RamCo: An integrated assessment tool for sustainable coastal zone management

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Introduction

RamCo (Rapid Assessment Module for Coastal Zones) is a prototype of an information system for the rapid and integrated assessment of sustainable solutions to coastal zone management problems. It helps policymakers to test alternatives in the wider context of climate change, demographic growth or changing economic demand.

RamCo describes the natural and anthropogenic processes in a coastal zone under the influence of the dynamic behaviour and interaction of agents, such as inhabitants of the coastal area and economic activities (fishery, cultivation of shrimps, agriculture, industry, tourism and commerce). Characteristic of **RamCo** is the way in which processes are linked on different levels to form one system, and how these sub-models use very detailed data layers from a built-in Geographical Information System (GIS). It is possible to design policy alternatives and to assess their impacts.

The quantitatively defined relationships between the different elements of the natural and socio-economic processes are based on large scale 'field observations'. Each of these relationships can be changed through expansion and aggregation functionalities. The period under analysis time (in years) can be also be defined.

Application

The current version of **RamCo** has been applied to a coastal zone near Ujung Pandang in south-west Sulawesi (Indonesia). It shows how, in the next 25 years, the coastal zone will become urbanised under the influence of a growing population (annual growth ± 3%) driven by external economic growth. It shows how this results in increasing pollution of rivers and coastal waters. It also illustrates how the increasing demand for food leads to destruction of the forests, how this in turn increases soil erosion in the mountains, causing river floods in the coastal zone. Policy makers can intervene in these dynamic processes by choosing other settings such as rehabilitation of mangroves, treating sewage waste, management of the Bili-bili dam and reforestation, and with fishery regulations and the development of marine parks. In this way, they can test policy alternatives.

RamCo differentiates between influences that can be controlled by 'policy makers', and those that cannot, such as precipitation.

After configuring **RamCo** with the input values, the calculations will yield results in various formats such as maps, graphs and numerical values that give the policy analyst insight into the evolution of factors such as human welfare or river sediments. These outputs are viewable in **RamCo** itself, or written to files to be analysed by generic tools such as spreadsheets or GIS software.

Further developments

The CZM-Centre of the Dutch Ministry for Transport, Public Works and Water Management financed the development of **RamCo.** A consortium consisting of Research Institute for Knowledge Systems (RIKS), INFRAM, University of Twente and Maastricht University, Delft Hydraulics (Deltares) and the Memorial University Newfoundland developed the product.
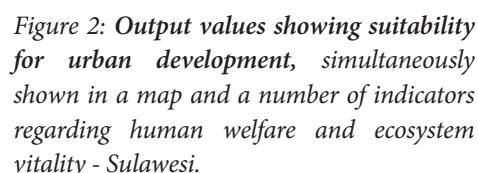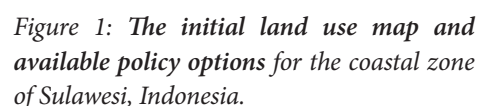
Since the development of **RamCo**, its model integration concept and the underlying Geonamica software platform (Hurkens ea, 2008) have been used and further developed in a wide range of products. It has evolved into a platform for spatial dynamic modelling for policy support in an integrated context called Metronamica. This modelling framework is used for developing integrated impact assessment software tools worldwide, in fields such as:

- Impact assessment of agricultural policies and land use changes (LUMOCAP PSS);
- Integrated spatial planning for multi-scale integrated land use (**Xplorah**);
- River basin management: analyses of scenarios and policy options (**Elbe-DSS**),

- Desertification (**MedAction PSS - Policy Sup-port System** and **DeSurvey IAM**);
- Shifting cultivation in the Ruhunupura area in Sri Lanka (Wickramasuriya, et al 2009);
- The metropolitan area of the city: Belo Horizonte, Brazil.

Recent versions of **RamCo** include several tools, facilitating the work of policy analysts to define, adjust and compare different assumptions more easily. This uses a flexible model configuration and integrated statistical tools such as Monte Carlo analysis for uncertainty analysis and generating probability maps.

Lessons learnt

From the design, development and use of Decision Support Systems in a wide range of countries and policy contexts, important lessons have been learnt regarding the user interface and the design and development process of these systems (Van Delden, e.a. 2010). Sharper definition of the specific roles of the four parties (end-users, resource scientist, IT specialist, system architect) and improved communication between the parties resulted in a product more suited to the end-user.

A demo of Ramco

A **Ramco** module **for Rapid Assessment for coastal zones**, including a short user-guide (www.riks.nl/projects/ramco) is available for demonstration, training and evaluation. The module allows the various functionalities of the GIS based model, including the comparisons of the chosen policy options (strategies) and the scenarios (socio-economic, climate change), and it's geographic and macro-dynamic, schematic computational representations to be trialled.

*Figure 1: **The initial land use map and available policy options** for the coastal zone of Sulawesi, Indonesia.*

*Figure 2: **Output values showing suitability for urban development,** simultaneously shown in a map and a number of indicators regarding human welfare and ecosystem vitality - Sulawesi.*
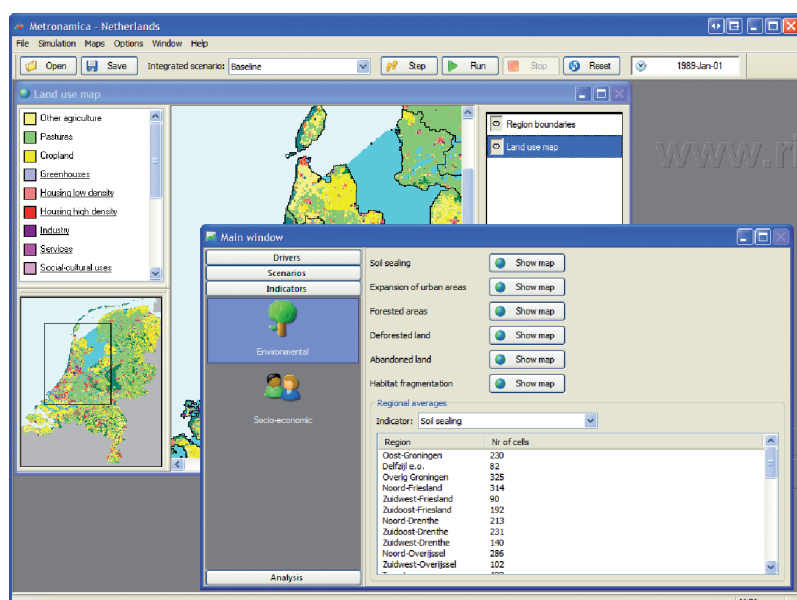
Figure 3: The Metronamica generic integrated impact assessment tool, a next generation of spatial, dynamic modelling, applied to coastal zones in the Netherlands.

For more information about the **RamCo** system, its approach and recent developments in Decision Support System application please contact:

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Website to download the **RamCo** software and user manual: www.riks.nl/projects/ramco: and the **Metronamica** brochure: www.metronamica.nl

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