

Sub Project 2 – Modelling – MOLAND

1. Project Statement

Models are abstractions and simplifications from reality that allow us to understand relationships, and help us predict the answers to 'what if' type questions. They are used in a variety of settings to support policy and management decisions. The key is to further develop MOLAND (see appendix for details), to assist in the formulation of well informed decisions.

To develop MOLAND a number of factors need to be addressed, which include:

Scope. Development will focus initially on the Greater Dublin Region, then link to Northern and Border regions model, with the objective of in time extending to an all island basis. In undertaking detailed analyses initially, there will be particular concentration on the Dublin-Meath-Louth East Coast corridor.

Medium to long-term commitment. The model is complex and needs further development. The real benefits which could arise from use of the model will only become apparent as understanding and experience builds up.

Centres of expertise. It is necessary to build centres of expertise within the island of Ireland. Urban Institute Ireland will provide the fulcrum linked to other public and private sector developments as appropriate and useful. Users such as government departments/agencies will tap into this expertise as and when necessary.

Joined up research. An important aspect of MOLAND is that it provides a flexible platform onto which specialist sub-models can be 'hung'. This means that it has the capacity to evolve as user requirements change and new data and knowledge become available. It could become a tool to break down the compartmentalism which currently exists within the research community.

Steering a Moland initiative. Draw potential users (departments etc) and model developers (academics, researchers) and data suppliers into an appropriate framework so as to provide a level of co-ordination and guidance to the model development process and the policy process.

2. Objectives and Targets

- Produce 2006 land-use database and update model.
- Test the appropriateness of MOLAND (see later for description) for integration of environment and development parameters at urban regional and local scale, modify as appropriate, with relevant feed in from sub-projects below.
- Test the feasibility of disaggregating Electoral Divisions (EDs) into Enumerator Areas, which is more relevant for linking health and environment spatially.
- Disaggregation of economic data and input into MOLAND.

3. Review of State of Knowledge

The formulation of policies for urban areas requires a detailed understanding of the system and its processes, which are all interconnected. Geographic Information Systems (GIS) blend digital data with imaginative software, however more powerful analytical environments link spatial interaction, location-allocation and network modelling. These links give rise to integrated environments that are termed, Spatial Decision Support Systems (SDSS). They have emerged as a result of the increasingly complex questions that urban planners face in attempting to make mutually consistent, long-term plans (Wadell, 2001, Bailey and Gatrell, 1995). SDSS developed in line with the advances in related technologies, such as GIS, remote sensing and multi-criteria decision support systems, which Moorthy et al. (2005) identify as all being key for successful land-use and transportation planning.

The power of an integrated spatial analytical environment enables users to readily interrogate and update datasets, but also enables forecasting, optimisation and impact analysis. It must be noted that such systems do not provide finite answers to complex questions, but facilitate discussions, thinking and ultimate agreement of plans. One particular example of a powerful, highly integrated SDSS is MOLAND, which emerged as part of the Murbandy project, run by

the European Commission Joint Research Centre and co-developed by RIKS bv and ERA Maptec Ltd. It was tested on a pilot basis in approximately thirty pilot urban centres in Europe, including the Greater Dublin Region and Northern Ireland, based on data from 2000. A collaborative agreement with the Joint Research Centre has been reached (See Annex).

MOLAND operates at two levels, a macro level that combines a number of linked sub-models representing natural, social and economic sub-systems of the region of interest (Engelen et al. 2004). In addition, the model operates at a micro-level during which a modelling process known as 'cellular automata'(CA) determines the fate of land parcels based on the characteristics of neighbouring parcels. Random factors as well as trends and stable interrelationships between land uses can be factored into the scenario generation process, as well as new infrastructure, land use zonings and other constraints. MOLAND provides output on an annual basis into the future. Present outputs from the model include 'predicted' land use patterns at future dates and indicators related to a variety of issues (e.g. proximity of residential areas to green spaces, housing densities etc). An important gap in the existing template is the environmental dimension, a lacuna which this project aspires to fill.

In parallel with the development of MOLAND, Anthony Staines and Emer O'Sullivan, Department of Public Health, UCD, are developing a health information system that integrates information from a range of sources and supports the core information requirements of the Health Services Executive (HSE), other dependent organisations and the public. The Health Atlas Ireland, aims to complete these functions and serve as an interface for spatial and epidemiological enquiries through a GIS platform. Tenders are currently being received for the development of the Health Atlas and work will commence as soon as possible. The Health Atlas will include demographic, mortality, morbidity, infectious disease, health status indicators and service activity data at the level of Electoral Division (ED). The Health Atlas will support the monitoring of disease trends in populations and support the investigation of suspected disease clusters and locally perceived health issues such as waste disposal facilities and transport corridors. The potential for linking the information gathered and mapped in the MOLAND model and that of the Health Atlas is substantial, and would support a more multi-disciplinary, cross-policy, centralised approach to planning and development, allowing for holistic decision-making; including issues such as sustainability, employment, quality of life and human health.

Ronan Foley of the National Geocomputation Centre at National University of Ireland Maynooth is developing a mechanism whereby the Census data, now disaggregated only to EDs, can be further disaggregated to Enumeration areas (4-5 per ED) which will allow much more statistically robust testing of various hypotheses linking location, environment and health.

4. Description of Work

In order to increase the usefulness of the current model, including the incorporation of environmental factors, it would be appropriate to develop the model in various ways as indicated below.

- Enhance the accuracy of the model using new or updated data sets and improved calibration. Medium resolution optical imagery will be interpreted using ancillary data Local Authority Development Plans
- Integration with fully developed transport models, in particular, the DTO's SATURN model.
- Improvement to the regional sub-model (e.g. include a Regional Authority level sub-model, improve the economic and transportation aspects)
- Include models related to environmental processes linked for example to flooding, biodiversity, habitat change etc
- Undertake LiDAR, 3 D mapping, of Dublin research area and integrate data into Moland. See Annex 4 for further details.
- Extend the range of environmental and quality of life indicators as outputs. Suitability for smaller town planning and development projections.
- Link both the Health Atlas Ireland and MOLAND through the same interface, allowing users to query across the multiple datasets, from quality of life indicators to up-to-date baseline health outcomes, for any population.
- Explore feasibility of linking health effects and air pollution emissions in the Malahide

corridor.

The sub-project envisages a working relationship with Joint Research Centre of the European Commission and with RIKS b.v. (the software developer). This will entail temporary placement of project staff at the office of the JRC and RIKS in order to maximise collaborative research and to benefit transfer of expertise to Irish researchers.

5. Project Management

The sub-project will be managed jointly by ERA-Maptec and Urban Institute Ireland (UII). There will be bi-monthly meeting of the main partners and reporting to the main project steering group. The development of MOLAND and integration of new datasets will require a post-doc researcher spending two months working with the MOLAND research groups at the JRC and RIKS offices.

6. Expected Results

An extended working MOLAND model that will integrate land cover, demographic, socio-economic, climate and environmental change information. The system will allow decision makers and researchers to interrogate data sets, model scenarios and facilitate decision making.

It is anticipated that this powerful system will be used in the following areas:

Planning (e.g. DoEHLG and Planning Authorities and Regional Authorities)

Capital budget planning (e.g. Depts Environment, Transport, Finance)

Transport planning (e.g. Dept Transport, NRA and DTO)

EIA and SEA impact assessments (e.g. Planning Authorities, infrastructure providers, EPA)

Evaluating the impact of major infrastructure projects (e.g. Depts Environment, Transport, Marine & Natural Resources, Planning Authorities, EPA, NRA)

Teaching (e.g. Planning, transportation, environmental, geography and possibly other courses at third level institutions).

Research (e.g. Urban Institute, NIRSA)

7. Composition and Experience of Modelling Team

Martin Critchley (Director ERA Maptec), leader, Debra Laefer (UCD), Daniel McInerney (UCD), Sean Morrish (UCD), post doc (to be appointed), Ronan Foley (NCG/NUIM), Anthony Staines (UCD), Brendan Walsh (UCD)

8. Facilities/Capabilities

Access and use of workstations located within the GIS lab at UII. Specialised software that will be used:

- . ArcINFO
- . ArcGIS
- . Erdas Imagine
- . ORACLE
- . MySQL

8. Declarations on Other Sources of Funding and on Tax Clearance

UCD, TCD and NUIM rely on this funding to cover marginal costs and have not sought additional funding; whereas ERA-Maptec provides 50% funding through their own sources.

University College Dublin will provide a current Tax Clearance Certificate, on request from the Environmental Protection Agency.

9. Compliance with National Policies on the Environment, Gender and Poverty

Urban Institute Ireland (UII), UCD (Project leader) UCD conforms with the university policy with respect to best practice in the areas of ethics, the environment and socio-cultural

matters, including poverty. In particular, this project focuses on the development of an in-depth understanding of the environmental issues associated with urban areas. University College Dublin has an Equal Opportunities Committee with the brief to support Gender Mainstreaming within the university.