Cartographic scale and minimum mapping unit influence in LULC Modelling

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UNIVERSIDAD DE GRANADA

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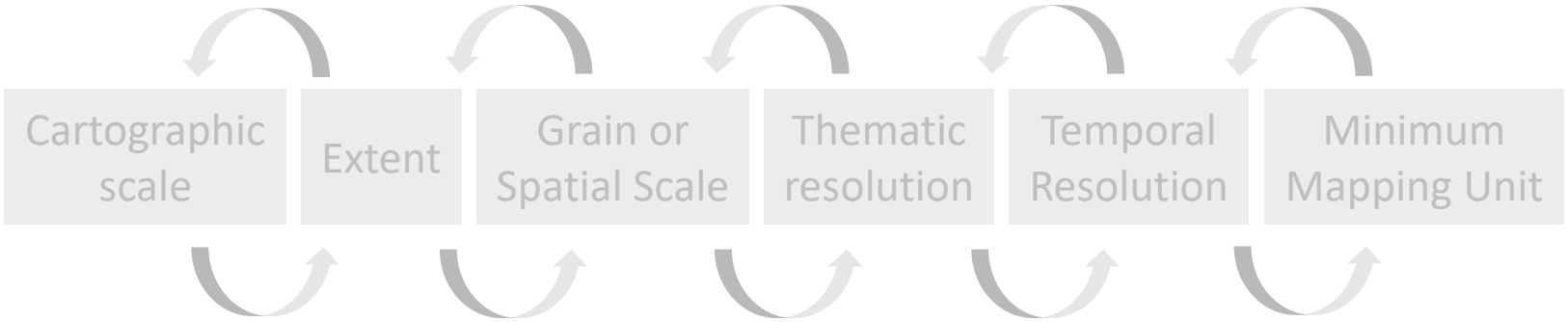
Geomatic approaches for modelling land change scenarios - GAMOLCS 2017

1 Background

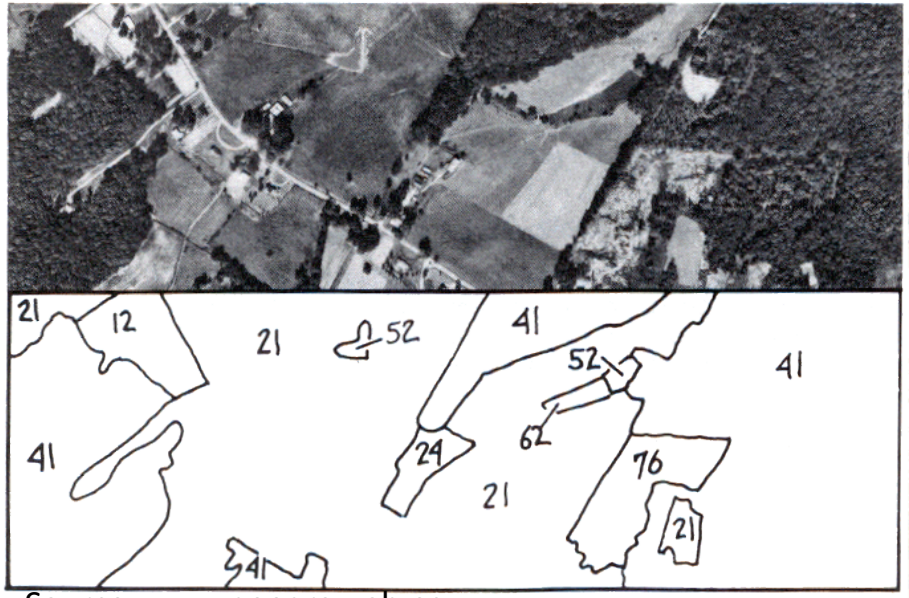
What is the scale?



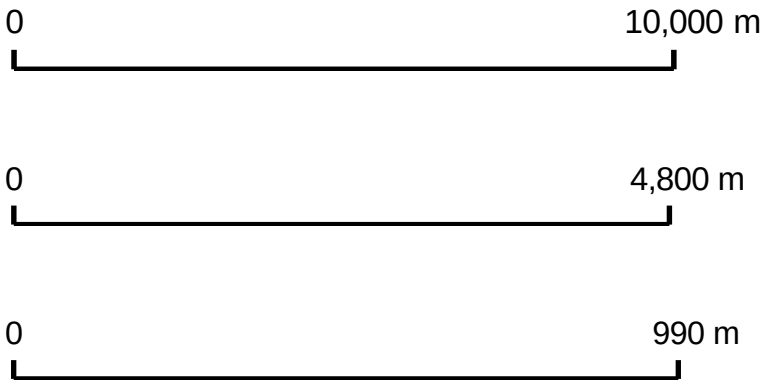
1 Background

What is the scale?

- **Cartographic scale**
- Extent
- Grain or Spatial Scale
- Thematic resolution
- Temporal Resolution
- Minimum Mapping Unit



Source: www.geogra.uah.es

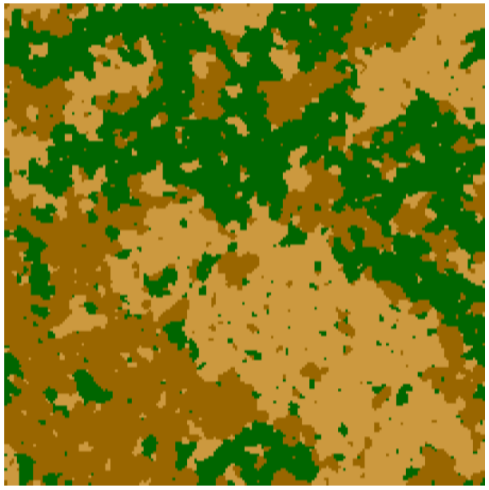


1 Background

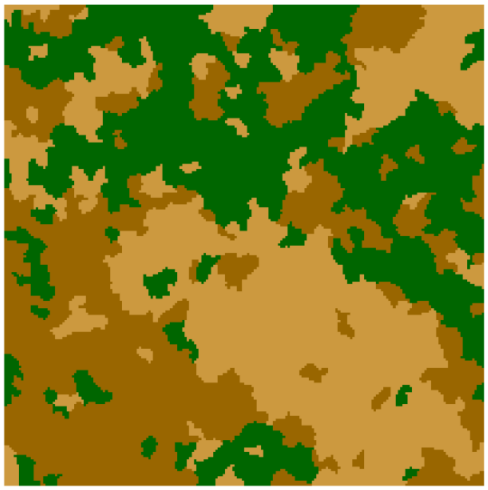
What is the scale?

Cartographic scale | Extent | Grain or Spatial Scale | Thematic resolution | Temporal Resolution | Minimum Mapping Unit

MMU=1



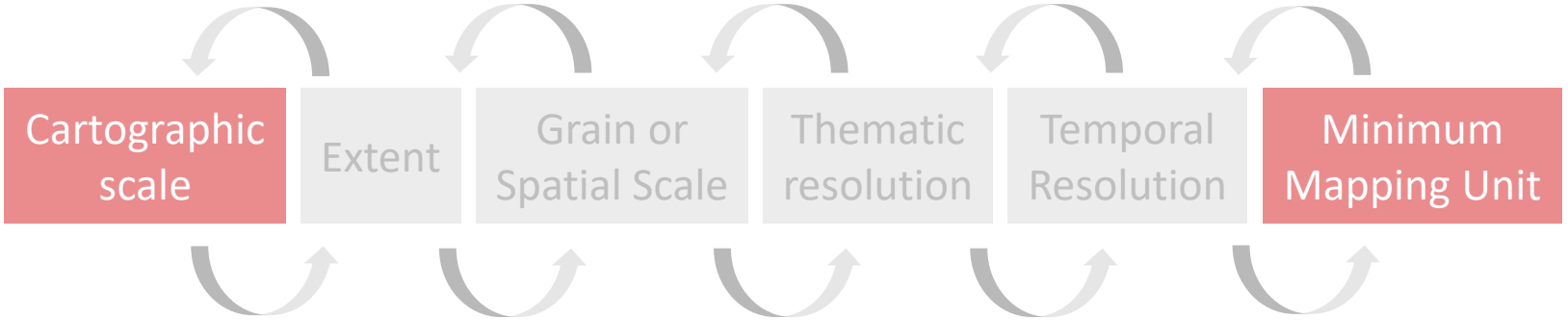
MMU=21



Source: Saura, S. (2002). Effects of minimum mapping unit on land cover data spatial configuration and composition. International Journal of Remote Sensing, 23(22), 4853-4880.

1 Background

What is the scale?



2 Data Sets

SIOSE

1:25.000

MMU: 0.5-2ha

MMU Changes: 0.4ha

MMW: 15m (excepcions allowed)

Dates:
2005 – 2009 - 2011

Classification System

CORINE

1:100.000

MMU: 25h

MMU Changes: 5ha

MMW: 100m

Dates:
1990 – 2000 – 2006 - 2012

Description System

2 Data Sets

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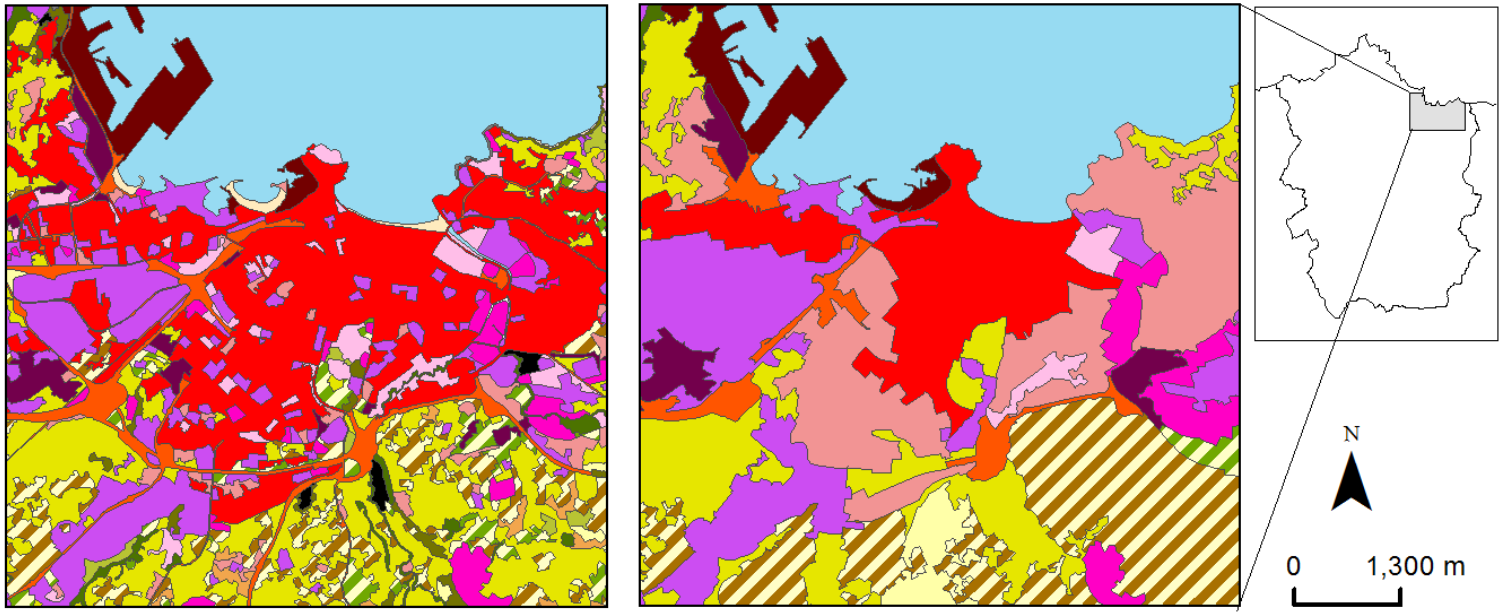
Description System

2 Data Sets

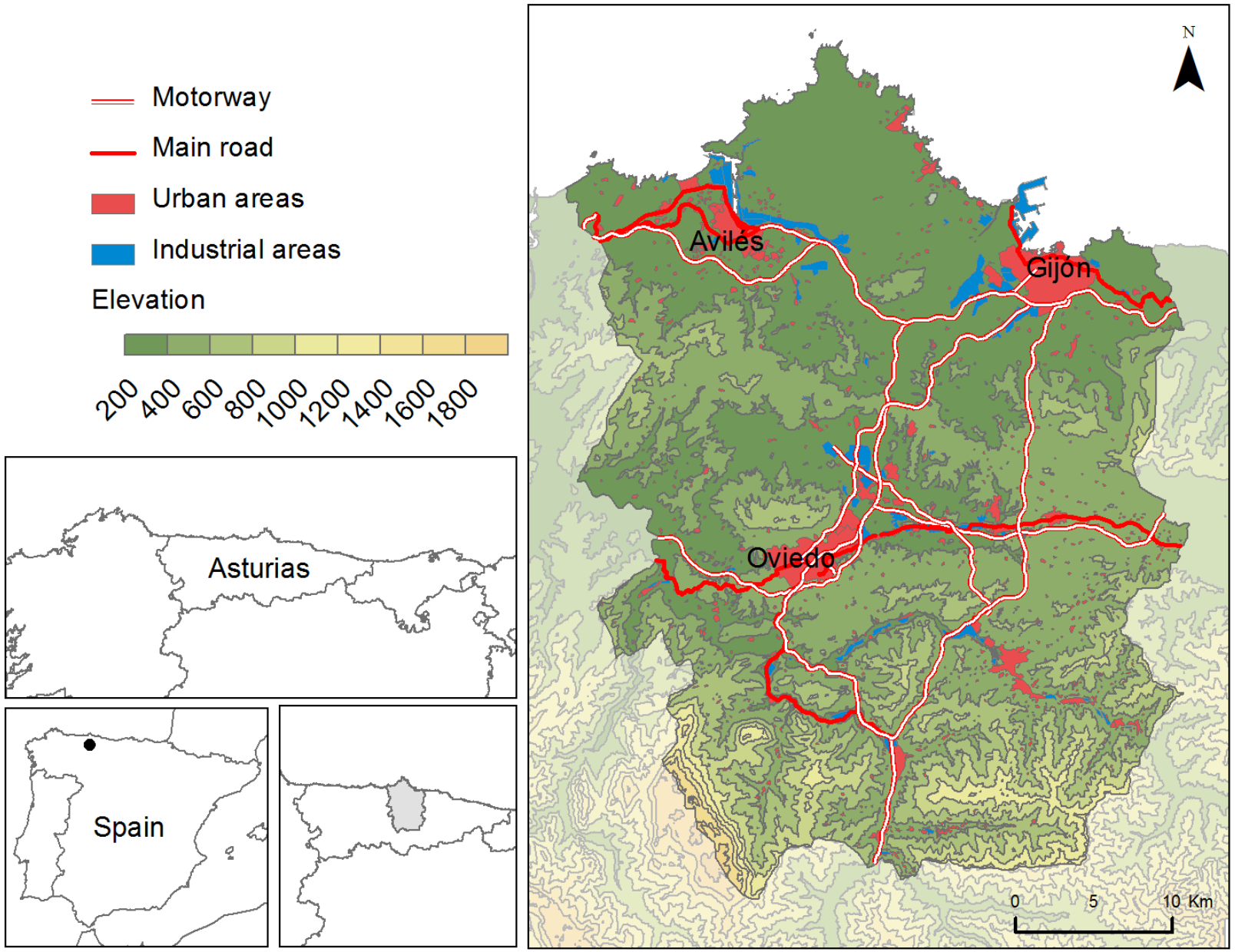
SIOSE

CORINE

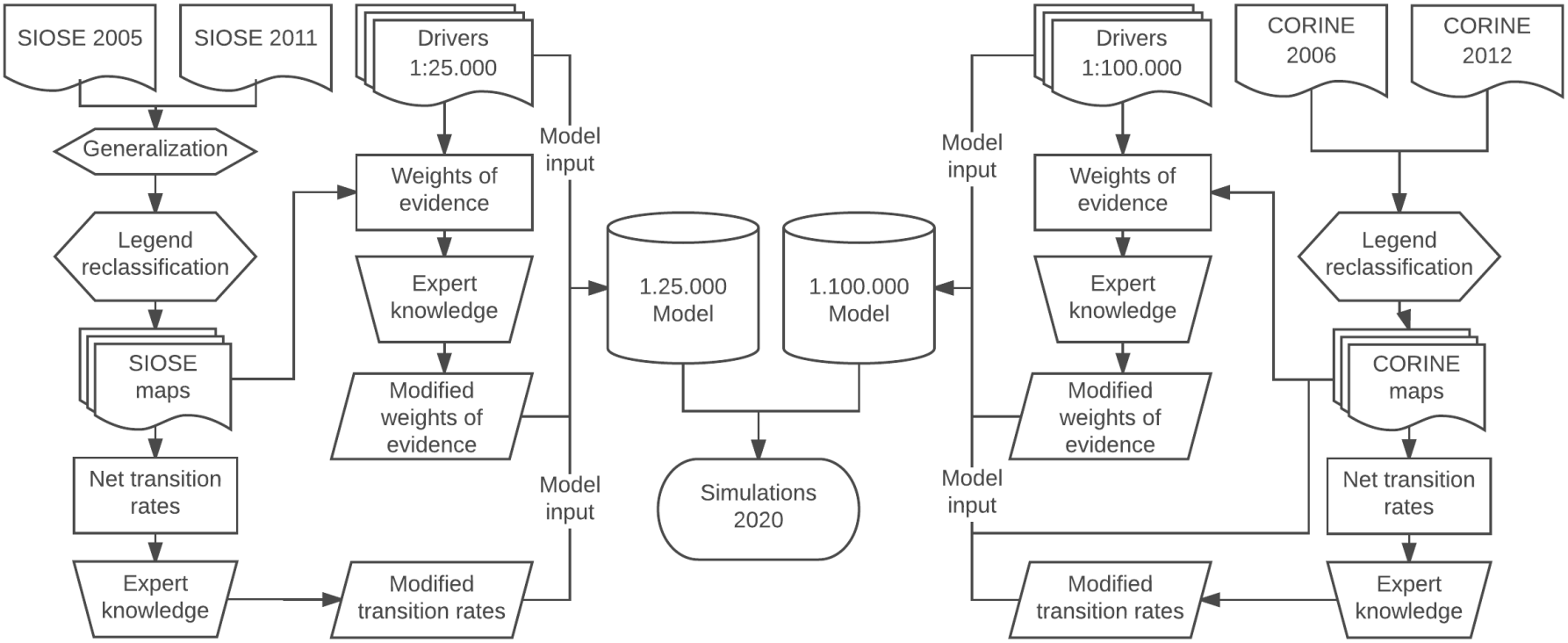


- Continuous urban fabric
- Discontinuous urban fabric
- Industrial or commercial units
- Road infrastructure
- Port areas
- Dump sites
- Construction sites
- Green urban areas
- Sport and leisure facilities
- Arable land
- Fruit trees
- Pastures
- Complex cultivation patterns
- Land principally occupied by agriculture
- Forests
- Scrubland
- Natural grasslands
- Beaches
- Bare rocks
- Marine water

3 Study Area


Motorway
Main road
Urban areas
Industrial areas
Elevation
200
400
600
800
1000
1200
1400
1600
1800
Asturias
Spain
N
Avilés
Gijón
Oviedo
0
5
10 Km

4 Method


SIOSE 2005
SIOSE 2011
Generalization
Legend reclassification
SIOSE maps
Net transition rates
Expert knowledge
Drivers 1:25.000
Weights of evidence
Expert knowledge
Modified weights of evidence
Modified transition rates
Model input
Model input
1.25.000 Model
1.100.000 Model
Simulations 2020
Model input
Model input
Drivers 1:100.000
Weights of evidence
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CORINE 2006
CORINE 2012
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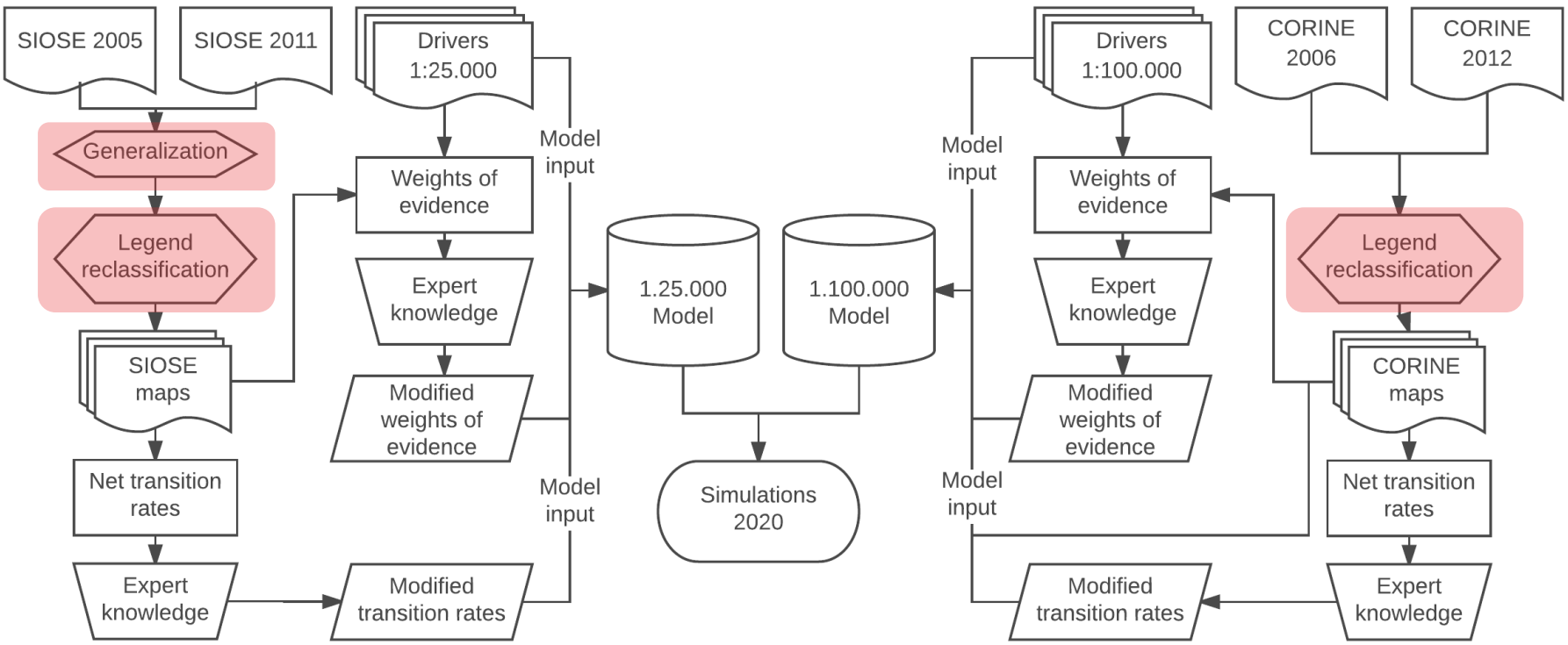
4 Method



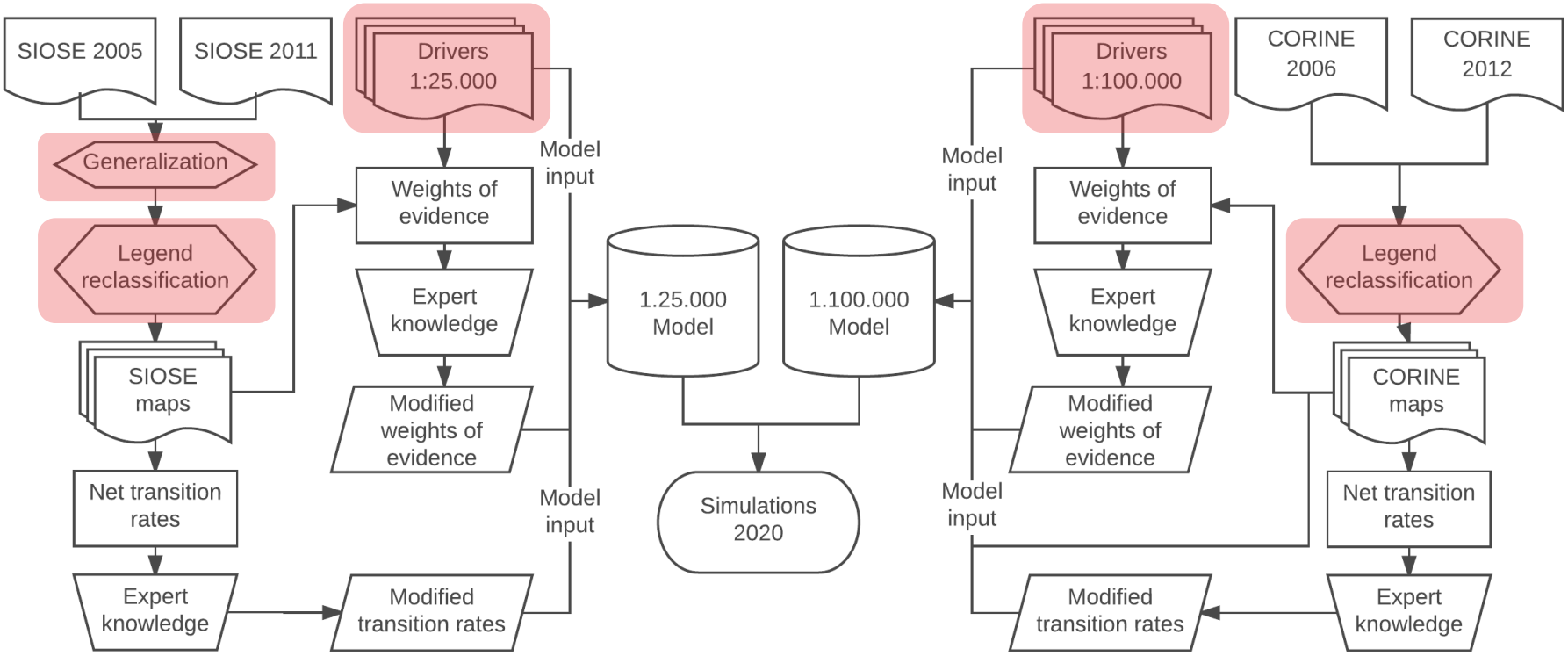
From a description system to a classification System Uncertainty

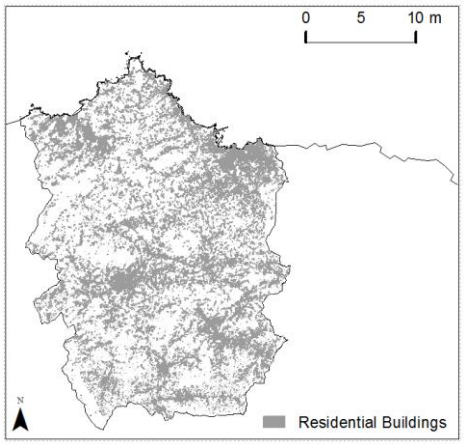
SIOSE → CORINE clases translation Uncertainty

Model inputs

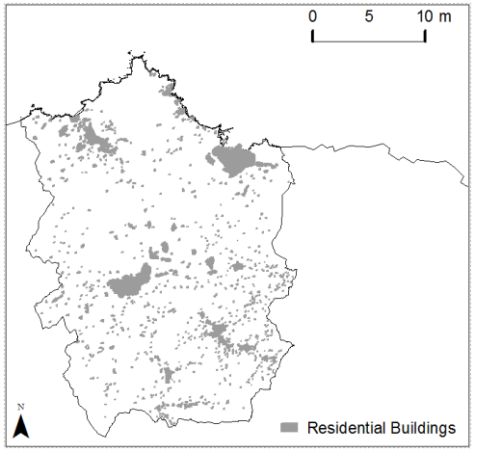
CORINE L3 legend simplification

4 Method

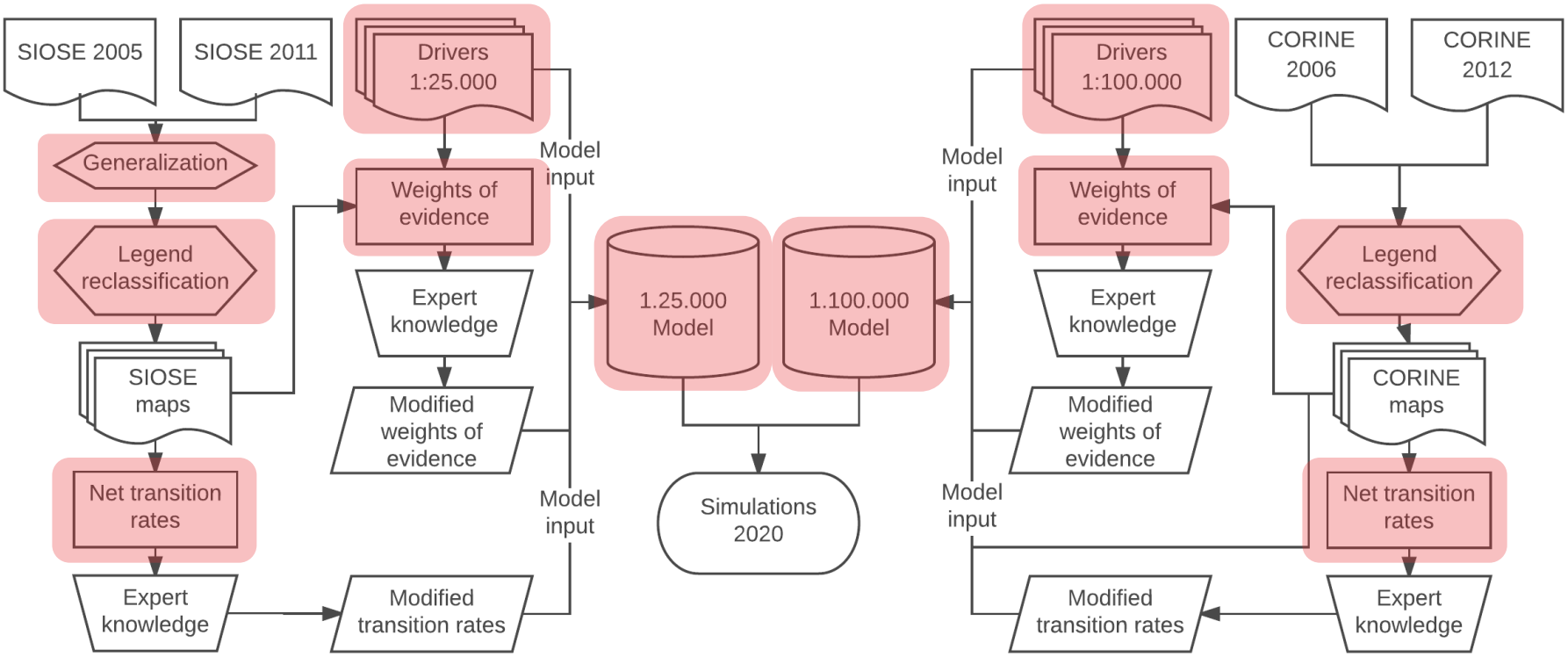




Model inputs



4 Method



DINAMICA EGO

Transition rates: Markov Chains

Probability Maps: Weights of Evidence

Simulation: Expander and Patcher

Model calibration

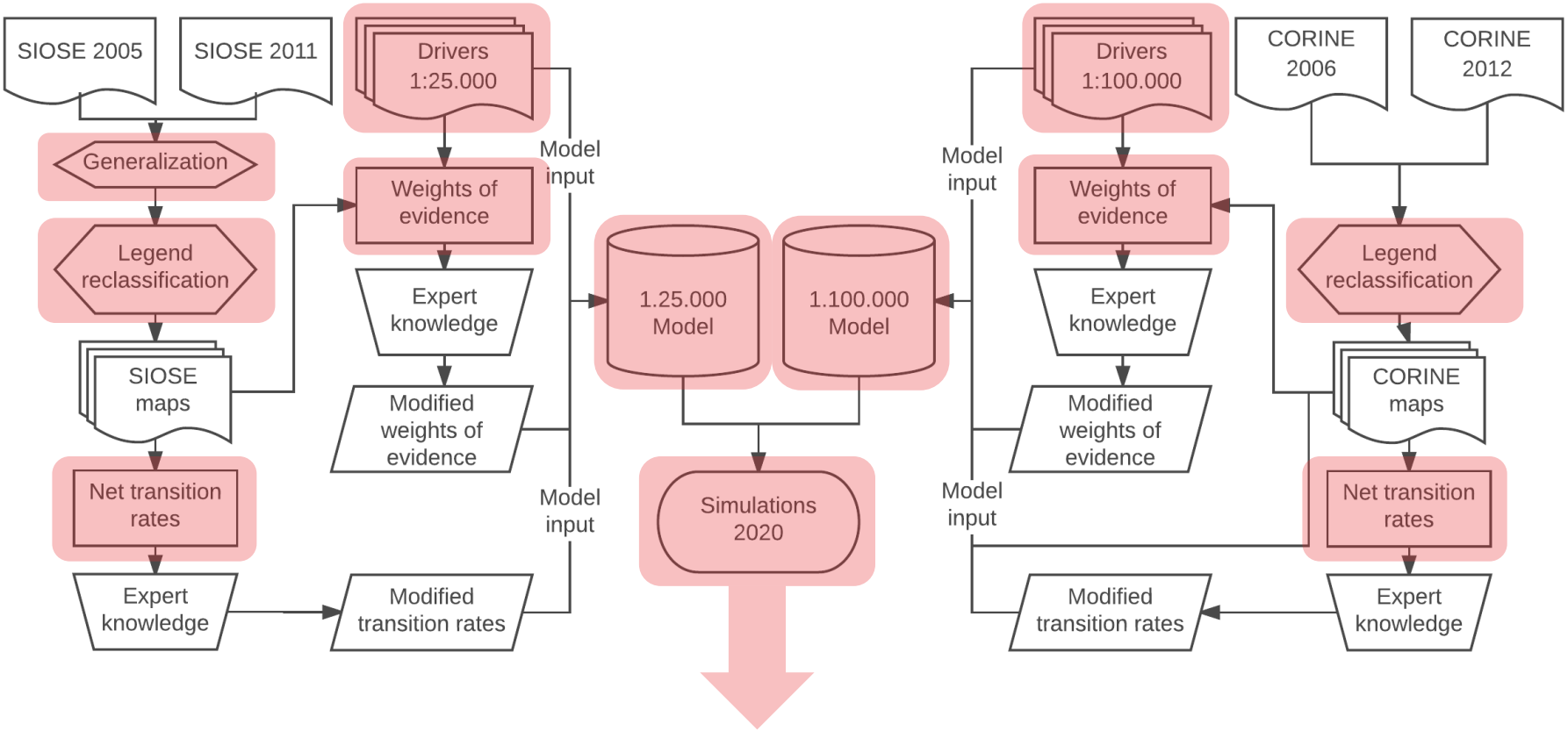
DINAMICA EGO

Transition rates: Markov Chains

Probability Maps: Weights of Evidence

Simulation: Expander and Patcher

4 Method



Comparison through

Pontius and Millones (2011) matrix

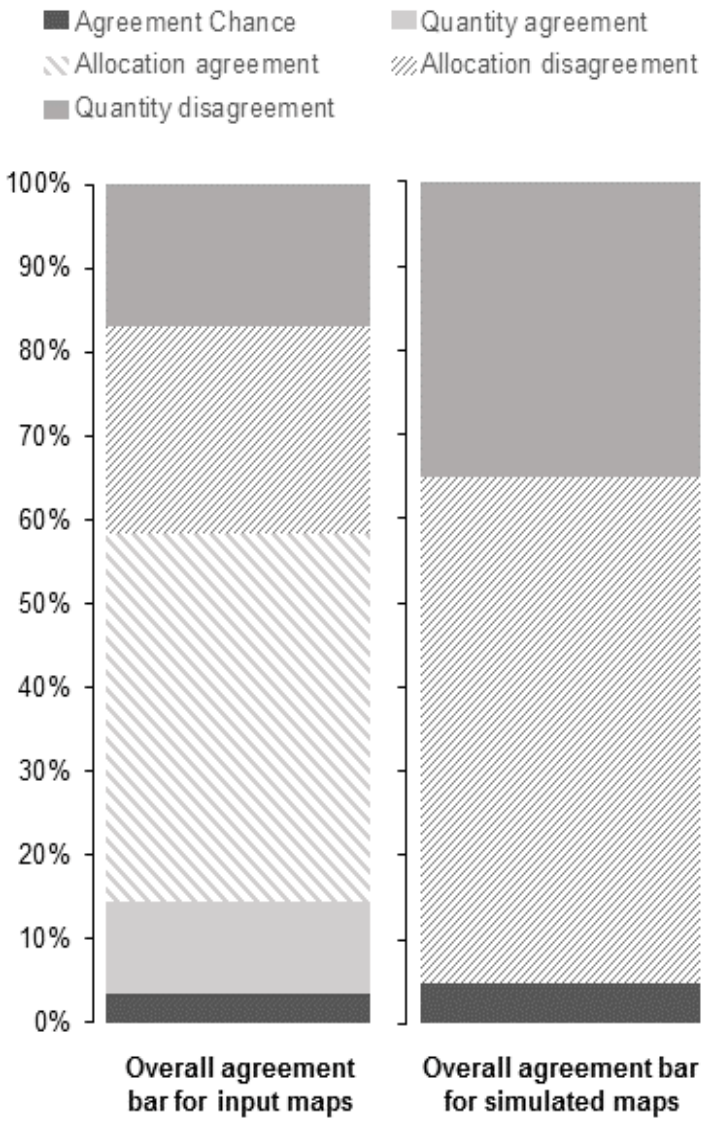
Quantity and allocation disagreement

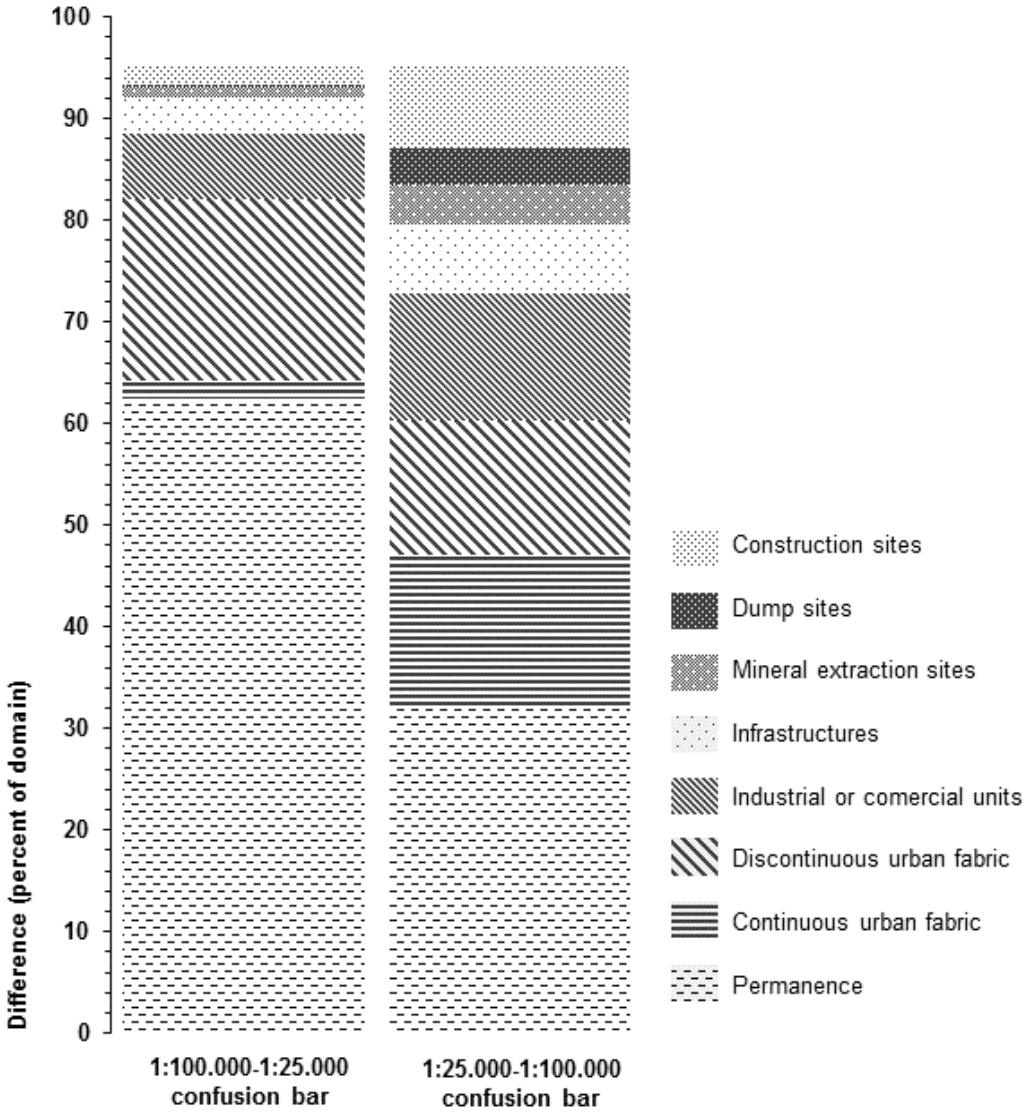
FRAGSTATS

Pattern disagreement

5 Results

Quantity and allocation disagreement





5 Results

Pattern disagreement

Simulated changes 2011-2020	Number of pathes		Area-weighted mean patch area		Patch cohesion index	
	1:25	1:100	1:25	1:100	1:25	1:100
Continuous urban fabric	44	13	10.7344	3.3967	95.0723	71.0631
Discontinuous urban fabric	79	88	11.9334	16.5856	93.7738	80.4932
Industrial or commercial units	81	42	14.9641	8.1407	95.7527	79.9843
Infrastructures	15	4	14.5344	32.3644	96.4041	92.4082
Mineral extraction sites	35	5	1.9123	3.537	90.3935	72.052
Dump sites	11	4	7.7488	5.1667	94.9689	77.3581
Construction sites	118	26	3.3104	2.9085	90.2173	63.8639
Input maps changes 2005-2011	Number of pathes		Area-weighted mean patch area		Patch cohesion index	
	SIOSE	CORINE	SIOSE	CORINE	SIOSE	CORINE
Continuous urban fabric	72	4	19.5006	12.5078	96.4369	86.0809
Discontinuous urban fabric	130	19	11.6396	43.5088	93.5797	92.4059
Industrial or commercial units	130	23	26.328	34.0165	95.7127	89.8172
Infrastructures	8	1	13.3087	35.75	96.6727	93.0449
Mineral extraction sites	64	2	5.3172	18.8616	92.89	88.8021
Dump sites	34	8	5.578	7.3148	93.4537	80.6492
Construction sites	95	10	37.7259	83.333	97.3597	95.4769

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6 Main Findings

- Input maps play an essential role in the model results. In consequence, it is very important to know their uncertainty and accuracy
- The finer the scale of the model, the bigger the quantity of changes to be simulated and the more complex the model
- The modeller has to find a balance between data detail and model complexity
- The bigger the diference between the Minimum Mapping Unit and the spatial resolution, the bigger the cotrast between input maps pattern and scenarios pattern

6 Main Findings

- Validation problem: the model allocates every pixel that change whereas input maps only allocate those pixels that meet the MMU rule
- The flexibility to vary the modelled pattern depend on the scale of the input maps

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Research Project: SIGEOMOD_2020

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ACKNOWLEDGEMENTS

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