Enviromatics: Environmental Information and Environmental Decision Support

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1. INTRODUCTION

Information Technology (IT) is a useful tool for many information and decision processes related to environmental protection and management. We see IT used in such diverse areas as environmental monitoring, natural resource management, planning, public information and disaster management. Today, IT systems serve a broad range of application domains dealing with environmental questions: landscape architecture, ecology, national, regional and local government, climate research, logistics and transport, mining, water resource management, and many more.

The development in *Enviromatics* (the shortened version, which I use for the term "Environmental Informatics", which itself is a shortened version of saying: "The application of Information Technology to environmental problems") over the past years has demonstrated that all computer science sub-disciplines are involved. Furthermore, each of them is of great use in certain application areas, but also that each of them face certain difficulties which are usually related to the *complexity* of the problems under investigation. As many problems are *interdisciplinary*, it is often necessary to combine methodologies from very different domains and to use many different software tools in combination. The *data sets* are often *large*, *incomplete* and contain *uncertainties*. Examples of such complex applications can be found throughout this book or in DENZER(1999) and GÜNTHER(1998). These problems make Enviromatics a challenging and

interesting area for a computer scientist. It is important not to forget, that simply looking on Enviromatics for its own sake does not make sense – it only makes sense if we look at it as a tool to solve environmental problems. Therefore it is very important that Enviromatics is *problem centred*.

When solving a real world interdisciplinary problem, the situation often arises that the solution (or a set of solutions, or different scenarios to support decisions) can only be achieved by combining the different disciplines and the tools used in these different disciplines. A typical example can be found in spatial decision support systems, which incorporate GIS, multiple databases from different origins (which may be distributed) and models. In this book, the article of Nigel T. Quinn demonstrating water management along a large watershed is such an example. For such problems, Enviromatics is often the integrating component, which fuses the various methods together. *This integration of information, methods and tools* is a key role Enviromatics can play. When it comes to integration software tools, is also a great challenge for the IT professionals involved.

It is very difficult to structure Enviromatics topics. Methods of structuring which have been used in early conference proceedings sometimes divided the domain by computer science sub-disciplines (environmental databases, simulation and modelling, visualisation, AI, ...) or by application domain (air pollution, water resources, ecology, ...). It is always wrong. Counterexamples occur for every classification.

How difficult any classification is, can be shown with AI methods. We can discuss them under *Methodologies and Systems for Decision Support*, but they are also very well used in *Data Analysis* and *Diagnosis* (e.g. Indicators, see article of Bill Walley in this book), and they are also very useful in data networks (e.g. agent technology).

2. ABOUT THIS BOOK

This book contains an edited version of papers presented at the ISESS 1999 conference, which was held at the University of Otago, Dunedin, New Zealand, from August 30 to September 2, 1999. All submitted contributions had been reviewed by 5 individual reviewers from an international program committee and only those of very high quality had been accepted for presentation in Dunedin. The book has then been edited by David Swayne and myself in collaboration with all authors.

Given the material provided by all ISESS 1999 presenters and given the fact that the proceedings in 1997 and 1995 were called "Environmental Software Systems" (Volumes 1 and 2), we called the book *Environmental Software Systems – Environmental Information and Environmental Decision Support*. This title reflects the fact that all three conferences, and in

particular the one in 1999, showed two primary application types: those which are "mere" Environmental Information Systems (EIS) and those which contain decision support components, so-called Environmental Decision Support Systems (EDSS). We also felt that "pure" application examples are important and that ongoing discussions must be included in this book as well. The book now follows the structure:

PART I: Enviromatics - Introduction
PART II: Environmental Issues
PART III: Environmental Information Systems - Tools and Techniques
PART IV: Environmental Information Systems - Implementations
PART V: Environmental Decision Support Systems
PART VI: Specialised Topics

PART I is this introductory chapter. PART II includes two application centred articles derived from keynote presentations. PART III and PART IV discuss EIS. PART III is concentrating on methods, while articles in PART IV are centred around applications. PART V discusses EDSS issues and PART VI contains two edited reports from working groups. V.1 gives a good overview of needs and requirements in one application domain. V.2 gives an approach to define what an EDSS is.

3. SOURCES OF INFORMATION

There are three main sources of up-to-date information about the scientific community dealing with Enviromatics. The first and historically oldest is a technical committee and working group in the German Informatics Society called "TC 4.6 – Computer Science for Environmental Protection". The second is a working group within IFIP (International Federation for Information Processing) called "WG 5.11 – Computers and Environment". The third is the ISESS conference itself. Entry points are the ISESS Web page (isess.crle.uoguelph.ca), IFIP (www.fip.or.at) and German Informatics Society (www.gi-ev.de).

4. ENVIROMATICS AND GIS

Many EIS and EDSS include Geographical Information Systems (GIS). GIS are often key components for environmental questions, because most of the data is spatially related (geo-referenced).
There is a large GIS community which historically has had little interaction with the Enviromatics community, unfortunately. It is difficult to say, why these two groups interact so little, perhaps because for the GIS

community, an EIS is "only" one application domain of many, and for the Enviromatics community, a GIS is "just" one tool of many.

If we try to look at the situation undogmatically, we see that GIS's are among the components which are the most used in EIS's and EDSS's. We also have to consider that we often have trouble integrating GIS's into EIS's because the tools on the market are mostly closed monolithic systems (which has nothing to do with GIS methodology, it has only to do with market policies of GIS companies) - although this situation is slowly changing with component technology. Better interaction between both groups could provide GIS developers with in-depth requirements for EIS integration. However the situation will develop, in-depth reading and understanding of GIS technology is usually important for an Enviromatics professional.

5. ACKNOWLEDGEMENTS

6. REFERENCES

DENZER (1999), Ralf Denzer, *Environmental Software Systems*, Encyclopedia of Computer Science and Technology, Volume 40, Supplement 25, Marcel Dekker Publishers, 1999
GÜNTHER (1998), Oliver Günther, *Environmental Information Systems*, Springer, 1998