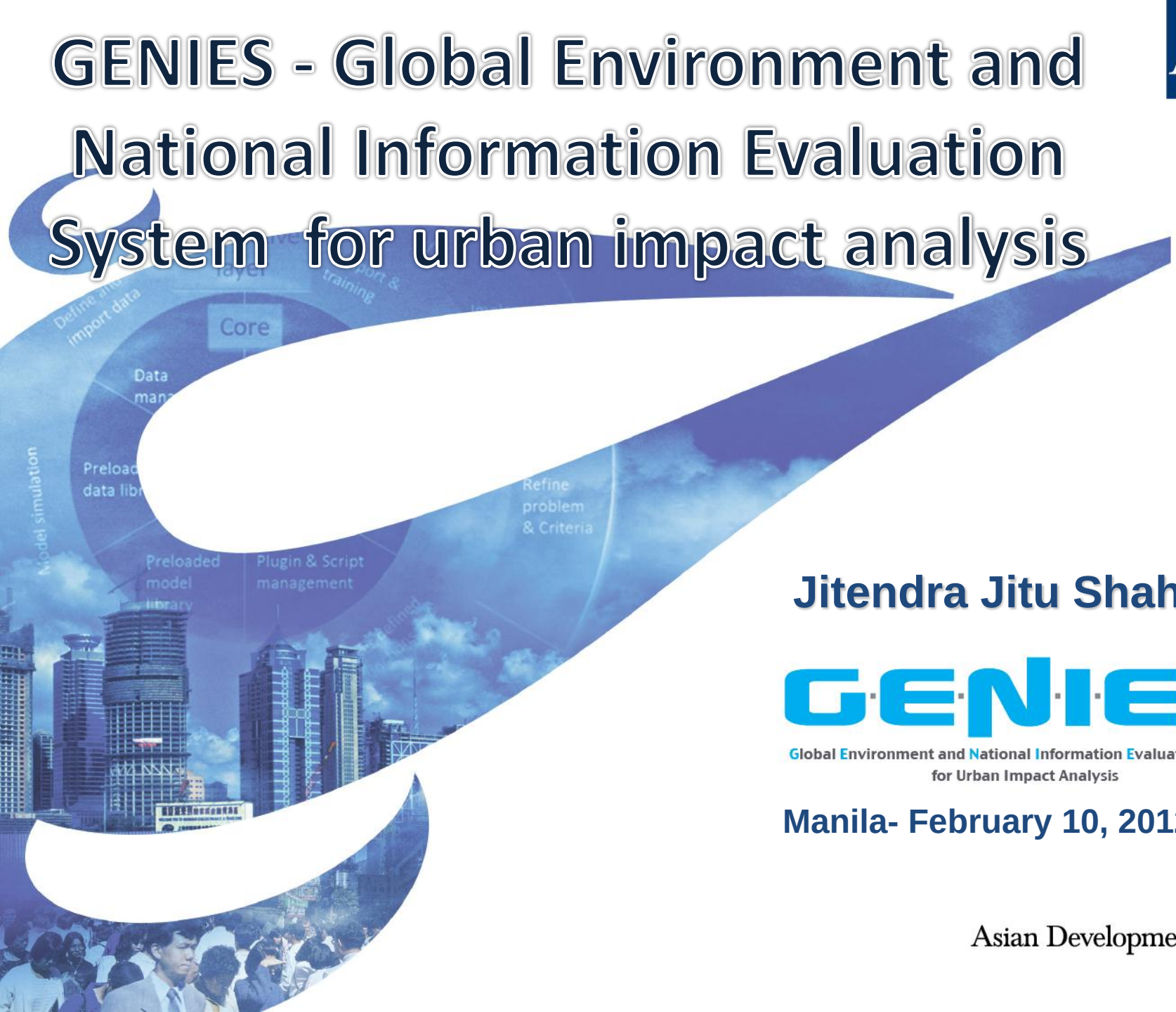
GENIES - Global Environment and National Information Evaluation System for urban impact analysis



Jitendra Jitu Shah

GENIES

Global Environment and National Information Evaluation System for Urban Impact Analysis

Manila- February 10, 2012

Asian Development Bank

GENIES Objectives

An integrated impact assessment tool for urban policy makers to

GUIDE DECISION BY

- Combining analysis of climate and local impacts
- Developing “what if” scenarios to consider climate and disaster risk in macro decisions
- Proposing and evaluating costs and benefits of interventions by sector and across sectors

OBJECTIVES & GOALS

- Institution and capacity development
- Science-based policy making
- Regional cooperation
- Analysis of potential future mega projects
- Effective linking with disaster risk reduction

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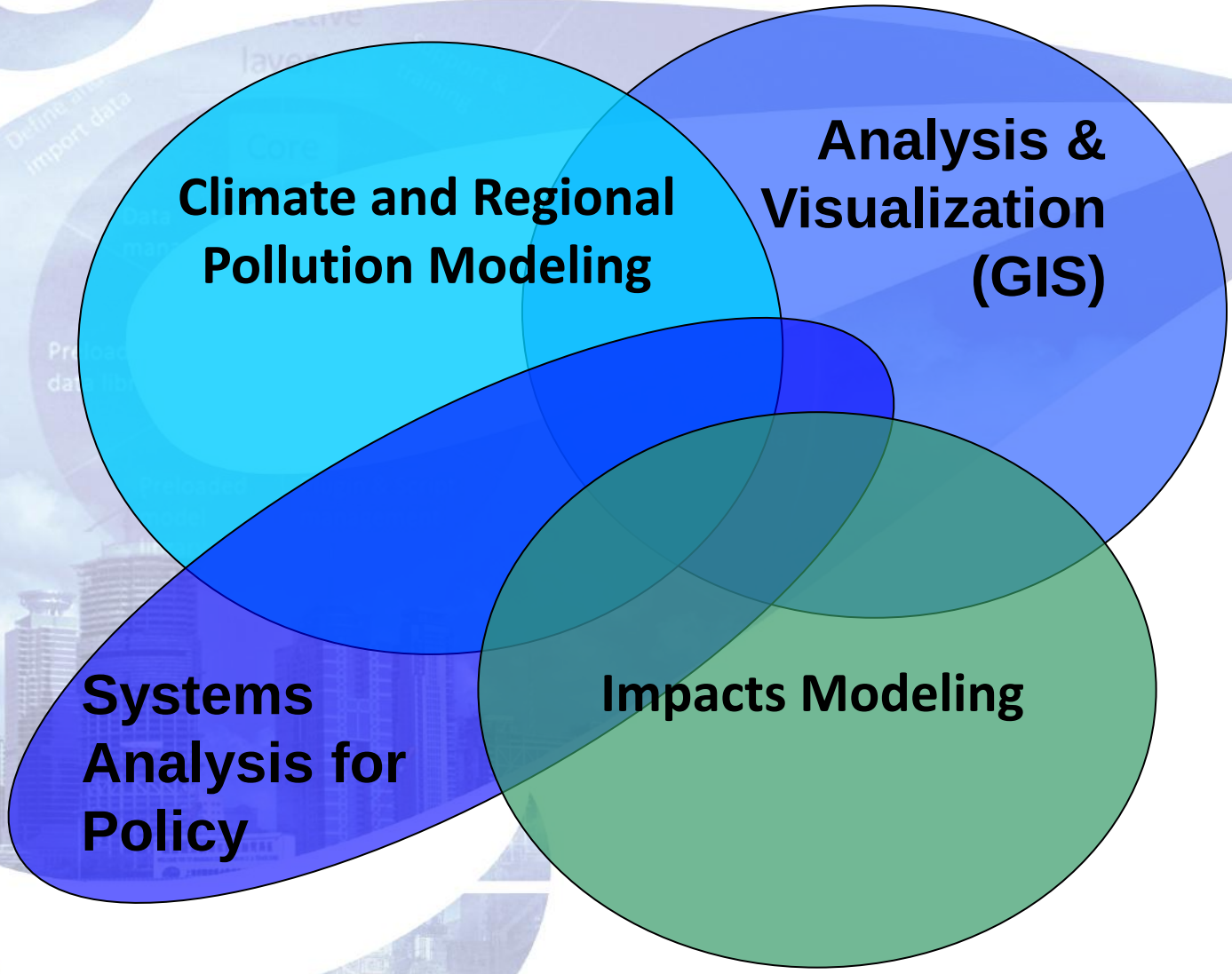
Conceptual Coverage of GENIES



Global

Regional

Urban

ADB

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Questions to Answer?

- Expected nature of infrastructure and health impacts due climate change?
- Which sectors are likely to be affected the most?
- What are the comparative recommendations to reduce the intensity of these impacts?
- How to evaluate the future costs of the impacts?
- Which other cities are experiencing similar impacts and what are they doing?
- What are the expected benefits and co-benefits of an action plan?
- What kind of information is required for prioritizing fund allocation?

What is proposed

AN INTEGRATED ASSESSMENT TOOL WHICH IS

- ✓Simple
- ✓Flexible & utility oriented
- ✓Easy to understand for urban policy makers
- ✓Suited to evaluating the costs and benefits for abatement, adaptation, and risk reduction

A SYSTEMS APPROACH THAT

- ✓Connects the various components of the urban system (economic, environmental, etc.)
- ✓Captures interactions between components to improve environmental and human health, water security, and infrastructure

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Desired outcomes

- ✓ Speed up problem solving: pre-loaded data, models, fast analysis functionality and user friendly
- ✓ Facilitate interpersonal communication and learning: All groups work with same data, platform and models
- ✓ Reveal new approaches to the formulation of problems and generate new evidence for decisions
- ✓ Encourage exploration and discovery on the part of the decision maker

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GENIES Conceptual Framework

Addressing local and global climate change → *Effects on natural systems* → *Impacts on people*

ASSESSING RISKS

- URBANIZATION AND DEVELOPMENT
- NATURAL DISASTERS
- CLIMATE CHANGE

ASSESSING VULNERABILITY

EXPOSURE TO RISKS	ROLE OF INSTITUTIONS	ADAPTIVE CAPACITY
Sea level rise …		
°Land subsidence °More people at risk °Wetland loss	°Strengthen zoning laws °Strengthen compliance	°Ecocities approaches °Developing new sources of water
°Floods and Storms °Heatwaves °Droughts	°Address all potential natural hazards in light of urbanization	°Early warning systems °Risk-sensitive land use planning
°More and larger storms °Salt water intrusion °More variability	°Add Climate projections as part of urban planning	°Seasonal & permanent migration °Protective infrastructure

Review of cross- sectoral links

INTERVENTION OPTIONS

Modular, incremental investments

2015	2030	2050
Sea wall 1m	Sea wall 3m	Sea wall 5m
	Rezoning of hazard areas	Relocation
		Desalin-ation
Other options	Other options	Other options

As modeling capability improves, so can the specificity of interventions.

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Genies Adoption Program

Adoption Phase – Mainstreaming
- Training and Mentoring
- Communities of Practice
- Media and Communication

20 Adopted Cities 2014-2016

Working Trials
- Wider Scope of Cities with multiple sectoral impacts
- More Sophisticated Cross-Sectoral Linkages
- Establish Systems Thinking Framework

5 working trials 2013/2014

Pilot Stage – Proof of Concept
- Small and Medium Cities - Limited Sector Impacts
- Opportunity to Develop Systems Approach
- Simple Cross-Sectoral Analysis

3 pilots 2011/2012

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How do we do this?

Partnership …

… with local and international institutions, experts in evaluating the environmental health endpoints, climate change, water security, and urban infrastructure needs …

Building on existing resources …

- IPCC GCM data is publicly available
- Regional Climate Model
- Asia Integrated Models (AIM)
- CLIMsystems impact model library +++++

Practical steps forward …

- Planning workshop at ADB in August 2011 with key institutions to initiate partnering platform
- Prototyping in example city to aggregate data and models, carry out case study, and refine design

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One Example: GENIES Ho Chi Minh City Mock UP

GENIES Ho Chi Minh City

File Edit View Tools Help

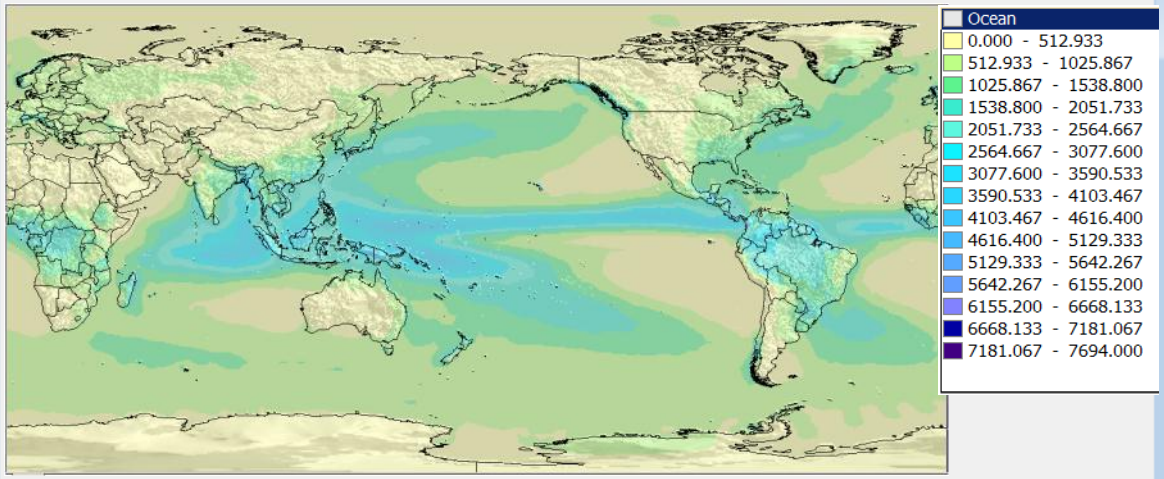
New Open Save Data Config Analysis Summary Help

Study area selection

- Global
  - Vietnam
    - Mekong Delta
      - HCMC

Study area selection – Global

Annual precipitation (mm)



Source: SimCLIM Baseline (1960-1990)

GENIES Ho Chi Minh City

File Edit View Tools Help

New Open Save Data Config Analysis Summary Help

City Master Plan

- Overall plan
- transport
- Urban development
- Flood control
- Waster water treat.
- Green space

Add new plan

Overall plan

Ho Chi Minh City has outlined its spatial development ambitions for moving towards the sea for the year 2025 in its (revised) Spatial Master Plan.

GENIES Ho Chi Minh City

File Edit View Tools Help

New Open Save Data Config Analysis Summary Help

City Master Plan

- Overall plan
- transport
- Urban development
- Flood control
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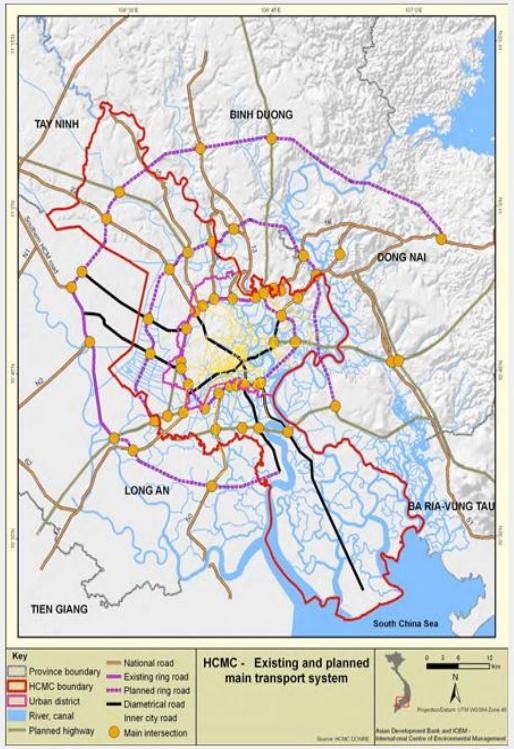
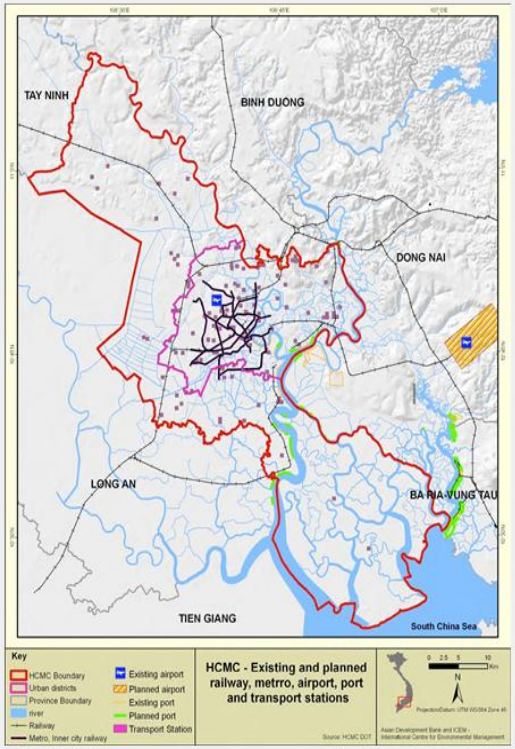
- Green space

Add new plan

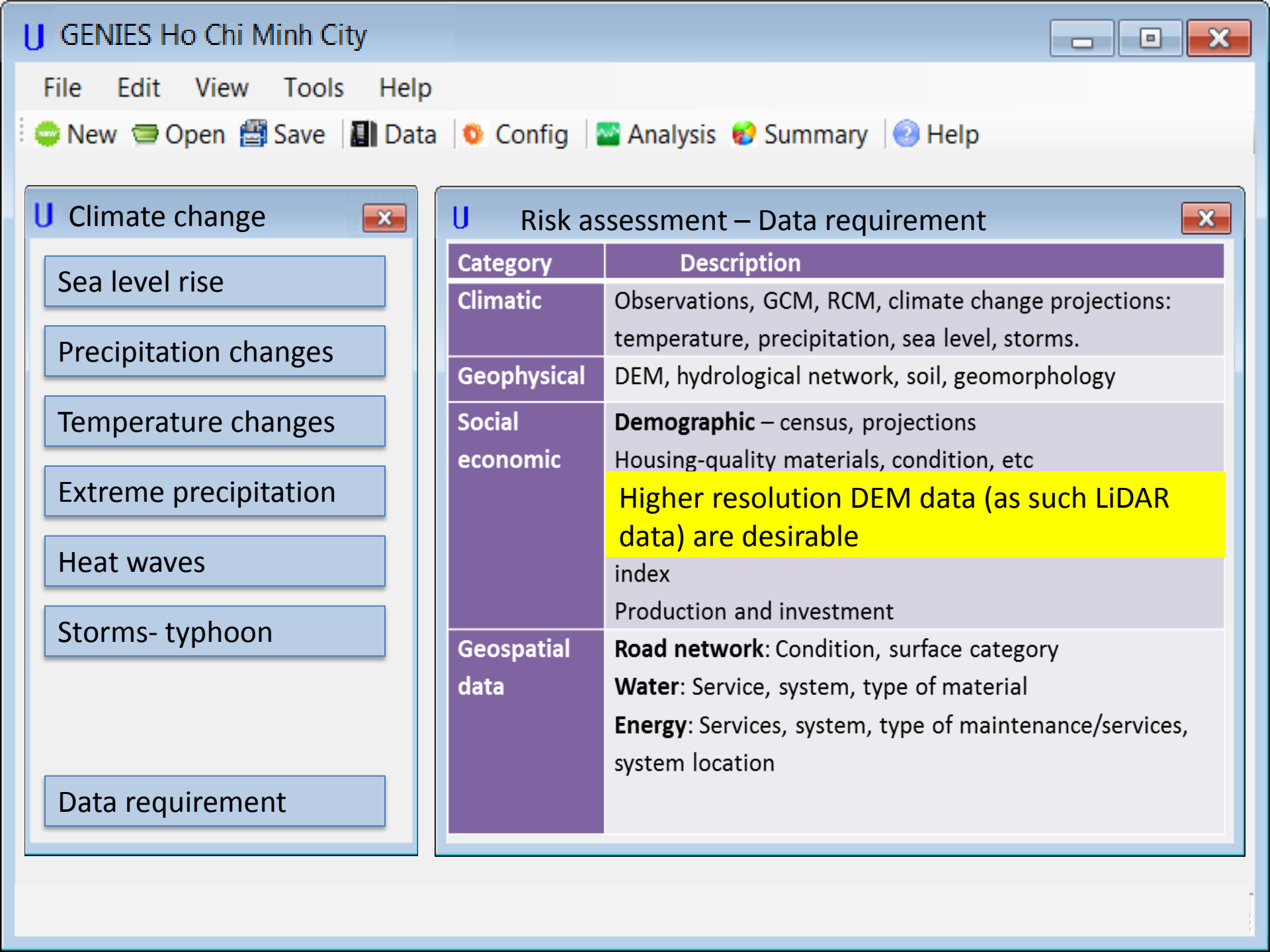
Transport



Existing and planned road network of HCMC



Existing and planned ports, railways


GENIES Ho Chi Minh City
File
Edit
View
Tools
Help
New
Open
Save
Data
Config
Analysis
Summary
Help
Climate change
Sea level rise
Precipitation changes
Temperature changes
Extreme precipitation
Heat waves
Storms- typhoon
Data requirement
Risk assessment – Data requirement
Category
Description
Climatic
Observations, GCM, RCM, climate change projections: temperature, precipitation, sea level, storms.
Geophysical
DEM, hydrological network, soil, geomorphology
Social economic
Demographic – census, projections
Housing-quality materials, condition, etc
Higher resolution DEM data (as such LiDAR data) are desirable
index
Production and investment
Geospatial data
Road network: Condition, surface category
Water: Service, system, type of material
Energy: Services, system, type of maintenance/services, system location

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File Edit View Tools Help

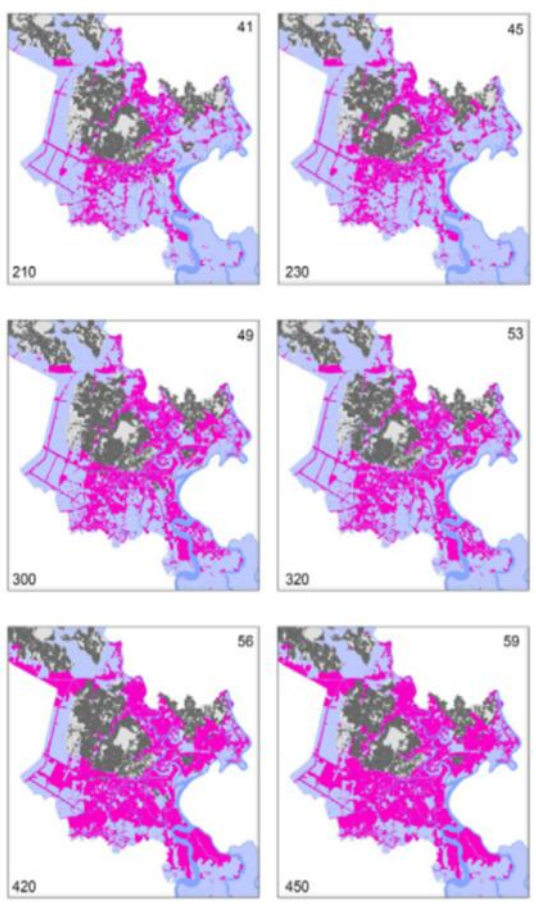
New Open Save Data Config Analysis Summary Help

SLR-adaptation options

- Dyke system
- Ecological restoration
- Climate proof building
- Planned relocation
- Floodplain

Add new option

SLR-adaptation – Climate proof building



New development and redevelopment of building design- port area

Shipping area and Floating warehouse

GENIES pilot in Vietnam

- One target province - Mekong Delta.

- The study involves:
  - Identifying future climate conditions in the Mekong Delta;
  - Assessing the effects of climate risks on agriculture, energy and transport sectors in the region; and
  - Identifying adaptation options and pilot projects

Main Pilot Phase targets

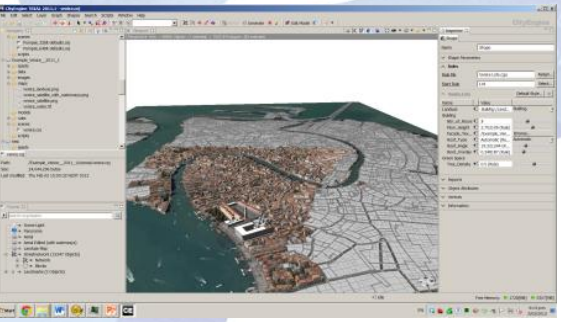
Focus on sea level rise and storm surge impact on coastal urban infrastructure

Key features needed for demo:

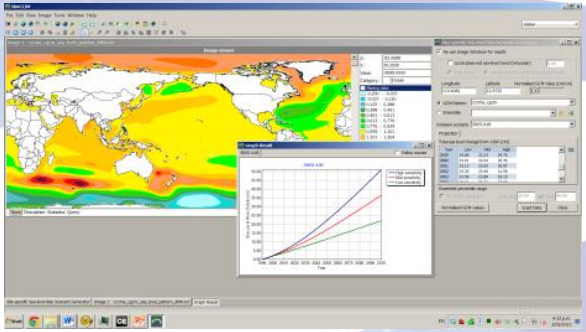
- 3D urban model buildings (using ARCGIS and City engine)
- Sea water inundation 3D visualization, change of water level and for the properties
- Multiple criteria decision analysis (decision tree)
- Dynamic model building (blocks and connectors)
- Scenario simulation (socio-economic and climate change)
- SimCLIM existing climate change features (climate change projection generation)

Story 1: Extreme sea level damage and loss

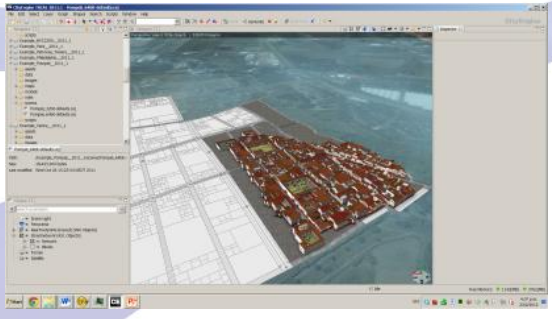
ESRI City engine 3D city model building



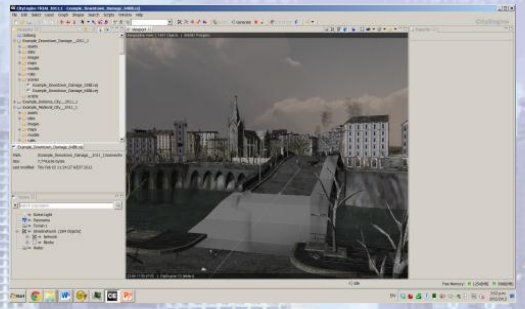
(1) Existing urban area



(2) Sea level rise projection
(mean and storm probability changes)



(3) Sea level and storm inundation
(users can see the inundated area and inundated properties)



(4) Damages: bridge road, and building: counting properties inundated or damage

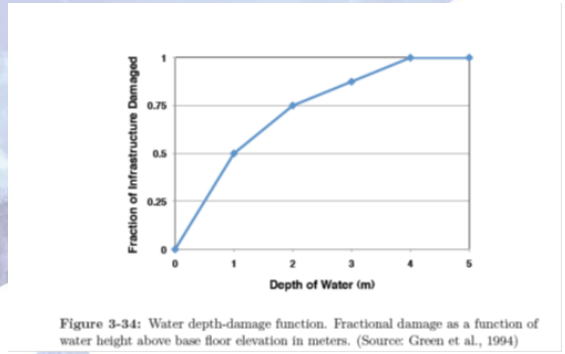
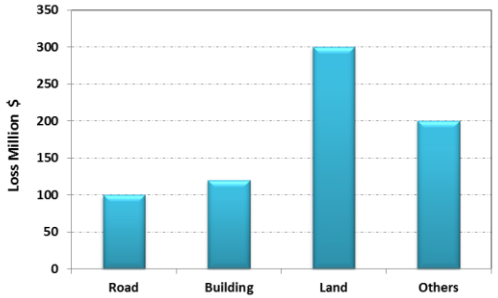


Figure 3-34: Water depth-damage function. Fractional damage as a function of water height above base floor elevation in meters. (Source: Green et al., 1994)

(5) Damage loss curve
(damage to $ value)



(6) Total cost Accounting function

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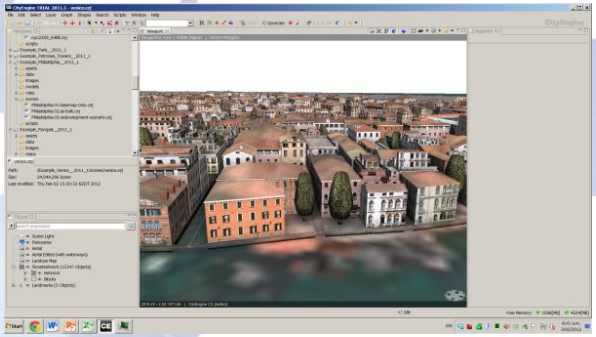
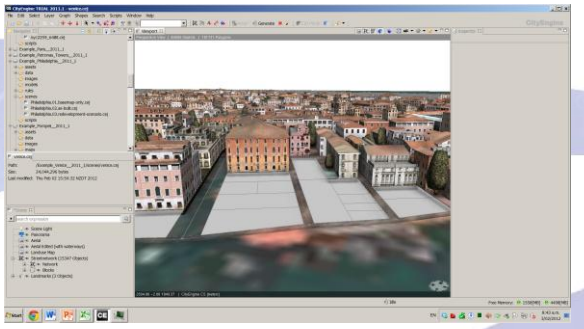
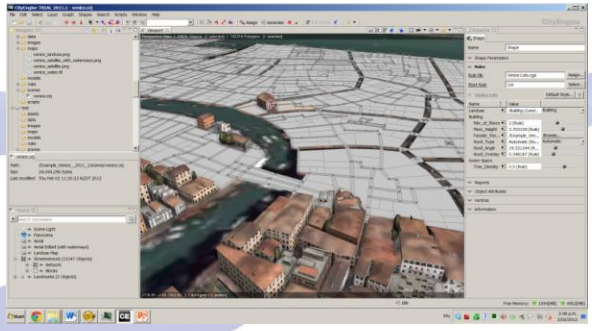
Story 2 Adaptation options



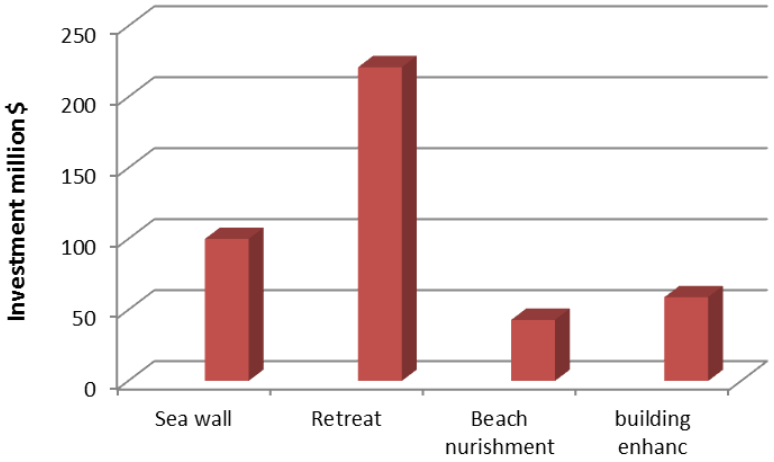
(1) Build sea wall defence (change the height of sea wall), see the difference in inundated area



(2) Relocate & retreat some buildings in the foreshore area, see the differences in loss

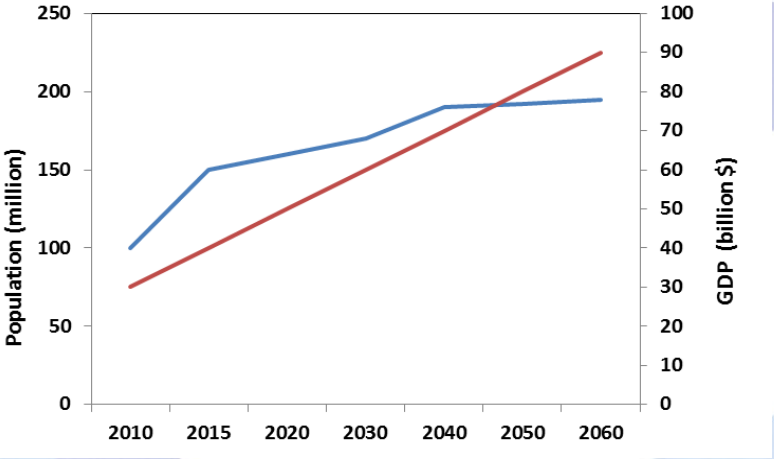


(3) Urban development in a new area (show the existing buildings and the planned building area)

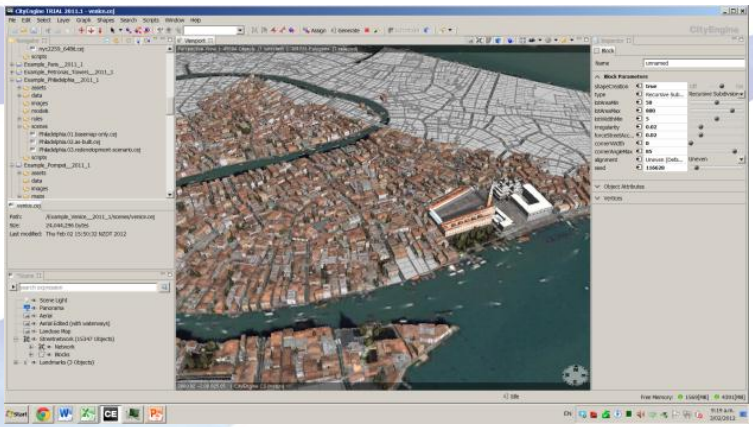


(4) Investment of each option, show the total investment of each option

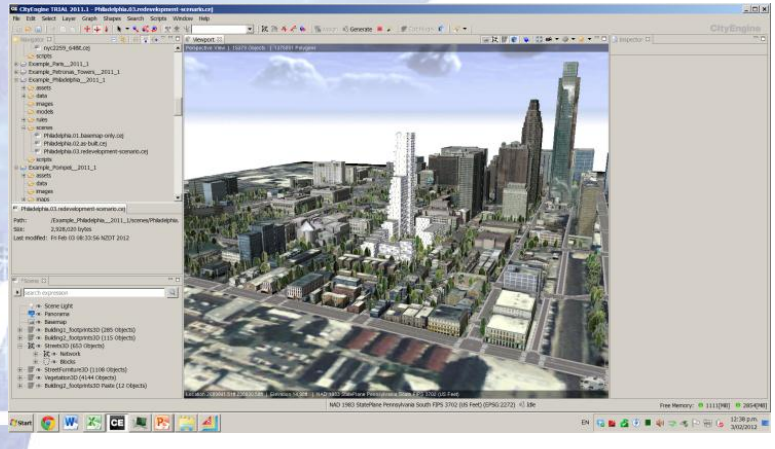
Urban development plan



(1) GDP and population projections
Show as plots go with table in a block type function, user can input and change the numbers in the table



(2) Urban development master plan: Land use, new urban area



(3) Different development plan scenarios (show maps)

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Long-term Planning

File Edit View Tools Help

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Economic Analysis

Damage projection

Cost-benefit of projects

Cost-benefit ranking

Cost-benefit timeline

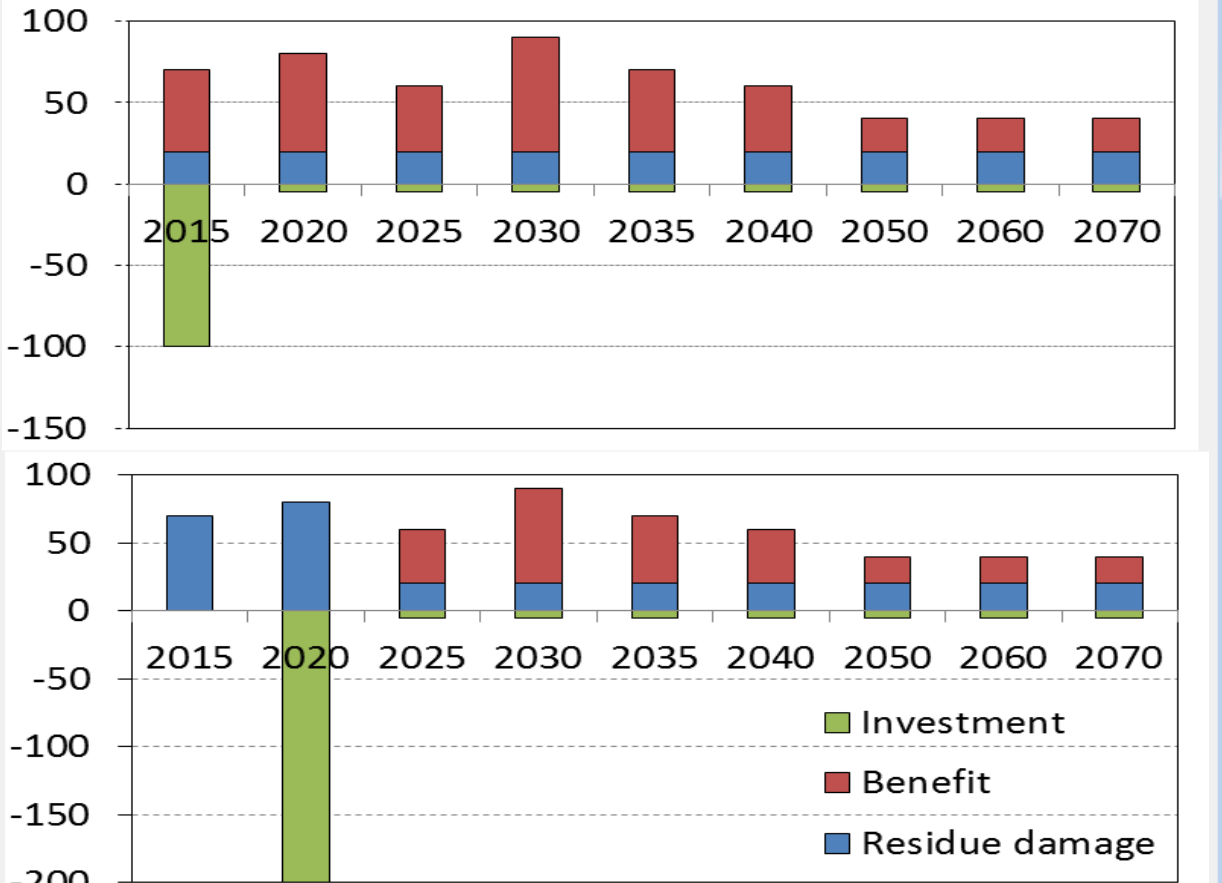
Add new project

Damage projection - road

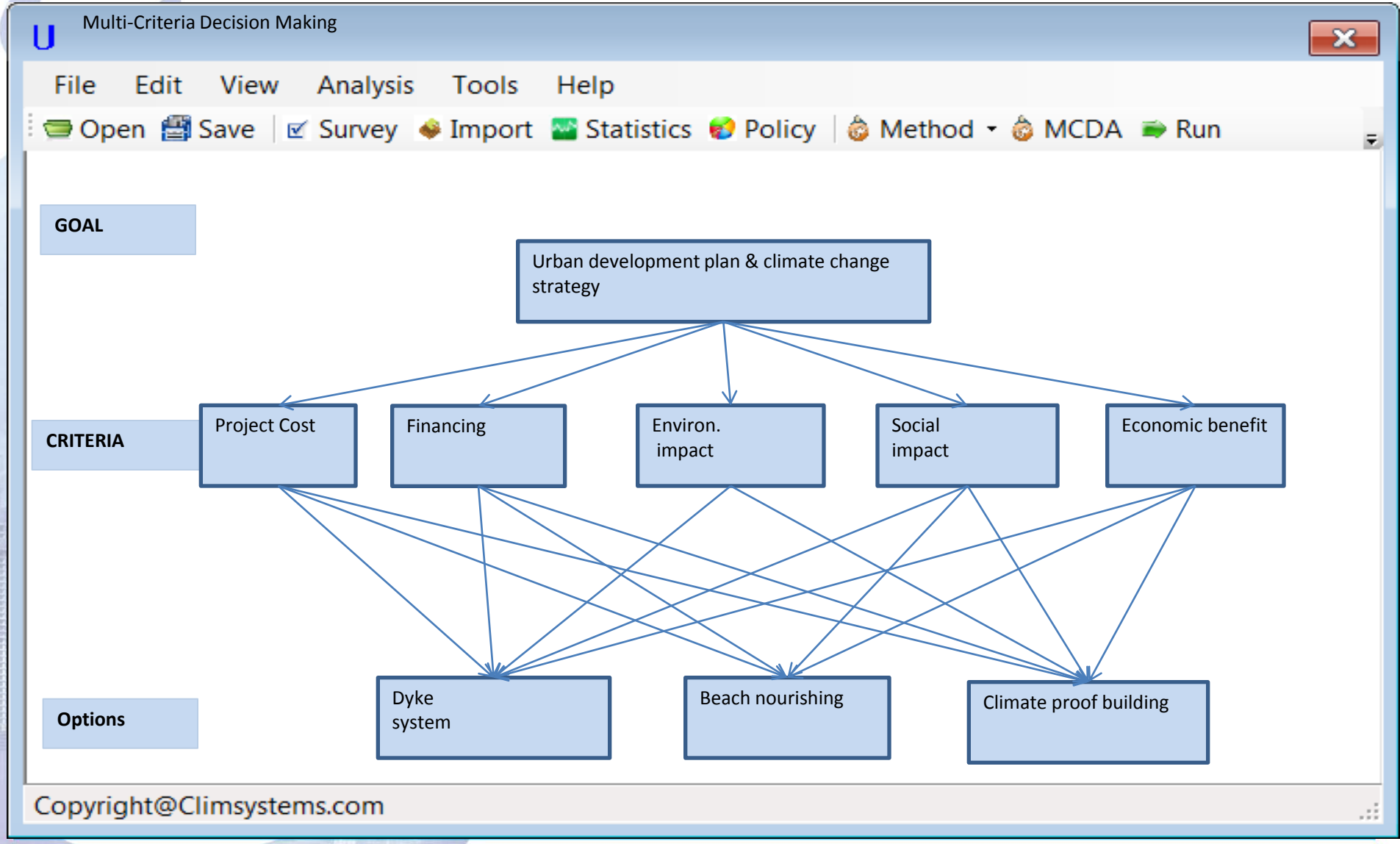
Damage projection -building

Cost benefit ranking

Cost benefit timeline



MCDA and optimization:



THANK YOU

Contact details for more information

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