Using the SLEUTH cellular automaton based model to evaluate the impacts of multiple land use policy scenarios on urban growth patterns in the Peninsula de Setúbal area

Marta Afonso, Pedro Arsénio & João Rodrigues

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INSTITUTO SUPERIOR DE AGRONOMIA
Universidade de Lisboa
Hinc Patriam Sustinet
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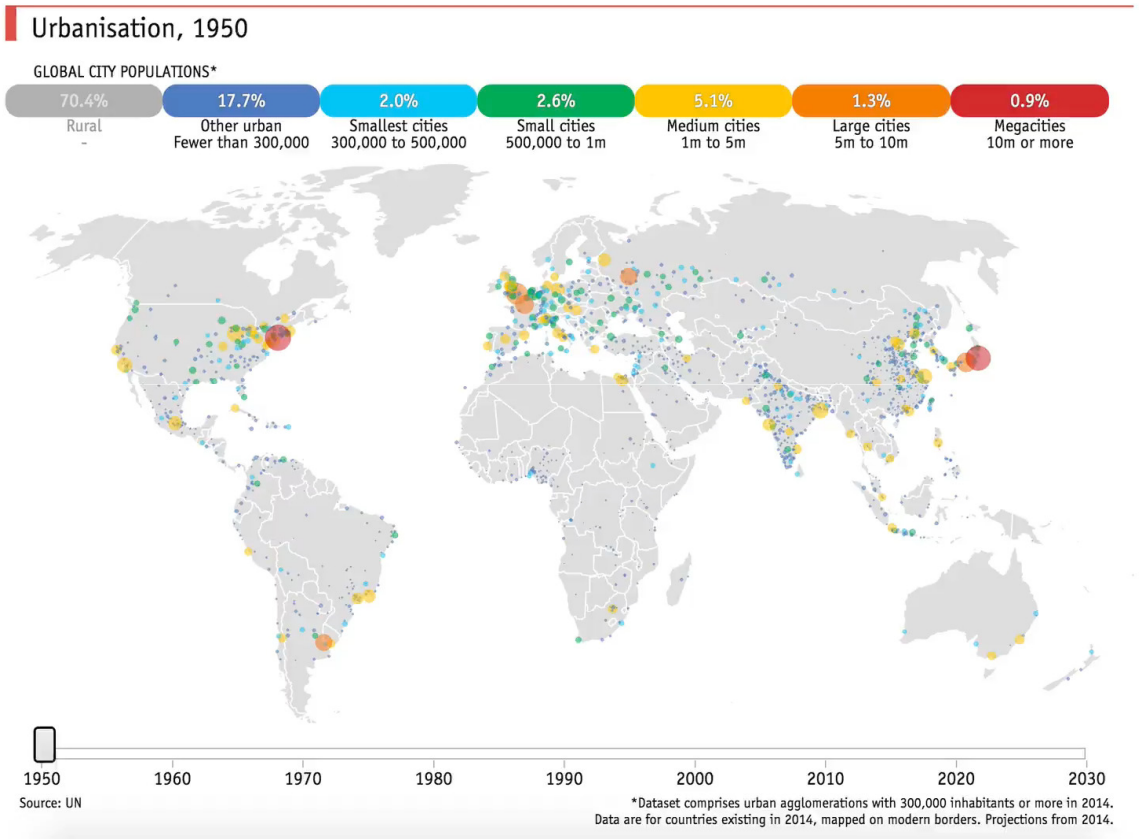
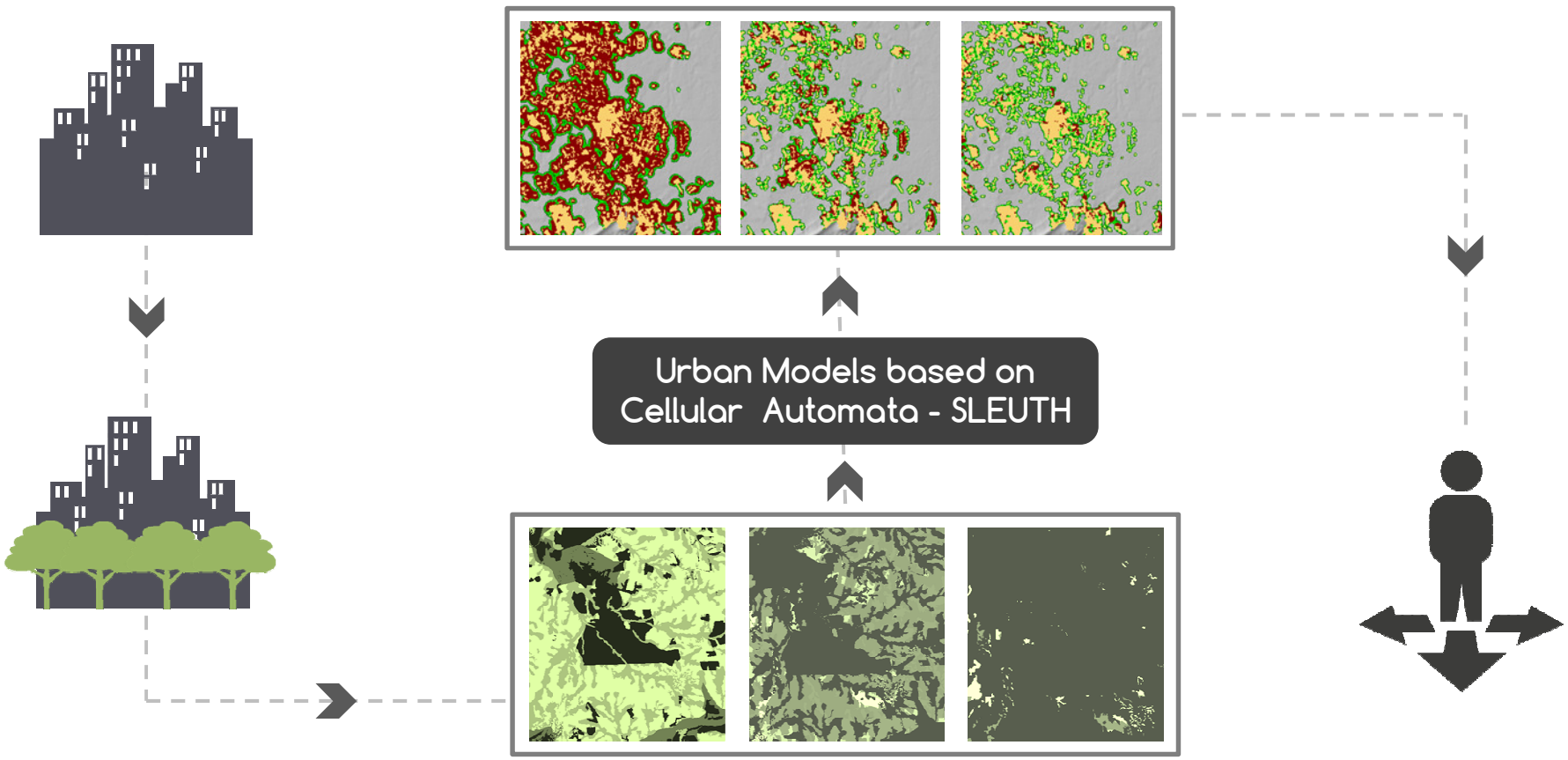
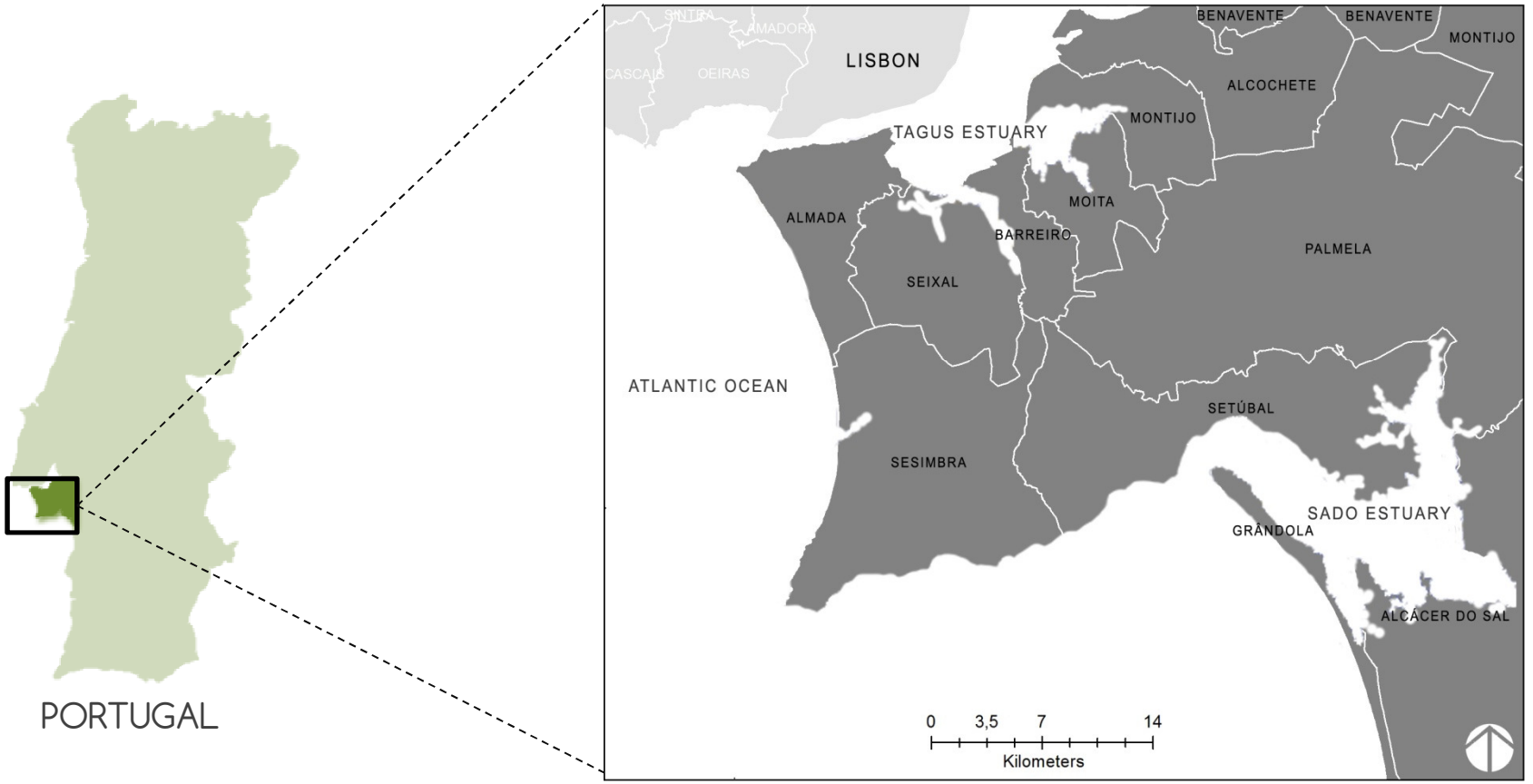
WORLDWIDE URBAN GROWTH 1950 - 2030



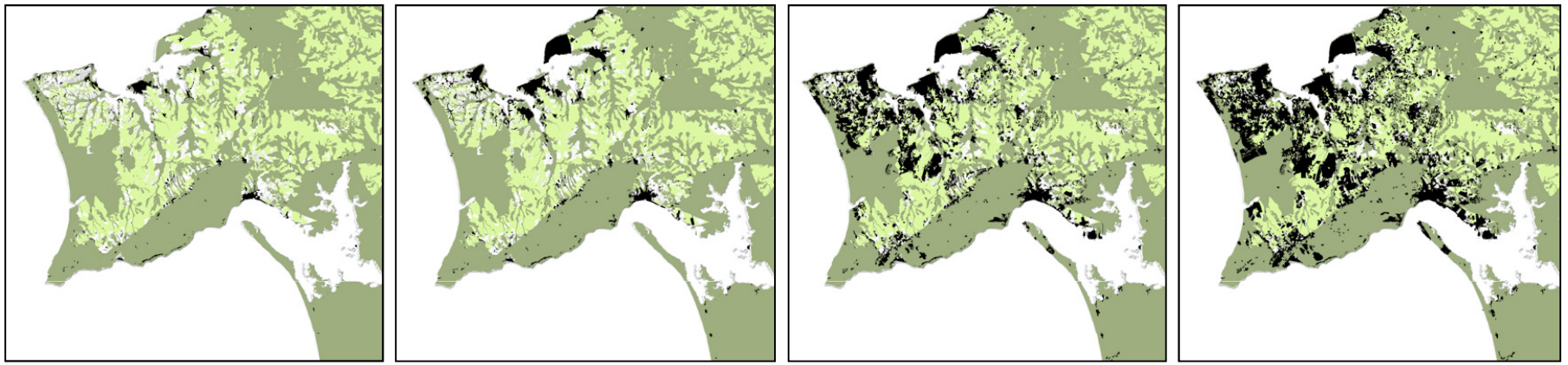
FRAMEWORK



PENINSULA DE SETÚBAL AND SADO ESTUARY STUDY AREA



PENINSULA DE SETÚBAL URBAN GROWTH BETWEEN 1942 - 2007

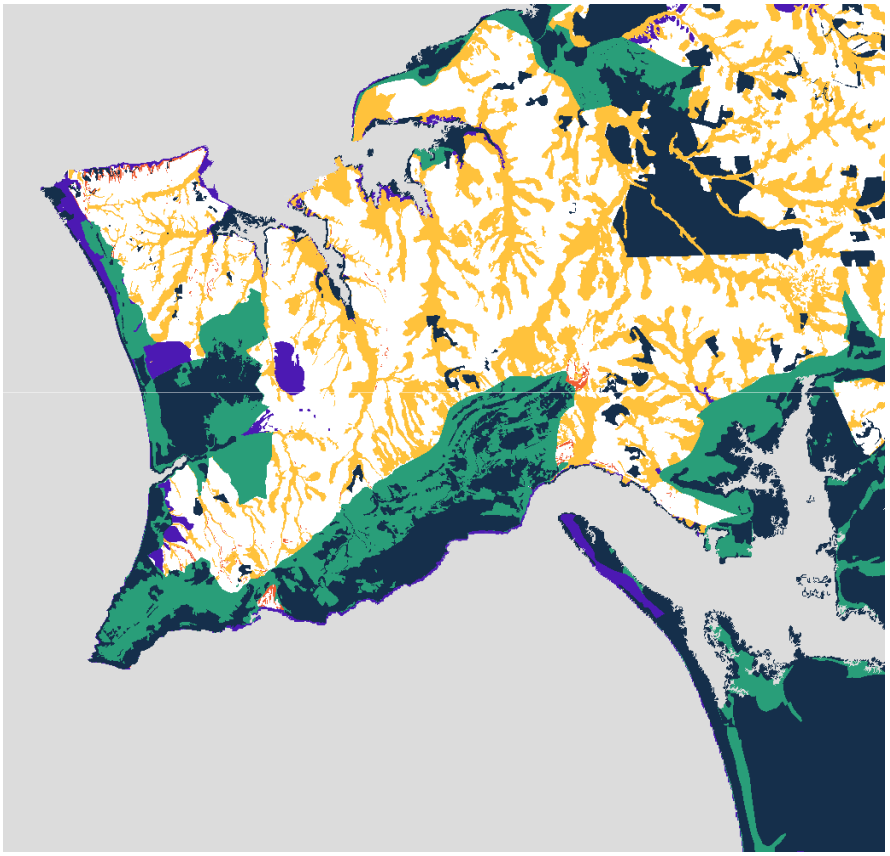


Ecological Network 1st Level (CEAP 2013) (Biophysical systems with a higher ecological value)

Ecological Network 2st Level (CEAP 2013) (Biophysical systems with a lower ecological value)

Urban Areas (Portuguese Military Map 1942, Portuguese Agriculture and Foresty Map 1963, PCOS'90, COS'07)

SCENARIO 1 – CURRENT TRENDS (CT)



95% OF PROTECTION
- Natural and Semi- natural Vegetation with High and Very High Conservation Value

85% OF PROTECTION
- Nature Conservation

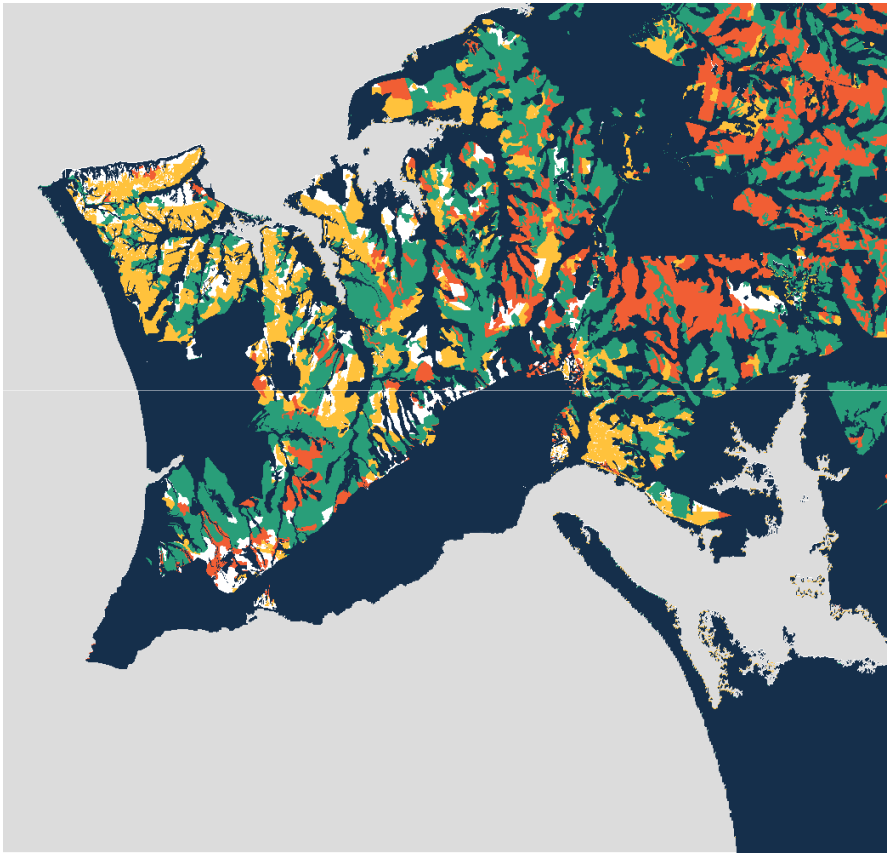
80% OF PROTECTION
- Coastlands

70% OF PROTECTION
- Steep Slope Area

60% OF PROTECTION
- Soil of High and Very High Ecological Value
- Wetlands

0% OF PROTECTION
- Areas with No Impediments for Urbanization

SCENARIO 2 – MODERATE ECOLOGICAL PROTECTION (MEP)



100% OF PROTECTION
- Wetlands
- Steep Slope Areas
- Soil of High and Very High Ecological Value
- Coastland
- Natural and Semi- natural Vegetation with High and Very High Conservation Value
- Nature Conservation

ECOLOGICAL NETWORK 1ST LEVEL

80% OF PROTECTION
- Maximum Infiltration Areas – Type I

50% OF PROTECTION
- Maximum Infiltration Areas – Type 2

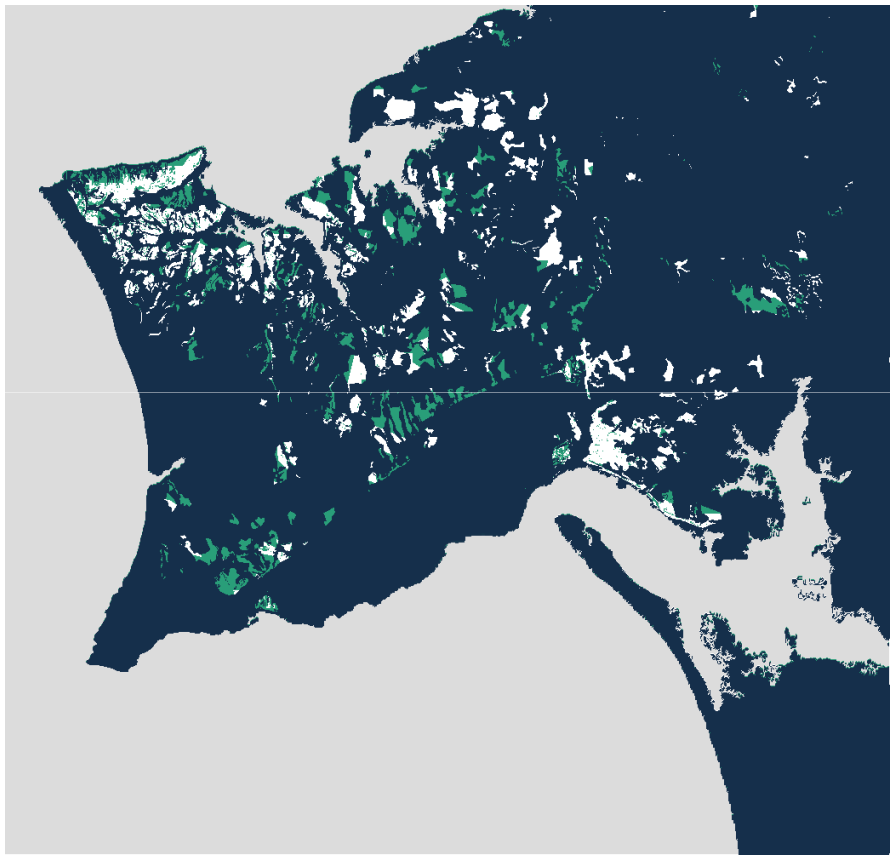
30% OF PROTECTION
- Hilltops in Ancient Wet System
- Natural and Semi- natural Vegetation with Low Conservation Value

ECOLOGICAL NETWORK 2 ND LEVEL

- Areas without Ecological Suitability for Building

0% OF PROTECTION
- Ecological Suitable Areas for Building

SCENARIO 3 – EXTREME ECOLOGICAL PROTECTION (EEP)



100% OF PROTECTION

- Wetlands
- Steep Slope Areas
- Soil of High and Very High Ecological Value
- Coastland
- Natural and Semi- natural Vegetation with High and Very High Conservation Value
- Nature Conservation

ECOLOGICAL NETWORK 1ST LEVEL

- Maximum Infiltration Areas
- Hilltops in Ancient Wet System
- Natural and Semi- natural Vegetation with Low Conservation Value

ECOLOGICAL NETWORK 2 ND LEVEL

80% OF PROTECTION

- Areas without Ecological Suitability for Building

0% OF PROTECTION

- Ecological Suitable Areas for Building

SLEUTH – URBAN GROWTH MODEL

S LOPE
L ANDUSE
E XCLUSION
U RBAN EXTEND
T RANSPORTATION
H ILLSHADE

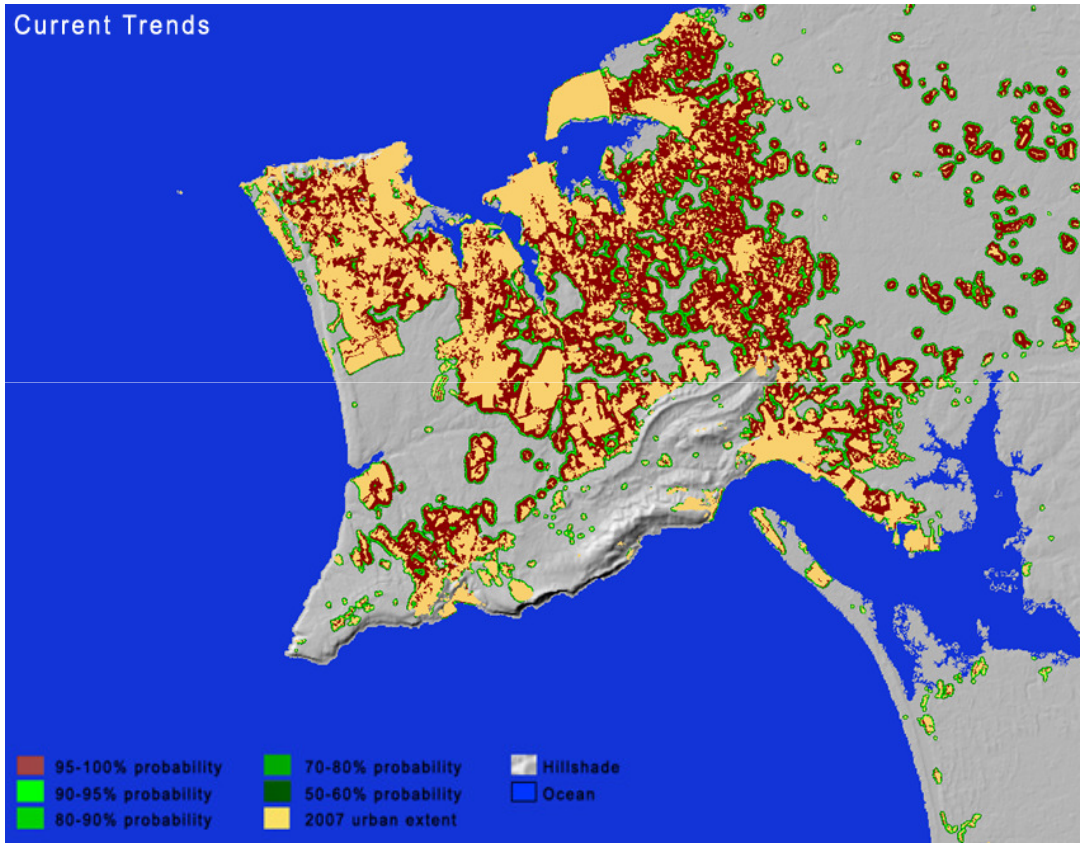
SLEUTH uses a cellular automaton approach and its purpose is to simulate urban growth and land use changes induced by urbanization processes. The output of the model forecast are probability maps generated through a set of Monte Carlo iterations.

(Clarke, 2008)

CALIBRATION
LEARNS HISTORIC GROWTH PATTERNS
1942 - 1963 - 1990 - 2007

PREDICTION
PREDICT THE FUTURE URBAN GROWTH
2030

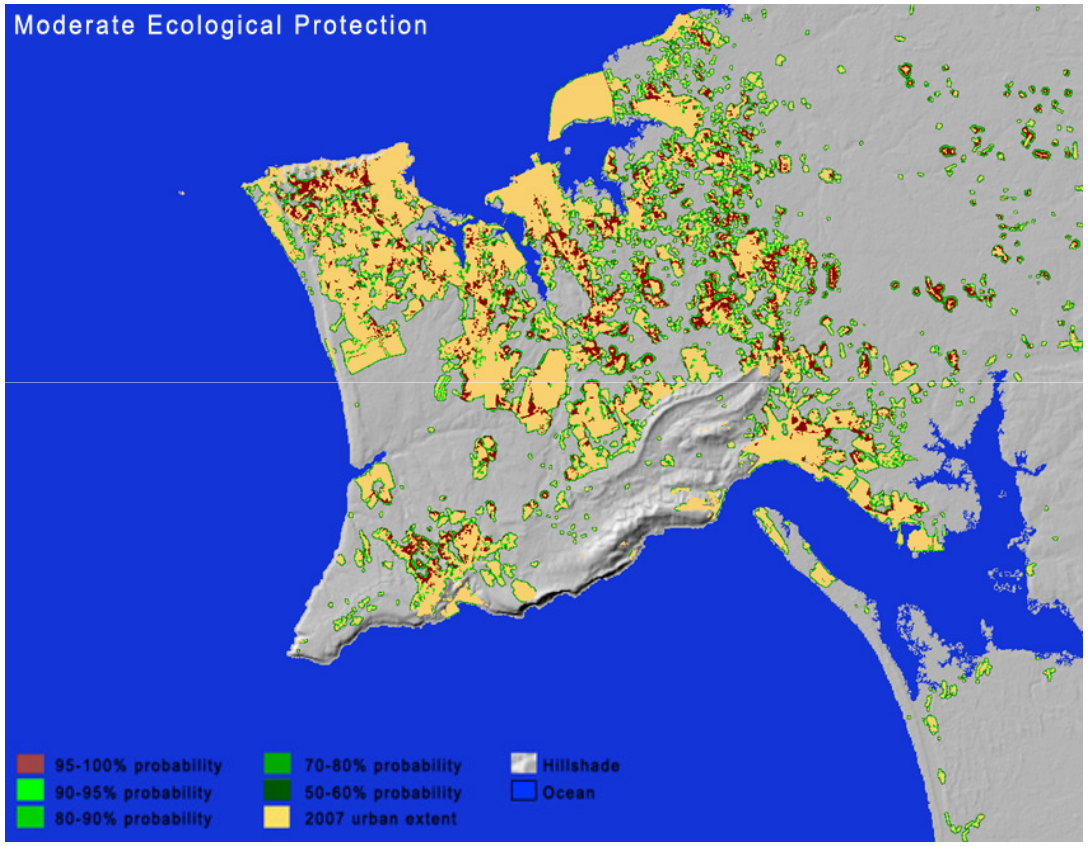
2030 FORECAST– CURRENT TRENDS SCENARIO



2007 URBAN AREA
251 km2
18% of the study area

2030 URBAN AREA
603 km2
45% of the study area

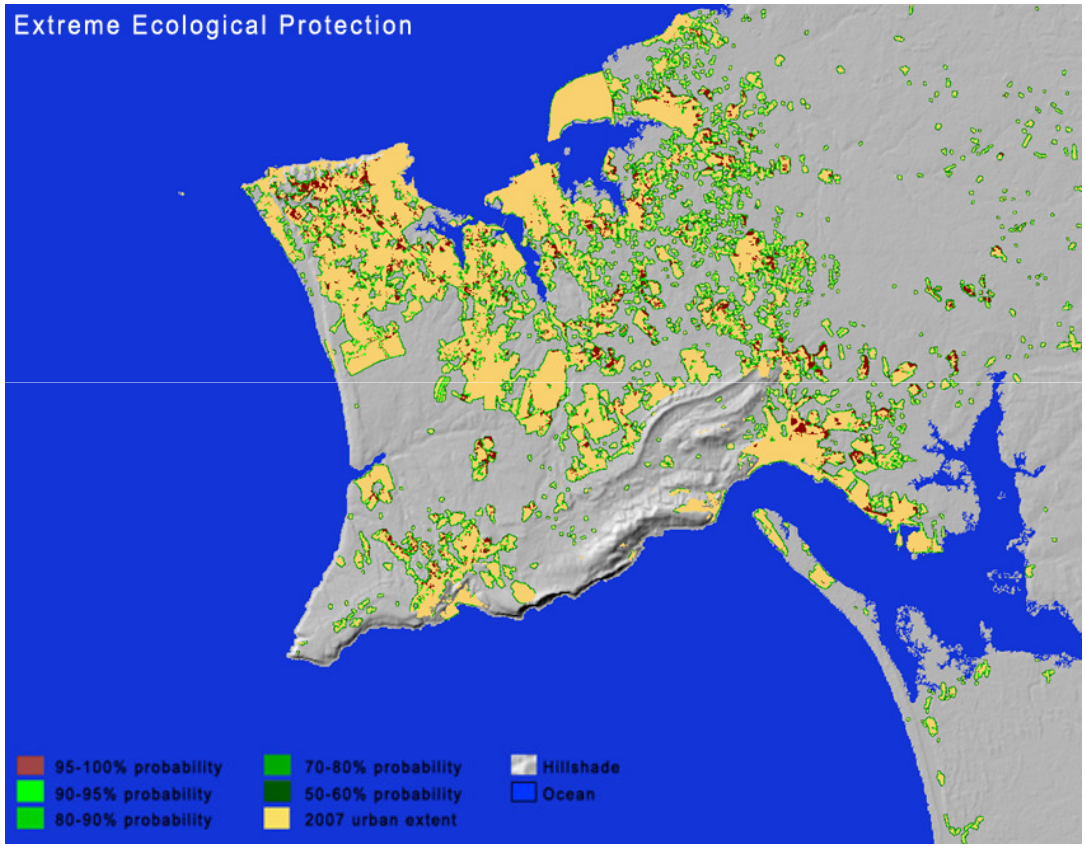
2030 FORECAST – MODERATE ECOLOGICAL PROTECTION SCENARIO



2007 URBAN AREA
251 km2
18% of the study area

2030 URBAN AREA
440 km2
33% of the study area

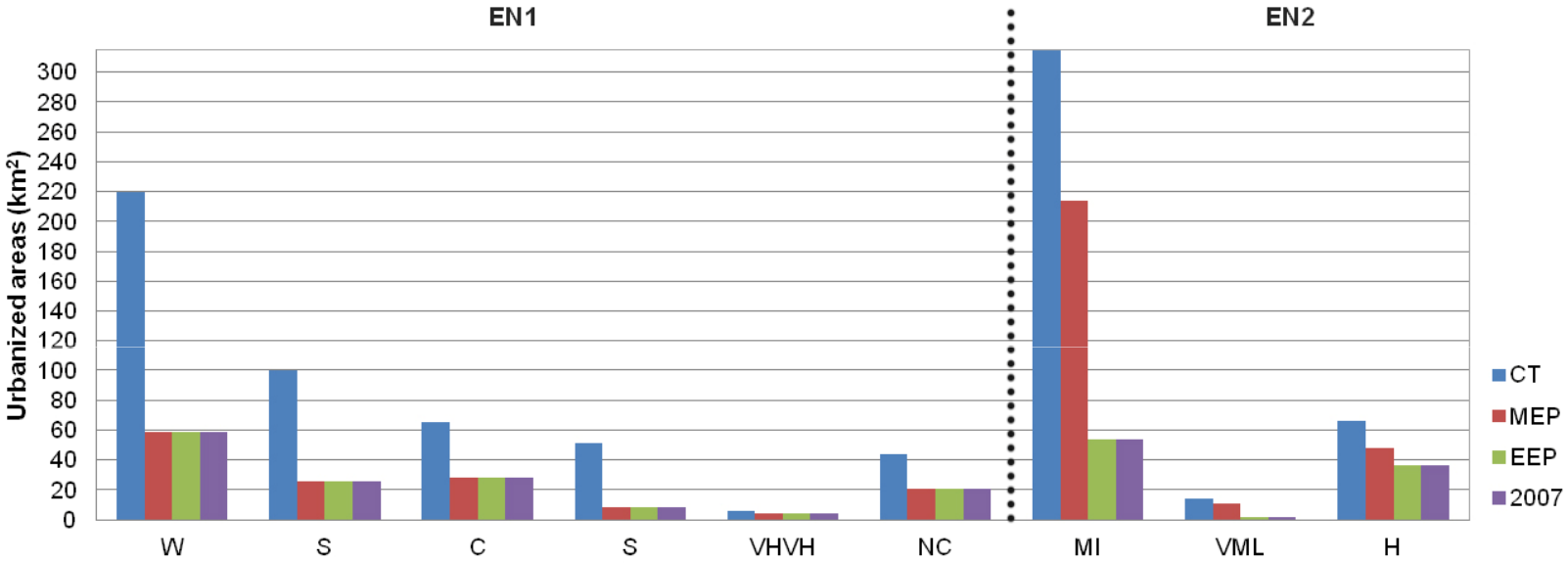
2030 FORECAST – EXTREME ECOLOGICAL PROTECTION SCENARIO



2007 URBAN AREA
251 km2
18% of the study area

2030 URBAN AREA
413 km2
31% of the study area

NATURAL RESOURCES PROTECTION ACCORDING CT, MEP AND EEP



W: Wet System; S: Soil of High and Very High Ecological Value; C: Coastlands; SL: Steep Slope Areas; VHVH: Natural and Semi-natural Vegetation with High and Very High Conservation Value; NC: Nature Conservation; MI: Maximum Infiltration Areas; VML: Natural and Semi-natural Vegetation with Moderate and Low Conservation Value; H: Hilltops in Ancient Wet System; EN1: Ecological Network 1st Level; EN2: Ecological Network 2nd Level

URBAN PATTERNS ACCORDING MTA, MEP AND EEP

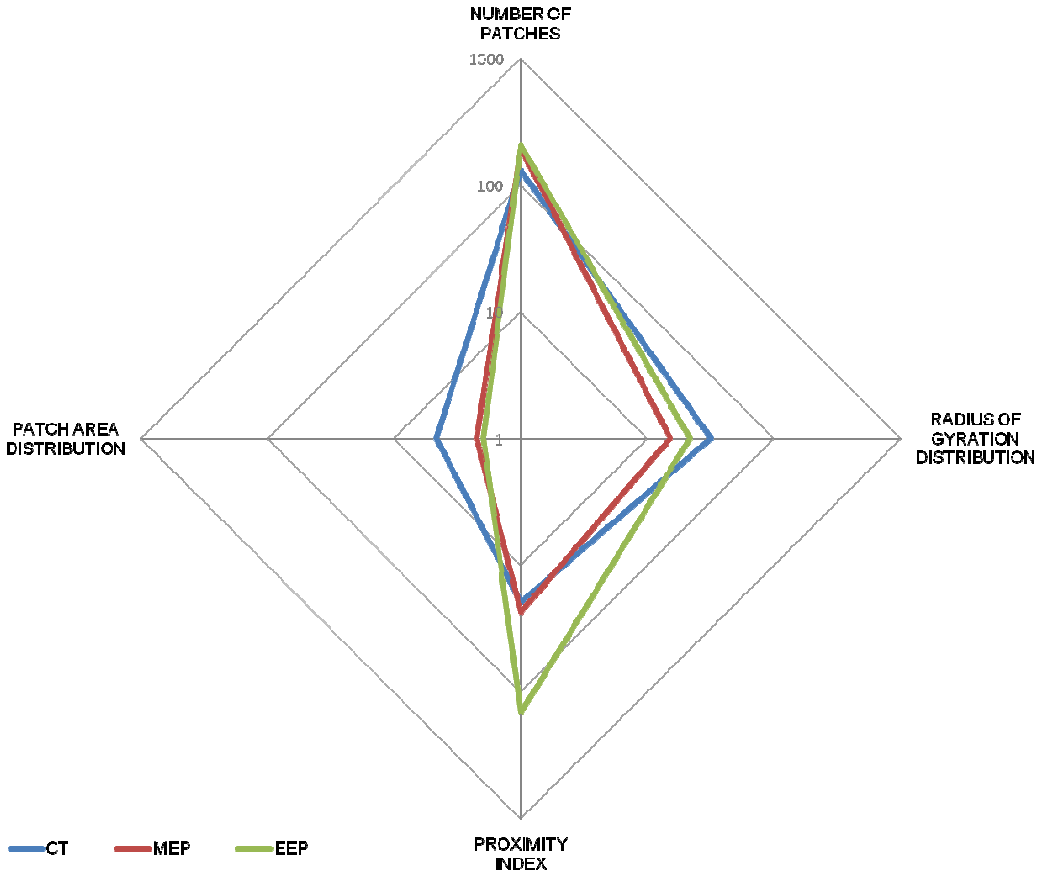
LANDSCAPE METRICS

Number of Patches
How many urban fragments exist?

Patch Area Distribution
What is the mean area of the urban fragments?

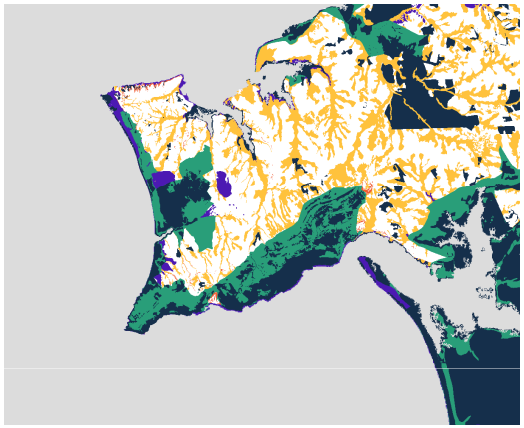
Proximity Index
How close are the urban fragments?

Radius of Gyration Distribution
How extensive are the urban fragments?

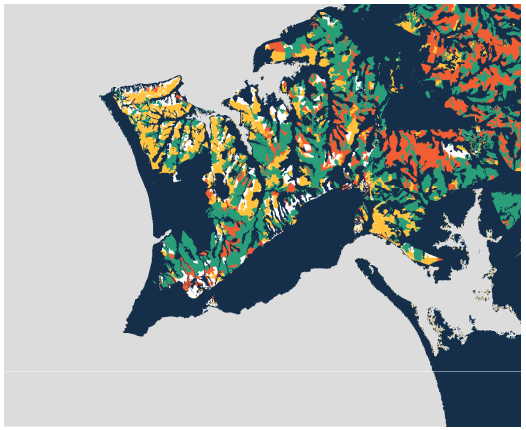


CONCLUSIONS

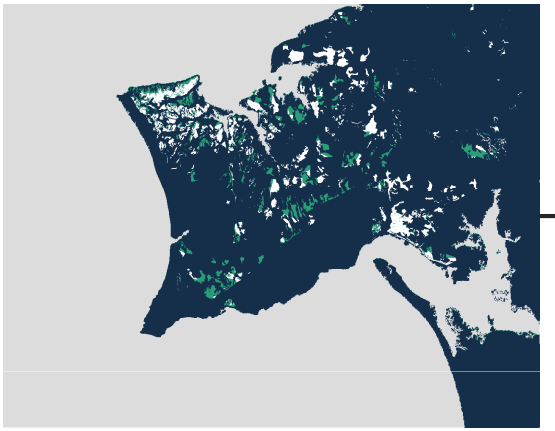
CURRENT TRENDS



MODERATE ECOLOGICAL PROTECTION



EXTREME ECOLOGICAL PROTECTION



URBAN SPRAWL

PROTECTION OF NATURAL RESOURCES

URBAN SPRAWL

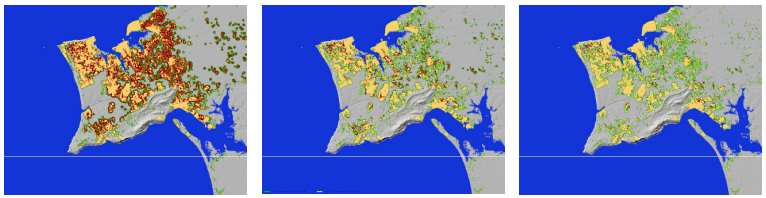
PROTECTION OF NATURAL RESOURCES

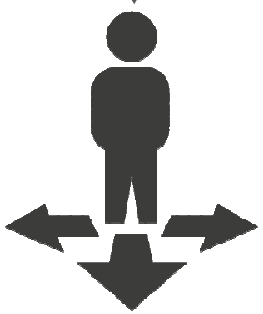
FIT THE PURPOSE OF PROT AML TO ADOPT A COMPACT CITY MODEL

EEP SHOWED THE BEST RESULTS

CONCLUSIONS

SLEUTH





It is important to point out that the model does not reflect all the complex phenomena that occur in city growth that could be essential for planning

Very usefull COMPLEMENTARY TOOL in urban planning

"I recognize the right and duty of this generation to develop and use our natural resources, but I do not recognize the right to waste them, or to rob by wasteful use, the generations that come after us.

Theodore Roosevelt, 1910

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marta.b.afonso@gmail.com

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