fauna. The Ecological State Group II (ESGII), on the other hand, comprises annual, opportunistic species characterized by filamentous or sheet like bodies. As ESGII species thrive in nitrogen rich environments, their increased abundance might indicate high levels of nutrients in the water often associated with anthropogenic pollution (Orfanidis et al., 2001).

The integrated assessment of the coastal ecological status of Samothraki resulted from the consideration of the following set of parameters:

- Ecological quality, as assessed through the RACES methodology
- Macro-Biodiversity records
- Detection of signs of overgrazing or other evident pressures (i.e. invasive species, litter).

Study Sites

Four shallow rocky mild-sloping sites were selected, two of which located within the Natura 2000 area (Jamaica and Agia Paraskevi) and another two (Katarti and Pachia Ammos) beyond the designated area (Fig. 1). Five systematic randomly placed replicate photoquadrats (21 cm × 30 cm) were collected at each site at depths between 0-1 m. Mean percentage cover per species (or higher taxon) was estimated using a digital grid. All taxa were assigned to their relevant ESG I or II and cumulative cover values were cross-compared on the EEI Matrix (Fig. 2) to allow the classification of each site among five distinct Ecological Status categories (i.e. bad = 2, low = 4, moderate = 6, good = 8, and high = 10) (Orfanidis et al., 2001).

Biodiversity records include all observations within the study sites as well as observations made during a boat trip around the coasts of the island.

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Figure 1. Map of the study area and study sites (Google Earth, 2016).

Results

Ecological quality

Our preliminary results suggest that all our sampling locations are in good or high marine ecological status (Table 1). The species with the higher percentage of coverage were: *Jania sp.* (Fig. 4). *Cystoseira corniculata*, *Padina cf pavonica*, and various encrusting red algae, which according to the EEI index indicate good ecological conditions. On the other hand, at stations Jamaica and Katarti we found a higher percentage of coverage of filamentous and fast growing macroalgae, which reveal more eutrophic conditions, probably due to freshwater input close to both sites.

Table 1. Ecological State Groups and Ecological Status (ES) assessed per sampling site.

	JAMAICA	PACHIA AMMOS	AGIA PARASKEVI	KATARTI
%ESGI	62	79.5	77.3	66.5
%ESGII	38	20.5	22.7	33.5
ES	GOOD	HIGH	HIGH	GOOD

Macro-biodiversity records

In total, we identified 86 taxa (Fig. 3), which include ten species of special conservation interest: the brown algae *Cystoseira corniculata*, the phanerogam *Posidonia*

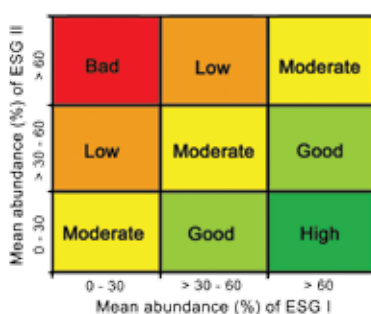


Figure 2. Ecological Evaluation Index Matrix (after Orfanidis et al., 2001).

oceanica, the sponge *Aplysina aerophoba*, the scleractinian coral *Balanophyllia europaea*, the sea-urchin *Paracentrotus lividus*, the sea cucumbers *Holothuria spp.*, the dusky grouper *Epinephelus marginatus*, the common stingray *Dasyatis pastinaca*, the loggerhead sea turtle *Caretta caretta*, the bottlenose dolphin *Tursiops truncatus*, and some tuna specimens (probably *Thynnus thynnus*).

Overgrazing and other pressures

Sea-urchin overgrazing, as indicated by the presence of abundant mixed *Paracentrotus/Arbacia* populations on rocky barrens with partial cover of red coralline crusts, was a common finding across the study area. Such facies were most extensive at Pachia Ammos (1-3 m), common but scattered at Agia Paraskevi (0.5-2 m) and Katarti (>2 m), and rare in Jamaica.

Three alien species were recorded, namely the green algae *Codium fragile* and *Caulerpa cylindracea*, and the bivalve *Pinctada radiata*, all of which in low abundance.

Marine litter, mostly plastic bags, plastic cups and aluminum cans, was also a common finding, but only locally abundant at the beach of Pachia Ammos.

Discussion and conclusions

As mentioned, the algal communities in all the sites we analysed scored a good or high status according to the EEI (Table 1), indicating that Samothrakian coastal waters are unimpacted by nutrient pollution. During the surveys,

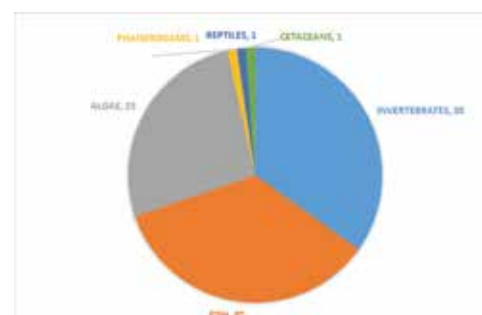


Figure 3. Identification of 86 taxa of macroflora and macrofauna.

however, early stages of sea urchin overgrazing were detected, corroborating findings by Salomidi et al. (2015). High densities of sea urchins leading to the creation of rocky barrens have been reported from several other areas in the Mediterranean; it is a typical trophic cascade effect largely attributed to overfishing of seabreams *Diplodus* spp., which, being the natural predators of sea urchins, mostly control their populations (i.e. Sala et al., 1998).

Marine litter is another common pressure affecting coastal zones worldwide. In the case of Samothraki, scattered presence of litter was recorded across our study area, but only considerably abundant in the most frequented Pachia Ammos beach, thereby suggesting a land-based pollution source.

Although some alien species were recorded in this survey, none of them presented signs of invasiveness. Monitoring their expansion and abundance is however considered important.

Recording a rich and important biodiversity across the taxonomic spectrum in such a limited spatial and temporal frame adds significantly to the increasing evidence of the urgency to study and protect this marine area. This study represents a starting point to uncover much that is still unknown. To be able to move towards the sustainable development of the Samothrakian environment, we must further our scientific understanding of what needs to be protected. The following recommendations are thus suggested:

- Survey more sites in a wider bathymetric range to get a better understanding of the marine ecological dynamics
- Further investigations to assess the current extent of trophic cascade effects and their implications for small-scale fisheries
- Investigate and build on the interest of local fishermen (see Petridis et al., 2013) in creating a no-take marine reserve.

References

Fischer-Kowalski, M., Xenidis L., Singh, S. & Pallua, I. "Transforming the Greek Island of Samothraki into a UNESCO Biosphere Reserve" *GAIA - Ecological Perspectives for Science and Society* 20.3 (2011): 181–190.

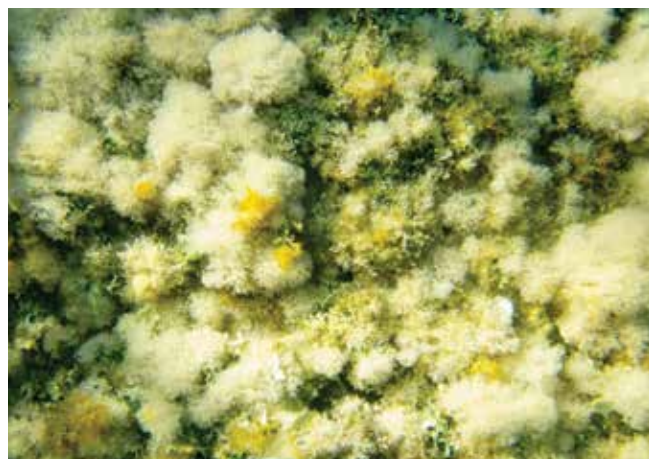


Figure 4. A rock covered with *Jania* sp.

Harlin, M. M. "Changes in major plant groups following nutrient enrichment". *Eutrophic shallow estuaries and lagoons*, edited by A. J. Mc Comb. Institute for Environmental Science, Murdoch University, Murdoch, Australia, CRC Press. (1995): 173-187.

Little, M.M. & Little, D.S. "The evolution of thallus form and survival strategies in benthic marine macroalgae: field and laboratory tests of a functional form model". *Amer. Naturalist*, 116 (1980): 25-44.

Orfanidis, S., Panayotidis, P. & Stamatis, N. "Ecological evaluation of transitional and coastal waters: A marine benthic macrophytes-based model". *Mediterranean Marine Science*, 2.2 (2001): 45-65.

Petridis, P., Hickisch, R., Klimek, M., Fischer, R., Fuchs, N., Kostakiotis, G., Wendland, M., Zipperer, M. & Fischer-Kowalski, M. "Exploring local opportunities and barriers for a sustainability transition on a Greek island". *Social Ecology Working Paper*, 142 (2013): 21-23.

WFD 2000/60/EC. "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy". *Official Journal of the European Communities* (2000).

Schramm, W. "Factors influencing seaweed responses to eutrophication: some results from EU-project EUMAC". *Journal of Applied Phycology*, 11.1 (1999): 69-78.

Schramm, W. & Nienhuis, P. H., (Eds) "Marine benthic vegetation: recent changes and the effects of eutrophication". *Ecological studies*, Springer-Verlag. 123 (1996): 470.

Theocharis, A. & Georgopoulos, D. "Dense water formation over the Samothraki and Limnos Plateaux in the north Aegean Sea (eastern Mediterranean Sea)". *Continental Shelf Research* 13.8 (1993): 919-939.

Salomidi, M. "Rapid assessment of the coastal ecological status (races) by means of photographic sampling of macroalgal communities of the upper infralittoral zone": A step towards the practical implementation of the water framework directive". *PhD thesis*, University of the Aegean (2009).

Salomidi, M., Tsiamis, K., Issaris, Y., Gerakaris, V., Panayotidis, P. "Assessing the status of shallow infralittoral rocky reefs in the eastern Mediterranean Sea: Losing our bioindicators". *2015 Aquatic Sciences Meeting*, 22-27 February 2015 Granada, Spain (2015).

Sala, E, Boudouresque, C.F., Harmelin-Vivien, M. "Fishing, trophic cascades, and the structure of algal assemblages: evaluation of an old but untested paradigm". *Oikos* 82 (1998):425–439.



Figure 5. Overgrazed (barren) infralittoral rocks in Agia Paraskevi.

The health care system on the Greek island of Samothraki: First insights from the perspective of local health care professionals



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Introduction

Previous investigations within the SUSAKI¹ project revealed that the population of Samothraki is exposed to serious challenges in accessing certain social services. Focus groups with inhabitants have shown that the local health care system represents a great concern regarding the future of the island (Petridis et al. 2013). The health system on Samothraki has therefore been identified as a potential social tipping point that might cause population decrease if not improved towards local needs. The island's geographical distance and limited ways of transport to the mainland make it imperative to provide basic health care at the local level. Against this background, the aim of my master thesis is to investigate the health care system on Samothraki and to identify synergies with the sustainable development of the island population. The present report is based on my initial approach to the subject and integrates a literature review and the findings of my first field stay on the island.

One of the main principles of the National Health System in Greece is to provide universal access to health services for the population. Various publications indicate that this mission has failed: The system is considered fragmented and pervaded by structural inefficiencies, which impede continuous health care services being delivered to those in need (Mossialos et al. 2005, Economou 2010, Economou 2015). The majority of legislative reforms that intended to address actual problems and to shift power relations towards the regional and local level have never been fully implemented (Athanasiadis et al. 2015). Relevant studies highlight political particularism, administrative weaknesses and the lack of an overall policy with shared goals as main factors for this "immunity towards change" (Economou 2010, Athanasiadis et al. 2015). Furthermore, the health sector was heavily affected by the continuing fiscal crisis. While the demand for health care services of the population has become substantially higher, the health supply situation has decreased dramatically (Kentikelenis et al. 2015). Between 2009 and 2013 total health expenditures dropped by 31% (ELSTAT 2015).

¹ <http://sustainable-samothraki.net/project/sustainable-samothraki-susaki/>

Currently, the Greek health system is divided into seven administrative health regions. Their administrations are directly subordinated to the Ministry of Health. The health system on Samothraki belongs to the 4th health region of Macedonia and Thrace.

Methodology

In July 2016 I visited Samothraki for the first time. In addition to my participation in the Summer University I got in contact with stakeholders of the local health system to obtain an overview of available health services, their organization and existing problems. In sum I conducted six semi-structured interviews with local health care professionals (two physicians, two nurses, one social worker and one administrator). All interviews have been recorded as well as transcribed. The data material is submitted to an ongoing semi-open coding process by using a software for qualitative data analysis (ATLAS.ti). Codes and categories are developed in-vivo and supplemented with findings from scientific literature.

Preliminary findings

The main local health facility on the island is the public health center in the capital village Chora. The core staff consists of one general practitioner, seven nurses, several administrators, two paramedics, two emergency drivers and two trainees who are completing an obligated practice year on Samothraki in order to become specialists. A legal requirement of the National Health System provides that health centers are manned 24 hours a day by at least one general practitioner. Therefore additional temporary general practitioners are supplied by health facilities outside of Samothraki to fill the staff shortages. This measurement is organized by the 4th Local Health Authority, to which the health center is subordinated since 2013. This organization also sends specialists (cardiologists, psychiatrists, pediatricians, etc.) offering services at the island's health center. In rare cases associations like "Doctors Without Borders" provide specialists. Aside from the health center there exists a mobile municipal eldercare service involving two teams, each comprised of a nurse and a social worker. Other relevant facilities are located in the village of Kamariotissa. There are two pharmacies, two private

hematology laboratories and a private dentist who offers biweekly services in her own practice. In emergency cases patients have to leave the island. Depending on the urgency and the weather conditions they are brought by ferry, coastguard boat or helicopter. It's the "National Center for Emergency Care" that decides which way of transport is chosen. In addition to these "official" services, several persons who are not employed as medical personnel on Samothraki support the local health system on a voluntary basis. For instance the former X-ray technician stands in if necessary. Also doctors offer services during their vacation on the island. I was told of an ophthalmologist who regularly provides his services during his private time without asking for money.

Without exception, all interview partners emphasized that available health care resources on Samothraki are not sufficient to meet the needs of the population. The lack of medical staff was reported as the main problem and most interviewees referred to the unfilled position of an X-ray technician to illustrate this problem. Although one of the former employees sometimes operates the old machine, he is not available in many cases and patients are forced to travel to the mainland for treatment. This happens especially during summer when broken bones are a more frequent incident. Other medical personnel noted as lacking are specialists for cardiology, pediatrics, surgery and dentistry. The support of specialists from the mainland to temporarily fill certain gaps was rated as insufficient in terms of frequency and service quality. Interview partners reported that the relationship between these temporary doctors and patients was impersonal and weak. They argue that external staff shows little interest in the local health situation and were described as not willing to develop a good understanding of the patients' health history. While only one interview partner emphasized that the health center doesn't keep a medical record system of patients, this circumstance can certainly be seen as a factor for the weak relationship between temporary doctors and patients. It is a barrier with regard to delivering patient-oriented quality services.

The situation in terms of human and physical health resources seems to have worsened within the last decades. When the health center was established in 1999, all main positions for specialists were covered. Nowadays, many positions are cut or are not even advertised by the health region's administration, thus remain unfilled. When the employment contract of the X-ray technician on Samothraki expired, it was not renewed. Until today the position is unfilled. Since the subordination of the health center to the 4th Local Health Authority in Thessaloniki in 2013, the local supply situation has further deteriorated, both in terms of staff and technical equipment. Before, the health center on Samothraki was attached to the hospital in Alexandroupoli. Interview partners described the past exchange of information, personnel and equipment between these two organizations as sufficient and oriented towards local requirements. The reason given was the similar organizational structure of both organizations as health facilities. Also the short distance between Alexandroupoli and Samothraki made it easy to meet local needs at short notice. One interview partner

emphasized that the 4th Local Health Authority is not a hospital but an "administrative machinery" which is too far away and probably overburdened to be able to meet the needs of more than 40 health centers in Macedonia and Thrace. The cooperation seems to be limited on information flow rather than material or financial resources. The health center is obliged to send monthly statistics about its performance to this administration as well as to the higher-level authority of the Ministry of Health. Usually, any answers provided by the higher-level authorities are perceived as unhelpful. The local health center merely gets information on when a specialist is actually coming, but has no influence on the frequency or the specialty of doctors. One interview partner described it as "shouting in the wind" when he communicates local bottlenecks in terms of staff or equipment.

Conclusion

First investigations of the health system on Samothraki revealed that the local health infrastructure is seen as having deteriorated in terms of capacities needed to meet the demands of the island population. Interviewees noted the lack of medical workforce as a major problem. Several health services have not been offered for many years. This problem of a shortage in human resources is reinforced by its negative impact on the efficient usage of physical supplies, such as technical equipment. Without a trained person who is able to permanently operate the X-ray machine, the machine is a weak resource, not used to its full potential in order to contribute to service availability.

Against the background of the struggling Greek health system, the resilience of the health infrastructure on Samothraki is questionable. Due to the centralized structure of the National Health System the scope of action at the local level is limited. The health center's subordination to the 4th Local Health Authority seems to have resulted in an increase in bureaucratic structures and a decrease in meeting local needs.

The second field visit is scheduled for November 2016. The main objective is to gain insights into perspectives of patients through focus group discussions.

References

- Athanasiadis, Athanasios, Stella Kostopoulou, and Anastas Philalithis. "Regional Decentralisation in the Greek Health Care System: Rhetoric and Reality." *Global Journal of Health Science* 7.6 (2015): 55–67. PubMed. Web.
- Economou Charalambos. *Greece - Health System Review*. Vol. 7. European Observatory on Health Systems and Policies, 2010. Health Systems in Transition: Greece 12. Print.
- Economou Charalambos. *Barriers and Facilitating Factors in Access to Health Services in Greece*. Denmark: World Health Organization Regional Office for Europe, 2015. Print.
- ELSTAT (2015). Press release: System of Health Accounts (SHA) of year 2013 & revision of SHA data of years 2009–2012. Athens: Hellenic Statistical Authority (<http://www.statistics.gr/por-tal/>)

page/portal/ESYE/BUCKET/A2103/ PressReleases/A2103_SHE35_DT_AN_00_2013_01_F_EN.pdf, accessed 8 August 2015).

Kentikelenis Alexander, Karanikolos Marina, Papanicolas Irene, Basu Sanjay, McKee Martin and Stuckler David. "Health Effects of Financial Crisis: Omens of a Greek Tragedy." *The Lancet* 378 (October 22, 2011).

Mossialos Elias, Sara Allin, Davaki Konstantina. "Analysing the Greek Health System: A Tale of Fragmentation and Inertia." *Health Economics* 14.S1 (2005): S151–S168. Wiley Online Library. Web.

Petridis Panos, Hickisch Raffael, Klimek Milena, Fischer Rebekka, Fuchs Nina, Kostakiotis Giorgos, Wendland Maike, Zipperer Michael and Fischer-Kowalski Marina. *Exploring local opportunities and barriers for a sustainable transition on a Greek island*. Vienna: Social Ecology Working Paper Nr 142, June 2013. Web.

Simou Effie and Eleni Koutsogeorgou. "Effects of the Economic Crisis on Health and Healthcare in Greece in the Literature from 2009 to 2013: A Systematic Review." *Health Policy* 115.2–3 (2014): 111–119. ScienceDirect. Web.



View of Chora where the Health Centre of Samothraki is located © O. Lange





FINDINGS FROM SUMMER UNIVERSITY COURSE WORK & WORKSHOP COORDINATORS

Course B

*“Integrated Water and Coastal Management - Educational
and Participatory Approaches”*

Samothraki Island speaks of itself: An ecological survey based on observations



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Scope

Ecology is a field of study, which tries to explore interactions, interrelations, interdependencies among the infinite number of integral parts of the entire universe (ecosphere), regardless of any categorization, classification, grading, rating, measuring, and whatsoever. Humans, with all their capability, are simply one of the integral parts of the ecosphere and see, perceive, understand, manage it through to their own eyes, values, classifications, interests, and whatnot. The ecosphere we perceive is unique to us and certainly very disparate from the perceptions of other integral parts.

The terms or concepts such as management, sustainability, cultural heritage, pollution, conservation, green, good, big, ecology, etc. we use are all man-made and therefore reflect our own values or perceptions, which may differ from the values and perceptions of other integral parts.

If we are to manage the ecosphere sustainably, first thing we have to do is to try to understand the relevant interactions, interrelations, interdependencies, processes, independently, i.e. by avoiding the use of our own values, definitions, ratings, etc. as much as possible. This may be called an eco-centric approach, an arduous but indispensable task. As Charles Darwin underlined, there is no good or bad, no useful or harmful, etc. in nature.

Only after having understood the ecological processes independently may we start to take our management decisions (man-made) by using our own values, definitions, ratings, etc. This may be called an anthropocentric approach, which gives priority to human

values and needs. The anthropocentric management decisions that are taken before the eco-centric understanding of the ecological processes cannot solve the issue in question adequately but may rather aggravate it. From an eco-centric perspective, for instance, fire is just one of the essential ecological processes affecting and being affected by the entire ecosphere. Some of the effects might be considered destructive for us humans, whilst some might be vital for the other integral parts of the system. All plants, although at different degrees, evolved in an environment where frequent fires were one of the integral parts of the system, so they have co-evolved by affecting and being affected from each other.

We generally consider fire as a destructive phenomenon and strive to manage our forests by keeping fires away. This is an anthropocentric approach. In the absence of fires, for instance, the Mediterranean vegetation type cannot regenerate itself adequately and grow older and taller leaving almost nothing for goats, deer, etc. to graze on. In addition to that, populations of fungi, ticks, bacteria, viruses, etc. which attack wildlife, explode when there are no recurring fires which function as a population control agent. Consequently, and by virtue of

anthropocentric management decisions, vegetation as well as wildlife are both affected negatively.

On the other hand, the eco-centric approach foresees that we understand the ecological roles or functions of fire on the ecosystem and vice versa. As managers, we may not want fire or its use as a tool for the regeneration of Mediterranean vegetation or for controlling the population of fungi, ticks, bacteria, etc., but we cannot undermine the ecological role or function of recurring fires on ecosystems. We may execute the same functions by coppicing the vegetation and/or by using chemicals

This is an Island of mountain, streams, goats, winds, earthquakes, tourists, waters, beaches, hotels, sanctuary, etc. They have evolved together affecting and being affected by each other. It should continue this way without isolating any of the integral parts. Managers should try to understand the interdependencies among the integral components and try to manage it on the basis of this understanding.



Figure 1. Location of Samothraki Island: at the meeting point of two continents (Asia and Europe) and two seas (Black Sea and Aegean Sea), over the North Anatolian Fault Line and Anatolian Trench (1500m).

to control populations of fungi, ticks, bacteria, virus. The latter is the management decision taken on the basis of the eco-centric approach. Isn't this in the favor of all, vegetation, wildlife and humans?

For the sake of simplicity, we may compare the processes of drought, wind, grazing, etc. on ecosystems to the process of fire. To cope with the external impact of drought, Mediterranean vegetation had to develop many adaptive traits such as thick and waxy leaves, deep roots systems, deep stomata, etc. This has also applied to fire and other external impacts. Yet, our perception of fire is much different than that of drought.

The ecological issues of Samothraki Island (including, living things, nonliving things, humans, culture, economy, art, justice, etc.) are to be studied through this systemic (every integral part is interconnected to each other) perspective. Categorizing ecology into isolated parts such as animal ecology, social ecology, economic ecology, plant ecology, river ecology, etc. may trammel the holistic or systemic understanding. The ecosphere does not evolve as the sum of individual parts but evolves as an interrelated, interconnected whole.

Observations

With my wife we had a nice supper in a restaurant in Alexandroupoli with a view of Samothraki Island. The menu gave away that the city receives a lot of Turkish tourists since it was written in two languages Greek and Turkish. A Turkish couple was sitting next to our table.

Visually, the island can be characterized as an irregular ellipse that occupies an area of approximately 178 square kilometers.

The view of the island, even from 40 km away, was gorgeous. It seemed to be kissing the clouds. It is something special and unique; a small island (178 km²) with a high mountain (+1600 m) rising up over the dark blue waters of the Mediterranean. The projection of the summit, which might be snow capped during some winter months, can't be, horizontally, more than 10 km to the coastline. This, for sure, is one of the major characteristics of the island affecting severely many other features. This feature alone is good enough to explain

the abundance of water, the rate of erosion, lack of sandy beaches, biodiversity, landscape diversity, sanctuary of great gods, so on, on the island. It also gives the island the advantage of offering the visitor in one single day, walking on foot, the experience of dramatic changes in landscape, land use practices, plant coverage, water abundance and scarcity, etc.

There is always more than one (if not infinite) ecologically sound answers to the same question.

As we were approaching the island on Monday, July 11, the ferry was almost full. The majority of the passengers were Greeks, young Greeks with their backpacks. There were also some family groups. The number of international tourists was not more than 15-20 excluding a bus full of Turkish tourists. All this made me think that the island is not a popular sea and sun destination but an area of adventure particularly for youth. The dark blue color of the sea and dolphins we saw were indicators of deep, rich, and clean waters.

Closer to the island and cruising parallel to the northeastern coast, what struck me was the sharp visual difference between the east and west part of the island. The eastern part was high, steep and green in contrast to the low, rolling and brownish western part.

I saw only a few structures (hotels, summer homes, etc.) and no sandy beach along the coast, explaining why the island is actually not a popular sun and sea area. The lush and dark green vegetation covering the steep slopes all the way down to the sea is unusual for a small island like this. It is also a clear sign of abundant water resources even in mid-summer. The fire break lines seen at a distance revealed the danger (!) of wildfires.

At the point of disembarkation, port of Kamariotissa, the number and the size of fishing boats and the appearance of the buildings warned that we would spend the next 4 days in a moderately wealthy fishing island rather than in a tourist destination island of Greece. This was further confirmed by the over-aged shuttle bus, which took us to the hotel. The bus was full of young travelers carrying heavy backpacks.

Along the way to the hotel we drove east following the coast and passed through a dry, degraded, pastoral,

rolling landscape for about 4-5 km. Between Kamariotissa and Paleopoli we saw many abandoned farmlands, which might be considered as a sign of socioeconomic shift from agriculture to tourism and/or migration of the population from the island to the mainland. The shape and structure of the bushy vegetation we saw along the way betrayed the exact direction of the prevailing winds (NW-SW) and also the severe overgrazing mostly by goats. Scattered *Sacropoterium spinosum* patches revealed the degree of site degradation.

We gradually entered into a green, wooded area where hills fell steeply into the sea. We got off the bus at a gigantic plane tree. The number of people sitting under the dark shade of that plain tree, the number of souvenir stalls, coffee shops and restaurants gave us the impression that here was the meeting point of the area. The hotel we stayed overnight was also in dense vegetation.

Later we went back to the same transitional spot to study the river bed and visit the Sanctuary of the Great Gods. Located in between two sacred mountains, Mount Ida on the east, known as Mountain of the Goddess and Mount Athos on the west and having the shape of a breast, Mount Saos and its sharply rising summit, Feggari (= moon), presents a very suitable site for the Sanctuary of the Great Gods. The Pantheon of the Great Gods probably had numerous chthonic deities, pre-dating the arrival of Greek colonists on the island in the 6th century BC, centered around the Great Mother. The sanctuary was open to all who wanted to worship the Great Gods.

Upon arrival to the site the first thing that immediately drew our attention was the shape and structure of the vegetation just next to the dry streamlet. Forests or shrub lands are ecosystems that have adapted to withstand disturbances such as drought, flood, fire, wind and grazing. All disturbances affect plants to some extent, either directly or indirectly, depending on the timing, intensity, and frequency of the disturbance. All native plants, animals and all other integral parts (living or nonliving) evolve altogether under all these determinants (disturbances). Therefore, ecosystems as an interdependent whole developed the ability to cope with, or to survive these determinants up to certain levels.

The bending of plants towards a certain direction is generally caused by the prevailing wind. When branches of shrubs are continually bent in one direction by prevailing winds, they become "wind trained" and hold their position permanently. Some branches grow completely around the trunk from the windward to the leeward side and leaves become smaller. These lopsided shrubs with branches extending from only one side are called "flag shrubs", because they resemble a flag fully extended from its pole by the wind and point out clearly the direction of the prevailing wind, NE-SW. Some trees, like plane trees (*Platanus orientalis*) along the streamlet have leaves that curl in strong wind, reducing the exposed surface area and wind drag on the crown canopy.

On the other hand, the same shrubs speak of other realities too, the severity of grazing, fire frequency,



Prof. Tuncay (front) and Prof. Scoullos (back) in the archeological site of Paleopolis.

rate of erosion, etc. For woody plants, growing points are elevated above ground and, therefore, are easily accessible to grazing animals particularly by deer and goats. If these growing points are removed, lateral buds are stimulated to sprout and produce leaves. Hedging is an ecological plant response to grazing marked by twigs that have many lateral branches under which the shrunken leaves take refuge. Whilst the severity of grazing increases, the production of shorter twigs with even smaller leaves builds up and finally the plants get a compacted shape. The inaccessible parts of the plants by grazing animals stay intact. The vegetation on the western side of the streamlet clearly showed severe grazing and the direction of the prevailing wind.

The older trees around, but also the structure and the estimated age of the shrub vegetation allowed an expert to conclude that there had not been a wildfire here for about 30-35 years. The existence of the sanctuary might have played a role in keeping wildfires away for a relatively long time. There was almost nothing, neither over nor under the canopy of the vegetation, to be grazed by animals (goats). Similar sceneries were observed along the road between Chora and Paleopoli.

Over-grazed and over-aged vegetation needs to be regenerated. If fire (prescribed burning) is not considered, coppicing is recommended for regeneration, which will help control the erosion more effectively and improve the quality of the vegetation.

The streamlet probably flooded occasionally with relatively high quantities of water. The marks on the stream banks carved by the rushing water and debris such as leaves, plastic bags captured by tree trunks or branches allowed us to estimate the maximum water level at the time of flooding. The size of the boulders in the river bed gave an idea about the volume and flow of the water, which brought them to the spot. By visually observing and investigating the trees (including seedlings and juveniles) -their age, density and location- the size of the boulders, etc. in the river bed and the marks on the banks and trees, very interesting rough information related to that particular area was deduced, such as: the year of the last flooding, the average frequencies of flooding, stream flow (m^3/s), rainfall regime, rate of erosion, and different rock types within the catchment area. The inspection of the beach at the mouth of the stream was the most suitable site to get data related to the rock types within the catchment area. Nature keeps record of every change, for those who know its language. The streamlet, which crosses the sanctuary from one end to the other, whispered in my ear that heavy downpours are quite usual on this island. This disclosure was confirmed by the heavy supporting walls, which have been built along the banks of the streamlet.

I saw dazzling hydrangeas blooming in blue around almost all establishments reminding me of the Portuguese Island Faial, also known as blue Island because of the abundance of blue hydrangeas. Based on this, we may conclude that the soil of the area contains aluminum and is acidic (low pH).

The walk uphill along the Fonias streamlet was quite different. Like the others flowing through the dense vegetation it has an L shape, a very steep upstream section and a moderately steep downstream section. The downstream section was steeper than the streamlet around the sanctuary. We walked almost half an hour to reach the junction of the horizontal and vertical L axis. The pools (vathres) and waterfalls were all on the upstream section.

The majority of the boulders in the stream bed were granite and serpentine (green rock), which testified the existence of lush riparian forest and the purity of the water. The water snake we saw as we were walking was further evidence of this. The low temperature of the water indicated that it comes from a natural spring and that the spring was not very far away (in July).

The walk I took from the Education Centre to Chora and then to Therma via Paleopoli was a nice cross-section of the island. Between the center and Chora there were mostly farmlands but between Chora and Paleopoli, I saw herds of goats, heavily grazed vegetation and eroded landscapes. Two watering troughs (probably fed by a spring) I came across on the way to Paleopoli could be taken as a sign of water availability at the height of the dry season.

Conclusion

Islands are more suitable to be designated as an area of protection and Samothraki is a unique island, which deserves to be designated as a biosphere reserve (I personally prefer the term ecosphere) for the reasons given above. This is an Island of mountain, streams, goats, winds, earthquakes, tourists, waters, beaches, hotels, sanctuary, etc. They have evolved together affecting and being affected by each other. It should continue this way without isolating any of the integral parts. Managers should try to understand the interdependencies among the integral components and try to manage it on the basis of this understanding.

The ecosphere will certainly change the understanding and management decisions of humans but in return the ecosphere has to evolve taking the impact of humans into account. Think of the story of the wolves in Yellowstone National Park.

The need of modeling: Experience from the Samothraki Summer University



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During the Summer University I had the opportunity to give a short lecture on modelling and simulation of dynamic systems with some examples on the Biosphere Reserves and other environmental related cases.

To study, analyse and control systems we need to know them very well and therefore to have a mathematical model that describes them, which can be used either as a simulator or as a control model. A simulator-model is complex in order to describe as accurate and realistic as possible the real system behavior. A control model takes a simpler representation but always taking into account the essence of the real system and its characteristic behavior. Therefore, modeling techniques can achieve models in a simple or complex manner depending on the objective.

The models serve to determine criteria of lawful change and thus fulfil at least three purposes:

- Prediction: given a description of the system over a period of time and the set of rules governing change, to predict the way the system will behave in the future.
- Learning new rules: given a description of the world at different times, to produce a set of rules which accounts for regularities in the system.
- Data compression: to generate a model that represents data on a compact form with a low complexity.

Models can be developed in two ways: The theoretical approach consists in building a model from physical laws. Here, the modeler can face the difficulty of managing all the physical laws that take part and the obtained model can be very complex and thus difficult to manage. Another drawback of this approach is that real phenomena such as components wearing, tolerances and noise are not taken into account.

When a system is not suitable for the theoretical approach for any reason (e.g. complexity, lack of knowledge of its structure, etc.), we resort to the experimental or identification approach that permits the achievement of valid models. This approach consists in analysing the system in basis of studying of the system response signals to other stimulation signals. In this approach, not adopting any hypothesis about the system's characteristics makes the study difficult and limits its quality.

The experience demonstrates that the best solution is the combination of both approaches if possible. In the first analysis stage, based on the physical laws and working conditions (operation modes) an hypothesis is set. In the next experimental stage, starting from the hypothesis, the obtained experimental measures are considered to determine the coefficients of the mathematical model.

For a system having response, it is necessary to stimulate it through the input variables that are generated for the environment and influence its behavior. There exist two kinds of input variables: those that can and those that cannot be controlled (disturbances, automatically generated by the environment). The variables generated by the system are the output variables, influencing the environment. Those variables are measurable and, sometimes, observable.

With a system like that of Fig. 1, mainly, two problems can arise:

Firstly the direct problem of analysis: knowing (input, system), find (output). This problem has a unique solution.

Secondly there are inverse problems:

1. Knowing (input, output), find (system). This problem does not have a unique solution but infinite correct solutions. This is a problem of structure identification and state estimation, and it is called a problem of synthesis.
2. Knowing (system, output), find (input). This is a problem of control (instrumentation).

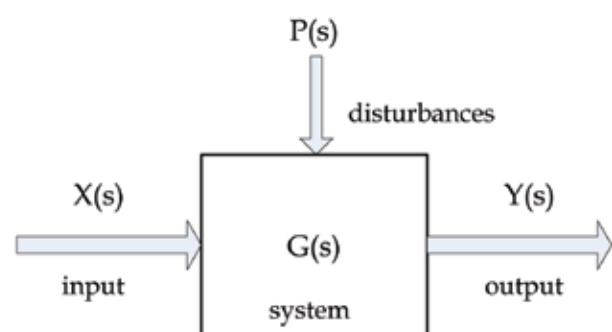


Figure 1. The system diagram.

Type of systems

Depending on the models, they can be classified using different criteria:

According to the technology of its elements: There are mechanical systems (built with springs, wheels, etc.); electrical (motors etc.); electronic (RLC, amplifiers etc.); thermal (oven, chemical reactors etc.), hydraulic ones (tanks, pipes, canals etc).

According to the number of inputs and outputs: SISO (Single Input, Single Output); MIMO (Multiple Inputs, Multiple Outputs); SIMO; MISO; etc.

According to the properties distribution we distinguish those with distributed parameters (properties distributed in time and space) and those with concentrated parameters (the changes in the variables occur in specific points).

According to the relation among the system variables, we distinguish the stochastic (the relations among the system variables are described in a probabilistic way and the response to the input is unpredictable) and the deterministic ones (the relations among the system variables are not random, and the response to the input is predictable and repeatable).

According to the discretization of the variables, we distinguish the continuous (in a finite time interval, the state variables take infinite values) and the discrete time ones (the changes succeed only in the discretization or sampling time).

Modeling and simulation spectrum

A system can belong to different disciplines and each one presents different aspects to be taken into account when treating it. The modeler can face systems that present only historical data (e.g. public opinion). Models can only be built from experimentation and the modeling technique that is mainly used when the system structure is unknown is *identification*, leading to models called *black box*, represented with differential equations (discrete systems).

In the real world there exist complex systems whose evolution depend on various variables (time, space etc.) and the most suitable way to describe them is through Partial Differential Equations (PDE), being systems with distributed parameters. Such systems can be found in Environmental Science (Ecology, Pollution, Biodiversity, etc). The models developed in these systems are mostly for prediction and experimentation of management strategies.

Finally, there is another kind of systems whose structure and physical laws are perfectly known and they can be built using *white box models*. From those models the differential equations are generated and, in most cases, they are straightforward enough to be represented with Ordinary Differential Equations (ODE), since, normally their parameters are concentrated.

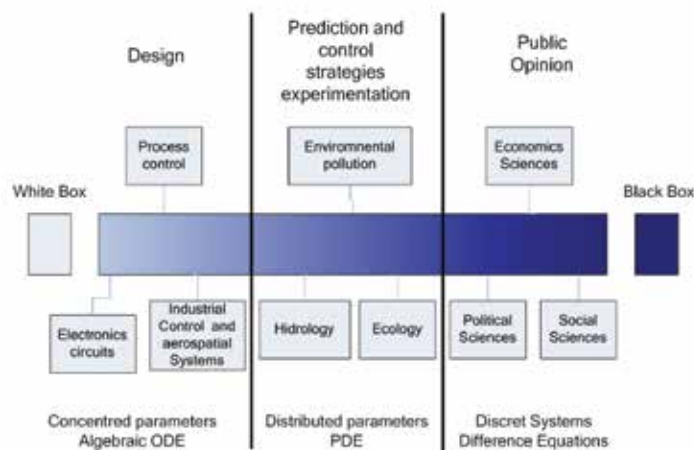


Figure 2. The models that can be found in the real world, ranging from black box to white box ones.

Simulation of real processes

Figure 2. The models that can be found in the real world, ranging from black box to white box ones.

- The real system-plant may not be available. Before building the plant it is important to ensure its viability with the desired features.
- To experiment with the real plant may be dangerous. In order to test the control algorithm reaching extreme conditions might be needed, causing injuries, deaths or destruction (e.g. a nuclear reactor or a plane flight).
- The cost of experimentation could exceed the given budget (e.g. energy production plants, oil tanker berth).
- The system time constants might not be compatible with observations (e.g. too fast or too slow systems).
- The control variables, state variables, perturbations or parameters of the real system might not be accessible.

Conclusions

In this short communication the basic theoretical concepts taught in the Summer University were summarised. Only three hours were available, but many more would be needed to give more concepts and realise some software practices with real models. Interested students are welcome to go more in depth in the fascinating world of modelling and simulation.

References

- F.E. Cellier, *Continuous System Modeling*. Berlin and New York: Springer-Verlag, 1990.
- R. Murray-Smith and T.A. Johansen. *Multiple Model Approaches to Modelling and Control*. London: Taylor&Francis, 1997.
- D. Hinrichsen and A.J. Pritchard. *Mathematical Systems Theory I, Modelling, State Space Analysis, Stability and Robustness*. Springer, 2005.

Reflections on the two day workshop on the IWRM ToolBox



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The workshop began with a presentation on the GWP organisation and functioning as an international network, its strategic priorities for the coming years.

GWP DEFINITION OF IWRM

Integrated water resources management (IWRM) is defined as a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

(GWP, 2000) Integrated Water Resources Management. TAC Background Paper No. 4. Global Water Partnership, Stockholm

In 2016 GWP celebrates its 20 years. In its first two decades an impressive number of water partnerships and networks have been formed all around the world to help governments take a cross-sectoral approach to water resources management. Thanks to the GWP efforts in the past two decades, not only water managers but a growing number of the general public are convinced today that the current water crises stem from inadequate or improper management, rather than water shortages. Admittedly, making the necessary water policy changes against the patterns of decades, even centuries is a long-haul process, but there are already many good examples of changes, at city level, watershed level, or national or transboundary level. These are made known through the numerous projects, the knowledge products including the GWP IWRM Toolbox (see below), and the capacity



Objective of the IWRM approach is not water management as such but human development.

IWRM approach can only work if it does not focus exclusively on water.

Figure 1. The objective of Integrated Water Resources Management (IWRM).

building and know hoe exchange events taking place worldwide.

As the organization enters its “adult” phase, the key challenges and priorities to address are:

1. To catalyse change in policies & practice: In this respect, any IWRM strategy should be linked to relevant national and regional plans and strategies (e.g. SDGs, plans on sustainability, biodiversity, climate change, etc).
2. To generate and communicate knowledge: the need for transition from information management to knowledge management was mentioned.
3. To strengthen partnerships. Partnering with other think tanks to generate knowledge is crucial, and there are already examples of partnership of GWP e.g. with UNICEF, OECD, etc.

The next one and a half day of the workshop was dedicated to the GWP IWRM Toolbox. The GWP IWRM Toolbox is an open online repository of case studies (>300 currently available) and references on water management at global, regional, national and local levels. The participants were navigated to the main features of the GWP IWRM ToolBox and how this knowledge resource could be a complementary study material in their study courses. The presentations were complemented by case studies



Figure 2. The challenge of Integrated Water Resources Management. Source: Pangare. V.; *Global Perspectives on IWRM*, 2006.

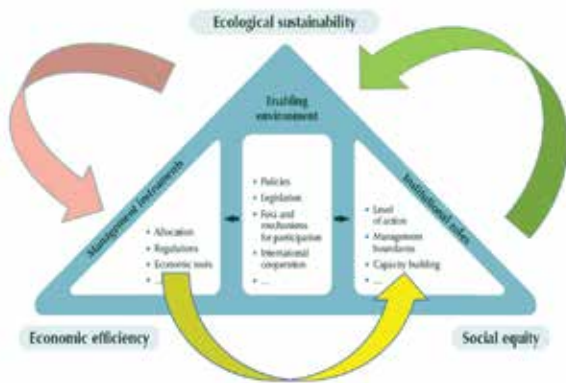


Figure 3. The three areas, where IWRM can bring a change.

to show complexity of IWRM approach and to illustrate a practical application of sustainable development in small abandoned area with low investment and political power of local community (Figure 3 and 4).

Split in small groups and using selected cases of the GWP IWRM Toolbox they analysed the essential components and barriers in IWRM; they did stakeholder identification and mapping; they tried out experiential games on issues such as non renewable resources, causal loops, as well as stereotypes and how to avoid them. The water problems in the cases analysed were highly technical, but required complex solutions. Indeed, the solutions proposed by the trainees in the end included social change instruments, economic incentives, and regulatory frameworks. By the

The results of the discussion suggest that IWRM principles are widely translated into the legislation, however, the implementation is lacking. Most participants see corruption, funding gaps and low education priorities for IWRM as the most obvious barriers in implementing it. It was interesting to note that most participants see a good communication and soft investments to be the key elements for a proper implementation of IWRM.

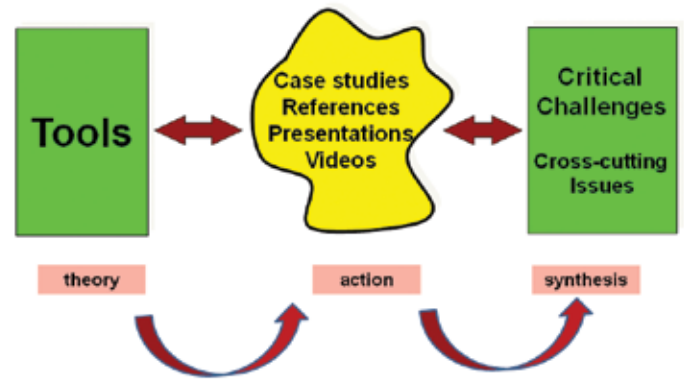


Figure 4. The dynamics within the IWRM Toolbox.

end of the workshop the trainees had a clear idea about IWRM practice and its potential to address complex issues, such as climate change.

There was sufficient time devoted to mutual interactions and discussions among the participants. The results of the discussion suggest that IWRM principles are widely translated into the legislation, however, the implementation is lacking. Most participants see corruption, funding gaps and low education priorities for IWRM as the most obvious barriers in implementing it. It was interesting to note that most participants see a good communication and soft investments to be the key elements for a proper implementation of IWRM.

Resources:

GWP IWRM ToolBox: www.gwptoolbox.org

Case studies available online:

Czech Republic: Implementation of sustainable sanitation in rural areas; an integrated approach in Hostetin (#467) www.gwp.org/Global/ToolBox/References/CS_467_Hostetin_full%20case.pdf

Slovakia: Urbanization and wetland restoration: Conflict or Concord? (#367) www.gwp.org/Global/ToolBox/Case%20Studies/Australia%20and%20Oceania/CS_367_Slovakia_wetland%20Sur.pdf

Mediterranean: Non-Conventional Water Resources Programme (# 464) www.gwp.org/Global/ToolBox/Case%20Studies/Americas%20and%20Caribbean/CS_464_Mediterranean_NWRM.pdf

Slovakia: Ruzinov Strkovec Lake in Bratislava (#275) [www.gwp.org/Global/ToolBox/Case%20Studies/Europe/Slovakia.%20Ruzinov%20Strkovec%20Lake%20in%20Bratislava%20\(%23275\).pdf](http://www.gwp.org/Global/ToolBox/Case%20Studies/Europe/Slovakia.%20Ruzinov%20Strkovec%20Lake%20in%20Bratislava%20(%23275).pdf)



Figure 5. Snapshots from the Workshop on the GWP IWRM Toolbox in Samothraki.

Engaging stakeholders in water management planning in the Mediterranean area

Roles in participatory approaches for water management planning to adapt to global change



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Introduction

Though the effects of climate change will be felt over the entire earth, some areas will experience the negative impacts far more than others. As is well known, the Mediterranean region is such an area, with severe impacts to be expected related to changes in temperature and precipitation. Inevitably, it will become increasingly challenging to ensure a sustainable supply and use of high quality water resources in the Mediterranean area, as can be seen in Figure 1.

Water management at the level of the river basin has a major role to play in dealing with global change. Yet, a river basin is a complex system, the dynamics of which are driven by many factors that are often linked with each other. Therefore, understanding these dynamics, as well as how global change will impact this system is not obvious.

It isn't obvious either to understand how options for water management will influence the river basin dynamics.

If evaluating the effectiveness of water management options is not a simple task, how can effective river basin adaptation plans be developed?

It is clear that the evaluation of the effectiveness of potential water management options, when developing a river basin adaptation plans, calls for an approach based on a scientific methodology that can deal with the complexity of a river basin.

On the other hand, in view of its cross-cutting nature, water management at the level of a river basin impacts many stakeholders - at the local level, at the level of the river basin, or even at a larger scale. As stated in the Water Framework Directive (2000/60/EC), it is important to involve these stakeholders in the production, review and updating of the river basin management plans.

However, if the development of a river basin adaptation plan calls for a scientific approach, hence the involvement of experts, how can local stakeholders be involved? In

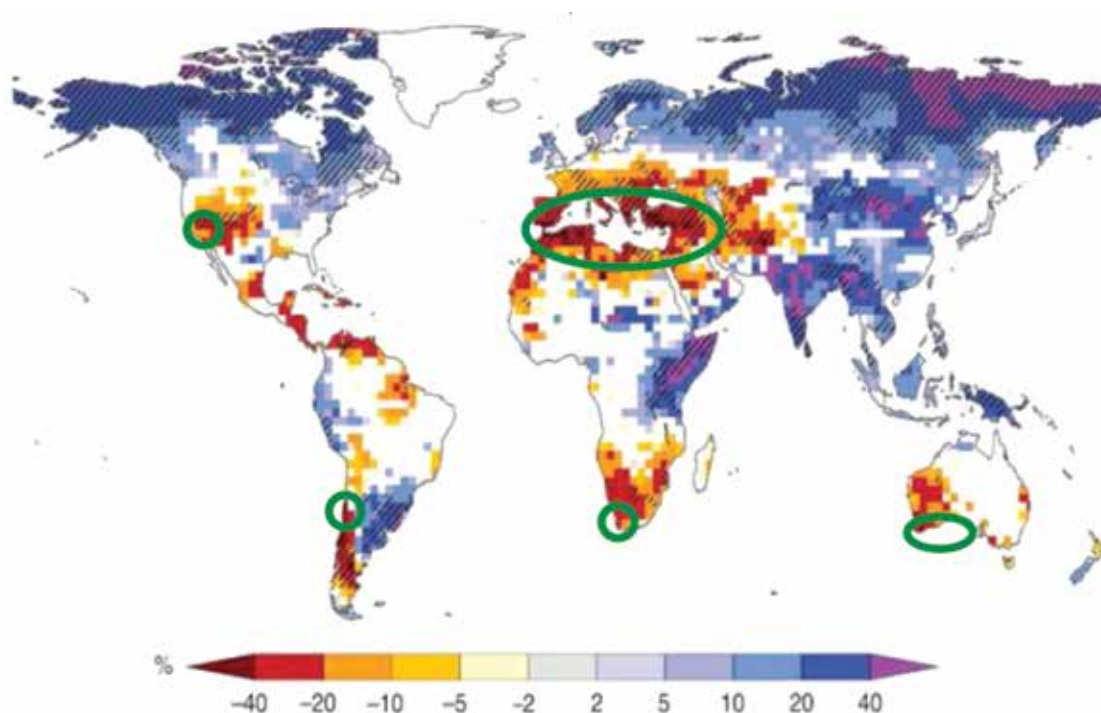


Figure 1. Available water by the end of the 21st century (IPCC).

other words, would it be possible to define a suitable approach for river basin adaptation planning in which a scientific methodology is combined with stakeholder participation? Even if the answer would be positive, the question remains under what conditions would such an approach be suitable to be adopted by the multitude of river basins in the Mediterranean area (and beyond)?

The BeWater project

There is a range of projects in which stakeholder participation is used in combination with scientific methodologies. Indeed, there are several well-documented projects on climate change related challenges, in which the qualitative arguments given by stakeholders is used in combination with science based (semi-)quantitative modelling approaches (Gramberger et al.). These projects often focus on formulating recommendations for policy makers, rather than on dealing with concrete challenges at a local level i.e. by preparing concrete plans that can be implemented. Furthermore, the stakeholders involved in such processes often represent a cross-section of stakeholders from a European perspective and not often involve stakeholders active at a local level.

On the other hand, the use of participatory approaches at the local level, involving local stakeholders is also well-documented. However, examples of stakeholder driven science based processes aimed at preparing water management adaptation plans at the level of a river basin, are less easy to find. For this reason, BeWater, a project funded by the European 7th Framework Programme, was initiated. BeWater (www.bewaterproject.eu) has the objective to develop water adaptation plans following a science based yet stakeholder driven approach in four different river basins situated in the four cardinal points of the Mediterranean: Pedieos in Cyprus, Rmel in Tunisia, Tordera in Spain and Vipava in Slovenia - see Figure 2.

In Table 1, some key characteristics of the four case study river basins, together with the challenges as identified by the stakeholders are presented:



Figure 2. The four river basins that acted as case studies in the BeWater project.

Methodology adopted within the BeWater project

The approach that has been developed within BeWater consisted of a scientific and a stakeholder engagement process.

For the scientific process, the following objectives had to be met:

- the creation of a model to discuss and improve the understanding of the dynamics of each river basin and that could be used to identify and evaluate the impact of water management options;
- the methodologies and methods needed to be suitable to handle qualitative, semi-quantitative or unprecise data or statements and to be integrated with a participatory approach.

For these reasons, a combination of fuzzy cognitive mapping, with multi-criteria analysis was selected. Fuzzy cognitive mapping is the process of building graphical representations of a system, in this case a river basin. The fuzzy cognitive map represents the dynamics within the river basin (with factors contributing to the dynamics and the dynamics being created by the relationships between these factors) based on the understanding of the people that have created the map. The technique has been used in climate change related modelling (Özesmi et al.; Kok). The use of the multi-criteria analysis allowed to take the preferences of stakeholders regarding the water management options into account.

A more detailed description and discussion of the scientific process is in the process of being published (Verkerk).

The methodology selected for the stakeholder engagement process covered several areas. The process used for the identification and selection of stakeholders was based on the CQI method (Gramberger). In essence, CQI stands for:

- C-Criteria: defining a set of criteria and categories for stakeholder groups;
- Q-Quota: setting specific minimum quota for all categories e.g. requesting a gender representation of at least 30% of each gender, when organising structured stakeholder workshops;
- I-Individuals: identifying individuals that fit the categories, with the overall selection fitting the quota.

In practice, however, as the process of inviting local stakeholders was sometimes less straightforward e.g. with responses to invitations only coming in late in the process, CQI could not strictly be applied - though it remained the framework for the identification and selection of stakeholders.

Furthermore, for the interactions with the stakeholders, several structured participatory workshops were organised, seamlessly integrated with the scientific process - from a point of view of timing in the process, material and themes being discussed with the stakeholders, workshop design (selection of exercises). The outcome of the scientific process was discussed in

Table 1. Some characteristics of the four case study river basins.

River Basin	Pedieos (Cyprus)	Rmel (Tunisia)	Tordera (Spain)	Vipava (Slovenia)
Area	120 km ²	860 km ²	865 km ²	589 km ²
Inhabitants	192,000	40,000	157,500	52,000
Main land uses	Forests (42%), agriculture (31%), urban (27%)	Forests (20%), agricultural land (75%)	Forests (81%), agriculture (10%)	Forests (61%), agriculture (33%)
Main water uses	Agriculture (90%), urban (10%)	Irrigation (60%)	Urban (39%), industry (35%), agriculture (26%)	Urban (43%), industry (34%), agriculture (20%)
Challenges in the river basin	Quantitative and qualitative status of ground water	Water quantity	Water quantity	Water availability during droughts in growing season
	Quantitative and qualitative status of surface water	Water quality	Water quality	Appropriate water quality
	Flooding from the river	Agriculture	Health of forests and ecosystems	Food risk reduction
		Forest and biodiversity management	Integrated Water Management	
		Awareness of civil society		

these workshops; the outcome of the workshops was fed back into the scientific process. The same workshop process was applied in all four river basins - though with some flexibility to adapt to the local culture and setting.

These interactions were complemented by interviews and (larger) stakeholder events.

A more elaborated description and discussion of the stakeholder engagement process is currently being prepared for publication (Libbrecht).

Overall, the resulting process consisted of the following steps:

1. Identification of stakeholders for the river basin;
2. Compiling the available information on the current state of the river basin and future climate change impacts;
3. Development of a narrative on the current status and challenges of the river basin;
4. Development of a model for the river basin (based on fuzzy cognitive mapping);
5. Formulation of water management options;
6. Assessment of the impacts of the options using the model;
7. Evaluation of the options based on multiple decision criteria.

Role distribution within the methodology

In order to operationalise the methodology, a distinction was made between the following three roles:

- the **local stakeholder management** party that is familiar with the local setting, that is knowledgeable about the status and challenges of that river

basin, that is regarded as a neutral party by the local stakeholders, and that is willing to dedicate substantial time - for an extended period of time - to local stakeholder management. In practice, in view of the required expertise and neutrality, this role would be best assumed by a local (i.e. in the same country) research organisation.

- an **expert party** that masters the **scientific methodology**: this is a research organisation that has the expertise to handle the scientific process including fuzzy cognitive mapping and multicriteria analysis, and that is willing to integrate the scientific approach with a stakeholder driven approach;
- an **expert party** that masters all aspects of the **participatory approach** including processes for stakeholder identification and selection, that has the expertise to design and facilitate the stakeholder engagement processes and that is willing to integrate stakeholder involvement in a complex scientific process.

Obviously, the project has been actively supported from a communication point of view including initiatives aimed at increasing awareness at a larger scale in the river basins.

The parties that have taken up these roles are presented in Table 2.

Attributing these three roles to three different parties (when considering one river basin) has a major advantage that each party can focus on one distinct key objective:

- for the local stakeholder management party: realising a strong and sustainable link with local stakeholders. In fact, the local stakeholder management party faces the huge task to implement the methodology in that particular river basin, i.e. to apply the scientific

Table 2. Role division for the articulation and evaluation of the water management options, within the four case study river basins.

River Basin	Pedieos	Rmel	Tordera	Vipava
Case Study Leader	Cyl	INRGREF	CREAF	IzVRS
Local Stakeholder Management	(The Cyprus Institute)	(National Research Institute of Rural Engineering, Water and Forests)	(Centre for Ecological Research and Forestry Applications)	(Institute for Water of the Republic of Slovenia)
Expert party on the scientific methodology	EFIMED (European Forest Institute, Mediterranean Regional Office)			
Expert party on stakeholder engagement (participatory processes)	Prospex			
Expert parties for communication and awareness campaign	EFIMED and GWP-Med (Global Water Partnership - Mediterranean Office)			

process locally (which requires the expertise of a research organisation) and at the same time to take care of local stakeholder management (even beyond the participatory process steps of the methodology).

- for the scientific expert party: providing the objectivity of the scientific approach which creates a neutral framework in which the stakeholders can exchange their opinions and experiences. At the same time: keeping an eye on making sure the rigour that is an essential part of a scientific process is respected;
- for the stakeholder engagement expert party: engaging stakeholders in a constructive and productive way.

There are other reasons to argue that it is important to keep the three roles separated. Indeed, both expert roles (on the scientific process, on the stakeholder engagement) require a different set of skills, and while both help to create a neutral setting to the process of river basin adaptation planning, they also need to balance each other. For this reason, they could best be treated as separate roles, taken up by different parties. Similarly, the local stakeholder management party should be in a position to liaise with the stakeholders without having to worry about the technicalities of either the scientific or the stakeholder engagement process. This in turn also allows the two expert parties to operate from a certain distance, which only contributes to enhancing the neutrality of the process. While it cannot be excluded that there exist parties that have the competencies to combine some of the roles, we believe the total set of skills needed to successfully implement the methodology are unlikely to be found in one single party. For this reason, the three roles can be considered essential sides of what can be referred to as the river basin adaptation triangle, presented in Figure 3.

Note that only the local stakeholder management party was physically located in the (relative) proximity of the river basin (same country or region). This was felt to be a precondition to successfully organise local stakeholder management. The expert parties (on the scientific methodology, on the participatory processes) were not based in the river basins. They obviously needed to be

flexible to adapt to the local setting and do the necessary efforts to get the work done in the local setting (adapting to local habits, making sure all documentation was available in the local language, making sure the local language would be used in all workshops etc.).

Outcomes and next steps

A full discussion of the outcome of the process outlined above is beyond the scope of this article. While the results for each of the four river basins will be published in other channels, the top-3 most preferred water management options in the river basins is presented in Table 3.

In all four case study river basins, a water management adaptation plan is being prepared, based on the water management options that have been identified, discussed, evaluated and prioritised. The development of these plans requires additional steps, notably:

- Evaluating the role of existing policies in the implementation of the options;
- Identifying key stakeholders and their potential roles in implementing the options;

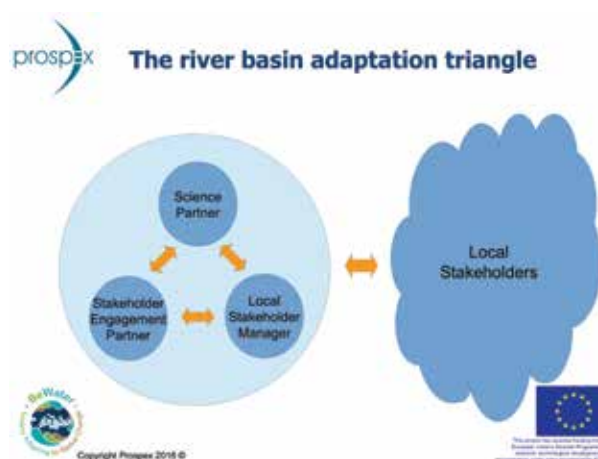


Figure 3. The river basin adaptation triangle.

Table 3. Top-3 most preferred water management options for the four case study river basins

Pedieos	Rmel	Tordera	Vipava
Farm education	Use of water irrigation technologies	Adaptive forest management	The creation of intermunicipal expert working group for the Vipava river basin
Code of Good Agricultural Practices enforcement	Creation and rehabilitation of hydraulic infrastructure	Environmental flow regime	Awareness campaign for local public on impact of their activities on the river
Volunteerism	Protection against forest fire	Integrated Plan for the protection of the Tordera delta	Construction of water reservoirs on the water courses in the upper part of the river basin

- Assessing co-benefits and conflicts arising between options in order to group them in bundles;
- Assessing the optimal timing for the implementation of the options.

In parallel, a policy review focusing on mapping and analysing the policy landscape regarding water management, at the national level, has been carried out. The results are being fed into the process. During these steps, the case study leaders are being coached and supported by other BeWater project partners that are experts in the matters at hand: Ecologic and Deep Blue Consultants.

As the BeWater project reaches its final stages (the project will be finished in March 2017), the final water adaptation plans for all four river basins will become available.

Conclusions

So what is to be the answer to the questions posed at the beginning? Is it possible to define an approach for river basin adaptation planning that is based on a scientific methodology yet deeply involves local stakeholders?

What can be said is that the BeWater project framework:

- made it possible to develop a scientific methodology based on the combination of fuzzy cognitive mapping and multi criteria analysis, to develop and evaluate water management options as a basis for river basin adaptation planning;
- seamlessly integrated this scientific process with a purpose-designed stakeholder driven approach;
- applied this methodology in four river basins, representing very different settings in the Mediterranean area.

In order to operationalise the methodology, three distinct roles have been identified as being the essential sides of the river basin adaptation triangle: the local stakeholder management party, the scientific expert party, the stakeholder engagement expert party.

As only the local stakeholder management party needs to be familiar with the local setting, and needs to have in-depth expertise on the river basin, the approach to river basin adaptation planning that has been presented in this article could, in principle, be implemented in any river basin in which a local party that has the necessary competences (most likely a research centre), is willing to take up the role of local stakeholder management party. Indeed, the expertise of the two other parties needed to create the river basin adaptation triangle can be brought in from outside the river basin, as demonstrated during the BeWater project.

This opens a very positive perspective for numerous river basins in the Mediterranean that face severe sustainability challenges.

References

IPCC Technical Paper VI, 2008

Gramberger, Marc; Zellmer, Katharina; Kok, Kasper; Metzger, Marc J. "Stakeholder integrated research (STIR): a new approach tested in climate change adaptation research." *Climatic Change*, Volume 125, Nos. 3-4. August 2014, Springer

Özesmi, U; Özesmi, S.L. "Ecological models based on people's knowledge: a multi-step fuzzy cognitive mapping approach." *Ecological Modelling*, 176, 43-64. 2004

Kok, K. "The potential of Fuzzy Cognitive Maps for semi-quantitative scenario development, with an example from Brazil." *Global Environmental Change* 19, 122-133

Verkerk, Pieter Johannes; et al. "Involving society in water management planning to adapt to global change." (in preparation)

Libbrecht, Steven; et al. "Roles in participatory approaches for water management planning to adapt to global change." (in preparation)

Placing a place: Towards a place-conscious education

Notes of a workshop



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Summary

This article concerns the theoretical background, the methodology and the conclusions of a lecture aiming mainly to introduce basic principles and objectives of place-conscious education. The lecture was given in Samothraki, during the works of the Summer University of Samothraki 2016 and was addressed to course B participants.

Introduction

It is widely known that place-based education practices are commonly used in Environmental Education and in Education for Sustainable Development (Woodhouse and Knapp, 2016). Place-based practices emerge from the particular attributes of place and connect place with self and community. Place-based education is inherently multidisciplinary and experiential, and also reflective of an educational philosophy that potentially contributes to the well-being of community life (Woodhouse and Knapp, 2016), (Gruenewald, 2003).

A critical pedagogy of place such as place-conscious education derives from blending the principles of place-based education with those of critical pedagogy and aims to change ways of thinking that injure other people and places. In parallel, this kind of education tends to create places that teach us how to live well in our total environments and leave them behind for future generations (Gruenewald, 2003).

Theoretical Background

“The power of place will be remarkable” –Aristotle, Physics

It is characteristic how Edward Casey describes the significance of a place: “To be at all—to exist in any way—is to be somewhere, and to be somewhere is to be in some kind of place. Place is as requisite as the air we breathe, the ground on which we stand, the bodies we have. We live in places, relate to others in them, die in them. Nothing we do is unplaced. How could it be otherwise? How could we fail to recognize this primal fact?” (Casey, 1997).

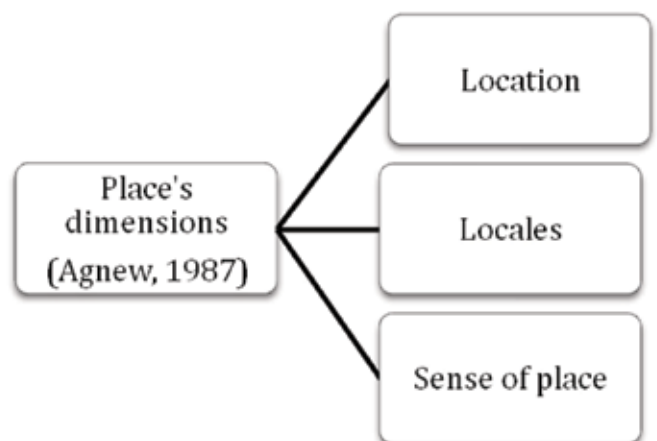


Diagram 1. Place's dimensions by Agnew, 1987.

Place is used in a variety of ways but its meaning can be specified and identified in terms of three dimensions that were set by Agnew 1987, Diagram 1, (Agnew, 2011).

The first dimension is “place” as location or a site in space where an activity or object is located and which relates to other sites or locations because of interaction, movement and diffusion between them.

Second is the view of “place” as a series of locales or settings where everyday-life activities take place. In this view “place” is where social life and environmental transformation takes place. Examples would be social settings from everyday life such as workplaces, homes, shopping malls, vehicles, internet chat rooms etc., whose structuring of social interaction helps forge values, attitudes and behaviors.

The third dimension is “place” as sense of place or identification with a place as a unique community, landscape, and moral order. In this construction, every place is particular and, thus, singular. A strong sense of “belonging” to a place, either consciously or as shown through everyday behavior such as participating in place related affairs, would be indicative of “sense of place.” It is worth mentioning that the same sense of place is a necessary prerequisite for social solidarity and collective action.

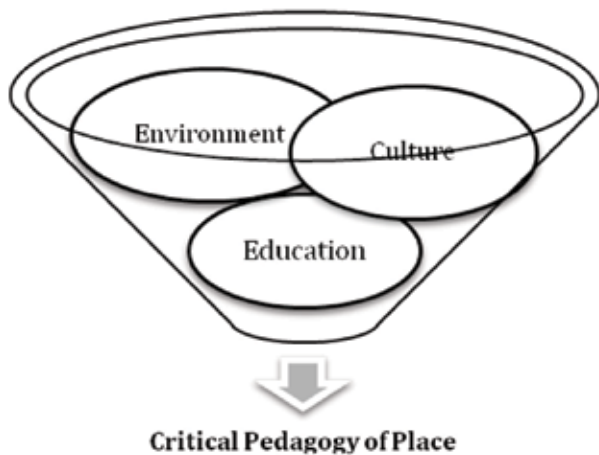


Diagram 2. Critical Pedagogy of place components (Gruenewald, 2003).

In accordance with Agnew’s notion of place, Greenwood has given a rather simple but far from simplistic meaning of place. In this view, a place is conceived as a unique and bounded biophysical and cultural environment (Greenwood, 2013).

Therefore, if a place is considered as a meaningful location attributed by the three afore mentioned characteristics and having such a simple and powerful meaning, it can be pedagogical.

To be concrete, a critical pedagogy of place aims to contribute to the production of educational discourses and practices that examine the place-specific nexus between environment, culture, and education, Diagram 2. It is a pedagogy linked to cultural and ecological politics that investigates the relation between cultures and ecosystems and helps to bridge the negligent and unproductive gap between environment and culture in educational thought and practice (D. A. Gruenewald), (D. A. Gruenewald). In this way, the pedagogy of place theorizes two broad and interrelated objectives of decolonization and reinhabitation, Diagram 3, (Greenwood, 2013).

On one edge of the spectrum, decolonization is assumed as the process of learning to recognize disruption and injury and address their causes.

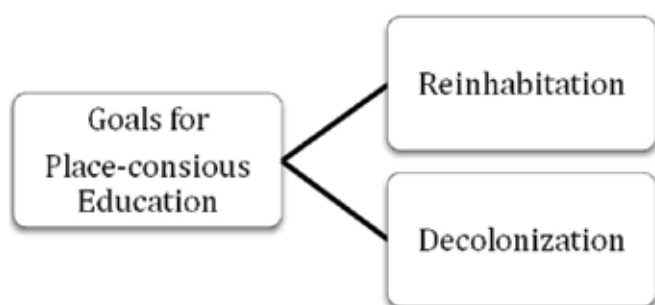


Diagram 3. Parallel goals for Place-conscious Education set by the Critical Pedagogy of place (Greenwood, 2013).

On the other edge of the spectrum, reinhabitation is the process of learning to live-in-a-place that has been disrupted and injured through past exploitation.

In many ways decolonization describes the underside of reinhabitation, which may not be possible without decolonization. If reinhabitation involves learning to live well socially and ecologically in places that have been disrupted and injured, decolonization involves learning to recognize disruption and injury and to address their causes. In other words, reinhabitation and decolonization depend on each other.

A critical pedagogy of place, such as place-conscious education, aims to (a) identify, recover, and create places that teach us how to live well in our total environments, in other words to achieve reinhabitation; and (b) indentify and change ways of thinking that injure and exploit other people and places or reach decolonisation.

In order to achieve place –conscious learning through decolonization and reinhabitation some key component questions should be addressed. Answering questions like: “what is happening here?,” “what has happened here?,” “what will happen here?” and “what should happen here?” contribute to get through the processes of decolonization and reinhabitation. (Aikens, 2016; Greenwood, 2013; Gruenewald, 2003; Gruenewald, 2003).

Objectives and Brief Methodology

The main objectives of the lecture aimed mainly to introduce place-conscious education processes and practices, were as follows:

- The recognition and realization of the significance of the concept of place.
- The identification of the concept of place and the specification of its attributes.
- The familiarization with place–conscious related processes such as decolonization and reinhabitation through a cooperative learning activity.

Last but far from least, the ultimate aim of this lecture was the evolution of place–consciousness for sustainability.

After having introduced the basic theoretical background, a cooperative activity related to the main aims/constructs

A critical pedagogy of place, such as place-conscious education, aims to (a) identify, recover, and create places that teach us how to live well in our environments (reinhabitation); and (b) indentify and change ways of thinking that injure and exploit other people and places (decolonisation).

of place-conscious education such as decolonization and reinhabitation was applied to the trainees. Through this learning activity and while key component questions were being addressed by trainees' groups, the basic principles of reinhabilitation and decolonization were put in practice.

At first, the trainees formed groups and every group "adopted" one place (depicted in a photograph). After having discussed and reached a decision, each group filled one worksheet for each place (appendix).

At a next stage, the group that was the adopter of a particular place summed up the contributions of all groups for this place. Finally, the results were presented to all of the trainees by the adopter. This stage was repeated for the rest of the places.

It is worth mentioning that this kind of group work manifests the existence of different views and opinions and also provides evidence of the difficulty faced by a community to come to a common decision.

Discussion

First and foremost, the main aim of the lecture was the introduction of place-conscious education. At the end of the day, and as mentioned by the majority of the participants, the main objective was fulfilled.

On the other hand, it is undeniable that putting in practice the two parallel aims/constructs of reinhabilitation and decolonization needs plenty of time. That is because giving an answer even to a single component question is equivalent to completing a project and this obviously needs plenty of time and effort. Consequently, trying to achieve such an objective in a couple of hours was a very ambitious plan. However, the majority of the participants tried to overcome this challenge and meet the goal.

So, at the end of the activity the trainees managed to conceptualize decolonization and reinhabitation, as can be seen in the final notes of one of the group:

Group name:	<i>Hippie Goats</i>
What is happening here?	<i>A couple came on holiday and is doing free camping in their van. They found a nice place with free access, in the shade and by the sea, to park.</i>
What has happened here?	<i>It was a free nice wild place, with a nice view to the sea, so the tourists took it.</i>

What will happen here? *Tourists will have a nice time, relax and enjoy their vacation. So, more people will come and then... they will get caught for being in a protected area.*

What should happen here? *No more free camping and more eco-friendly solutions for man and place.*

In conclusion, following the principles of place-conscious education is a continuing process that never ends. And it is undeniable that if everyone reaches the far-reaching aims of decolonization and reinhabitation, all places will be sustained for future generations.

References

Agnew, John A. "Space and Place." Agnew, John A. and David N. Livingstone. The SAGE Handbook of Geographical Knowledge. Sage, 2011.

Aikens, K., Maina, N. M., Bogdan, A. M., & Shahadu, H. "How We Came to Inhabit These Spaces: Reflections on the Role of Place in Our Individual and Collective Journeys as Emerging Sustainability Scholars." Journal of Sustainability Education February 2016: n. pag.

Casey, Edward S. The fate of place: A philosophical history. Berkeley: University of California Press, 1997.

Greenwood, David A. "A critical theory of place-conscious education." Stevenson, R.B., Brody, M., Dillon, J. & Wals, A.E.J. The International Handbook of Research on Environmental Education. New York: Routledge, 2013. 93-100.

Gruenewald, David A. "Foundations of place: A multidisciplinary framework for place-conscious education." American educational research journal 2003: 619-654.

Gruenewald, David A. "The best of both worlds: A critical pedagogy of place." Educational researcher 2003: 3-12.

Klein, Robert. "Educating in place: Mathematics and technology." Philosophical Studies in Education 2007: 119-130.

Semken, S., & Freeman, C. B. "Sense of place in the practice and assessment of place-based science teaching." Science Education 2008: 1042-1057.

White, S. & Reid, J. "Placing teachers? Sustaining rural schooling through place-consciousness in teacher education." Journal of Research in Rural Education 2008.

Woodhouse, Janice L. and Clifford E. Knapp. "Place-Based Curriculum and Instruction: Outdoor and Environmental Education Approaches." 00 12 2000. Eric Digests. 9 10 2016. <<http://files.eric.ed.gov/fulltext/ED448012.pdf>>.

Appendix: The worksheet used in the workshop



One of the “blind” photos that were used in the workshop, without any indication of its theme or source. Source: Winning photo in “My Samothraki Exhibition” of Acropolis Museum, 2015 © [instagram.com/eli_alxp/](https://www.instagram.com/eli_alxp/).

Group name:

Group members' names:

What is happening here?

What has happened here?

What will happen here?

What should happen here?

Setting the vision for the management of Samothraki: Course B participants' outputs



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The background of Course B

We had the opportunity to be part of the 14 days intensive Course B entitled "Integrated Water and Coastal Management - Educational and Participatory Approaches" as part of the multidisciplinary and innovative program of the Summer University of Samothraki 2016. Course B aimed to provide a high quality education, collaboration, exchange of experience and implementation of the gained knowledge in order to improve, implement, establish and raise awareness for fulfilling the gaps for better understanding and protection of the cultural and natural heritage in the frame of established and newly proposed Biosphere Reserves.

Using the integrated management approaches strengthens the quality and innovative character of research and raises the awareness about the cultural and natural heritage with the reasonable use of the available natural resources at national and international level.

The main objectives, in the eyes of the participants of Course B, were for us to:

- Get familiar with the long-term development of the Integrative Methodological Framework (IMF) and its steps (UNEP/MAP-PAP/RAC, GWP-Med & UNESCO-IHP, 2015).
- Recognize the importance of sustainable development for continuous successful implementation of the measures from good practice examples for the sustainability of the Biosphere Reserve.
- Get more acquainted with the procedures of establishing, monitoring, evaluation and reporting that are required for a BR and any designated area. Such processes are demanding and require a long term commitment.
- Explore the connection between the local communities (their needs, tradition, obstacles, cultural heritage, authority awareness) and the available resources (natural capacity).

- Be more skilled to combine the measures and approaches for better identification of the advantages/disadvantages, obstacles and gaps that need to be taken into consideration when trying to strengthen the connection between the local communities, local authorities and nature.

The "Setting the Vision" exercise

The objective of the "Setting the Vision" task is to engage stakeholders in setting the course for the eventual shape of the area's plan and its implementation. Of course, the "vision" should be rational and inventive and thus, be complimented by a set of goals. Along this line, a stakeholders mapping and survey took place to identify the concerned stakeholders and their perspectives about their vision of the plan area. During the working session for mapping the stakeholders the following categories of stakeholders were identified: Public authorities' officers; Tourism sector professionals; Merchants/Shop owners; Farmers (agriculture/livestock); Tourists and visitors. It was agreed to approach these groups of stakeholders through interviews.

The main tool for the "vision" exercise was the semi-structured interviews and the target audience was, primarily, the permanent residents and, secondly, visitors or tourists of Samothraki Island. The interviews were based on the adapted questionnaire of the SUDECIR methodology (Scoullos, MIO-ECSDE, 1999). The interviews were semi-structured, using as a starting point the same four questions, but allowing for an open conversation to collect the peoples' opinions.

All Course B participants were involved in taking the interviews. They were split in groups with at least one Greek-speaking participant in each, as most of the interviewed people were Greeks. The authors were involved in the elaboration of the results, under the scientific coordination of Prof. Michael Scoullos. The short questionnaire used can be found in the following text-box.

1 Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences (IBER-BAS)

2 National Kapodistrian University of Athens

3 Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE)

In your opinion is the development of Samothraki Island sustainable?

Yes / No

2. If No, what are the main reasons for not being sustainable?

Examples of responses to support the interview: Lack of legislative framework on environment, Lack of implementation of environmental legislation, Agricultural pressures, Livestock pressures, Lack of wastewater management, Inappropriate solid waste management, Inappropriate tourism development, Illegal fishing activities, Limited opportunities for youth employment, Lack of educational infrastructures, Inadequate protection/promotion of cultural and archaeological heritage, Food security/sufficiency of local production, etc.)

3. In order to obtain a sustainable future for the island what are your key suggestions?

Examples of responses to support the interview: Strengthen existing conservation rules/legislation, Better implementation of existing conservation rules/legislation, Allocate more financial resources, All socio-economic sectors to be integrated into the decisions and management, Stimulate/support local socioeconomic development e.g. eco-tourism and nature related leisure activities, Training of local professionals, Awareness raising / education of local society, etc.

4. What could be your contribution?

Examples of responses to support the interview: Respect regulations, Reuse & recycle, Opt for products that are: eco-friendly, locally produced, organic, with the minimum packaging, etc; Participate & volunteer in local initiatives for cultural heritage promotion, pro-environmental actions (clean-up activities, etc.)

Results

In total we conducted 49 interviewees. The demographic profile of the sample was the following:

- Gender: 71% men / 29% women.
- Age: 10% aged between 18-30 yrs, 25% aged between 31-40, 35% aged between 41-50, 16% aged between 51-60 and 14% aged between 61-80.
- Origin: The majority (71%) were permanent residents with the rest (23%) being seasonal or residents of an extended stay and 6% tourists or visitors.
- Occupation: 29% work in public services, 25% in the tourism services, 19% are shop owners, 6% in agriculture, 6% were tourists and 15% work in various sectors (non-categorised).

The elaboration of the interview's data -under the coordination of Prof. Scoullos- had the following results:

- 89% of the interviewees envisage maintaining and improving the quality of life highlighting the sectors of: health, education, and water-waste-sewage management, as a prerequisite condition for the island's development.
- 86% identify themselves with the island and wish to participate and contribute to its future.



Shot from the interviewing process at the Town Hall of Samothraki.

- 78% value the island's natural and cultural (tangible and intangible) character; they consider it as a main capital for the future development.
- 80% acknowledge tourism as a major source of income; they propose a prolonged tourist season and increase in the number of visitors, if transport, infrastructure and services are amended, as well as to attract specific tourist targets i.e. medical tourism, sports tourism, gastronomy, etc.
- 72% consider as important other than tourism economic activities such as: livestock, agriculture, fisheries, beekeeping, branded local products. But a considerable improvement of management, infrastructure and regulation is needed.
- 63% aspire that governance is improved and supported so that responsibilities are undertaken and regulations at local level are better enforced.
- 40% raised the issue of sufficiency in energy and food security of the island.
- Last but not least, 80% of the interviewees believe that development should be driven by local and national initiatives.

These findings were announced during a public event organised on 18 July 2016, and were presented as part of Course B trainees' work.

End remarks

Summer schools of this kind are an effective way of dealing with the current situation and status of Samothraki Island. Gathering in one place young researchers of different backgrounds, can produce useful inputs that may help address the shortcomings of the previous effort of Samothraki's nomination to the UNESCO MAB BR list. It may also significantly raise the awareness of the necessity for urgent protection of this unique natural and cultural heritage.

References

- Scoullos M, et al., Planning Sustainable Regional Development: Principles, Tools & Practices – The case study of Rhodes Island-Greece, MIO-ECSDE – SUDECIR Project, 1999.

- UNEP/MAP-PAP/RAC, GWP-Med and UNESCO-IHP, 2015, "An Integrative Methodological Framework (IMF) for coastal, river basin and aquifer management" http://meetings.pap-thecoastcentre.org/docs/imf_guidelines.pdf

- The Mediterranean Strategy on ESD (MSESD) <http://www.medies.net/staticpages.asp?aID=1072&overRideCategory=1>

A mini marine litter survey at the Katarti Beach of Samothraki: Course B participants' outputs



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The problem of marine litter

Marine litter is solid waste produced by human activity, either on land or at sea, that somehow finds its way into the marine environment. Worldwide it is considered as a challenging environmental issue for a number of reasons (MRS-LICO exhibition, 2014):

- It is a threat to wildlife and ecosystems: Litter items kill or cause suffering to marine mammals, reptiles, fish and seabirds that are trapped in them or mistake them for food.
- It is a threat to human health and livelihood: Litter in the sea and on beaches can cause, among other things, serious injuries and damages.
- It can cause bio-accumulation of pollutants and toxins. Any toxins leaching from litter items may build up in an organism, or pass from one organism to another through the food chain.
- It travels long distances: Travelling with sea currents, waves, winds and runoffs, it can be found in places very far from its source. Often species "hitchhike" on litter items.
- It is long lived: A single plastic bottle poses threats to sea life and people for hundreds of years -the time it takes to degrade in the sea.
- It is difficult to track: It is almost impossible to follow the route and fate of a litter item: where it started, what happened along the way and why it ended up where it did.
- Microlitter refers to objects with diameter < 5 mm, usually generated as the brittle plastic objects break down to small particles, or with direct input (e.g. microfibers from laundry machines). This floating "plastic dust" is ingested by a wide range of organisms. Invisible to the naked eye, microplastics mingle with plankton and simply cannot be scooped out of the ocean.
- The heavy bulky items that are abandoned or brought by rivers, storm water, etc. quickly reach the

Marine litter is any persistent, manufactured or processed solid material that is discarded, disposed of or abandoned in the marine and/or coastal environment (Galgani et al., 2010).

sea bottom because of their weight. After a certain depth these items are seldom approached by humans and are almost impossible to remove.

Our activity on Samothraki

The voluntary clean-up activity took place in Katarti beach of Samothraki on 18/7/2016. We approached the beach by boat, the only possible access to it. About 20 - 25 people gave us a hand in the collection process. Some aspects we recorded about the Katarti beach:

- It is surrounded by rocky steep cliffs and can be accessed only by boat.
- It is sandy, covering a total estimated space of ~2,500 sq meters.
- It has a small stream of fresh water on one side.
- During the summer season the beach receives daily ~ 50 visitors by boat (daily cruises).
- It is regularly cleaned by the boat owner.

Results

From a distance the beach looked clean and pristine, but once we started collecting we realized the 'picture' was not so untouched. Our collection outcome was two full garbage bags with a total weight of ~ 4-5 Kg (we couldn't be more accurate, as many items were wet).

The next day an interactive course by Prof. M. Scoullos followed, on litter interpretation, using the data collection form of the DeFishGear project "Monitoring Marine Litter on Beaches" (Vlachogianni et al., 2016). This is the monitoring

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Figure 1. View of the Katarti Beach on Samothraki.

protocol that is expected to be used in all European Regional Seas, after 2017 and the data will be compiled annually by the European Environment Agency (EEA).

Table 1. Categorisation of the marine litter items found on the Katarti beach with a diameter > 2.5 cm.

ARTIFICIAL POLYMER MATERIALS	201
RUBBER	5
CLOTH/TEXTILE	8
PAPER/CARDBOARD	1
PROCESSED/WORKED WOOD	3
METAL	4
GLASS/CERAMICS	1

As expected, plastic dominated, with the artificial polymer materials having outnumbered all other categories found in Katari beach. Specifically of the 201 artificial polymer items counted, we have estimated that most of them are expanded polystyrene used in fish boxes (51), followed by pieces of rope (20), pieces of nets (19), cups and cup lids (18), plastic caps/lids drinks (12), and cigarette lighters (10), with the rest of the items being counted in numbers lower than 10.



Figure 2. The two bags of litter generated a lot of discussion between participants regarding the nature, degradation, possible origin of litter, as well as possible solutions to tackle the problem.

Marine litter origin

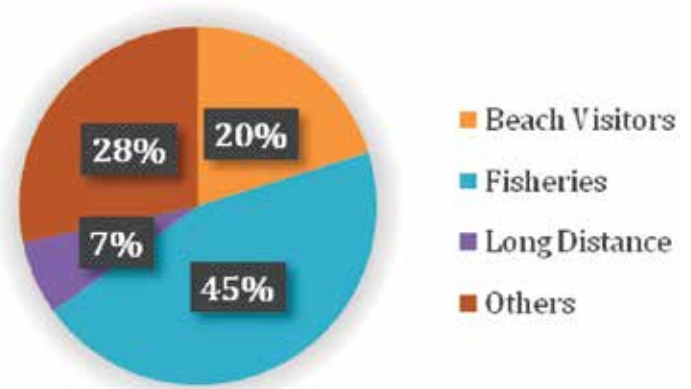


Figure 3. Based on our observations these are the estimations for the origin of the litter items found at Katarti beach.

Conclusions

This was a demonstration 'litter monitoring' activity aiming primarily to train the participants on how to apply a specific monitoring method dealing with beach litter. The two filled bags of litter generated a rich discussion and the participants' assumptions were either confirmed or rejected, with the guidance of the tutors.

One of the conclusions we reached is that solving the problem requires a series of concerted actions from the state, private sector (tourism and fish industry, etc.), local authorities and individuals, at the heart of which is prevention and good solid waste management. One main tool in the efforts against marine litter is public awareness and education. Even though beach cleanups can't solve the problem, they are considered to:

- Be a useful tool to raise awareness and sensitize.
- Generate data highly useful for marine litter scientists and policy makers, when combined with an accurate recording.

References

- Alampei I., "MARLISCO Awareness Exhibition on the theme of Marine Litter", MIO-ECSDE, 2014: <http://www.marlisco.eu/exhibition.en.html>
- Galgani, F., Fleet, D., Van Franeker, J., Katsanevakis, S., Maes, T., Mouat, J., Oosterbaan, L., Poitou, I., Hanke, G., Thompson, R. and Amato, E., 2010. *Marine Strategy Framework Directive: Task Group 10 Report Marine Litter*. Luxembourg: Office for Official Publications of the European Communities.
- The Mediterranean Strategy on ESD (MSESD) <http://www.medies.net/staticpages.asp?alD=1072&overRideCategory=1>
- Vlachogianni et al., "Methodology for Monitoring Marine Litter on Beaches Macro-Debris (>2.5cm)" IPA Adriatic Cross-Border Cooperation Programme: http://mio-ecsde.org/wp-content/uploads/2016/08/Beach-litter_monitoring-methodology_Aug-2016.pdf

Scaling-up ESD activities through UNESCO/GAP, Paris, 5-6 July 2016

MIO-ECSDE/MEdIES contributed actively to the GAP Meeting's sessions in Paris during which the developments of all Partner Networks (PN) were presented. Participants discussed ideas on how to scale up partners' activities and what could be the future steps of the GAP. Prof. Michael Scoullas is co-chair of the GAP Partner Network 1 on "Advancing Policy" and Vicky Malotidi represents MEdIES as one of the PN1 official partners.

GAP is the UNESCO Global Action Programme for ESD covering the post-2014 period: 2015-2019. More at: <http://en.unesco.org/gap>

Project to foster Lebanese civil society launched, Beirut, 20 September 2016

The kick off meeting of the Project "Civil Society in Action for Sustainable Development" was held in Beirut in the presence of all partners: Armadilla, MIO-ECSDE, ALMEE, the Lebanese National Commission for UNESCO, at the premises of the Makhzoumi Foundation (Coordinator). Funded by the EU (OMSAR / AFKAR III Programme), the project aims at fostering socio-economic sustainable development in the Bekka region of Lebanon, through raising public awareness, empowering people's skills and enhancing energy efficiency solutions in communities. MEdIES has undertaken the set up and implementation of a survey addressing students (15-18 yrs old) from 30 selected schools of the Bekka region, aiming to "capture" their perceptions on current local problems, issues about sustainable development, etc.

More at: www.medies.net/articles.asp?cID=7

More than 200 people at the COP22 Side Event on ESD, Marrakesh, 14 November 2016

MIO-ECSDE in cooperation with CMED, RAED and CERCEO coorganised the Official COP22 Side Event "The Mediterranean Strategy on Education for Sustainable Development (ESD): how to educate youth and local communities to effectively address climate change". It was a big success bringing together about 200 participants who discussed and exchanged experience and ideas on how ESD can contribute to the implementation of the Paris Agreement and the outcomes of Marrakesh COP22. More at: www.medies.net/articles.asp?cID=7&aID=1098



Ministerial Conference
8-9 December, 2016 Cyprus

Ministerial Conference unanimously adopts the Action Plan on Education for Sustainable Development in the Mediterranean, Nicosia, 8-9 December 2016



Hosted by the Cypriot Education Ministry, the Ministerial Conference held in Nicosia on 8-9 December 2016 has adopted the Action Plan on ESD in the Mediterranean. Some 60 high level delegates unanimously adopted the Nicosia Declaration and the Action Plan of the Mediterranean Strategy on ESD (already endorsed in UfM Ministerial Conference in Athens 2014). The adopted Action Plan sets the Mediterranean Strategy on ESD, a visionary and progressive policy document, in motion, through proposing, thematic directions, concrete activities and strategic partnerships throughout the region. More at: www.esdmedcyprus.pi.ac.cy/

NICOSIA DECLARATION ON ESD IN THE MEDITERRANEAN

Nicosia, 9 December 2016

We, the Ministers of Education and Delegations, joined by International and Regional organizations and Stakeholders from the Euro-Mediterranean region, meeting in Nicosia, Cyprus, at the invitation of the Minister of Education and under the High-Patronage of the President of the Republic of Cyprus in order to promote **Education for Sustainable Development (ESD)** in our countries and the region, and decide on the appropriate ways to implement the provisions of the **Mediterranean Strategy on ESD (MSESD)** endorsed with the UfM Ministerial Declaration on Environment and Climate Change adopted in Athens (May 2014), through the **adoption of an Action Plan,**

Considering the recommendations of the UNESCO World Conference on ESD that took place at the closing of the UN Decade on ESD (Nagoya, December 2014); the Global Action Programme (GAP) (2015-2019) on ESD, where the elaboration and adoption of MSESD Action Plan is included among the Flagship Projects; the relevant to ESD provisions of the UN Convention on Biological Diversity (UNCBD), the UN Convention to Combat Desertification (UNCCD), the UN Framework Convention on Climate Change (UNFCCC); and the Sustainable Development Goals (SDGs), taking into consideration that their effective implementation implies a strong articulation with educational policies,

Encouraged by (a) the recognition of the MSESD by the 19th Meeting of the Contracting Parties of the Barcelona Convention and its *Athens Declaration* (Athens, February 2016) as an integral part of the Mediterranean Strategy for Sustainable Development and as a contribution to the implementation of the SDGs in the Mediterranean; (b) the UN-ECE Batumi Ministerial Statement on Education for Sustainable Development (Environment for Europe Conference, June 2016) which supports the MSESD and its Action Plan as a demonstration of regional synergy in achieving ESD and Sustainable Development;

Noting that our meeting is taking place few days before 2017 which marks the anniversary of:

45 years of the Stockholm Conference on the Human Environment (1972), which first introduced EE as a tool to promote the protection of the Environment;

40 years since the Tbilisi UN Conference (1977) on EE; 25 years since the Rio Conference on Environment and Development (1992) where Sustainable Development was introduced followed by the creation of the Mediterranean Commission of Sustainable Development (MCSD) under the Barcelona Convention and UNEP-MAP, which identified Education, Public Participation and Awareness as critical for SD in the region; 20 years since the UNESCO Conference in Thessaloniki (1997), which paved the road for the introduction of ESD; 15 years since the Johannesburg (2002) UN Conference when the UN Decade on ESD was decided and the Mediterranean Educational Initiative on Environment and Sustainability (MEdIES) was launched.

Recognizing that considerable progress has been made in protecting the environment and promoting sustainable development in the Mediterranean region and that numerous excellent educational programmes, projects and activities on EE and ESD have been undertaken at country and regional levels by governments, international organizations and various non-state stakeholders;

Regretting that despite efforts, crises and conflicts - including armed ones - continue in the region and in some cases have intensified, damaging populations of entire cities, destroying lives, social fabric, the natural and cultural heritage, as well as education opportunities and infrastructures, forcing flows of refugees and migrants to and through the Mediterranean region;

Reaffirming that the achievement of sustainable development in the Mediterranean is key in preventing and eliminating the root causes of the aforementioned problems;

Recognising that appropriate education is the prerequisite for addressing the key issues related to Sustainable Development;

Recognizing that the process towards sustainable development is a difficult one that requires concerted fact-based understanding and policies that address the challenges in an integrated way, and **stressing** that in essence, this is the process needed to meet, among others, the Sustainable Development Goals (SDGs);

Recognizing that economic and sociopolitical factors are undoubtedly critical in driving the transition towards a green/circular economy and a more just and better governance;

In view of the above, We, Ministers of Education and Delegations,

Stress that the above could be addressed, to a large extent, through ESD, including through: (a) raising awareness about the need to change lifestyles and adopt a culture of sustainable consumption; (b) building capacities among stakeholders for contributing to meaningful participatory processes; and by (c) re-orienting vocational education and training pathways to enhance SD innovation and green employment.

Welcome the adoption by the United Nations Environment Assembly in May 2016 of a resolution on investing in human capacity for sustainable development through EE and training, which is fully reflected in the MSES and its Action Plan,

Emphasize that ESD, as stipulated in the Objectives of the Action Plan should be understood as a major contributor to the “new humanism” called for by the Director-General of UNESCO, which, *inter alia*, will strengthen social cohesion and peace,

Recognize that the implementation of the MSES is an urgent yet continuous, long-term, multi-stakeholder and cross-cutting process that provides for a better understanding of and enhanced competencies in all aspects of sustainable development and may extend beyond the horizon of the Action Plan (2017-2030),

Recognize the challenges and substantial needs of the countries of the region in introducing and effectively advancing ESD and **acknowledge** that some countries, particularly those with economies in transition, may need support, including donor support, to carry out ESD activities,

Adopt the Action Plan for the implementation of the MSES that provides further guidance on the objectives, directions and activities to be undertaken at national and, particularly, at regional level for the period (2017-2030),

Commit to systematically advance the enabling conditions specified in the Action Plan,

Commit to promote the integration and implementation of the provisions of the Action Plan into existing educational systems and national budgets,

Invite and encourage stakeholders as well as bilateral and multilateral donors to contribute and support the implementation process,

Adopt the Priority Thematic Issues (PTIs) identified in the Action Plan and **support** the coordinated implementation of regional programmes and projects integrating several of the PTIs, in order to, on one hand, achieve a “new humanism” that could contribute to peaceful coexistence, social cohesion and welfare, and on the other, promote Blue/Green/Circular Economy based on renewable energies, non-conventional water resources and eco-innovation, involving, apart from the Ministries of Education, all other Ministries and Agencies, Academia and Research Institutions, productive economic sectors and civil society at large.

Establish a *Mediterranean Committee for ESD*, open to participation from all countries of the region, for following up the implementation of the MSES and its Action Plan and coordinating collaboration among countries and with competent international and regional organizations, Conventions and bodies, *inter alia*, UNESCO, the Secretariat of the Union of the Mediterranean (UfM), the Mediterranean Commission for Sustainable Development and UNEP/MAP, the European Union, the League of Arab States, and UNECE.

Request the MEDIES Secretariat and the UNESCO Chair on Sustainable Development Management and Education in the Mediterranean of the University of Athens to continue providing technical, scientific and advisory support under the guidance of the *Mediterranean Committee for ESD*.

Regard this Action Plan as a “new generation” tool to be considered by other regions as well, since it could (a) mainstream the various educational commitments under the different sustainable development related Conventions and the SDGs, (b) facilitate national administrations and donors in designing and running in a cost effective manner relevant educational programmes, and (c) simplify monitoring and reporting obligations.



MIO-ECSDE

The Mediterranean Information Office for Environment, Culture and Sustainable Development, is a Federation of Mediterranean Non-Governmental Organizations (NGOs) for the Environment and Development. MIO-ECSDE acts as a technical and political platform for the intervention of NGOs in the Mediterranean scene. In cooperation with Governments, International Organizations and other socio-economic partners, MIO-ECSDE plays an active role for the protection of the environment and the sustainable development of the Mediterranean Region.

Background

MIO-ECSDE became a federation of Mediterranean NGOs in March 1996. Its roots go back to the early 80s, when the expanding Mediterranean membership of the European Community encouraged the European Environmental Bureau (EEB) to form its Mediterranean Committee supported by Elliniki Etairia (The Hellenic Society for the Protection of the Environment and the Cultural Heritage). The Mediterranean Information Office (MIO) was established in 1990 as a network of NGOs, under a joint project of EEB and Elliniki Etairia and in close collaboration with the Arab Network of Environment and Development (RAED). The continuous expansion of MIO-ECSDE's Mediterranean NGO network and the increasing request for their representation in Mediterranean and International Fora, led to the transformation of MIO-ECSDE to its current NGO Federation status. Today it has a membership of 130 NGOs from 26 Mediterranean countries.

Our Mission

Our mission is to protect the Natural Environment (flora and fauna, biotopes, forests, coasts, natural resources, climate) and the Cultural Heritage (archaeological monuments, and traditional settlements, cities, etc.) of the Mediterranean Region. The ultimate goal of MIO-ECSDE is to promote Sustainable Development in a peaceful Mediterranean.

Major tools and methods

Major tools and methods used by MIO-ECSDE in order to achieve its objectives are the following:

- Promotion of the understanding and collaboration among the people of the Mediterranean, especially through their NGOs, between NGOs and Governments, Parliaments, Local Authorities, International Organizations and socio-economic actors of the Mediterranean Region.
- Assistance for the establishment, strengthening, cooperation and co-ordination of Mediterranean NGOs and facilitation of their efforts by ensuring the flow of information among relevant bodies.
- Promotion of education, research and study on Mediterranean issues, by facilitating collaboration between NGOs and Scientific and Academic Institutions.
- Raising of public awareness on crucial Mediterranean environmental issues, through campaigns, publications, exhibitions, public presentations, etc.

Sustainable Mediterranean is a Newsletter produced by the Mediterranean Information Office for Environment, Culture and Sustainable Development, in collaboration with the European Environmental Bureau and the Arab NGO Network for Environment and Development.

The views and opinions expressed in Sustainable Mediterranean by individual contributors do not necessarily reflect those of UNESCO, GWP, MIO-ECSDE nor those of any other sponsor of the Summer University.

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