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Land use changes in the urban area of Montpellier (2010-2040): Scenarios of the impact of urban sprawl on agricultural land and protection of agricultural land from urban sprawl

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Introduction

Montpellier large urban area, south of France, with periurban and rural communes (2,200 km²) has an important population growth for several decades (707,000 inhabitants in 2010 ; and between +114,000 and +118,000 inhabitants more in 2040). Urban sprawl is an important phenomenon which is a set of challenges for public land policy, development of economic activities and natural heritage management. The French law of modernization of agriculture and fisheries, adopted in July 2010, includes a section that defines the goal of halving the loss of farmland in 2020. To do this, a "National Observatory of Agricultural Land Consumption" was established in June 2011. Lands with high production potential (especially due to the soil nature) would be priority excluded areas to be urbanized.

Materials and Methods

Principle: Land use change modeling using the 'Spacelle' software (Cellular Automata), on the large urban area of Montpellier for the years 2010-2040, by considering different scenarios: (i) a baseline scenario (BAU) as a vision of the urban sprawl and consumption of agricultural land, (ii) an alternative scenario with protection of agronomic potential for crops (national strategic issue), and (iii) a scenario about protection of vineyard (regional issue).

The spatial model uses land use states, spatial constraints (slopes, risk areas, urban planning types), accessibility by transport networks and soil data (Quality soil index, from INRA). Outputs are analyzed with GIS and spatial analysis methods: description of dimensions (areas, patches, relative positions), definition of types of urban sprawls according the scenarios constraints.

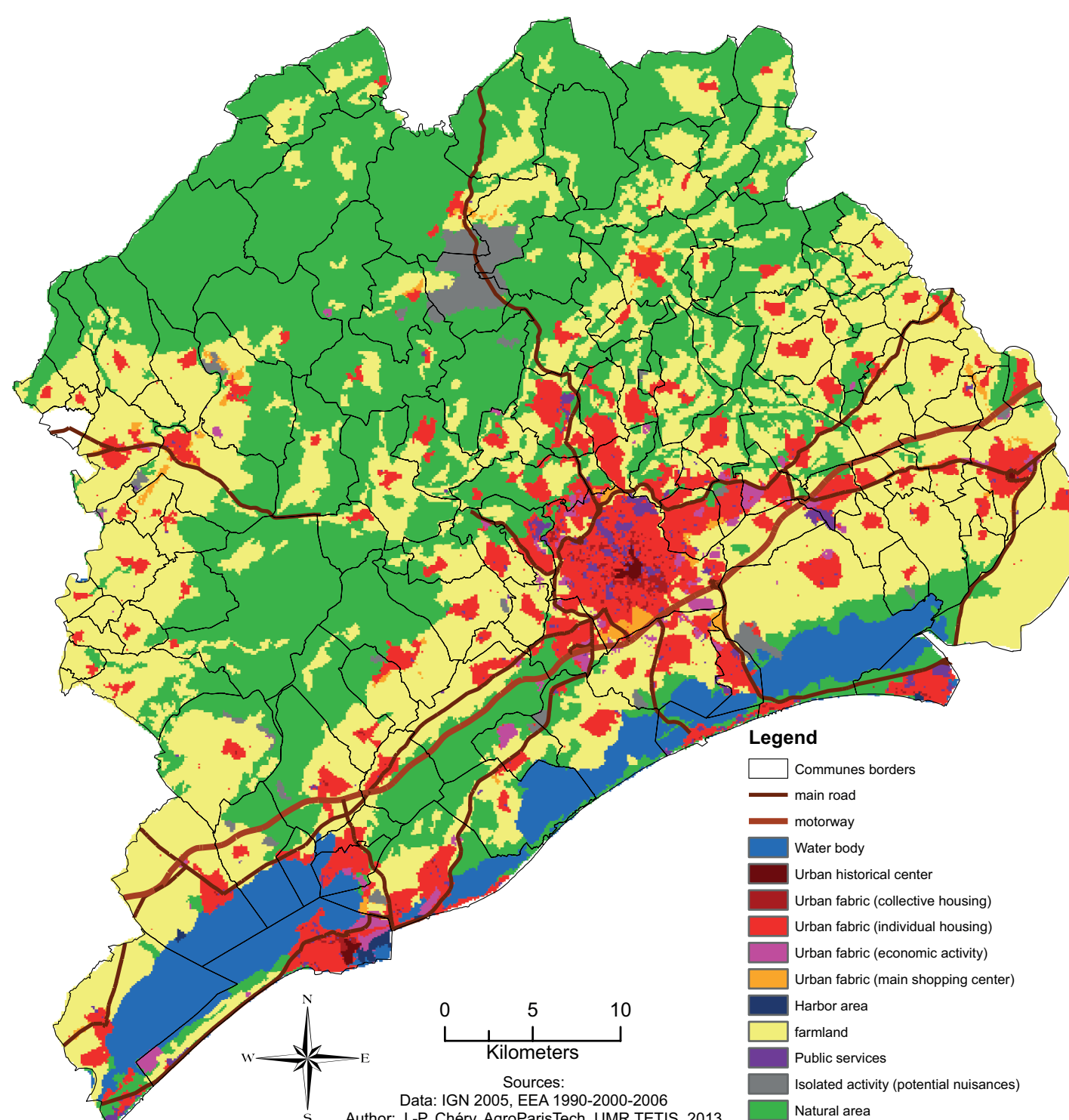


Fig. 2: A land use data for the 'Spacelle' modelling: Corine Land Cover (EEA, 2006) and added informations (public services, transport networks, IGN, 2005). Application of Montpellier case study.

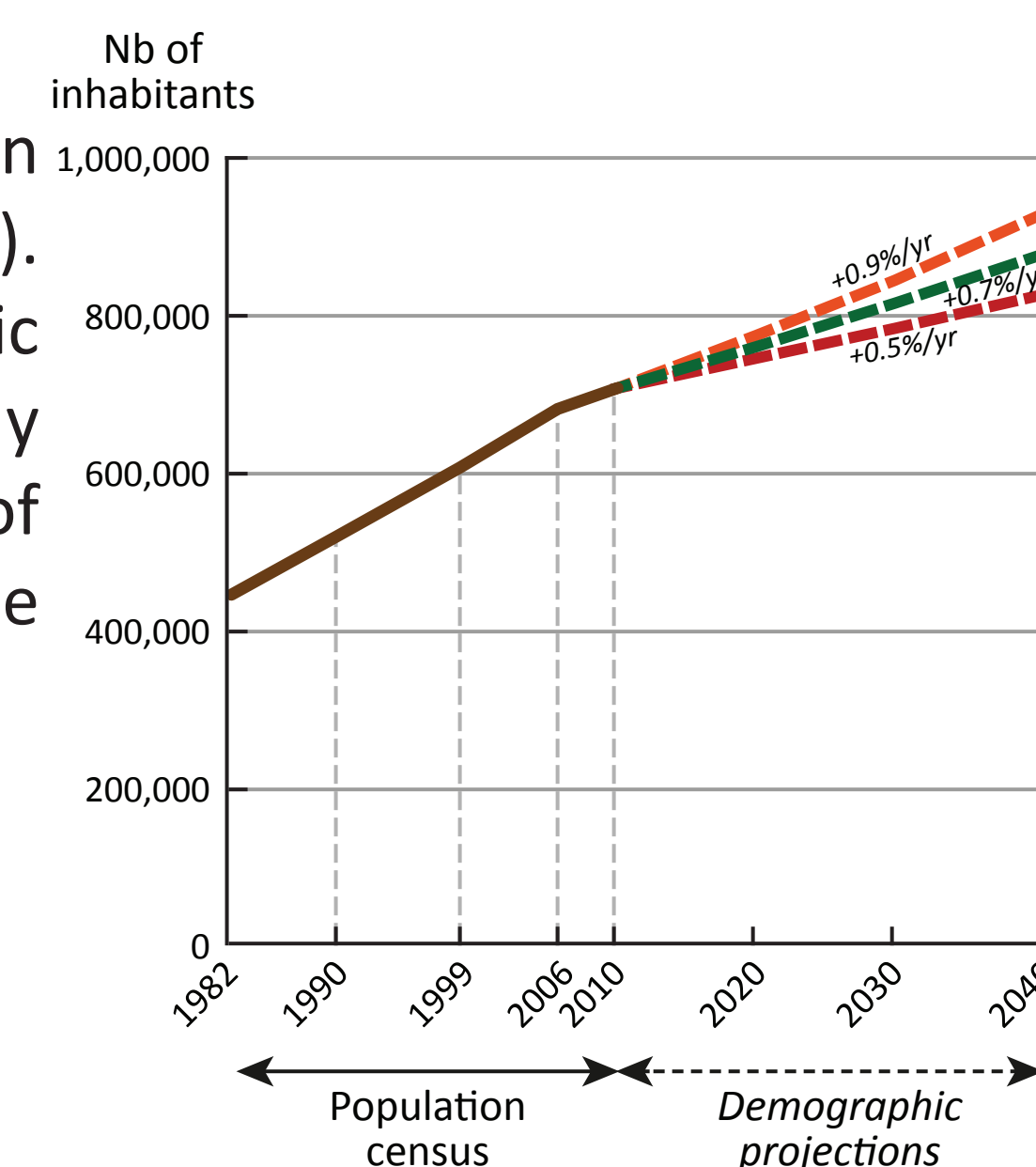


Fig.1: The demographic growth in the Montpellier large urban area (134 communes), main cause of the urban sprawl (source: INSEE, 2010)

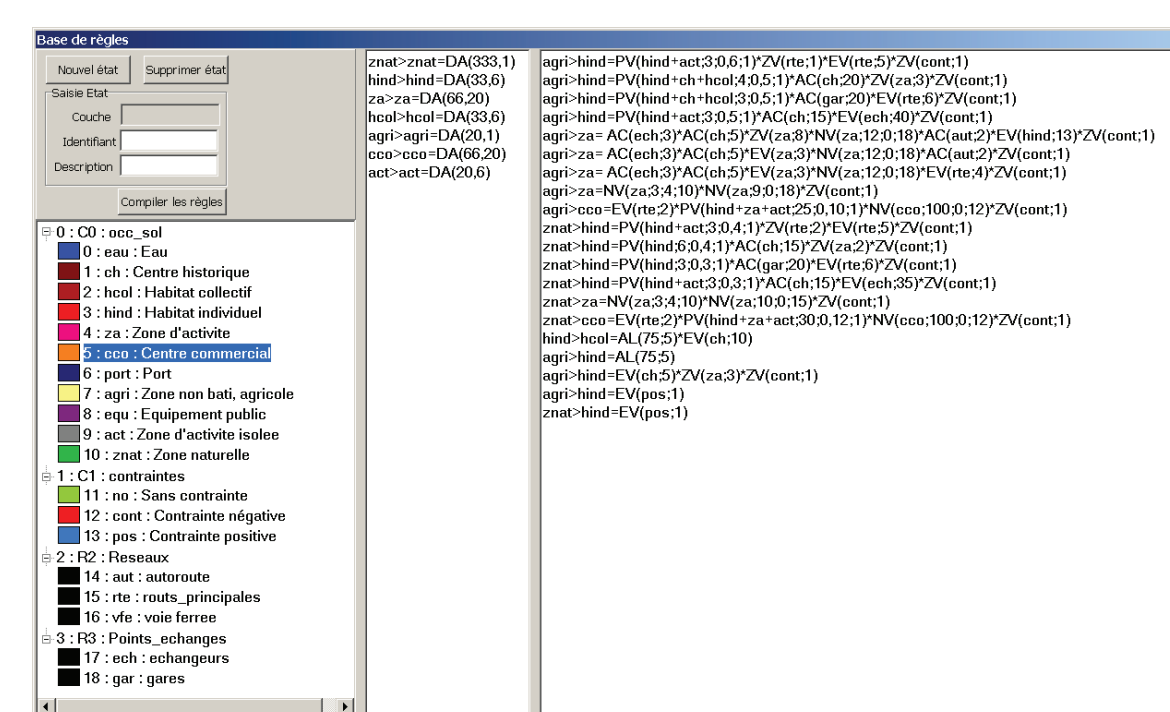


Fig. 3: 'Spacelle' cellular automata interface (v. 5.1.8): Definition of states and rules. Application of Montpellier case study. Spacelle is developed by P. Langlois, University of Rouen

Fig. 4: Map of simulation outputs, according the three scenarios (year 2040): types of evolutions by combinaison of results

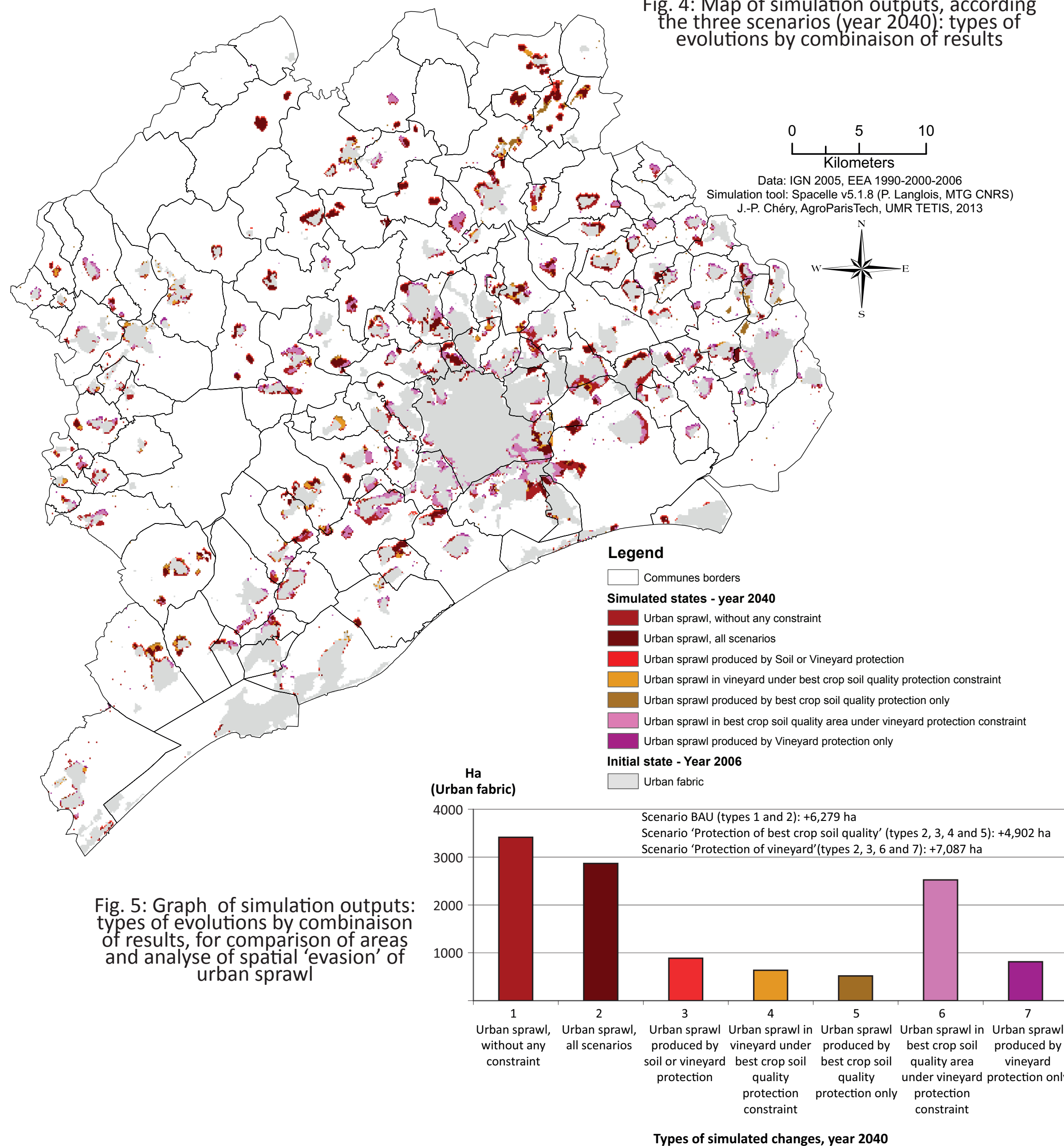
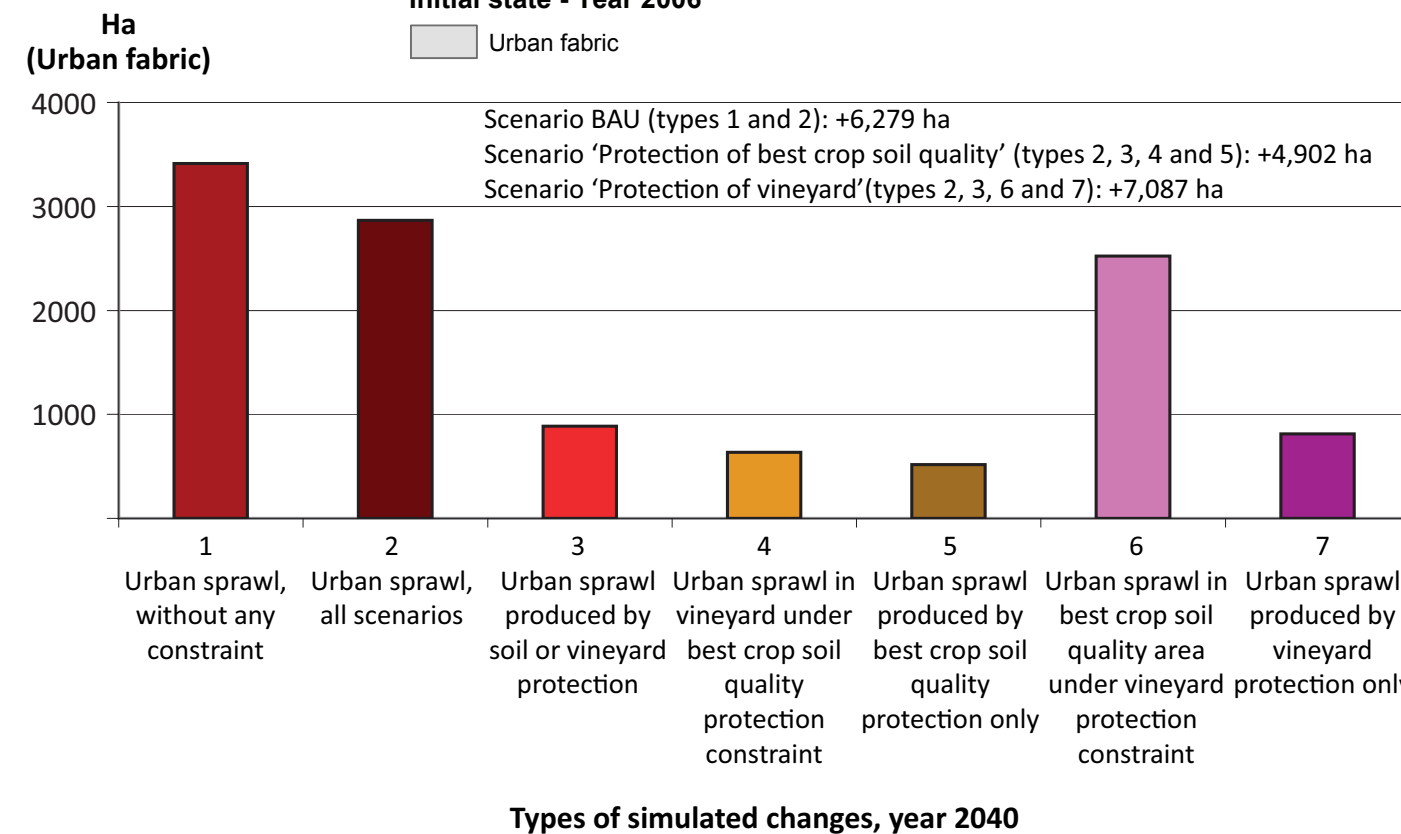


Fig. 5: Graph of simulation outputs: types of evolutions by combinaison of results, for comparison of areas and analyse of spatial 'evasion' of urban sprawl



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