SPATIAL DIFFUSION MODELING IN SIMULATION OF SUBURBAN SPRAWL
A Case Study in the Chicago Metropolitan Region

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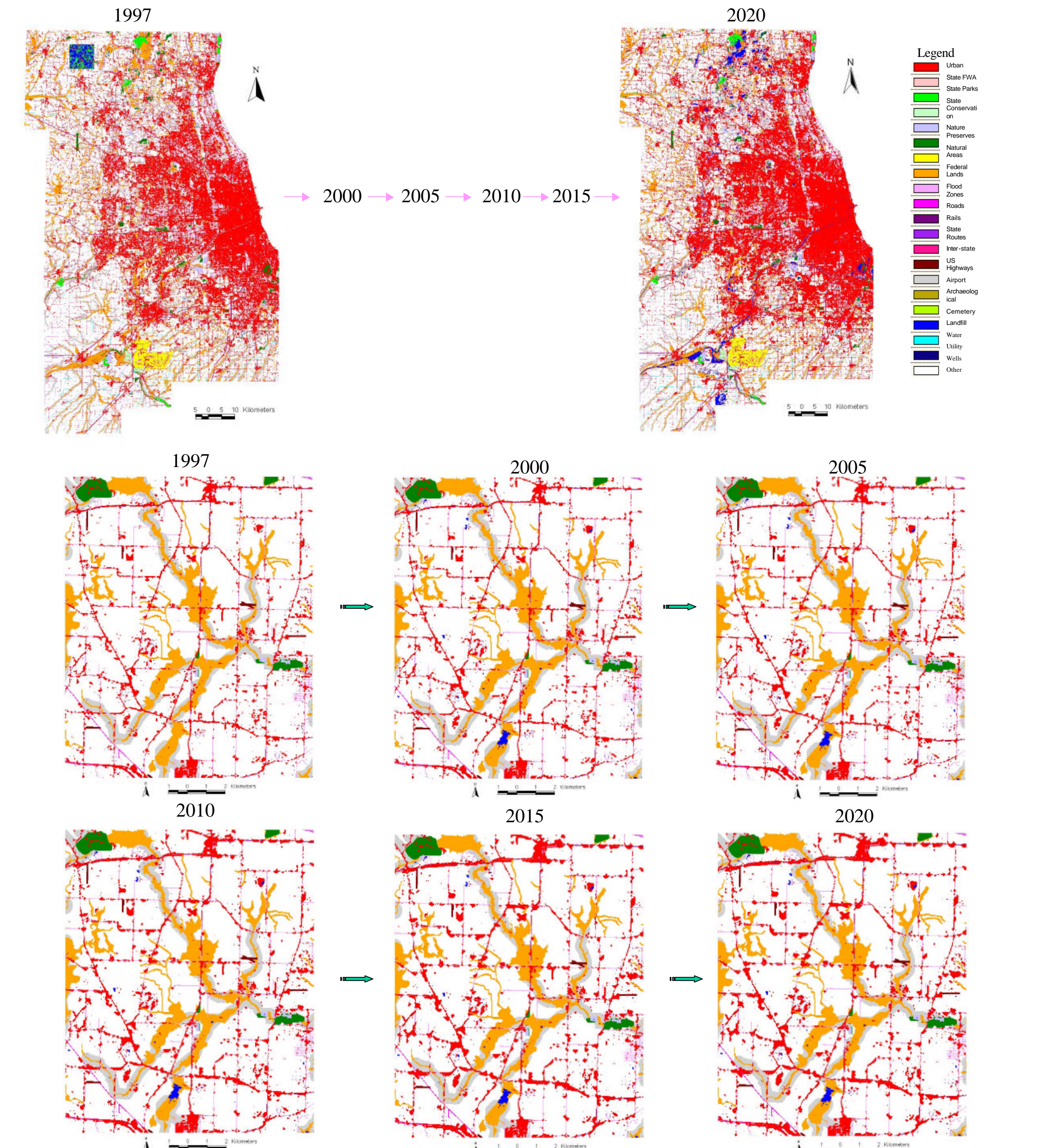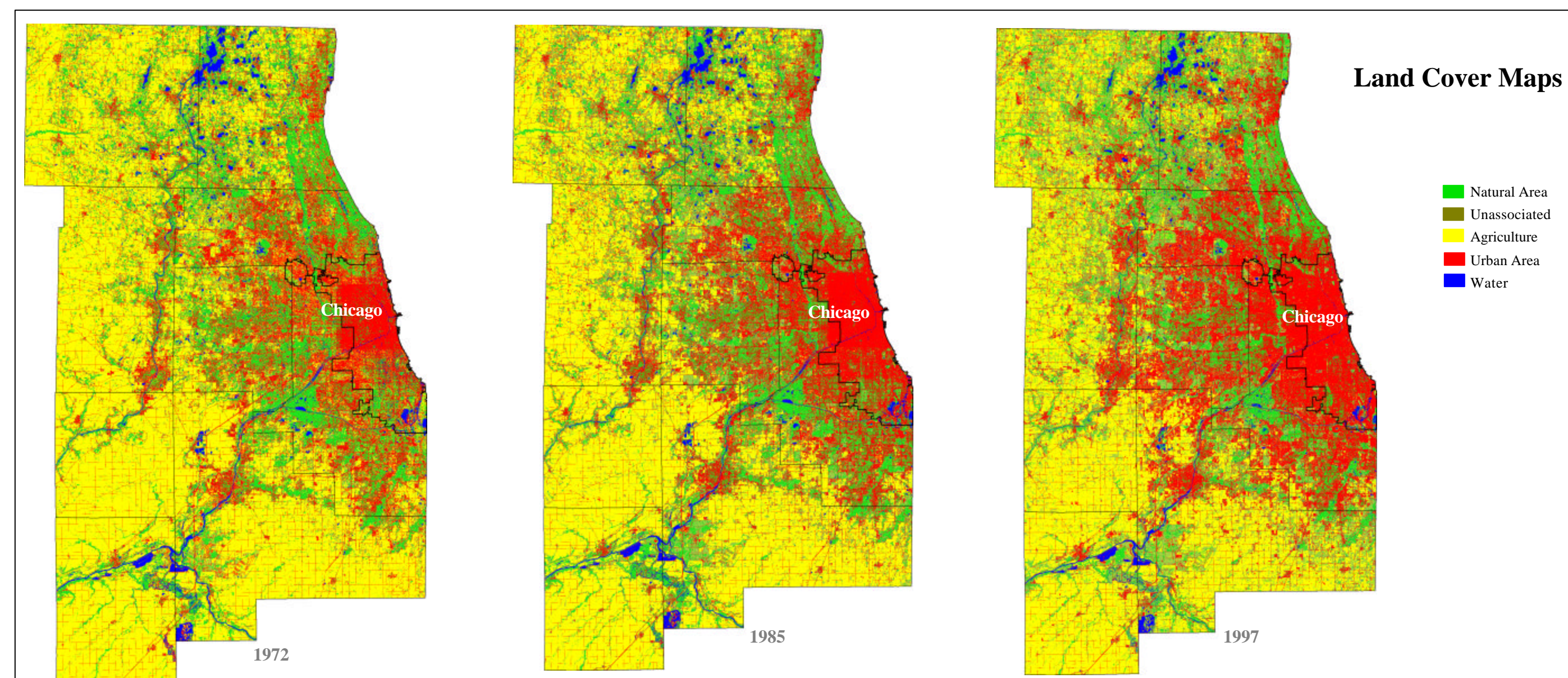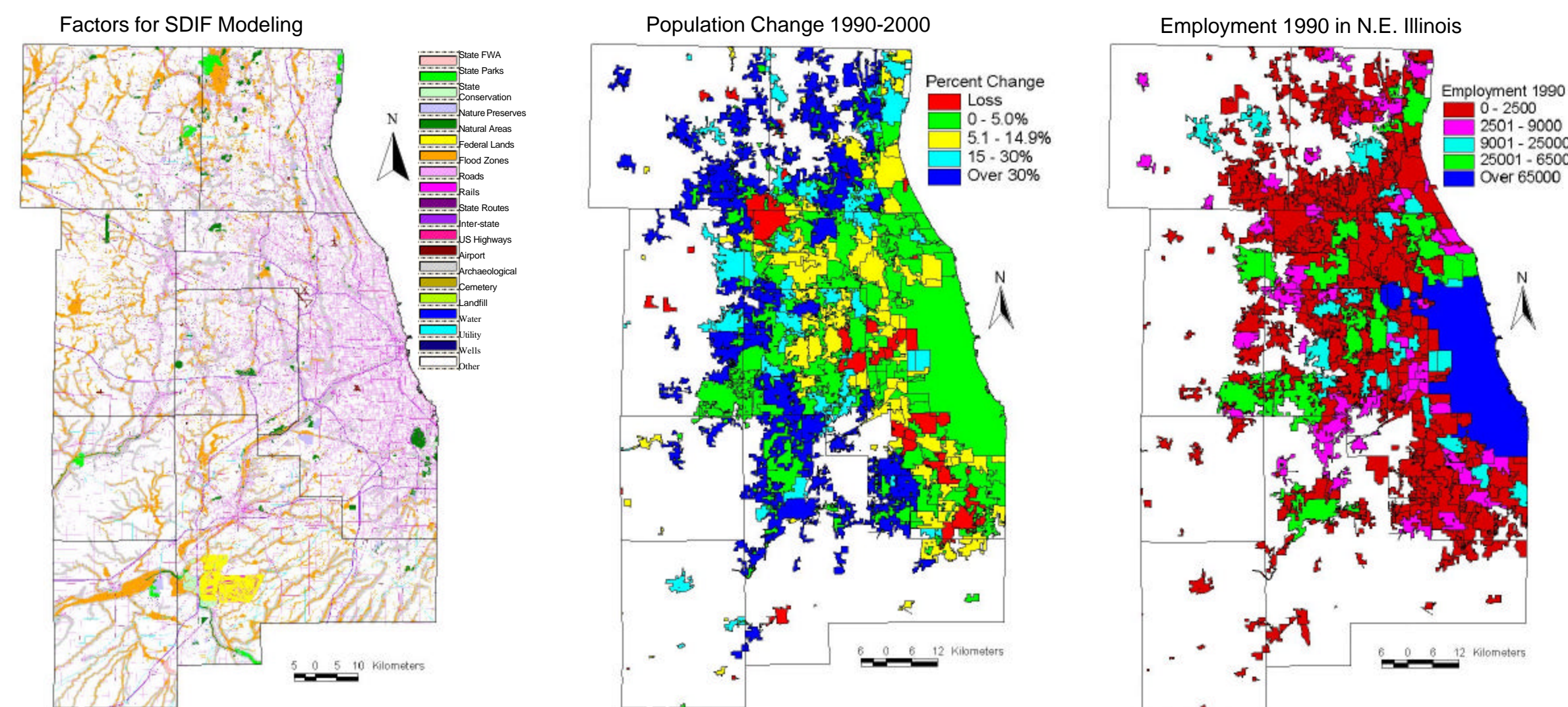
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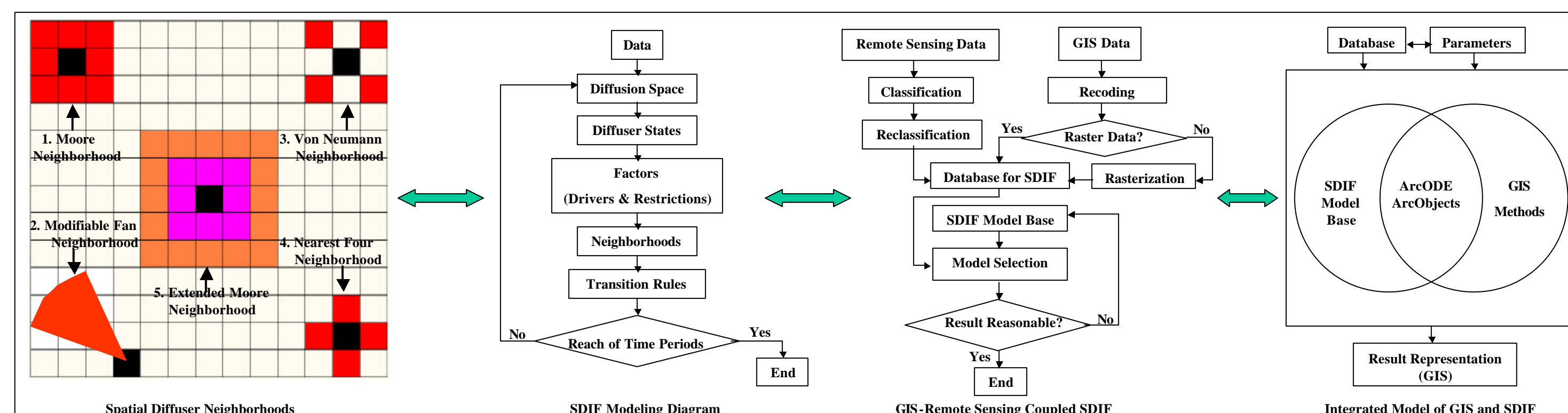
INTRODUCTION

Spatial diffusion phenomena occur because of the existence of a concentration gradient of information or material flow. The spatio-temporal process of suburban sprawl manifests the dynamic mechanism of spatial diffusion, the existence of concentration gradient. In this study, we developed a new methodology, spatial diffusion (SDIF) model to simulate suburban sprawl in the Chicago metropolitan region. Remote sensing, GIS and Census data were applied in the modeling process.

DATA

• Land cover data of 1972, 1985 and 1997 obtained from classification of Landsat images, and other available GIS data.

• Projection of the region's population, households and employment for the year 2020, which was made by the US Census Bureau and endorsed by the Northeastern Illinois Planning Commission (Drivers).

• Federal land, natural preserves, state conservation, open water, state parks, and state fish and wildlife areas (Barriers).

• Transportation, Federal or State policy.

Factors for SDIF Modeling

Population Change 1990-2000

Employment 1990 in N.E. Illinois

Land Cover Maps

Legend: Natural Area, Unassociated, Agriculture, Urban Area, Water — 1972, 1985, 1997

MODELING PROCEDURES

Spatial Diffuser Neighborhoods
1. Moore Neighborhood
2. Modifiable Fan Neighborhood
3. Von Neumann Neighborhood
4. Nearest Four Neighborhood
5. Extended Moore Neighborhood

SDIF Modeling Diagram

GIS-Remote Sensing Coupled SDIF

Integrated Model of GIS and SDIF

1997, 2000, 2005, 2010, 2015, 2020

Category	1972	1985	1997	2000	2020
Urban	221097	259965	338868	347005	387603
Natural Area	229805	208959	175659	173236	161332
Unassociated	66276	181739	234016	229526	211028
Agricultural	618910	489107	394974	393814	383620

Category	1997-2000	2000-2020
Urban->Urban	4191966	4272149
Natural Area->Urban	29825	146556
Unassociated->Urban	55280	227737
Agricultural->Urban	14285	125500

DISCUSSION

Most traditional models for urban sprawl are static, and are not efficient nor effective for simulating urban sprawl phenomena. Based on urban sprawl's dynamic characteristics, and according to the mechanism of spatial diffusion, a new modeling method for urban sprawl has been developed: spatial diffusion(SDIF) modeling. Since the SDIF model considers the spatial dynamics of urban sprawl phenomena, and also as many factors as possible, it is a feasible way to predict the trend of urban sprawl in any metropolitan region.