

A new ISGLUTI: the SPARTACUS and PROPOLIS Projects

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Second Oregon Symposium on
Integrated Land Use and Transport Models
18-20 July 2000, Portland, Oregon

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Information on the SPARTACUS and PROPOLIS
projects can be found on the project home pages

<http://www.ltcon.fi/spartacus>

<http://www.ltcon.fi/propolis>

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International Study Group on Land-Use Transport Interaction (ISGLUTI)



Country	Organisation	Model
Australia	CSIRO	TOPAZ
Germany	IRPUD	Dortmund
Japan	University of Tokyo	CALUTAS
	University of Kyoto	Osaka
Netherlands	University of Utrecht	Amersfoort
Sweden	Royal Institute of Technology	SALOC
UK	University College London	LILT
	ME&P	MEP/MEPLAN
USA	University of Pennsylvania	ITLUP

International Study Group on Land-Use Transport Interaction (ISGLUTI)

The International Study Group on Land-Use Transport Interaction

- was set up by the ***UK Transport and Road Research Laboratory*** (TRRL) in 1981,
- included ***nine modelling teams*** from seven countries

Phase I: 1981-1987

- 7 models applied to 7 cities

Phase 2: 1988-1991

- 7 models applied to 5 cities (21 combinations)

Policies tested:

- Base forecast
- Land use policies:
 - Residential development (5)
 - Industrial/commercial development (4)
 - Retail development (4)
- Transport policies
 - Travel cost changes (8)
 - Travel speed changes (11)
 - Timing of transport policies (7)



SPARTACUS

System for Planning and Research in Towns and Cities for Urban Sustainability

The SPARTACUS project

- was part of the ***4th Framework Programme for Research and Technology Development*** of the European Union,
- was carried out in **1996-1998** by the following five partners:
 - ***LT Consultants Ltd.***, Helsinki, Finland (Coordinator),
 - ***Marcial Echenique & Partners Ltd.***, Cambridge, UK,
 - ***Trasporti e Territorio srl***, Milan, Italy
 - ***Marcial Echenique y Compañía SA***, Bilbao, Spain,
 - ***Institute of Spatial Planning***, University of Dortmund, Germany,
- with co-operation by local authorities and organisations in the case study cities
 - ***Helsinki***,
 - ***Naples***,
 - ***Bilbao***.

SPARTACUS

System for Planning and Research in Towns and Cities for Urban Sustainability

The objectives of the project were:

- to **design** and specify a system for analysing the interactions between transport, land use, economy, the environment and social factors and forecasting these into the future,
- to **build** strategies for urban sustainability using combinations of land-use, transport and environmental policy instruments (regulation, pricing and investment),
- to simulate and assess the **long-term effects** of introducing these policies in each of the pilot cities and to compare and explain any differences in results,
- to specify **common sets of policies** that are economically, environmentally and socially sound and viable and that could be successfully used in different types of cities within the European Union
- to give policy **recommendations** and to **disseminate** the results.

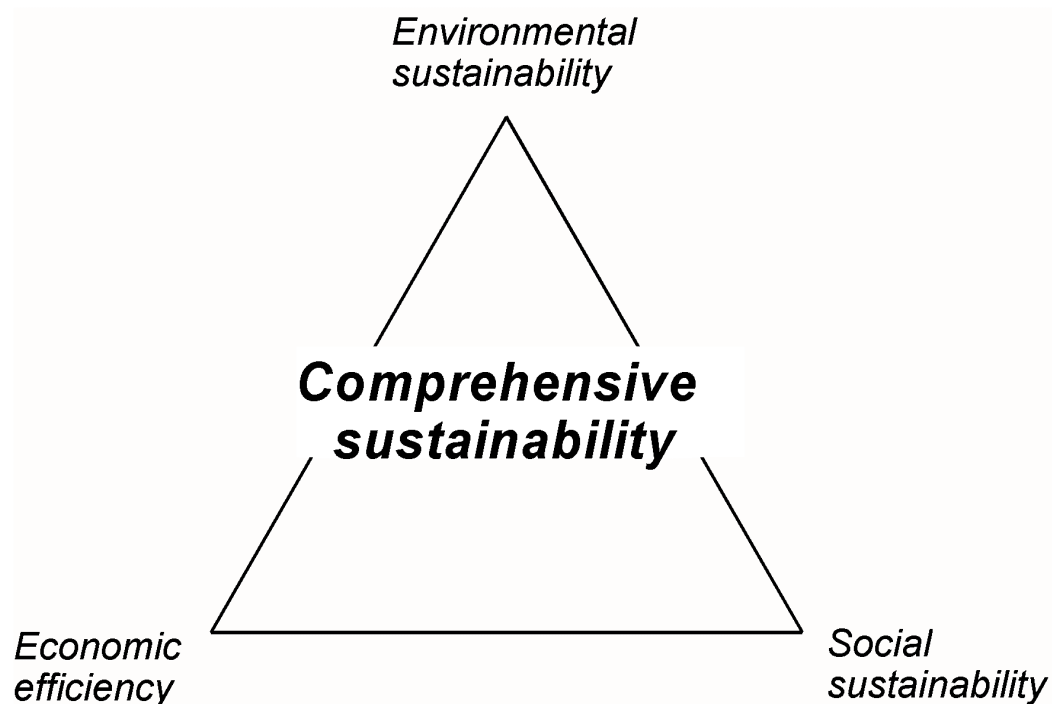
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Sustainable development

In SPARTACUS, sustainable development consists of three interconnected components:

- ***ecological*** or environmental sustainability
- ***social*** or human sustainability
- ***economic*** efficiency





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Sustainable urban development

The three components of sustainability are interpreted for cities as follows:

- ***Ecological*** limits are set by the exploitation of natural resources and the carrying capacity of the environment.
- ***Social*** sustainability comprises access to resources and services, health, individual opportunities and the equity of distribution of these factors in the urban society.
- ***Economic*** efficiency exists if maximum utility is achieved with minimum use of resources.

A city cannot be called sustainable unless all three components of urban sustainability are achieved.



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The SPARTACUS model system

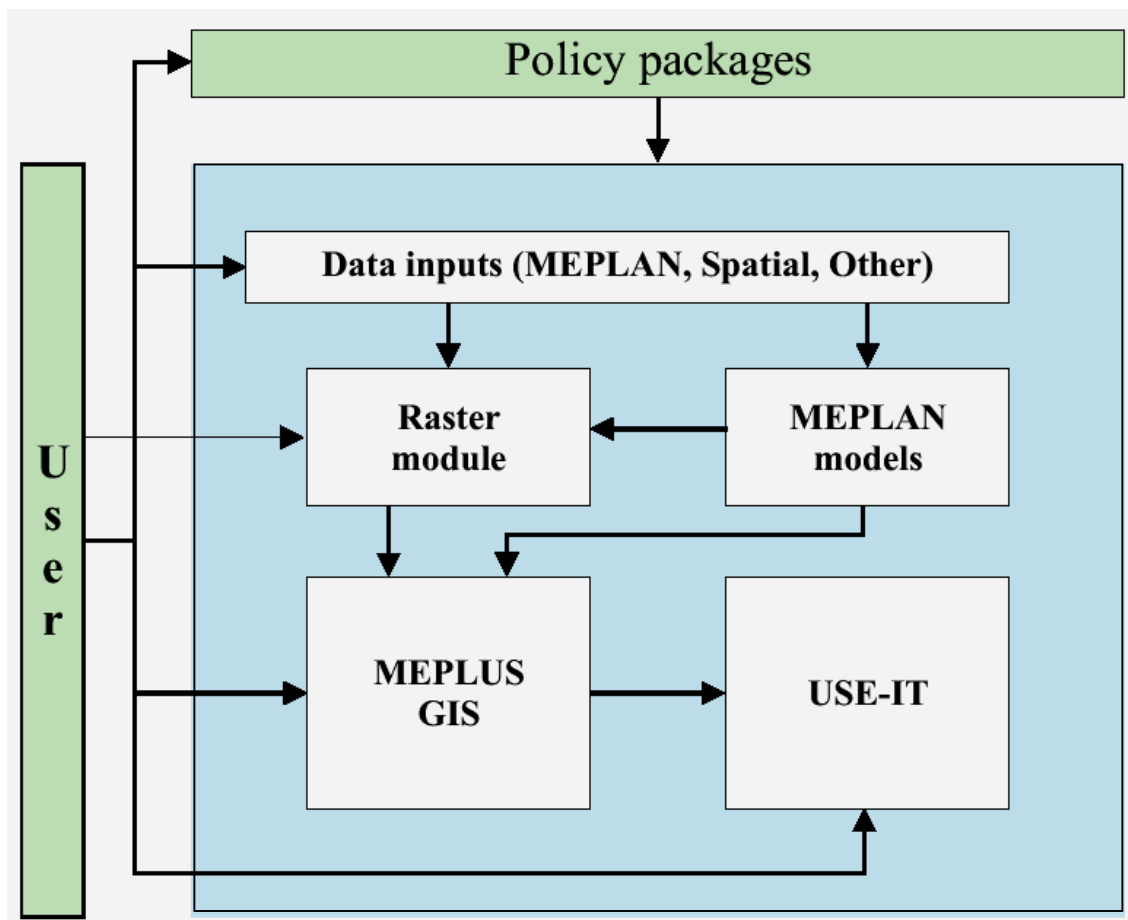
The model system developed for SPARTACUS combines newly developed modules with an existing land-use transport model:

- **MEPLAN** is an integrated land-use transport model forecasting land uses and traffic flows subject to regulation, pricing and investment policies in land use and transport.
- The **Raster** module uses GIS techniques to calculate spatially disaggregate indicators of emissions, air quality and noise intrusion.
- **MEPLUS-GIS** is an analysis, report and presentation module.
- **USE-IT** is a decision-support tool for the evaluation of policy alternatives based on multi-criteria utility theory.

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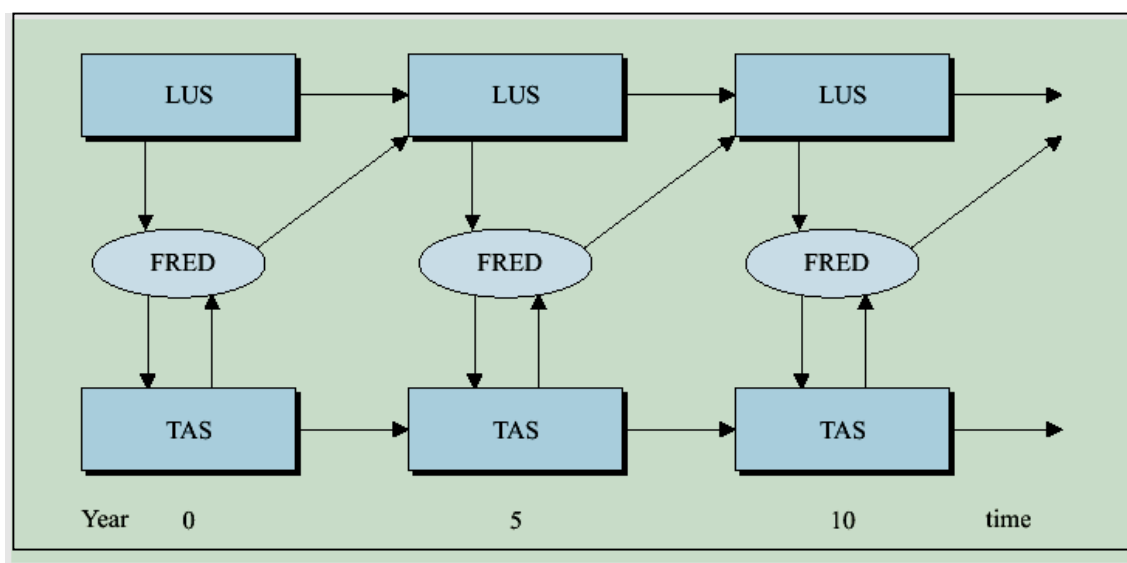
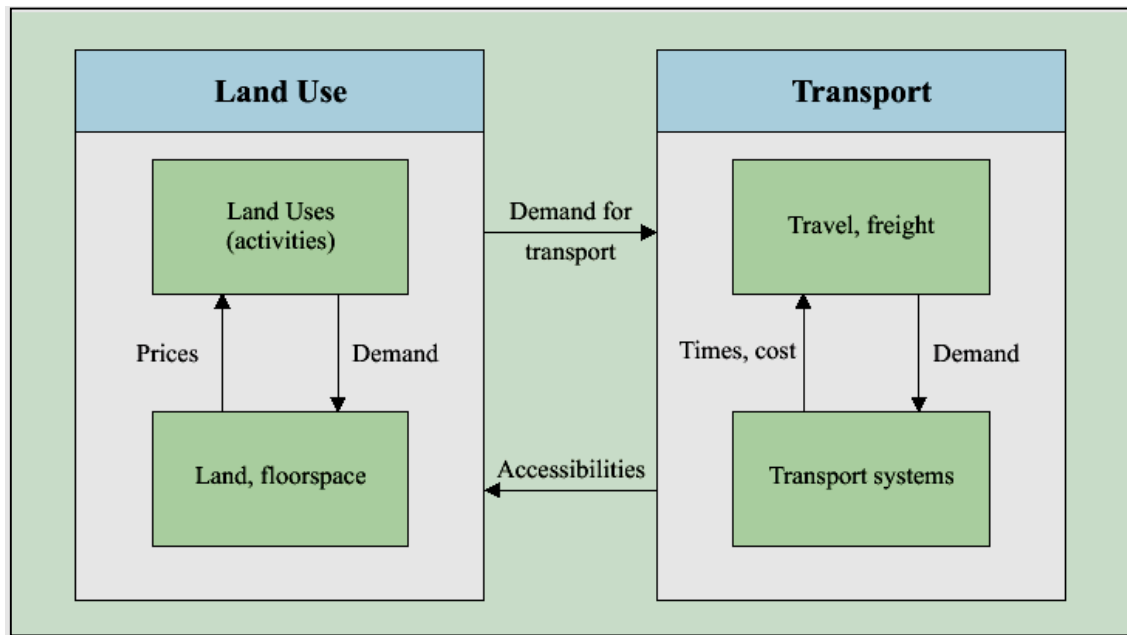
The SPARTACUS model system



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The SPARTACUS model system: MEPLAN





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The SPARTACUS model system: MEPLAN

The MEPLAN model consist of the following components:

- The ***Land Use module*** (LUS) models the spatial location of activities such as employment and population and produces trades between zones.
- The ***Interface module*** (FRED) converts land use trade matrices into transport flows or transport disutilities into trade disutilities.
- The ***Transport module*** (TAS) assigns flows to the different transport modes and routes. The resultant transport disutilities act as an influence on land use location in the next time period.

These modules operate typically in time periods of ***five years***.



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The SPARTACUS model system: Raster

The Raster module converts the output of the aggregate MEPLAN land-use transport model to ***raster cells*** of 100 x 100 m size.

The Raster module has two kinds of input:

- a spatial database of ***zone boundaries*** and ***land use categories*** recorded as polygons and the ***network*** coded as vectors,
- ***households*** by socio-economic group, ***employment*** and ***floorspace*** by zone and ***link loads*** by mode from the MEPLAN model.

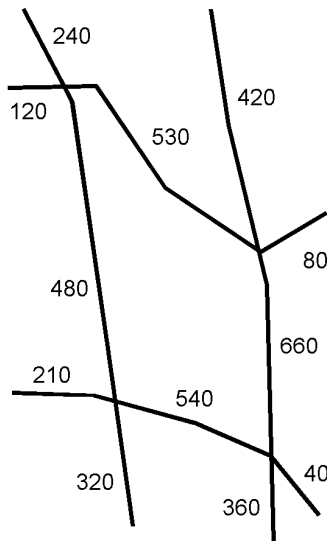
Environmental submodels are used to assess ***land coverage***, ***air quality*** from road transport and ***noise levels*** by raster cell.

Output of the Raster module are ***five indicators*** of urban sustainability and maps of ***emissions***, ***air quality*** and ***noise levels***.

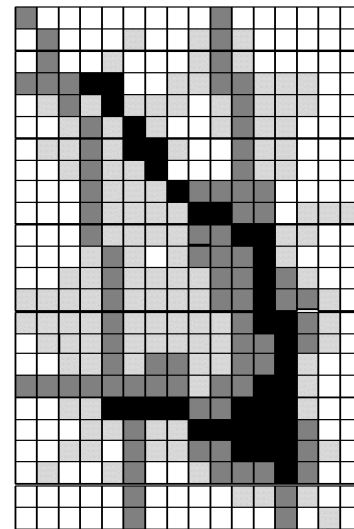
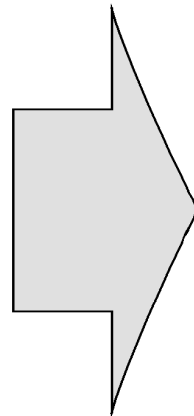
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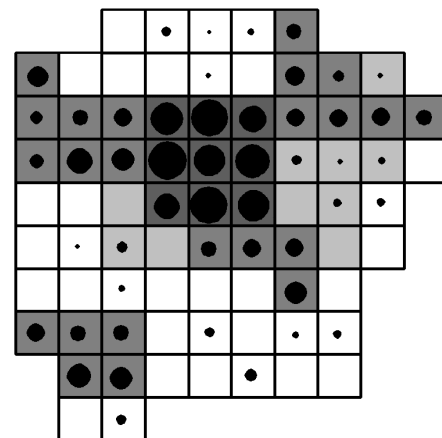
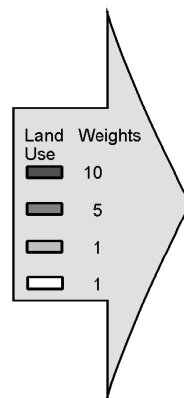
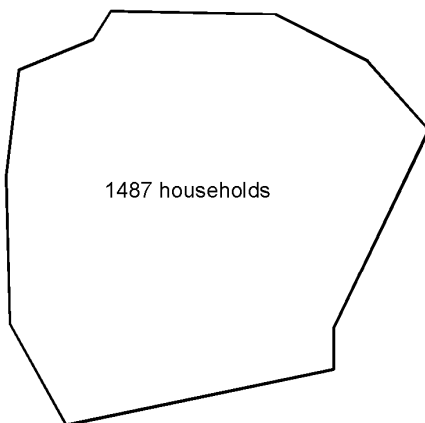
The SPARTACUS model system: Raster



plus car traffic on functional links:
 670 car access trips from zone to network
 410 car trips from network to zone parking
 340 intrazonal car trips



□ no car traffic
 □ 1 - 100 cars
 □ 101 - 500 cars
 □ 501 - ... cars



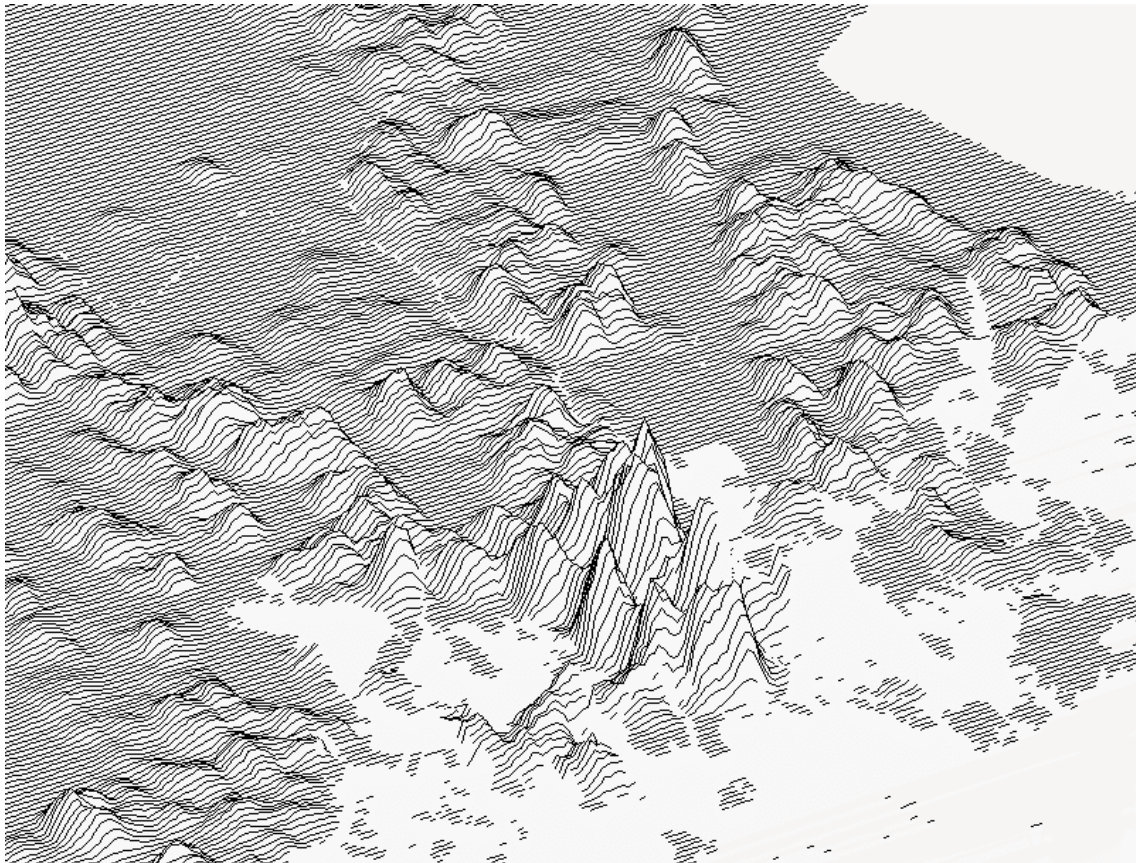
○ 100
 ○ 50 households
 ○ 10

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The SPARTACUS model system: Raster

Population density in the Helsinki region

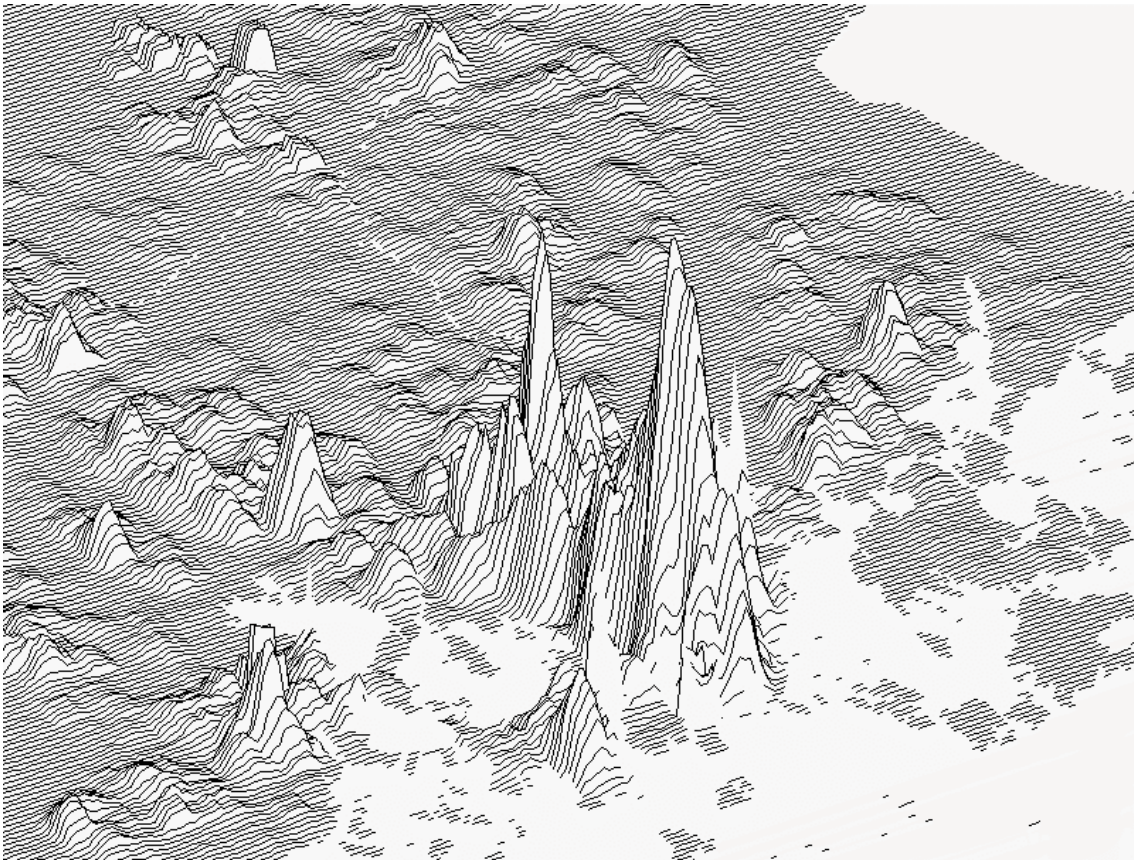


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The SPARTACUS model system: Raster

Employment density in the Helsinki region

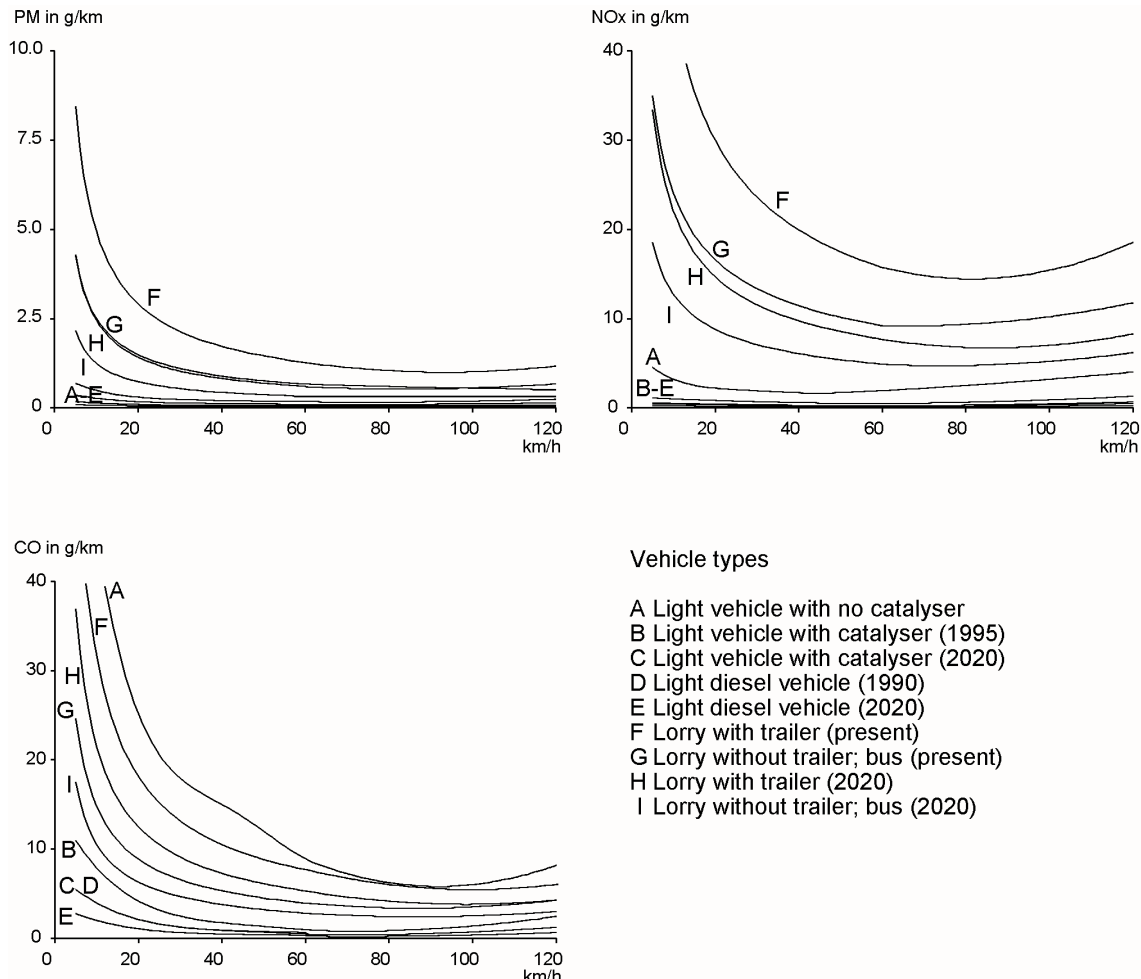


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The SPARTACUS model system: Raster

Emission functions for PM, NO_x and CO for different vehicle types

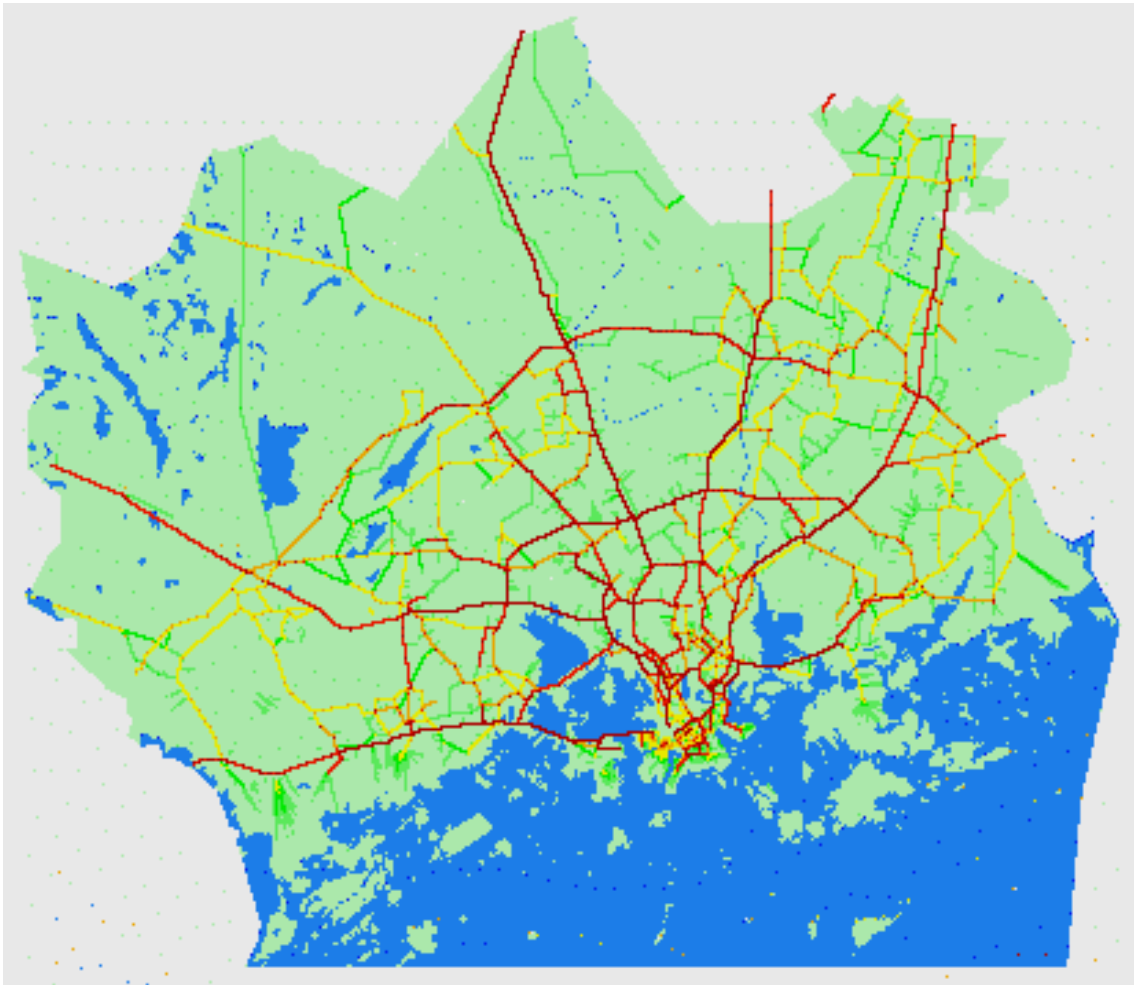


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The SPARTACUS model system: Raster

NO_x emissions of transport in the Helsinki metropolitan region



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The SPARTACUS model system: Raster

NO_x concentrations from transport in the Helsinki metropolitan region



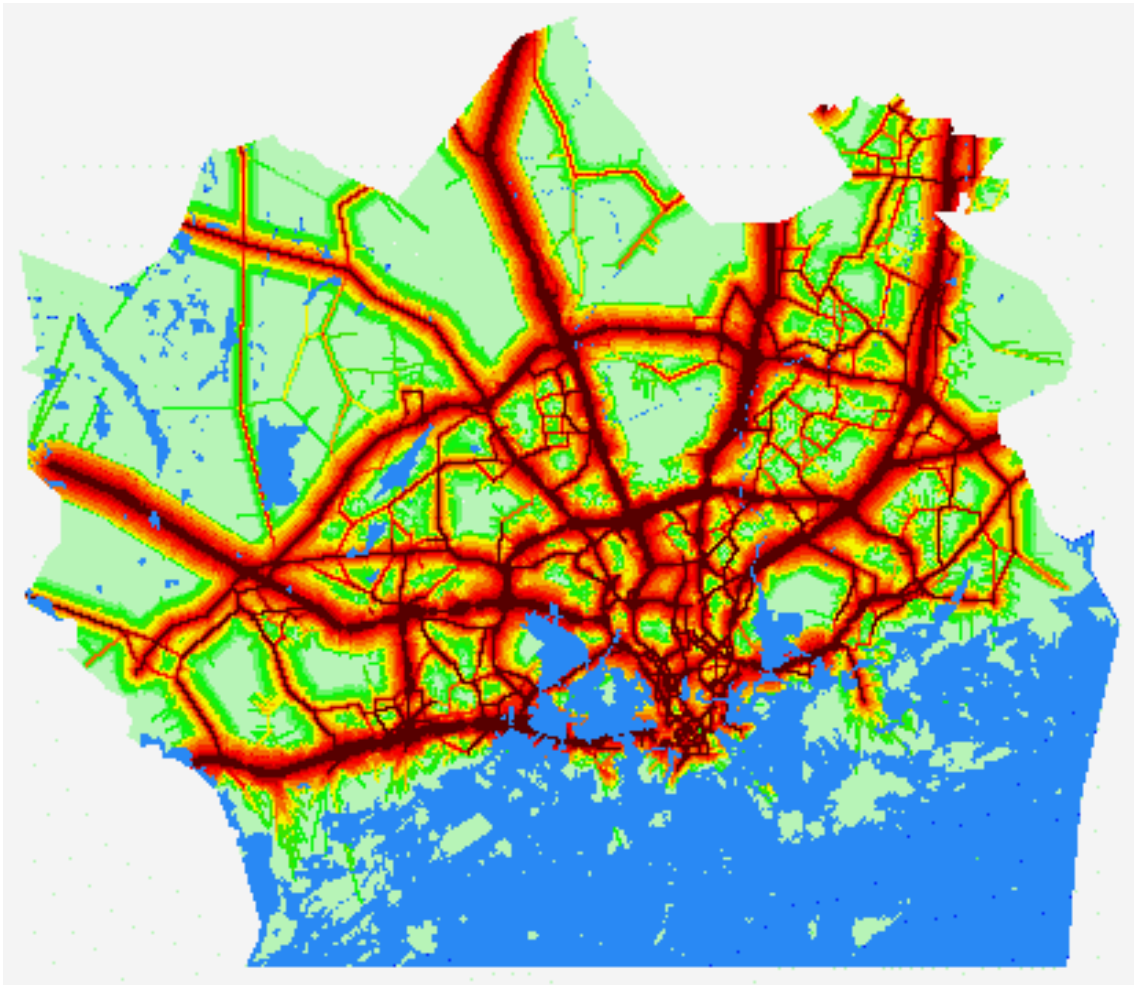
Exposure to NO_x above guidelines:
10.6 percent of total population
10.0 percent of SEG1
10.4 percent of SEG2
12.6 percent of SEG3

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The SPARTACUS model system: Raster

Exposure to traffic noise in the Helsinki metropolitan area



Population disturbed by traffic noise:
29.2 percent of total population
28.8 percent of SEG1
29.0 percent of SEG2
31.1 percent of SEG3



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System for Planning and Research in Towns and Cities for Urban Sustainability

The SPARTACUS indicator system

Sustainability is measured in SPARTACUS by a set of **indicators**. The indicators were chosen so that they (as far as possible)

- are **sensitive** to urban policies,
- are **independent** from each other,
- follow the **impact chain**,
- can be **forecast**.

The SPARTACUS indicators system consists of three components corresponding to the three components of urban sustainability:

- **environmental** indicators
- **social** indicators
- **economic** indicators

Within the three components, the indicators are grouped by **themes**.

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The SPARTACUS indicator system

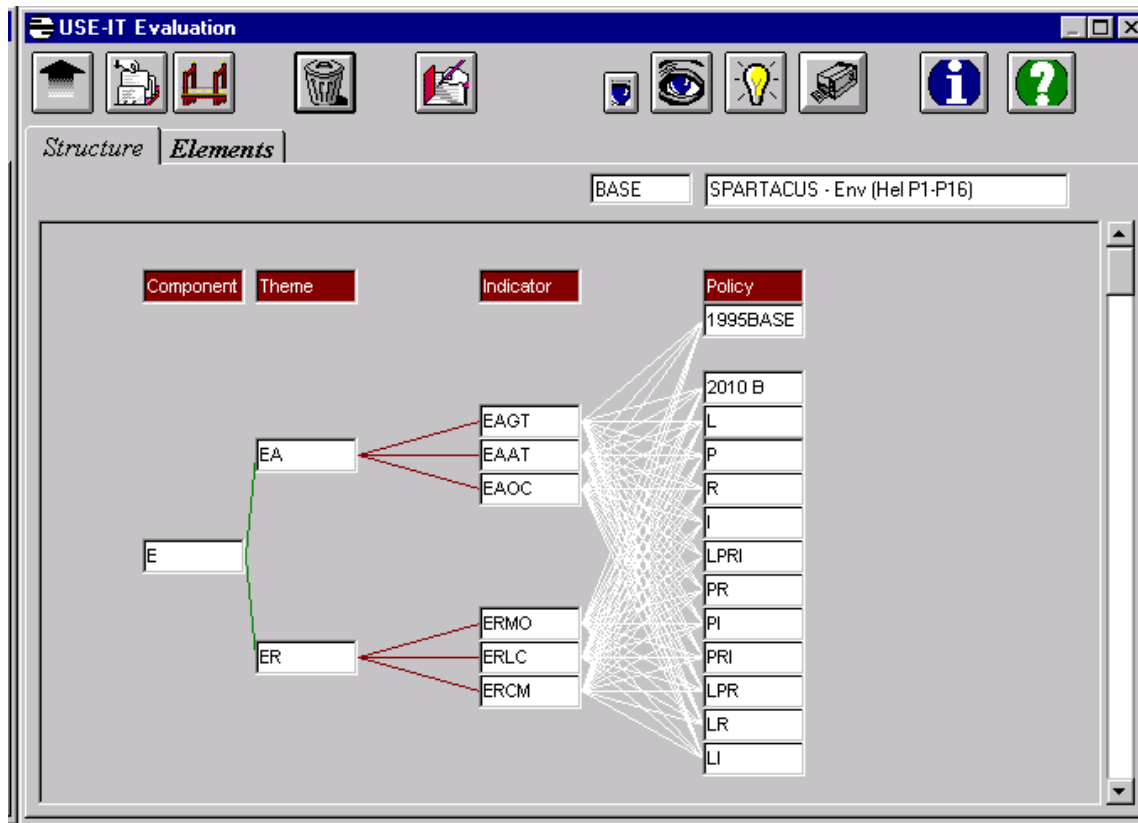
<i>Environmental indicators</i>	
Air pollution	Emission of greenhouse gases from transport Emission of acidifying gases from transport Emissions of organic compounds from transport
Resource consumption	Consumption of mineral oil products Land coverage Consumption of construction materials
<i>Social indicators</i>	
Health	Exposure to particular matter in the living environment Exposure to nitrogen dioxide in the living environment Exposure to carbon monoxide in the living environment Exposure to noise in the living environment Traffic deaths Traffic injuries
Equity	Justice of exposure to particulates Justice of exposure to nitrogen dioxide Justice of exposure to CO Justice of exposure to noise Segregation
Opportunities	Total time spent in traffic Level of service of public transport and slow modes Vitality of city centre Accessibility to the centre Accessibility to services
<i>Economic indicators</i>	
	Total net benefits (Euro/capita/year)

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The SPARTACUS model system: USE-IT

Representation of the hierarchical goal system in USE-IT

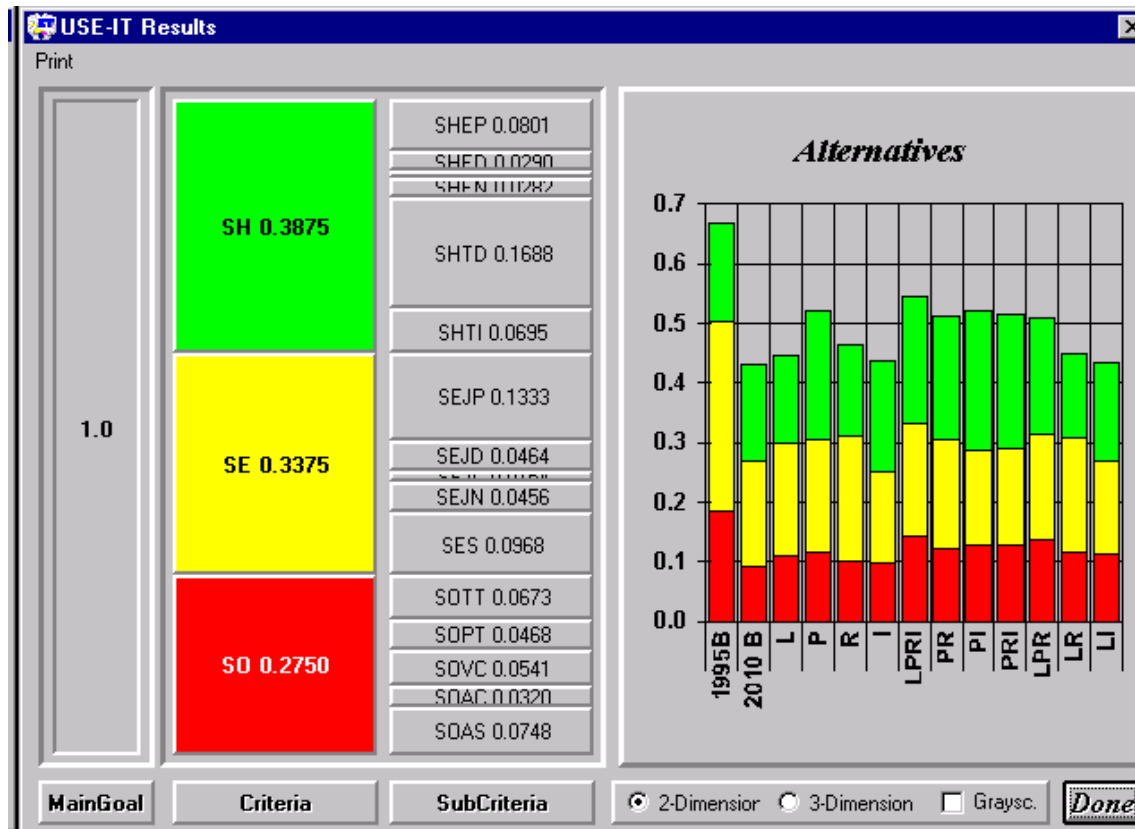


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The SPARTACUS model system: USE-IT

An example of the output of results for different alternatives in USE-IT

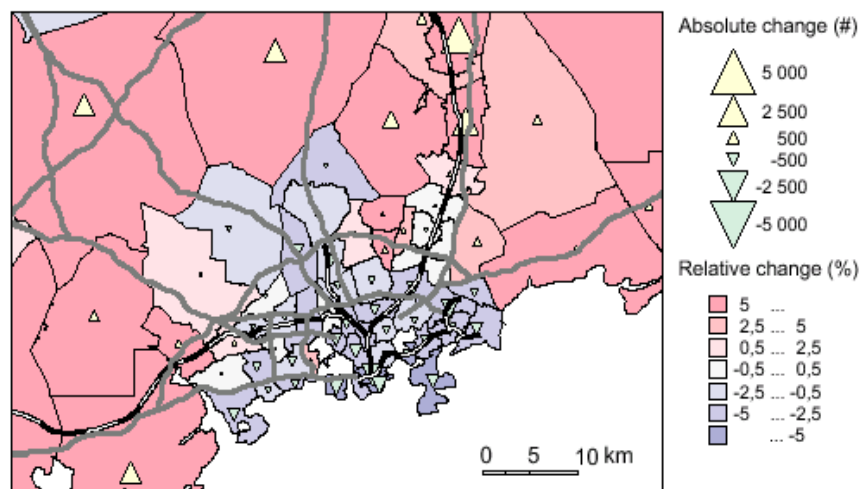
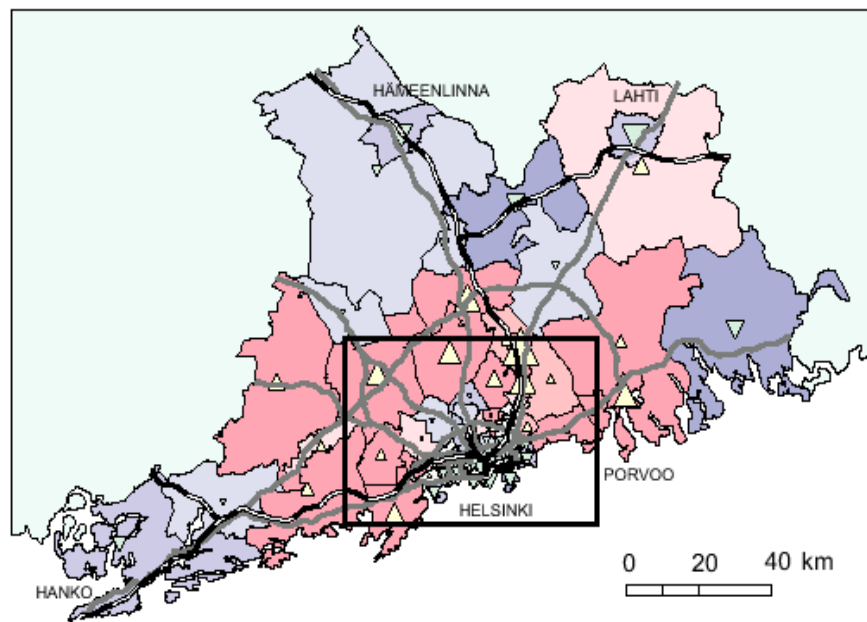


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Results

Population distribution in telework scenario compared with base scenario

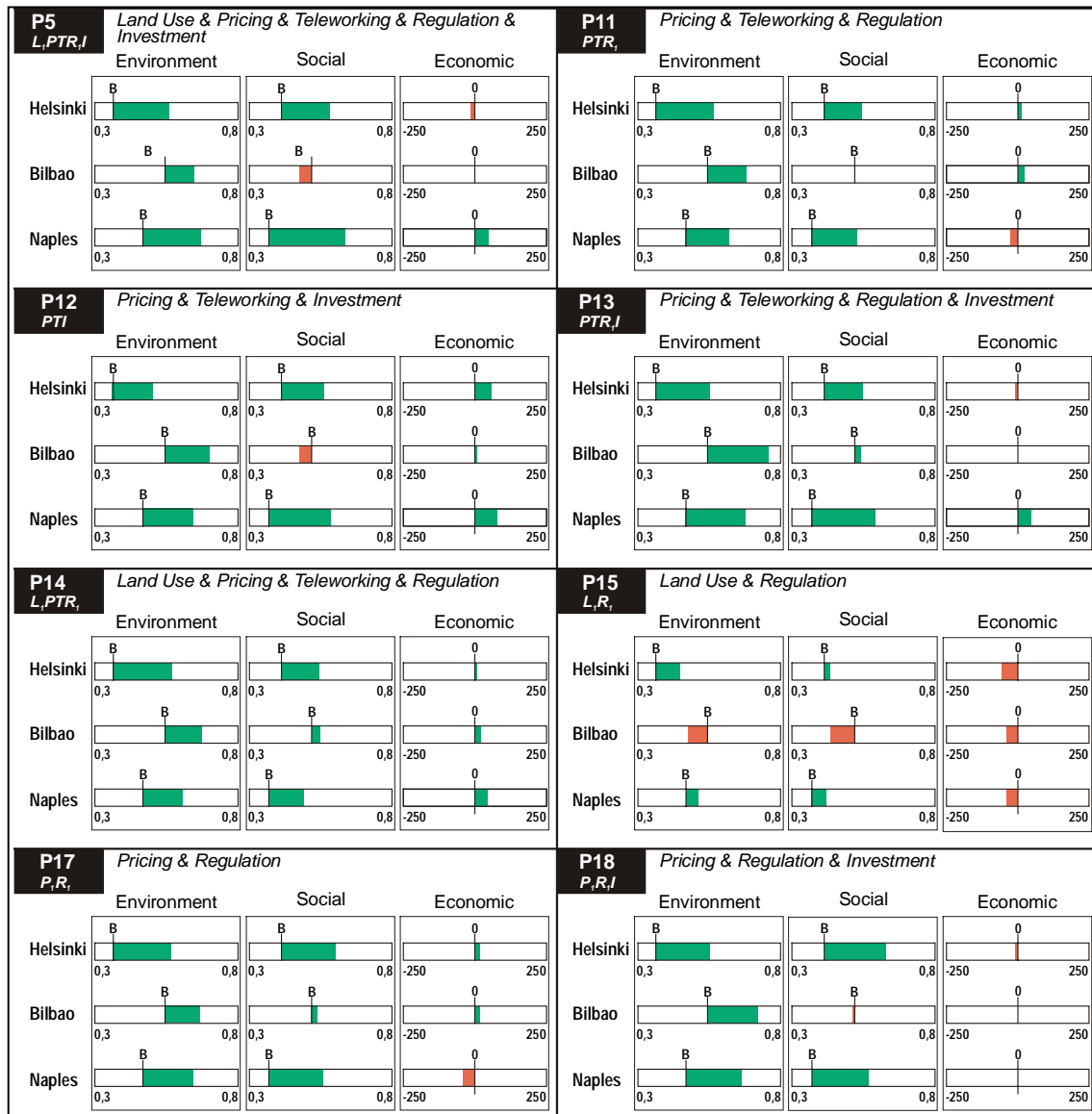


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Results

Comparison of policy scenario results relative to base scenario for all test cities



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Recommendations

- Environmental, social and economic sustainability can be substantially increased by adopting **innovative** policies and policy combinations.
- It is insufficient to merely evaluate policies on a one-by-one basis. Instead a complete **urban policy programme** should be evaluated in order to understand its effects and the mutual interactions of the policy elements.
- It is important to be aware of the **negative side effects** of policy options and especially of the socio-economic impact that the policy may have on the surrounding region.
- Issues related to the **justice** of the distribution of the effects of policy options should be carefully investigated. Different approaches to justice issues may result in different orders of priority for policy options.

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Recommendations (continued)

- The ***long-term*** and ***land-use*** effects of policy options should be carefully studied since the final effects may be opposite to the short-term ones.
- Adoption of ***pricing*** policies is recommended as a key means for increasing urban sustainability. Some of the pricing policy options that were tested turned out to be the ***most efficient ones environmentally, socially and economically*** in all test cities.
- ***Detailed studies*** are needed to find the appropriate level of pricing policies and ways to implement them in the most efficient way. An optimum level could be found but it is likely to be city specific and a general recommendation cannot be made.



PROPOLIS

Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability

PROPOLIS

- is a research project in the Key Action "City of Tomorrow and Cultural Heritage" of the **5th Framework Programme for Research and Technology Development** of the EU,
- is conducted by research partners from six countries:
 - **LT Consultants Ltd.**, Helsinki, Finland (Coordinator)
 - **Institute of Spatial Planning**, University of Dortmund, Germany
 - **University College London**, London, UK
 - **Marcial Echenique & Partners Ltd.**, Cambridge, UK
 - **Trasporti e Territorio srl**, Milan, Italy
 - **Marcial Echenique y Compañía SA**, Bilbao, Spain
 - **STRATEC S.A.**, Brussels. Belgium
- started in **January 2000** and will be completed in the **autumn of 2002**.

PROPOLIS

Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability

PROPOLIS case study cities





PROPOLIS

Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability

Objectives of PROPOLIS are

- to research, develop and test ***integrated land use and transport policy assessment tools*** and methodologies to define sustainable urban strategies and to demonstrate their long-term effects,
- to analyse ***policy options*** in seven European cities in order to arrive at optimum combinations of different policy types in the fields of land use, transport, regulation, pricing , fiscal and investment.
- to apply three ***integrated land-use and transport models*** in seven cities:

MEPLAN	Helsinki Naples Bilbao Vicenza
TRANUS	Inverness Brussels
IRPUD	Dortmund

PROPOLIS

Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability

The PROPOLIS approach

