



# Land use scenario modelling and policy support

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## Goals of the work:

- To simulate urban growth (and sprawl) in Greater Dublin Region (GDR) based on policy and zoning regulations
- To monitor urban sustainability in GDR for supporting integrated spatial planning



# CONTENT:

- SCENARIOS... how they link the scientists and stakeholders?
- SCENARIOUS... how they are a decision support tool for sustainable future land development?
- Case study: Greater Dublin Region, Ireland

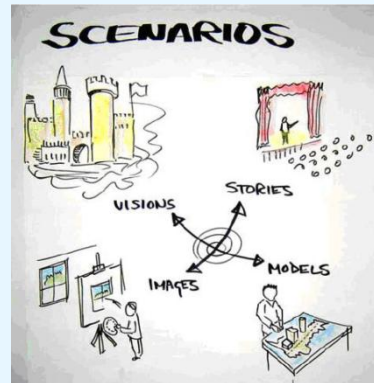


# Scenarios are the link among...

## SCIENTISTS/MODELLERS



## SCENARIOS



## STAKEHOLDERS

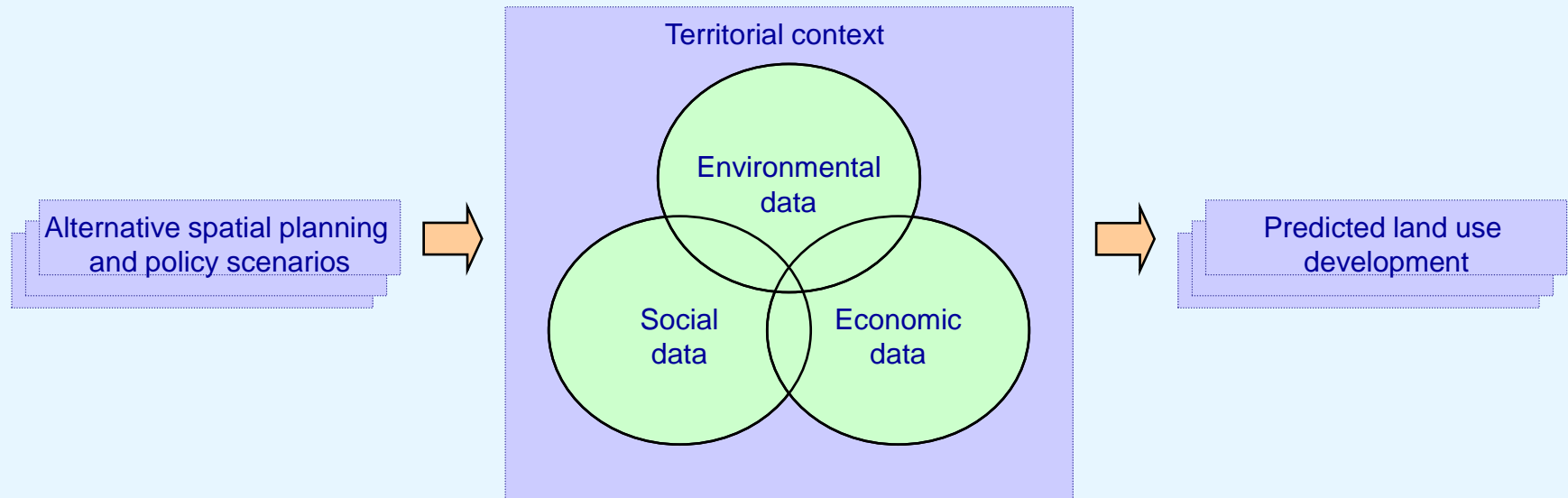


- Focus on qualitative pictures
- From qualitative to quantitative
- Creative thinking
- More emphasis on global trends
- From complex to simple
- Focus on uncertainty
- From future to present
- Analysis of new policies/instruments

# Through scenarios..

The two groups can:

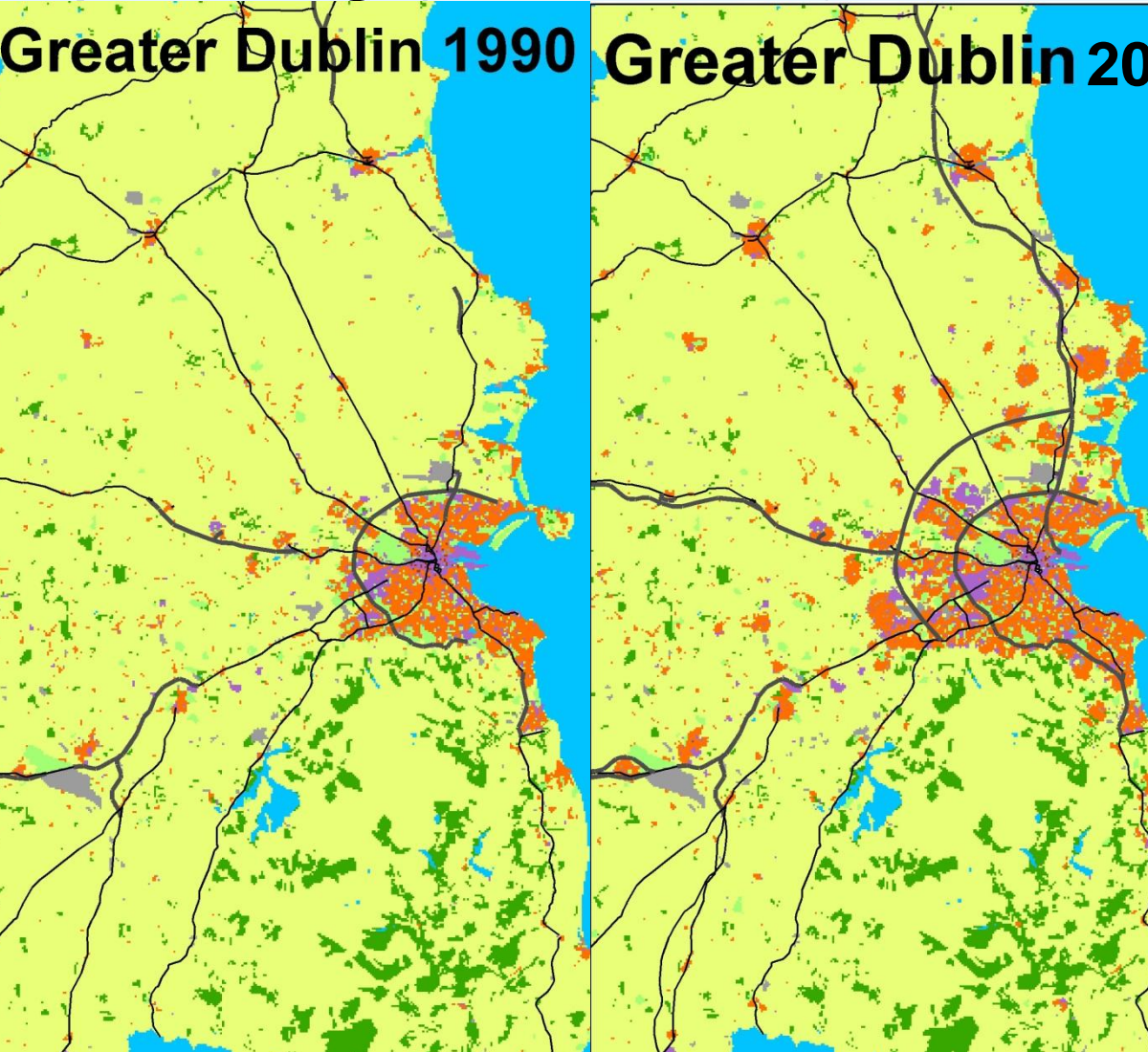
- Evaluate and compare **alternative scenarios** of spatial planning and policy
- Determine the **critical factors** in the input spatial plans and policies
- Monitor the progress **towards sustainability** under existing spatial plans and policies





# Dublin as 'worst-case scenario' of urban planning (EEA, 2006)

## Greater Dublin 1990 Greater Dublin 2025



The drivers of urban sprawl

### Box 3 Dublin metropolitan area: rapidly growing economy and population

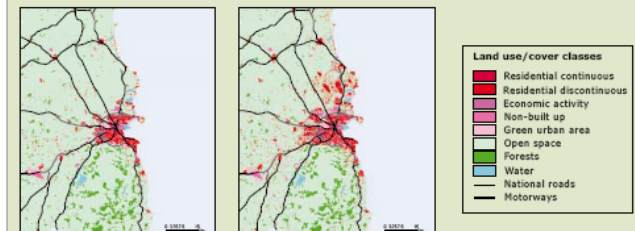
Dublin is a relatively small city by European and international standards. However, it dominates the urban pattern of Ireland in terms of demography, employment and enterprise (Bannon, 2000). The Greater Dublin metropolitan area population was 1 535 000 in 2002, 40 % of the total Irish population. The National Spatial Strategy (2002) suggests that by 2020 the Greater Dublin area population will be in the range of 1.9–2.2 million. The strong growth of the Greater Dublin is a result of the region's role both within Ireland and as a European capital city. Consequently, the Greater Dublin area will need to accommodate 403 000–480 000 additional inhabitants by the year 2020.

Population growth and economic development, as well as house type and price, are predicted to be the main drivers of land use change in the Greater Dublin area during the coming decades. High house prices in Dublin are a significant push factor driving the population towards the rural fringes of the city where it is cheaper to buy or build a house. Another push factor is the small size of apartments in the city centre, forcing families with children needing more space to move out of the city where houses prices are lower and housing more affordable. Personal housing preferences also play an important role as rural living is the Irish housing ideal (Michell, 2004). This preference is realised in single-family houses in open countryside with the benefits of the proximity to the capital or other urban areas. The realisation of this ideal is greatly facilitated by the planning regime which imposes few constraints on the conversion of agricultural areas to low-density housing areas.

Urban-rural migration in the Greater Dublin area has led to the growth of rural towns and villages at the expense of the City of Dublin. The growth of residential areas appears to follow the line of road and rail transport, suggesting a preference for rural living but with the benefits of proximity to urban areas including employment. Another push factor is the transport system in Dublin. Commuting times are long and the lack of orbital roads and rail networks means that to get from one side of the city to the other necessitates a journey through the centre. Often it is quicker to commute from outside Dublin to the centre rather than from one side to the other (Gkartzios and Scott, 2005).

The regional MOLAND model was applied to the Greater Dublin metropolitan region consisting of the following 9 counties: Dublin Co., Kildare, Laois, Longford, Lough, Meath, Offaly, West Meath and Wicklow. According to the 2025 scenario, the outward expansion of residential areas in the Greater Dublin area is estimated to increase by 110 % over the forecast period. In the same period commercial areas will more than double while industrial areas will grow slightly more modestly. The main development axis is to the north from the Greater Dublin area along the seashore as well as inland. To the south little new residential, or industrial or commercial development will take place because of the physical constraints of upland areas. The 2025 scenario also suggests the development of Dublin City to the northwest along the line of the Dublin-Belfast corridor. This development will encourage Dublin City to develop from a mono-centric to poly-centric relationship with the neighbouring cities of Dundalk, Newry and Drogheda. The Greater Dublin Metropolitan area needs land use guidance and zoning as well as new infrastructure if it is going to achieve a more sustainable form of development over the period to 2025.

Map Dublin 1990 and modelled scenario for 2025



Source: MOLAND (IRC).



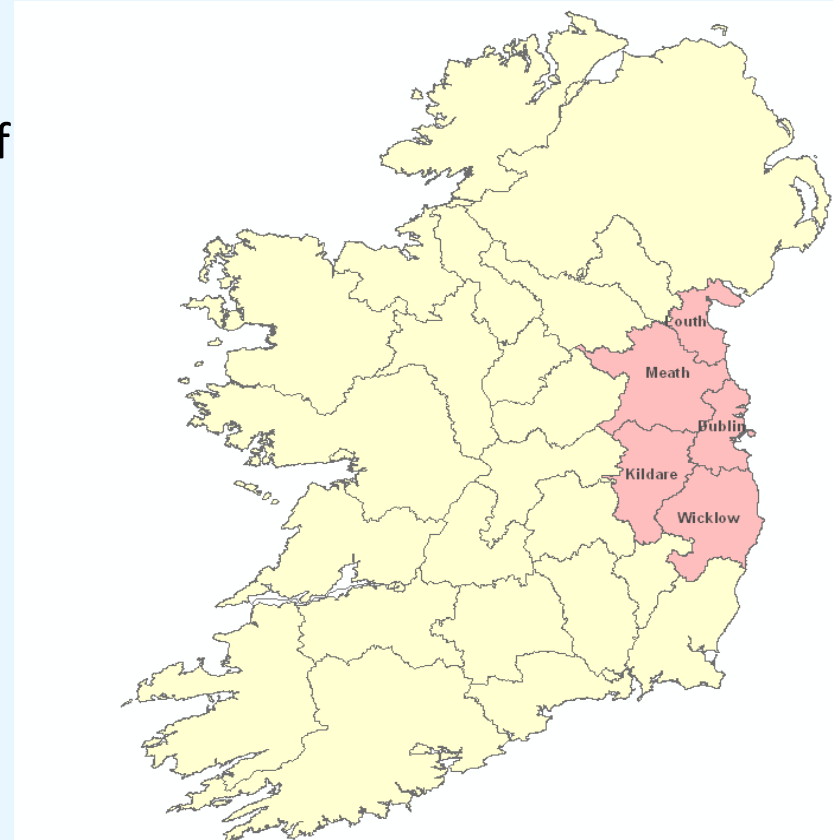
# Study area:

Between 1996 and 2006 Ireland's population growth was five times the European average of 3.25% (EPA, 2008).

The Greater Dublin Region experienced the biggest growth nationally with an increase of 8.3% between 2002 and 2006 (CSO, 2007)

## Main drivers for land use development:

- Demographic changes
- Economic development
- House prices and housing facilities
- Travel-to-work commuting patterns





# How we built the scenarios?

- **General context** (politic environment, cultural and social aspects, economy)
- **Local characteristics of the area** : historical; geographical; population size; urbanization – housing and households, housing density, infrastructure; political and environmental constrains; economic trends : economic growth, un/employment, employment by economic activity, land use patterns evolution, number of households, particular activities/interests of the area, etc.)
- **Stakeholders values, needs and perceptions**
- **What planning questions need to be addressed?**





# Land use scenarios matrix

		Planning policy storylines		
		Minimum restriction	Current planning system implementation	Strong planning control
Driver storylines Economy and Population	Growth (population, GDP)	<b>Managed Dispersed (MD)</b>		<b>Compact Development (CD)</b>
	Business as usual		<b>Business as Usual (BU)</b>	
	Economic decline/ crisis		<b>Recession (R)</b>	



# What IF?

## SCENARIOS : BU, CD, MD, R

Key drivers	Narrative of scenario
<b>Population</b>	Birth rate, Immigration/Out-migration, Ageing population, etc.
<b>Socio-Economic Trends</b>	GDP, Sectorial developments, Economic competitiveness, Growth and investment capacity, Regulatory and fiscal measures on location decision making, Drivers influencing markets/sub-markets, Research and innovation, Technology, etc.
<b>Urbanization/Spatial Planning</b>	Polycentric, Growth and sprawl, Urban-region, Small-scale development, etc.
<b>Transport and Infrastructure Provision</b>	Transportation, Cross border networks, Accessibility, Trans-European Transport Networks, etc.
<b>Policy Framework, 'Shock' Clues and Overall Trends</b>	Policies, Environmental sustainability, Climate change, Natural hazards, Economic competitiveness, growth and investment capacity, etc.



# **SCENARIOUS: from qualitative to quantitative**



# Why choosing MOLAND?

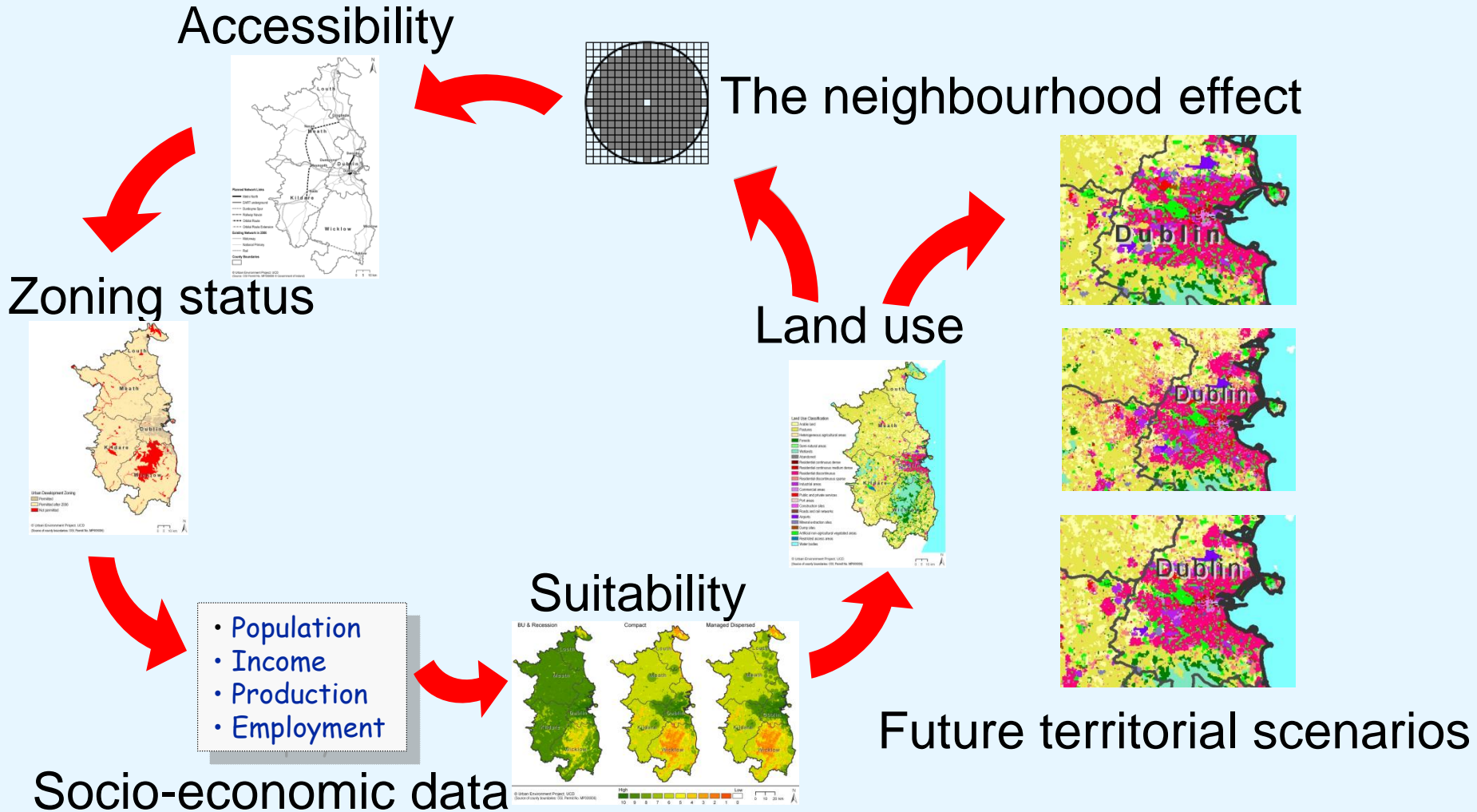
- A range of what-if scenarios can be explored
- The environmental impacts of different land-use policies can be quantified
- To monitor urban sustainability in cities and regions, a variety of spatial planning policies can be assessed
- Provide robust framework for comparing, discussing and visualizing a variety of spatial planning policies



# MOLAND assumption..

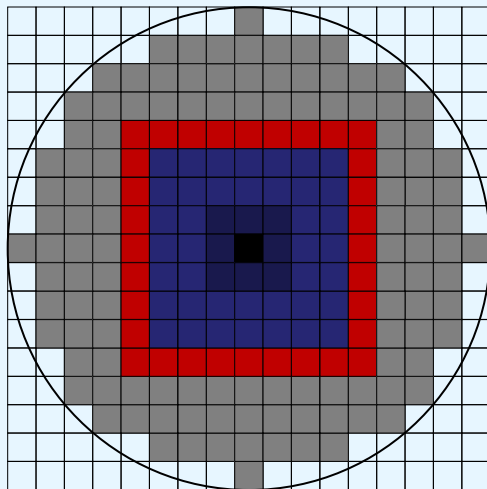
At some level, urban areas are fundamentally similar.  
They evolve by the same processes

# How the model works?

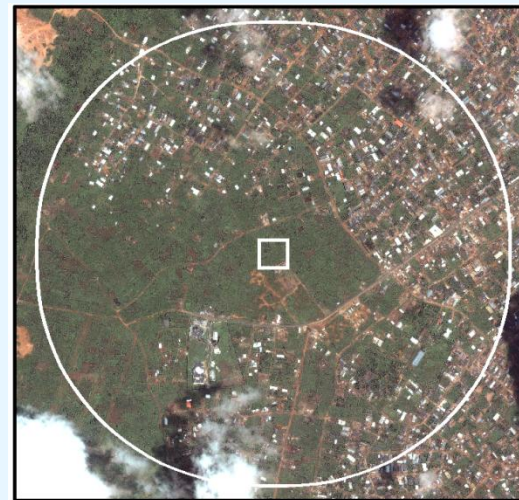


# Neighbourhood effect

- A circular neighbourhood consisting of 196 cells is applied (radius eight pixels)
- The effect in the central cell is calculated in a distance-decay way



1 cell = 200 x 200 m





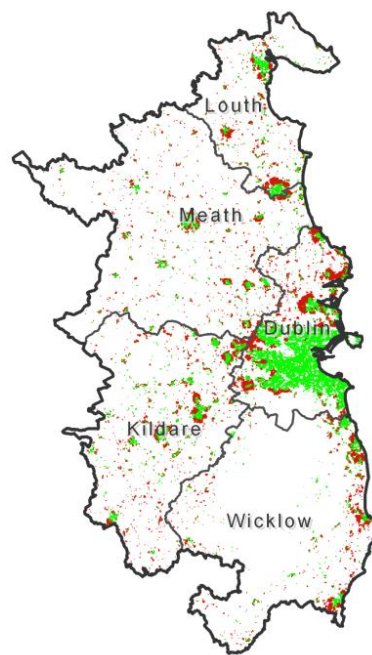




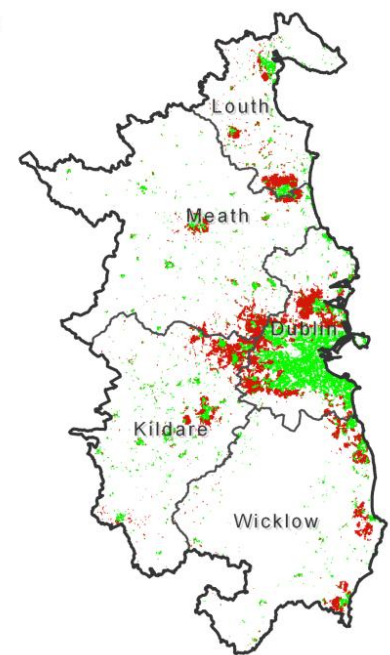
# GDR: 2006 - 2026



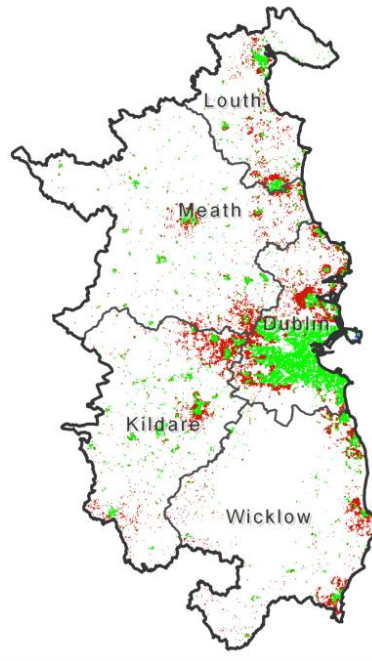
BU



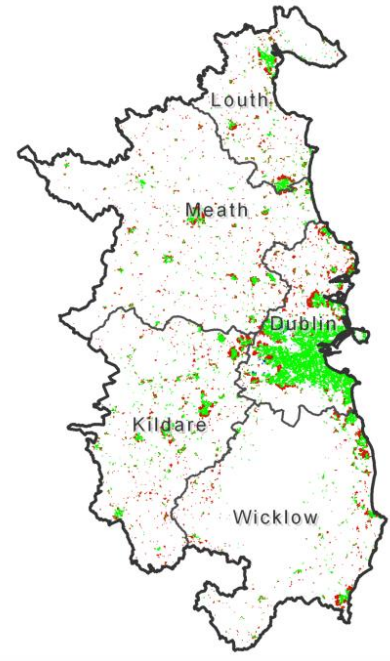
CD



MD



R





# A decision support tool for Integrated Spatial Planning:

## Input data

### Economy

- Income
- Production
- Employment

### Demography

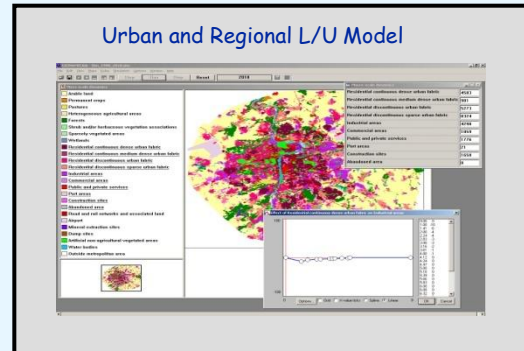
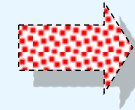
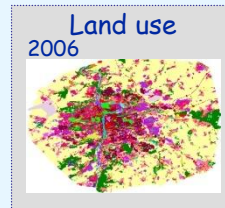
- Population
- Trends

### Policy

- Master plans
- Zoning plans
- Protected areas
- Nature reserves

### Geography

- DEM
- Soil quality
- Natural hazards
- Air pollution



## Output scenarios

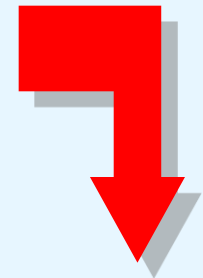
### Business as usual



### Managed dispersed



### Compact development



Spatial planning  
and policy  
recommendations  
and guidelines



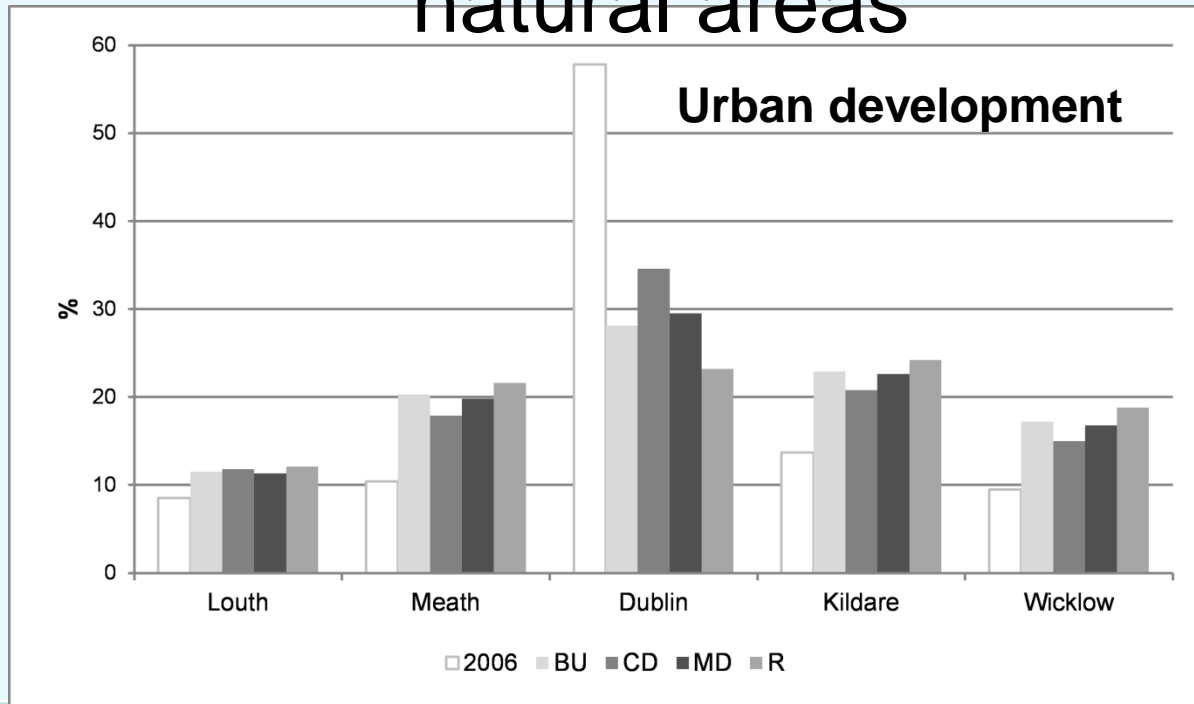
# Conclusions:

- Demand for different urban land uses & increasing accessibility are key elements responsible for urban development;
- Using scenarios is a way to evaluate several future environments in order to monitor sustainable development trends;
- Urban simulations offer a useful approach of understanding the effects of urban and regional planning policies.



# What's next?

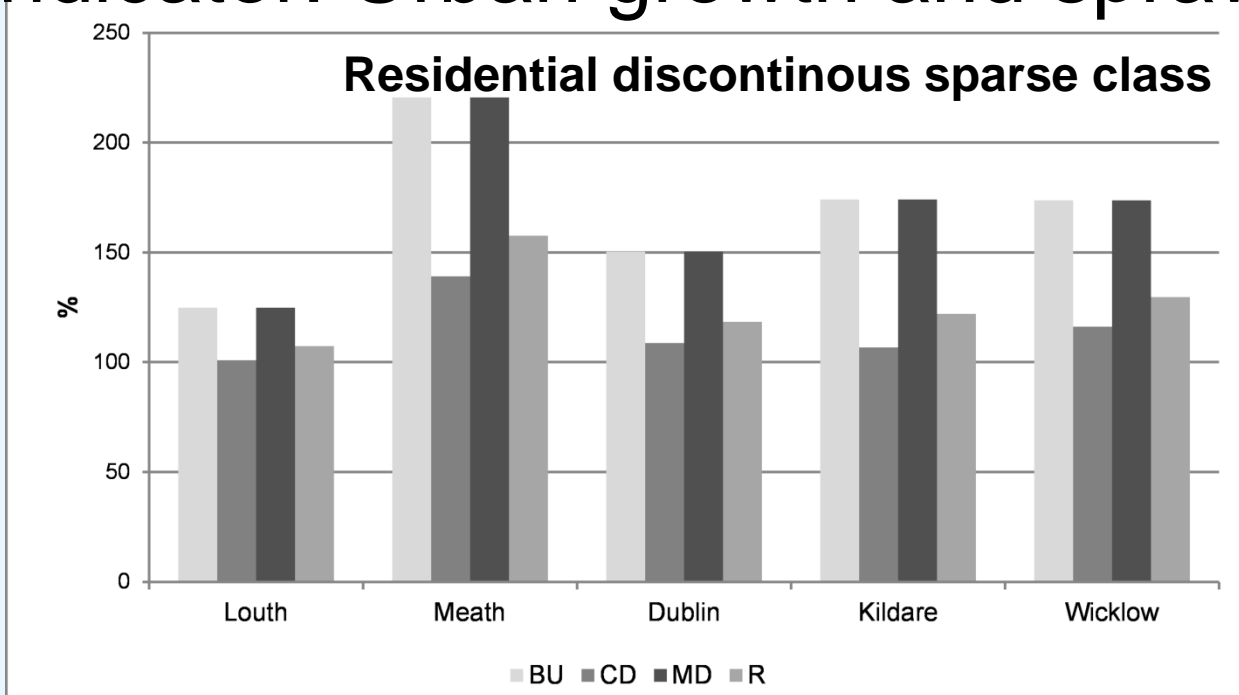
# Indicators: urban development and loss of natural areas



Urban areas vs. Natural areas	Urban Scenarios (%)			
	BU	CD	MD	R
Total urban areas in GDR	86.2	89.2	89.3	51.8
Loss of total natural areas in GDR	-5.6	-5.8	-5.8	-3.4
Total urban areas in Dublin Co.	41.8	53.4	45.6	20.8
Loss of natural areas in Dublin Co.	-21.1	-26.9	-23	-10.5



# Indicator: Urban growth and sprawl



Counties	Growth by Scenarios (%)			
	BU	CD	MD	R
Louth	216.5	223.4	218.0	173.5
Meath	267.9	253.0	269.4	207.2
Dublin	141.8	153.4	145.6	120.8
Kildare	243.7	234.8	246.8	191.1
Wicklow	256.5	241.2	259.0	203.1



# Questionnaire:

1. How do you find the relevance of the below indicators?
2. Suggested indicators for GDR.
3. Thoughts about difficulties and/or criticisms in the collaboration scientists-stakeholders/decision makers.
4. How could be improved the collaboration? Suggestions.
5. What are the main obstacles for applying land use modelling research for practical policy making in your country?
6. Any other comments.

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Thank you!!