Gis Educational and Training Courses in the Northwestern Region of Romania

Gheorghe M.T.RADULESCU
Ovidiu STEFAN
Eduard KELLER
Adrian T.G.RADULESCU
Romania

Key words: GIS, education, graduate and postgraduate course.

SUMMARY:

Founding a graduate and postgraduate course of Geographic Information Systems will contribute to the development of well-trained specialists in this activity domain, so that in the future, GIS technology will be successfully applied in the Northwestern region of Romania. The Northwestern region of Romania, and generally Romania, was behind in what concerns the implementation, use and development of this modern technology, because there were very few specialists in this activity domain. They attended a series of courses abroad, learned by themselves or attended certain courses after which, unfortunately, they did not reached very high standards, such that we can say without being wrong, that the Romanian graduate education does not take into consideration the training of real GIS professionals.
One of the conditions of Romania's integration in the European Union is represented by the general cadastre, the real-estate utilitarian cadastre and impact analysis upon the environment, at European standards. This can be accomplished only implementing and using Geographic Information Systems, which are currently applied with great success in the EU member countries, both in these activity domains and in those that use topographic maps, plans in their work or need to make decisions within the geographic space.

Gis Educational and Training Courses In The Northwestern Region Of Romania

Gheorghe M.T.RADULESCU
Ovidiu STEFAN
Eduard KELLER
Adrian T.G.RADULESCU
Romania

1. THE NORTHWESTERN DEVELOPMENT REGION OF ROMANIA

The northwestern region is situated in the northwest of Romania, neighboring Hungaria at west, Ucraine at north, the central development region and the western development region at south and the northeastern development region at east.

Fig. 1 The northwestern development region of Romaniei

The grographical position of the region is favorable, because it is situated at the intersection of some important European roads. The natural frame of the region has the shape of an amphiteatre that descends from east toward west, bordered by the Oriental Carpathian Mountains at northeast and by the Apuseni Mountains at southwest. The region has a surface of 34.159 km^2 (14.32% of the surface of the country), a population of 2.740.064 inhabitants, which represents 12.67% of the population of the country, and a population density of 80.21 inhabitants/km^2 compared to the mean population density of 94.1 inhabitants/km^2 at national level. 52.55% of the people in the region live in cities (1 494 599) and 47.45% (1 349 443) live in villages, compared to the national level data, which shows that 54.58% from the inhabitants live in cities, and 45.42% live in villages. In 2000 the active population represents 51.2% of the total population of the region, and the employed population represents 47.5% of the total population of the region. 13,5% of the total of employed population of the region has higher education.

A special feature of the industry of the northwestern region is that almost all industrial branches are repsented here. In what concerns the proportion represented in the economy of the region, the industrial activities stand out, followed by agro-sylvic activities and services. The proportions in the GDP in 1996 are: 30.68% for industrial activities, 23.95% for agriculture, 4.99% for constructions, and 10,9% for commerce, what remains coming from other activities. The human development statistic in the region was 0.751; the GDP is 5442 USD/inhabitant, less than the national GDP, which is 6153 USD/inhabitant.

2. ASPECTS CONCERNING THE EVOLUTION OF THE EDUCATIONAL PROCESS IN THE EUROPEAN UNION UNTIL 2010

The recent mid-term review of the Lisbon strategy confirmed the central place of education and training within the European Union's agenda for jobs and growth. The integrated guidelines call on Member States to expand and improve investment in human capital and adapt education and training systems in response to new competence requirements. In this context, the European Council has requested that the Education and Training 2010 work programme continue to be implemented in full.

The Council has repeatedly emphasised the dual role – social and economic – of education and training systems. Education and training are a determining factor in each country's potential for excellence, innovation and competitiveness. All citizens need to acquire and continually update their knowledge, skills and competences through lifelong learning, and the specific needs of those at risk of social exclusion need to be taken into account. This will help to raise labour force participation and economic growth, while ensuring social cohesion. Investing in education and training has a price, but high private, economic and social returns in the medium and long-term outweigh the costs. Reforms should therefore continue to seek synergies between economic and social policy objectives, which are in fact mutually reinforcing.

The Bologna process is continuing to drive reforms in higher education structures, particularly in relation to introducing the three-cycle structure of degrees and enhancing quality assurance. The Bologna process, rather than the Lisbon strategy, tends to be at the foreground of national policy development in this sector.

For many countries funding remains a key challenge and an obstacle to implementing the modernisation agenda.

Several new Member States are aiming to tackle this issue by establishing partnerships with universities abroad for the provision of joint degrees.

Strengthening collaboration between higher education and industry is recognised by most countries as a basic requirement for innovation and increased competitiveness, but too few have a comprehensive approach on this issue. Part of the problem is that national innovation strategies too often do not incorporate higher education reforms.

Many countries are encouraging universities to play their part in making a reality of lifelong learning by widening access for non-traditional learners, such as those from low socio-economic backgrounds, including through the establishment of systems for the validation of non-formal and informal learning. This is part of a general effort across Europe to raise participation levels in higher education. A great many universities offer continuing professional development, and open universities using distance and blended learning and ICT-based learning approaches are also increasingly popular.

At national level even though progress has been made, the priorities of the Education and Training2010 work programme need to be taken more fully into account in national policy making. Member States should in particular ensure that:

- education and training have a central position in the national Lisbon reform programmes, in the national strategic reference framework for the structural funds, and in the national strategies on social protection and social inclusion;
- mechanisms for coordinating the implementation of the work programme at national level are in place in all countries by 2008, involving the different Ministries concerned and the main stakeholders, especially the social partners;
- national policies contribute actively towards the Education and Training 2010 benchmarks and objectives. Governments should go further in establishing national targets and indicators, using these European references;
- the evaluation of policies is improved, to enable progress to be better monitored, and to create a culture of evaluation, making full use of research results. The development of high quality statistical instruments and infrastructure is therefore indispensable;
- the various European agreements (e.g. Council resolutions or conclusions on common references and principles) adopted in the context of the work programme are, by 2008, used as key reference points when designing national reforms.

At European level The Commission will ensure that the outcomes of the Education and Training 2010 work programme are fed into the implementation process of the Lisbon integratedguidelines and the EU guidelines for cohesion, and into the current debate and followup action related to the future of the European social model. In this context, the structural funds should give priority to investment in human capital.

In order to strengthen the implementation of the work programme, particular attention will be given to:

- the development of a well-focussed and relevant programme of peer learning activities in the framework of the new Integrated Programme for Lifelong Learning and in the light of experiences throughout 2005. Peer learning activities will concentrate on those areas where reforms are most needed (EU benchmark areas; lifelong learning strategies; efficiency and equity; governance and learning partnerships; higher education; VET);

- more systematic monitoring of the implementation of lifelong learning strategies in all Member States. This issue will be a main priority of the 2008 Joint Report, especially in relation to the role of lifelong learning in the strengthening of the European social model;
- reaching agreement on a European Qualifications Framework (EQF), as well as the recommendations of the Council and the European Parliament on key competences for lifelong learning, and quality of teacher education;
- better information and exchanges of experiences regarding the use of the structural funds and the European Investment Bank, to support education and training development, with a view to better exploiting these resources in the future.

3. ORGANIZING GIS HIGHER EDUCATION

The development of Geographic Information Systems made it possible to assign a topographic label to each piece of information from the field and to intercorelate the users of this information based on unique common references. What is GIS?

- GIS is a powerful set of instruments used to collect, store, transform and visualize spatial data from the real world. Burroug (1986)
- GIS is an assembly of people, equipment, programs, methods and norms having the purpose to collect, validate, store, analyze and visualize data. Săvulescu (1996)
- GIS is software that correlates geograhic information with descriptive information. (ESRI White Paper)
- GIS is a technology that analyzes data from geographic perspective, organizing, analyzing and categorizing geographic knowledge, which it represents as informational sets (http://www.gis.com/index.html).

The history of GIS education, as distinct university specialization, at global level, extends on almost two decades. Thus, at the Third Cartography Conference of United Nations, organized by the Economic Council of UNO in 1985, the report of the group of experts in Topography, Cadastre and Local Information Systems (LIS), says:

- LIS is a way to identify problems, to build local policies, to make local decisions, and generally to sustain the management of local projects.
- LIS needs managers. The increased interdisciplinarity level of the knowledge needed to “configure” the system makes this large domain specific.

I belive that this statement represented 20 years ago the foundation of education in the specialization of Local Information Systems, associated to the domain of Geodesy, which later developed under the well-known name of GIS.

The consequences consisted in the development of the first GIS schools in the world, in 1988 in Australia, at the initiative of the educational committee of the Australian Group of Topography and Local Information, which noticed that year the important interdisciplinary development of LIS/GIS in the last then years in the region. In the same period emerges the first school in Europe, at Edinbourg.

We believe that, in the next decades, the activities specific to GIS will develop rapidly, requiring specialists for collecting data in the field, for integrating them in the system, and for managing the various informational layers of the system, and the system as a whole.

2.1. The Academic Educational Process in GIS

GIS education can begin in the elementary school – that is scholar education, or can be addressed to the training of adults, through academic courses, through postacademic or after-high-school professional conversion classes.

The academic educational process in GIS can be seen as a stand-alone process, this paper synthetically sustaining this concept, or it can be seen as a component of the education in the domains of Geodesy, Geography or Computer Science.

The training of specialists can be accomplished through full-time courses, under the guidance of an instructor, or through individual study, based on a printed or on-line bibliography.

Stand-alone academic education can be achieved only by establishing GIS schools within one of the three possible areas: Geography, Informatics or Geodesy.

GeoCommunity has identified many Universities and Colleges that offer GIS classes and programs, as full-time education or distance-learning, which can be accessed at: http://spatialnews.geocomm.com/education/links/.

An essential condition for education in GIS is the interoperativity, which consists in building a flexible system of knowledge, reported to the information resources.

Because of the fast changes of technologies, products and services in GIS, the traditional educational instruments and methods need to change, in order to create the flexibility required to satisfy the needs of the students: interactivity, creativity, teamwork.

For this purpose, the professional educational products, specialized software, and the modern educational methods have the role to stimulate the efficiency and effectiveness of learning in the case of young people, who are more and more concerned about their future profession, which they wish to be directed towards competitiveness and profit.

The main chance of this action to succeed consists in creating an open, interoperable environment, between the GIS community, represented by specilised companies and institutions, and the professional trainers, in what concerns the exchanges of informational resources to be used in the educational process, and therefore increasing the value of these resources. The following question rises: "Can these companies or institutions create an environment that is favorable to cooperation with universities, such that GIS trainers are able to assimilate the last updates and the changes of the educational system, which are problems of technical nature, such as large amounts of data, the format of the data, the technologies, and also problems concerning the way these informational resources will be spread out." The effort to promote this cooperation should be equal for both parties; taking into account the benefits they can have by training and developing young specialists. However, professional trainers have an additional responsibility concerning the development of training and education stages, by:

- creating a knowledge base
- identifying the necessary knowledge from various information sources
- building and promoting educational resources
- developing learning systems and instruments
- developing strategies for educational infrastructure in GIS
- the response to the challenges concerning curricular development.

Analyzing the method and the form in which cooperation can be achieved represents the object of a study that should answer the following questions:

- How can GIS knowledge be formalized for educational purposes?

- Which are the categories of resources needed for GIS education?
- Which are the fundamental components that can be objects of GIS resources?
- Which are the requirements for owning metadata?
- How can we ensure the confidentiality of data, copyright and the security of the data of private companies?
- Which are the organizational and institutional subjects that can become the object of cooperation?
- How can we use global information as application for local education and which are the implications of using foreign materials or materials belonging to other domains?
- How can we express the quality of educational products and which are the mechanisms each teacher can evaluate them by?

2.2. Is the Development of GIS Specialists Justified?

The white book of ESRI specifies the following possible destinations – GIS beneficiaries:
- geography, archeology, agriculture, banking system, national defence and safety, electric networks, gas, water, sewage, telephone networks, cable TV networks, magistral pipes, local and central government, guarding, preventing and fighting fires, sylviculture, health, ensurance, education, architecture, justice, libraries and museums, various local services, air and naval navigation, coastguard, oceanography, mining and environmental sciences, natural resurces, monitoring the environment, media, oil and gas, realestate cadastre, business environment – chambers of commerce and industry, telecommunications, transport, waters, preserving nature, sustainable development. Such a diverse domain justifies the immediate action of changing to academic level training, as a stand-alone specialty.

2.3 Three domains, one specialization

Teoretically, Geographic Information Systems (GIS) can be academically associated to any of the three domains, which most of the knowledge involved in training specialists in this field comes from: Geography, Informatics, Geodesy. It should be mentioned that in some countries GIS was included in the first domain, in a few countries it was included in the second one, and in other countries it was included in the last domain. The consequences of including GIS in one or another domain are not only the length of studies, the possibility to attend courses, and the educational forms – distance learning, common lectures in the first years of study, and the content of the curriculum. The National Committee for Academic Assessment and Certification has issued very strict rules concerning the proportion of different groups of courses in the total hours of study. The three academic domains of study belong to different committees: Geography belongs to the Committee of exact sciences 2, Informatics to the Committee of exact sciences 1, and Geodesy to the Committee of engineering sciences 1, each committee having a specific number of mandatory fundamental and technical courses, which restricts the configuration of the plan of the GIS specialization. It should be mentioned that for Geography, the mandatory fundamental courses are: Cartography, Topography, Fotogrammetry, and mandatory specialty training courses are: Geodesy, Fotogrammetry – again, Cadastre and Legislation in the area, that is five courses in the area of terrestrial measurements.

Analizyng the educational plans of the main specialization from the three domains, we notice the existence of certain groups of courses, which facilitates conceiving an educational plan for the new specialization.
Thus, for Geography, we can identify:

Group 1: Geography,
Group 2: Meteorology – Climatology,
Group 3: Geology, Geomorfology, Pedology,
Group 4: Organizing, Developing, Managing, Geographic space and land improvement,

For Informatics:
Group 1: Mathematical Fundamentals of Informatics
Group 2: Programming,
Group 3: Databases,
Group 4: Applications
For Geodesy:
Group 1: Geodesy – GPS, Geodesic astronomy, Cartography,
Group 2: General and engineering topography,
Group 3: Cadastre,
Group 4: Urbanism, Systematization and Land organization,
Group 5: Fotogrammetry and Remote sensing,
Group 6: GIS,
Of course, each group of courses contains a smaller or greater number of courses, for example, in the case of Geography, we have identified not less than 28 courses: general geography, technical geography, geography of population and localities, general economic geography, geography of environment, landscape, continents, physical geography, human geography of Romana, geography of turism, geography of turism in Romania, geography of the Europene Union, regional general geography, social geography, regional geography of Romania, geographic theory and methodology, political geography, rural geography, historical geography, statistical geography, geography of traffic, hydroenergetic geography of Romania, geography of degraded lands degradate, biogeography, pedo-geography, research methods and models in human geography, methodology of phyisical-geographic research, geography risk phenomena. In the case of Databases, we have identified 8 courses: The fundamentals of databases, Knowledge databases, Software project management, Distributed databases and OO databases, Expert systems, Computer networks, Data codes and compressions, Client-server databases. In the case of Topography we have identified 13 courses: General topography, Engineering topography, Geodesic and topographic instruments, Monitoring the behavior of lands and constructions, Tracing investment works in cinematic regime, Sub-terrestrial measurements, Geodesic measurements through waves, The fundamentals of geodesy and topography, The fundamentals of engineering measurements, The technic of topographic engineering measurements, Dynamic topography, Special topographic surveying, Topographic tracing of special works.

The configuration of the educational plan can be drafted only after clarifying the academic domain, which GIS will be included in. The main reason for integrating in the domain of Geodesy is that all the information, which has not only geographic origin, has geometric-topographic label. Other reasons? The new educational plan has to contain the six groups of courses identified for Geodesy, with a different proportion than in the case of the specialization of Terrestrial measurements and Cadastre. The study of local information, regardless of the domain, can be performed only simoultaniously with the topographic plan of the region.

4. ORGANIZING GIS POSTACADEMIC STUDIES

4.1. Course Justification

Founding a postgraduate course of Geographic Information Systems will contribute to the development of well-trained specialists in this activity domain, so that in the future, GIS technology will be successfully applied in the Northwestern region of Romania, and in Romania in general.

Most sustainable development decisions are inherently multidisciplinary or cross-sectoral, because they require trade-offs between conflicting goals of different sectors. However, most natural resource development agencies are single-sector oriented. Geographic Information System (GIS) technology can help establish cross-sectoral communication - by providing not only very powerful tools for storage and analysis of multisectoral spatial and statistical data, but also by integrating databases of different sectors in the same format, structure and map projection in the GIS system

This course is intended to be innovator by means of the presented materials, the method used to present these materials, the method of interactive teaching and other means for developing a competitive course at European level.

4.2. Aims and Teaching Objectives

1. The main purpose of the post-graduate course of GIS is represented by the development of well-trained specialists in this activity domain, leading to the successful application of GIS technology in the Northwestern region of Romania, and Romania in general, and in the future, leading to a unity approach of the data structure and data exchange with the other member countries of the European Union.

The objectives from the perspective of teaching this course are:

- Methods for teaching different courses, using an interactive approach for students during courses and seminars, taking as example the courses and seminars of other field universities from European Union.
- The presentation of materials for courses and seminars will be carried out using a modern and highly improved system.

2. It is very important that the project obtains its desired outcomes. For that, it is very important to have the following information:

- The way in which GIS didactic materials are structured in the field universities from the EU member countries, with respect to those from Romania;
- The methods for teaching the courses that involve GIS technology in the field universities from the EU member countries, with respect to those from Romania;
- The ways to involve the students during GIS seminars in the field universities from the EU member countries, with respect to those from Romania.

This information will be used to identify and apply in the future the experience gained by the specialists from the field universities, and that of those that work every day using this technology, such that in the future, the methods for implementing and using the GIS technology, as well as the methods for teaching, structuring the lecture notes within the North University from Baia Mare, would reach the European standards as soon as possible.
Applying all these information in the post-graduate course of GIS, we shall have the following outcomes:

- Conceiving and editing the necessary course materials at European standards
- Conceiving and editing the seminar materials at European standards

4.3. Methods for Teaching the Course

Total number of hours is 180, out of which 84h are lectures and 56h are seminars, 40h practical stage, during 14 weeks, one semester.
The students' assessment will be made through an oral examination (50% of the final mark) and considering their technical papers (20%), results of laboratory work (20%) and class activity (10%).
A. Course lecture

- Direct Teaching,
- Cooperative Learning which helps foster mutual responsibility,
- Brainstorming and discussions,
- Lecture, incl.internet with discussion which involves students, at least after the lecture,
- Case studies,

- Slides OHP (power-point) and slide show presentation,
- Video (video-cassettes with GIS, GIS in Sustainable Development, environmental monitoring and protection programs),

  B. Seminars

- case studies which develops analytic and problem solving skills,
- ecological monitoring excursions to companies, environmental protection areas, polluted areas,
- simulations,
- team projects.

In order to establish post-graduate applied GIS courses within the North University of Baia Mare, there exist teaching personnel with experience in implementing and using GIS technology, and also an adequate technical equipment for the successful operation of courses and seminars.

4.4. The Contenct of the Course

The course will include the following subjects:

Week 1. Geographic Information Systems, Geospatial Science Fundamentals Introduces to the geospatial sciences, emphasizing the concepts and theories of cartography, remote sensing especially air photo interpretation, and geographic information systems.. Introduces to topics in geographic information science, emphasizing the concepts and theories of cartography and geographic information systems.

Week 2. Geographic Information Systems, Discussion of advanced geographic information science concepts in great detail, including spatial data structure, spatial analysis, and programming. Hands-on exercises demonstrate these concepts. Address selected issues related to data fusion, geographic information systems on the Internet, and database management.

Week 3. Geographic Information Systems, Exploration of existing and potential capabilities of geographic information systems in conducting spatial analysis and spatial modeling. Algorithms and Modeling in GIS. This course examines several fundamental GIS algorithms based upon computational geometry and computer graphics. It will also discuss issues in modeling features of different dimensions and surfaces in GIS. Distributed Geographic Information Science This course examines different aspects of science and technology in the context of distributed GIS. Issues included are general concepts, architecture, component design, component development, and system integration as well as other advanced topics, such interoperability and agent-based GIS.

Week 4. Databases, Introduction to database systems, emphasing the study of database models and languages and the practice of database design and programming. Topics include the Entity-Relationship model, the relational model and its formal query languages, SQL, the theory of relational database design, and object-oriented and logic-based databases.

Week 5. Spatial Analysis, Traffic management and land use planning: Real-time traffic analysis in a GIS framework will aid in the development of highway infrastructures, traffic and travel demand management, and land-use planning. Environmental problems: GIS can assist in the analysis of data extracted from models of water, air, and other types of environmental variables. Problems of fire control, species diversity, hydrology and flood control, hazard mitigation, and park usage are ideally suited for analysis with a GIS framework. Landscape characterization and measurement: A compelling problem of those using remotely sensed data for analyzing such things as land cover and land use is the classification of high-resolution data. Image analysis in a GIS analytical framework allows for various classification schemes to be tested and used in the analysis of land cover data. Social, cultural, and economic analyses: Economists and other social scientists will have the opportunity to use block, county, and individual data to test theories by means of spatial econometric analyses. The development of the use of these data sets in a GIS framework will increase our understanding of all sorts of social processes, including patterns of employment and unemployment, crime, economic growth, and population change. Physical processes: The analysis of hydrologic and climatologic processes under varying physiographic regimes in a GIS framework will enable researchers to pinpoint trends (e.g., global change), identify anomalous events, and further applied research in these fields. Improving the accessibility and equity of opportunities and services: GIS can accommodate more sensitive configurations of economic activities and public sector services. GIS capabilities for handling spatial data allow researchers to develop detailed representations and analyses of the spatial distribution of disadvantaged populations and their access to opportunities and services. GIS-based techniques for solving sophisticated and realistic location and distribution problems can allow these systems to be configured to maximize accessibility and equity.

Week 6. Data Collecting, Rationale for data collection forms, Electronic versus paper data collection forms, Data management and software, Key components of a data collection form, Study characteristics, Coding format and instructions for coders, Pilot testing and form revisions, Reliability of data collection, Blinded data extraction, Collection of data from investigator, Analysing and presenting results, Interpreting results.

Week 7. Data Quality, Data Analysis, Data Matching, Data Quality Enhancement: Data Standardization, Data Consolidation

Week 8. Environmental Modeling and Databases, Preparation of environmental data and information; analyses of cost, revenue, and efficiency in environmental management; the role of environmental database and information; principles of remote sensing and geographic information systems (GIS) and their application in environmental accounting; environmental auditing; concepts and principles of environmental accounting; disclosure of environmental accounting data at the enterprise level. Using state of the art software including ARC-INFO and ARCVIEW to display and manipulate digital map data.

Week 9. Environment Monitoring, Legislation, regulations and management strategies. Regulatory frameworks as an instrument of waste management strategies. The Basel Convention and its implementation Chemical pollution potential from solid waste: Short- and long-term effect. Assessment of pollution potential from solid waste Advances in solid waste characterization and monitoring. The changing face of environmental monitoring. Identification of unknown solid waste Remote monitors for in situ characterization of hazardous wastes. New developments in solid waste information and environmental control strategies.

Week 10. Sustainable Development, Problems and realities in implementation of the concept of sustainable development. United Nations Commission on Sustainable Development, CSD). Seeking a proper balance between the pressure of economic factors and the requirements of environmental law. Ecological management.

Week 11. Sustainable Development, Problems in developing environmental policy and implementation of the concept of sustainable development in Romania. Learning from positive examples in UE countries, USA, Canada AND Australia.

Week 12. Sustainable Development, Role of GIS in the field of environmental science, sustainable development.

Week 13. GIS in Sustainable Development, Analisys

Week 14.GIS in Sustainable Development, Conclusions and Recommendations

5. CONCLUSIONS

Academic and postacademic education in the domain of GIS has to coexist, addressing various categories of beneficiaries. The approach of organizing academic and postacademic courses was done in different countries, in some countries the academic education is missing, GIS training being performed only through postacademic forms.

This paper proposes a mixed GIS educational system, taking into account the large number of specialists that will be involved in implementing GIS in Romania in the future.

REFERENCES

1. McCormick J. Environmental Policy in the European Union. Palgrave Press. Houndmills and New York.
2. Rosenbaum W., Environmental Politics and Policy. -Washington D.C.: Congressional Quarterly Inc
3. C.Săvulescu şi colectiv Fundamente GIS, Editura HGA, Bucureşti 2000
4. COMMISSION OF THE EUROPEAN COMMUNITIES, Brussels, 10.11.2005 COM(2005) 549 final, COMMUNICATION FROM THE COMMISSION, Modernising education and training: a vital contribution to prosperity and social cohesion in Europe, Draft 2006 joint progress report of the Council and the Commission on the implementation of the “Education & Training 2010 work programme”{SEC(2005) 1415}
5. The European Environmental Management and Audit Scheme (EMAS). EC Regulation 1836/93.
6. http://spatialnews.geocomm.com/education/links/
7. http://www.ucgis.org/Default.asp
8. www.worldofgeomatics.com

9. http://www.uwm.edu/SARUP/gis/
10. http://www.gisdevelopment.net/education/papers/edpa0003a.htm
11. http://www.esri.com/events/educ/
12. http://www.gis.com/education/index.html
13. http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=1011715
14. ISO 14001. Environmental management systems — Specification with guidance for use. Brussels:ISO, 1996
15. ISO 14004. Environmental management systems — General guidelines on principles, systems and supporting techniques (1996). Brussels:ISO, 1996.
16. ISO 14010 Guidelines for Environmental Auditing — Audit.
17. UNITED NATIONS, Economic and Social Council, THIRD UNITED NATIONS REGIONAL CARTOGRAPHI CONFERENCE FOR THE AMERICAS, 1985, Item 6f and 6g of the provisional Agenda

BIOGRAPHICAL NOTES

Gheorghe-Mugurel T.RADULESCU

Birth date	April 17, 1950
Birth place	Bistrita, Bistrita-Nasaud County
Address	Baia Mare, str. Vasile Lucaciu nr.45
Phone	home 00400262-212274
	mobile 00400721-942189
E-mail	gmtradulescu@yahoo.com
Employment	The Northern University, Baia Mare
Teaching position	proffesor
High school education	The Theoretical High School, Targu Secuiesc, 1969
Undergraduate education	The Faculty of Geodesy, Bucharest, 1974
	The Faculty of Mathematics, Cluj-Napoca, 1990
Graduate education	Production Organization, M.E.E, 1976
	Computer Science, Inform Institute, Bucharest, 1991
Scientific titles	Doctor of Engineering Sciences, with the major of Civil Engineering, in the area of expertise of Geodesy, Cartography, Fotogrammetry and Teledetection.

Thesis title: “Modern topographic technologies used in the execution and exploitation of high-rise buildings” Scientific coordinator: Prof. Univ. Dr. Eng. Vasile URSEA

Professional activity

Geodesy engineer,	1974-1978, Energoconstructia Trust, Bucharest,
Teacher,	1978-1980, Agricultural high school with specialization in topography, Branesti, Ilfov County,
Assistant,	1980-1985, Institute of Polytechnics, Cluj-Napoca,
	1985-1990, Engineering Institute, Baia Mare, 1985-1990

Senior lecturer,	1990-2004, the teaching lines of Topography, Cadastre, Engineering Topography, The Northern University, Baia Mare,
Professor,	2004- the teaching lines of Topography, Cadastre, Engineering Topography, The Northern University, Baia Mare,

Scientific activity
Articles published abroad – 7
Articles published in international field journals – 14
Articles published in national field journals – 50
Articles published in the books of some international scientific meetings – 40
Field manuals for higher education published by native or foreign publishing houses – 4
Published Workbooks of problems and Tutorials – 19
Other published works – 1

Other professional activities

Member The Union of Geodesists from Romania,
The Association of Metrologists from Romania,
The Association of Mining Topographers,
The Senate of The Northern University, Baia Mare,
The Office of the Mine Department.
President of the Organizing Committee and **initiator** of the First National Symposium of Topography TEHNOTOP 88, Baia Mare, may 1988.
The Society of Terrestrial Measurements from Romania.

CONTACTS

Prof.univ.dr.ing.mat.Gheorghe M.T.Radulescu
North University aia Mare
Str.dr.Victor Babes, nr.62A
430083 Baia Mare
ROMANIA
Tel. +0040721942189
Fax + 0040262276153
Email: gmtradulescu@yahoo.com
Web site: www.ubm.ro