# Improving secondary education students knowledge and skills for environmental education programs in Greece

Argyriou A.[1], Papavasileiou C.[2], Mavrakis A.[1,3*]

[1] *West Attica Local Administration of Secondary School Education, Greek Ministry of Education, 70 Riga Feraiou str., 19200, Elefsis – Attica, Greece, e-mail: arargyriou@sch.gr*
[2] *West Attica Local Administration of Secondary School Education, Greek Ministry of Education, Homer & Diomedou str., 19600, Mandra – Attica, Greece, e-mail: xripapav@gmail.com*
[3] *Institute of Urban Environment and Human Resources, Department of Economic and Regional Development, Panteion University, 136 Syngrou Av., 176 71 Athens, Greece, e-mail: mavrakisan@yahoo.gr*

## Abstract
Greek Ministry of Education, through Locals Administration's of Secondary School Education, suggests to teachers to implement environmental programs during each school year.
Geography plays a leading role in developing the objectives of environmental education. Through geography lessons, applications and tools, pupils must learn about the major environmental and developmental problems (e.g. climatic change, deforestation, land degradation and desertification, depletion of natural resources, loss biodiversity, overpopulation, food security, drought, poverty, and urban decay) through issue-based learning. They must be given opportunities to explore how these issues relate to their everyday lives and how they impact on the quality of the physical and social environment. Teachers must promote a holistic outlook, through promoting a multidimensional (e.g. social, political, historical, cultural, aesthetic) study of environment problems on a variety of scales. Environmental education enables students to understand how people modify, respond to, and conserve their environment. However, environmental education through geography is somewhat difficult for teachers.
The purpose of this paper is to suggest and propose new, modern and up to date applications and tools, as for example geographic information systems and remote sensing applications in order to improve students knowledge and skills on environmental education issues.

**Keywords**: Knowledge and skills, environmental education, green economy professions, secondary education.

## 1 Introduction
Greek Ministry of Education, through West Attica Local Administration's of Secondary School Education, every school year, suggests to teachers to implement environmental programs according specific instructions.
West Attica Local Administration, located in an environmental stressed area, West Attica – Greece, which include the industrial area of Thriasio Plain, oversee 53 secondary general and technical schools. The student populations are different in their origins and their characteristics: usually general lyceum students come from the local municipality. In contrary technical lyceum students comes from the ex-soviet republic regions and settled in the area in the mid 90's. Students of general schools mainly were interested on everyday live problems on local municipalities. Exactly the opposite was the student's approach of technical education: they are interested on what they see and less in related problems (Papavasileiou & Mavrakis, 2013).
The pedagogical goals of the activities in the school such as the environmental education are contained to the instructions of Pedagogical Institute and they are referred to articles, which constitute guidelines (Scoullos, 2004; Kousoulas, 2008) and among them are: to understand what's mean sustainable development and to learn living in a kind of way that will allow contribution to sustainable development; to develop skills in order to work in groups; to develop critical way of thinking.

The teaching methods are usually commons. The implemented teaching method asked from students to work in groups. Students are separated to smaller groups of four – five students. Each group had to undertake different tasks.
Environmental programs usually are implemented by using, lectures, field research, bibliographic research, open space study, final report text and a power point presentation. Students were discussing the following issues: The issue divided into sub–topics – questions from the respective groups of students: Initially, the students say whatever words they believed that had to do with the topic (brainstorming). Finally each group put their own sub–topic. Results are grouped and summarized. In some cases, a Google Group is created to help coordination and collaboration and all students' work is included. (Solbes & Vilches, 1996; Aikenhead, 2002; Schreiner & Sjoberg, 2005; Edelson, 2007; Holubova, 2008; Smart & Marshall, 2013; Lemoni et al., 2013).
Also, emphasized is given to the students' experimental approach (field study). Excursions to local sites of interest can be an enriching and educational component of an environmental science course. In spite of the difficulty of arranging these and building them into the course curriculum, they should be strongly considered (Goodwin, 2003).
The purpose of this paper is to suggest and propose the use of new, modern and up to date applications and tools, as for example geographic information systems and remote sensing applications in order to improved knowledge and skills, related to environmental studies. This is important because: can acquire the knowledge and skills needed relating to the environment issues. Also can promote needed basic knowledge of environmental education to students, providing them with opportunities to understand major global environmental problems and develop students' teaching and learning methods about the environment within a geographical framework.

## 2 Materials

For the above purpose a review of some free applications and tools are presented and proposed for use by secondary education teachers and students.
The material was chosen according to free web access, to friendly interface environment and how easy can be implemented to secondary educational procedure.
Teaching place of the experimentation and implementation of those application and tools are computer labs of schools and not classroom. Written instructions were available and work sheet was used as a guide.
The implementation of the method has two parameters: The first is the difficulties of students to achieve this task given the fact that they are not familiar with maps (Paraskevas et al., 2010; Apostolopoulou & Klonari, 2011; Klonari, 2012). The second is that students are very familiar with mobile and web applications, tools and games (Papavasileiou & Mavrakis, 2013). This allow to them to play with all those web applications and tools.

## 3 Results and Discussion

1. Global Forest Change: http://earthenginepartners.appspot.com/science-2013-global-forest (Fig 1). Results from time-series analysis of 654,178 Landsat images in characterizing forest extent and change, 2000–2012. Trees are defined as all vegetation taller than 5m in height and are expressed as a percentage per output grid cell as '2000 Percent Tree Cover'. 'Forest Loss' is defined as a stand-replacement disturbance, or a change from a forest to non-forest state. 'Forest Gain' is defined as the inverse of loss, or a non-forest to forest change entirely within the study period. 'Forest Loss Year' is a disaggregation of total 'Forest Loss' to annual time scales. Reference 2000 and 2012 imagery are median observations from a set of quality assessment-passed growing season observations (Hansen et al., 2013).

Global Forest Change is an interactive, remote sensing application, useful tool to understanding deforestation, land degradation and desertification. Also is useful tool for environmental studies in secondary level education. User can easily find Landsat satellite images and make combinations between channels.

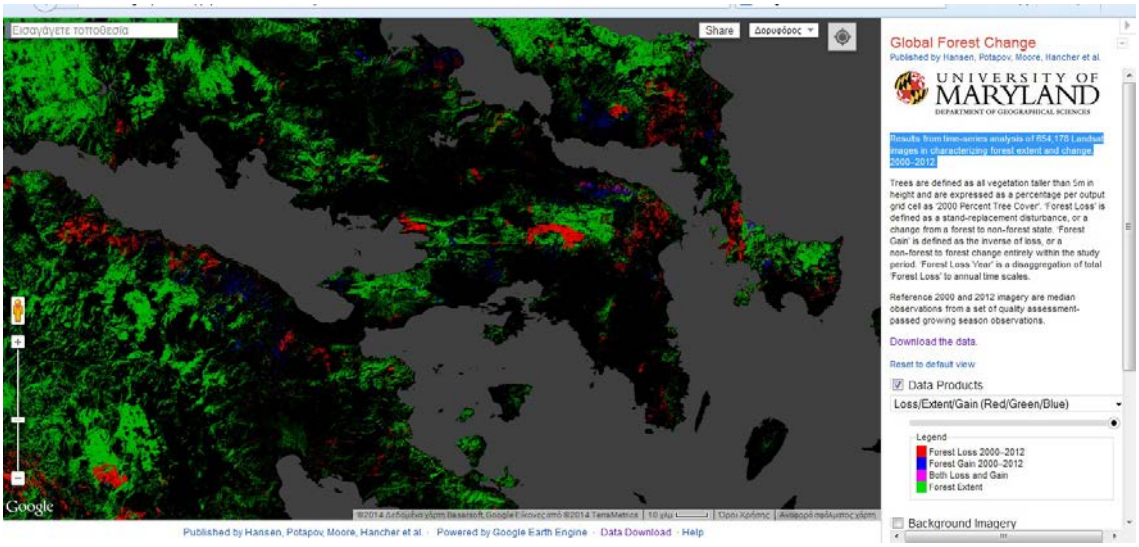

Fig. 1. Global Forest Change

2. Climatic Maps for Europe: http://www.climatic-maps.org/ (Fig 2). Daily maps are produced using Open Source software, with R language as a main tool. R is a free software environment for statistical computing and graphics (http://www.r-project.org/). Univariate and multivariate interpolation tehniques, implemented in R add-on packages, are applied for deriving surfaces of observed weather data. The maps are updated on daily basis, with a delay of two days.

Climatic Maps is useful tool for understanding weather and climatic parameters.

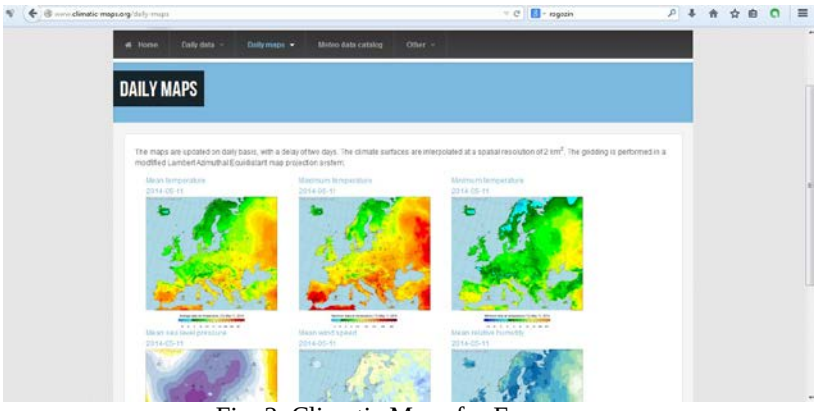

Fig. 2. Climatic Maps for Europe

3. CLIM-RUN Project: http://www.meteo.noa.gr/oikoskopio/index.php?lng=el-GR, (Fig 3). CLIM-RUN Project aims at developing a protocol for applying new methodologies and improved modeling and downscaling tools for the provision of adequate climate information at regional to local scale that is relevant to and usable by different sectors of society (policymakers, industry, cities, etc.). The protocol is assessed by application to relevant case studies involving interdependent sectors, primarily tourism and energy, and natural hazards (wild fires) for representative target areas (mountainous regions, coastal areas, islands). CLIM-RUN is thus also intended to provide the seed for the formation of a

Mediterranean basin-side climate service network which would eventually converge into a pan-European network. The general time horizon of interest for the project is the future period 2010-2050, a time horizon that encompasses the contributions of both inter-decadal variability and greenhouse-forced climate change.

CLIM-RUN application, is a very useful tool for understanding climatic change parameters. The application can give results to local level, so it's a very suitable tool, helping students to understand the effects of climatic change to their environment


Fig. 3. CLIM–RUN

4. Change Matters Viewer: http://www.esri.com/software/landsat-imagery/viewer (Fig 4). Change Matters Viewer use Landsat images and maps to understand earth changes that have happened over time. Advanced change detection tools are also available by clicking any full screen button. The first two panels show a region for the selected years with the selected image map applied. The third panel displays vegetation changes in vibrant green and magenta using NDVI (Normalized Difference Vegetation Index).

Change Matters is an excellent and very useful tool for understanding land use changes, overpopulation, deforestation, land degradation and desertification, and urban expansion through issue-based learning. Is given opportunities to explore how these issues relate to students everyday lives and how they impact on the quality of the physical and social environment. The application can give results to local level, so it's a very suitable tool, helping students and professionals to understand the effects of land use change to their environment.

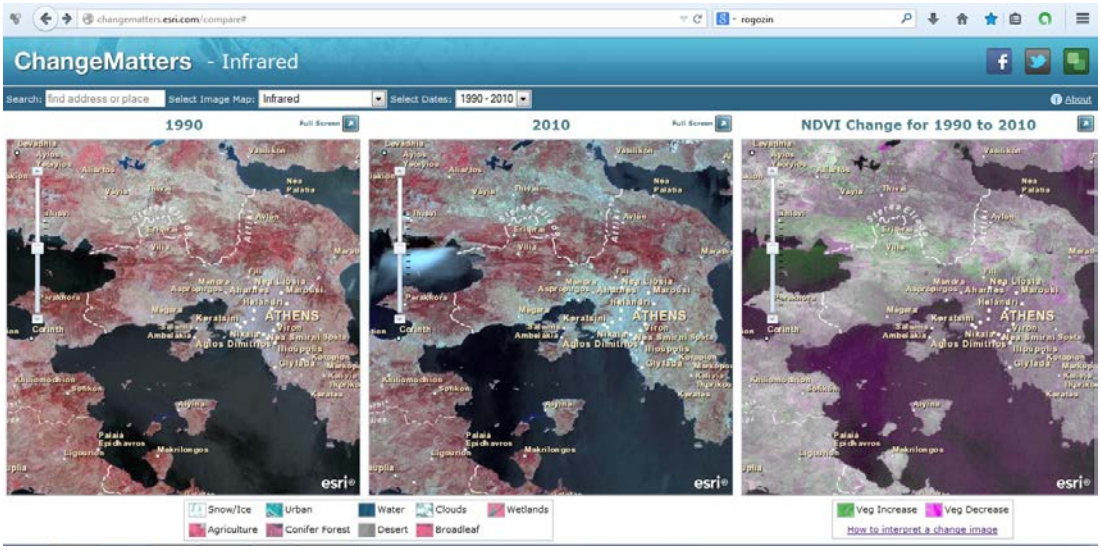


Fig. 4. Change Matters (from esri).

5. Geodata: http://geodata.gov.gr/maps/ (Fig 5). Geodata was designed, developed, and is maintained by the Institute for the Management of Information Systems of the "Athena" Research and Innovation Center in Information, Communication and Knowledge Technologies, with the aim to provide a focal point for the aggregation, search, provision and portrayal of open public geospatial information. Geodata is one of the Greek Government's open government initiatives in the framework of the Open Government Partnership. Further, its operation is included in the Road Map to support the enforcement of Law 3979/2011 for eGovernment, as a best practice example for the application of Information & Communication Technologies (ICT) in the public administration, and as an open data repository for the provision of geospatial information. Finally, geodata.gov.gr provides technical support to the National Spatial Data Infrastructure, in accordance to the National Strategy for ICT and eGovernment.

This application is a useful tool for students and teachers, because introduce them to Geographic Information Systems, and improve their knowledge and skills to use this kind of data bases. This tool is an official source of various information's and can be used for studies regarding built environment, land use changes and urban expansion, through promoting a multidimensional (e.g. social, political, historical, cultural) study of an area of interest.

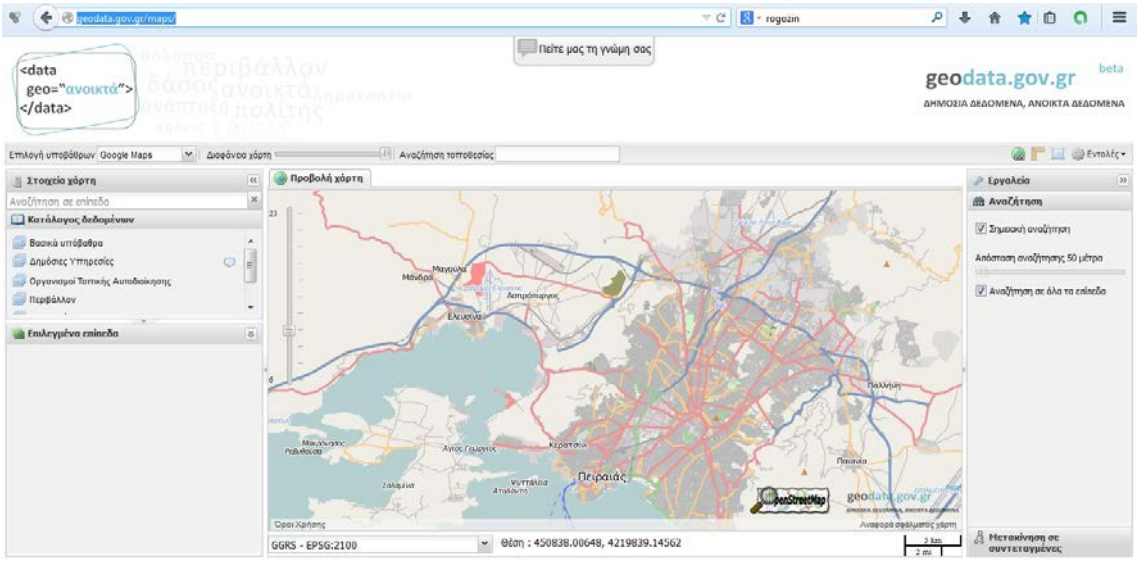

Fig. 5. Geodata

6. The PREVIEW Global Risk Data Platform (Fig. 6) http://preview.grid.unep.ch/index.php?preview=home&lang=eng, is a multiple agencies effort to share spatial data information on global risk from natural hazards. Users can visualise, download or extract data on past hazardous events, human & economical hazard exposure and risk from natural hazards. It covers tropical cyclones and related storm surges, drought, earthquakes, biomass fires, floods, landslides, tsunamis and volcanic eruptions. The collection of data is made via a wide range of partners. This was developed as a support to the Global Assessment Report on Disaster Risk Reduction (GAR) and replace the previous PREVIEW platform already available since 2000.

This application is a useful tool for students and teachers, because introduce them to Geographic Information Systems, and improve their knowledge and skills to use this kind of data bases. This tool is a source of various –simple or multilayer– information's and can be used for studies regarding natural and anthropogenic risk (for example: fires, droughts, earthquakes, floods, landslides, tsunamis, volcanoes), socio–economics risks, built environment, land use changes and urban expansion, through promoting a multidimensional study of an area of interest.

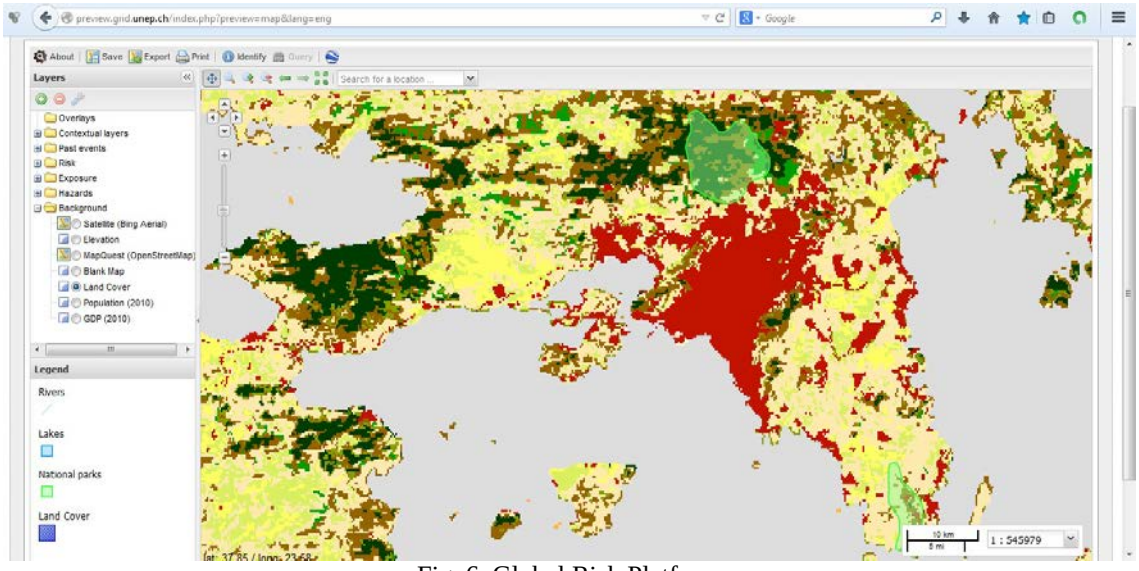

Fig. 6. Global Risk Platform

## 4. Conclusions

Students from both general and technical secondary education schools are very familiar with new technologies: mobiles, computers and web sites applications and tools. This fact eliminates the student's difficulties with maps. Therefore, they can very easily access web based literature and mining various information's just playing with them.

In this study, teachers and students are encouraged to use web based search methods (Fragou, 2006; Baltzis & Koukias, 2009) gathered information having focused on environmental, geographical, historical, cultural, scientifically data, historical maps, with ecological significance.

The proposed new, modern and up to date tools and applications can be used and implemented to secondary education procedure and more specifically to environmental education, in order to improve the knowledge, skills and the understanding of environmental issues both from secondary education teachers and students.

## References

Aikenhead G.S., 2002 Chemistry and physics instruction: Integration ideologies and choices. Chemistry Education: Research and Practice, 4, 2, 115–130

Apostolopoulou E.P., Klonari A., 2011. Children's map reading abilities in relation to istance perception, travel time and landscape. European Journal of Geography, 2, 2, 35–47

Baltzis K.B., Koukias K.D., 2009. Using Laboratory Experiments and Circuit Simulation IT Tools in an Undergraduate Course in Analog Electronics. Journal of Science Education and Technology, 18, 546–555

Edelson D.C., 2007. Environmental Science for All? Considering Environmental Science for Inclusion in the High School Core Curriculum. Science Educator, 16, 1, 42–56

Fragou O., 2006. Aspects of Personalization in Language Learning Process and Greek Literacy in a New Technology Based Environment. Proceedings of the 1st Doctoral Consortium in Technology Enhanced Learning, Crete, Greece, October 2, 2006

Goodwin D., 2003. Environmental Science Teacher's Guide. Kimball Union Academy Meriden, New Hampshire, www.collegeboard.com

Hansen M.C., Potapov P.V., Moore R., Hancher M., Turubanova S.A., Tyukavina A., Thau D., Stehman S.V., Goetz S.J., Loveland T.R., Kommareddy A., Egorov A., Chini L., Justice C.O., Townshend J.R.G., 2013. High–Resolution Global Maps of 21st–Century Forest Cover

Change. Science, 342, 6160, 850–853, DOI: 10.1126/science.1244693, data available on-line from: http://earthenginepartners.appspot.com/science-2013-global-forest
Holubova, R., 2008. Effective teaching methods – Project–based learning in physics. US-China Education Review, 5, 12, 27–35
Klonari A.I., 2012. Primary schools pupils ability to use aerial photographs and maps in the subject of Geography. European Journal of Geography, 3, 2, 42–53
Kousoulas G.K., 2008. Approaching Environmental Education. Technical Report, Environmental Friendly Technologies for Rural Development, LIFE05 ENV/GR/000245, www.ekke.gr/estia and www.pi-schools.gr/
Lemoni R., Lefkaditou A., Stamou A.G., Schizas D., Stamou G.P., 2013. Views of Nature and the Human-Nature Relations: An Analysis of the Visual Syntax of Pictures about the Environment in Greek Primary School Textbooks—Diachronic Considerations. Research in Science Education, 43, 117–140
Papavasileiou Hr., Mavrakis A., 2013. Environmental education: issue water: Different approaches in secondary general and technical education in a social and environmental stressed area in Greece. Procedia Technology, 8, 171–174
Paraskevas A., Lambrinos N., Psillos D., 2010. A study of blended didactic approach to teacher professional development in Geography. European Journal of Geography, 1, 46–60
Schreiner C., Sjoberg S., 2005. Science education and young people's identity construction – two mutually incompatible projects? Science Education and Youth's Identity Construction, www.ils.uio.no/english/rose/
Scoullos M., 2004. Concepts evolution and international initiatives for the environmental education and sustainable development. Proceedings of the 2nd National Conference: Sustainable Development, Environmental Education, Local Societies. Ouranoupolis Halkidiki, 15-17/10/2004, ION Publishing Group (CD)
Smart J.B., Marshall J.C., 2013. Interactions Between Classroom Discourse, Teacher Questioning, and Student Cognitive Engagement in Middle School Science. Journal of Science Teacher Education, 24, 249–267
Solbes J., Vilches A. 1996. Science–Technology–Society (STS) Interactions and the Teaching of Physics and Chemistry, CCC 0036-8326/97/040377-10