Using Geographic Information Systems To Support Conservation Management Decisions

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Using Geographic Information Systems To Support Conservation Management Decisions

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Introduction

Global changes threaten open semi- natural habitats that are collapsing and even completely disappearing. Their conservation is a priority to halt the biodiversity loss.

Semi- natural habitats appeared in most cases after forest clearance, several thousands of years ago and maintained by traditional agro-pastoral practises during the last 3000 years.

In the last decades, traditional management has nearly disappeared and since semi- natural habitats are not climax vegetation, they are being invaded by forest or other vegetation.

Semi- natural habitats conservation requires consistent and permanent management action to control the natural vegetation succession.The European heathland habitat is a typical example of such an active management.

**Heathland Man and Biosphere Reserve of Fontainebleau (France)**
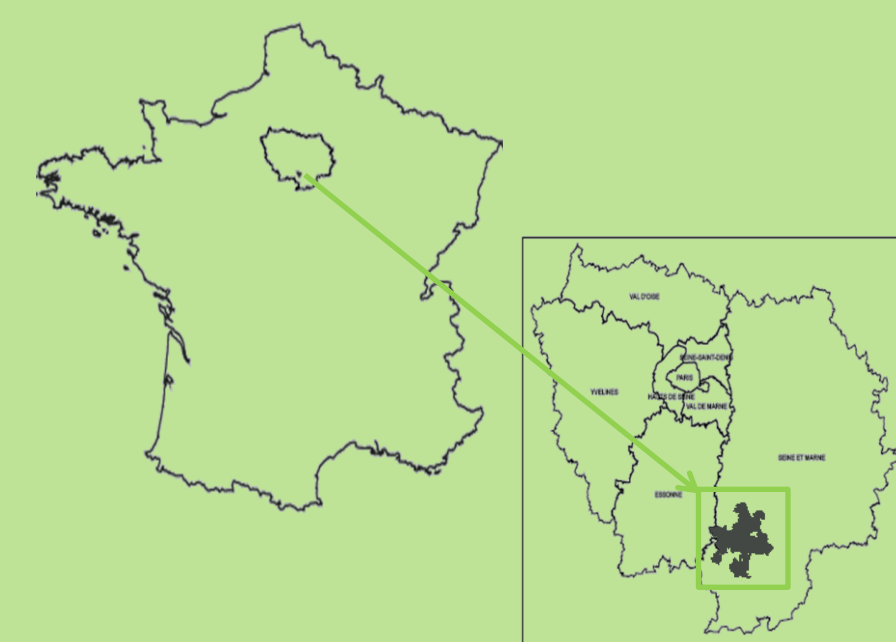
This study aims to demonstrate how spatial methods can used to identifying and monitoring vegetation dynamic and contribute therefore, to the design of reliable management methods of habitats such as the heathlands and other open habitats, which needs constant management to prevent succession to woodland.
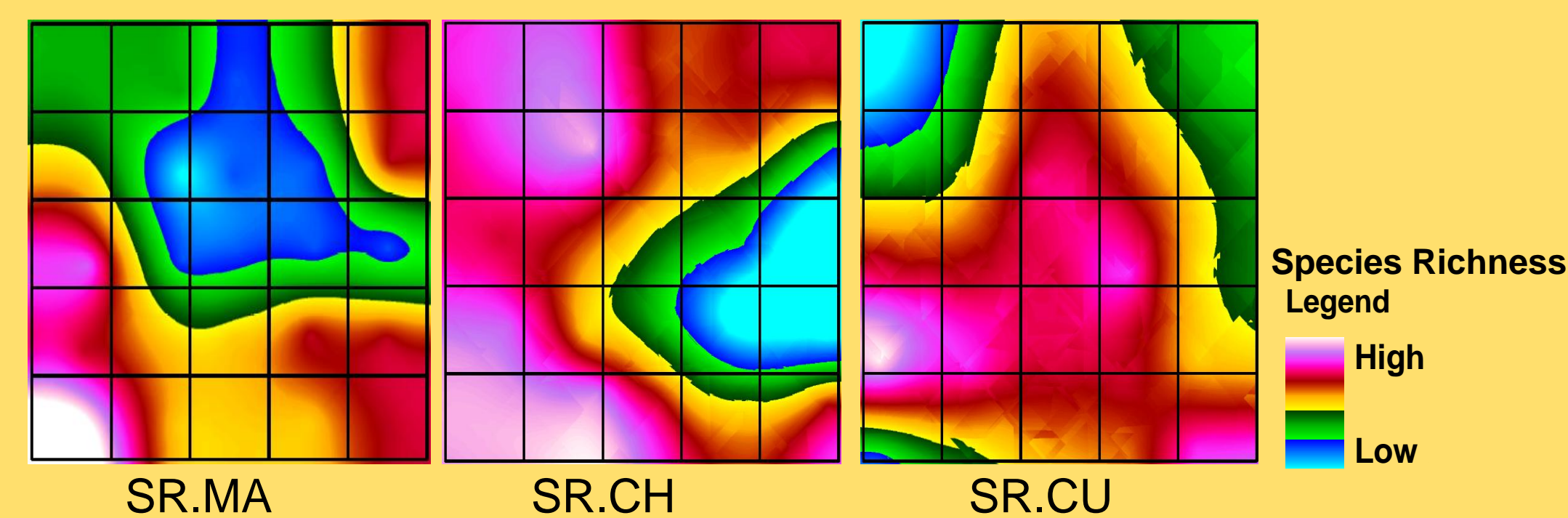
The Importance Of Spatiotemporal Heterogeneity For Biodiversity

This study was carried out on three sites (1 km² each) situated in Fontainebleau.
Three taxonomic groups have been studied : Vascular plants, Bryophytes and Carabids.

Mares aux Joncs   Chanfroy   Cul de chien
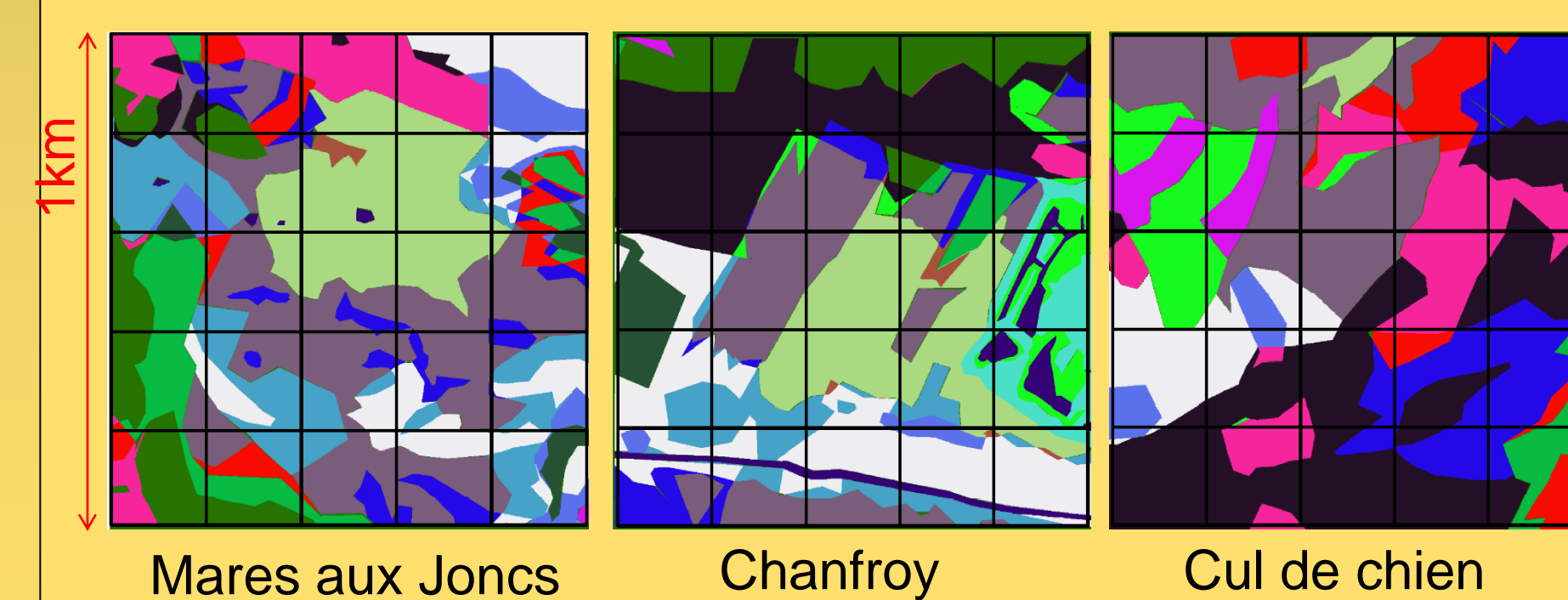
Habitat heterogeneity maps

Species Richness Legend
High
Low

SR.MA   SR.CH   SR.CU

Species Richness maps

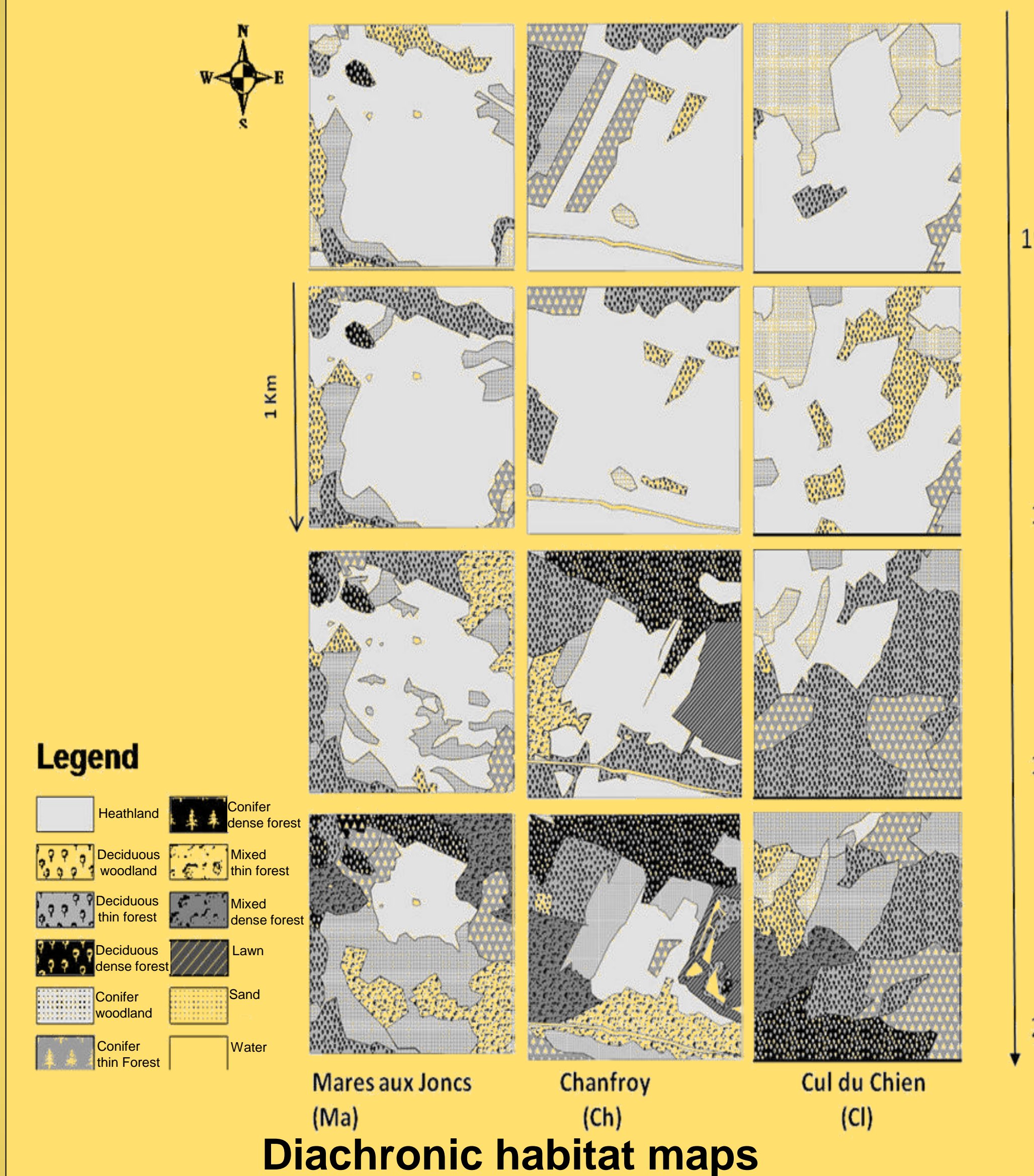Local diversity was studied in calculating species richness (SR) index.
Diversity index data were integrated into a GIS. A geostatistical study was conducted to obtain global species richness maps.
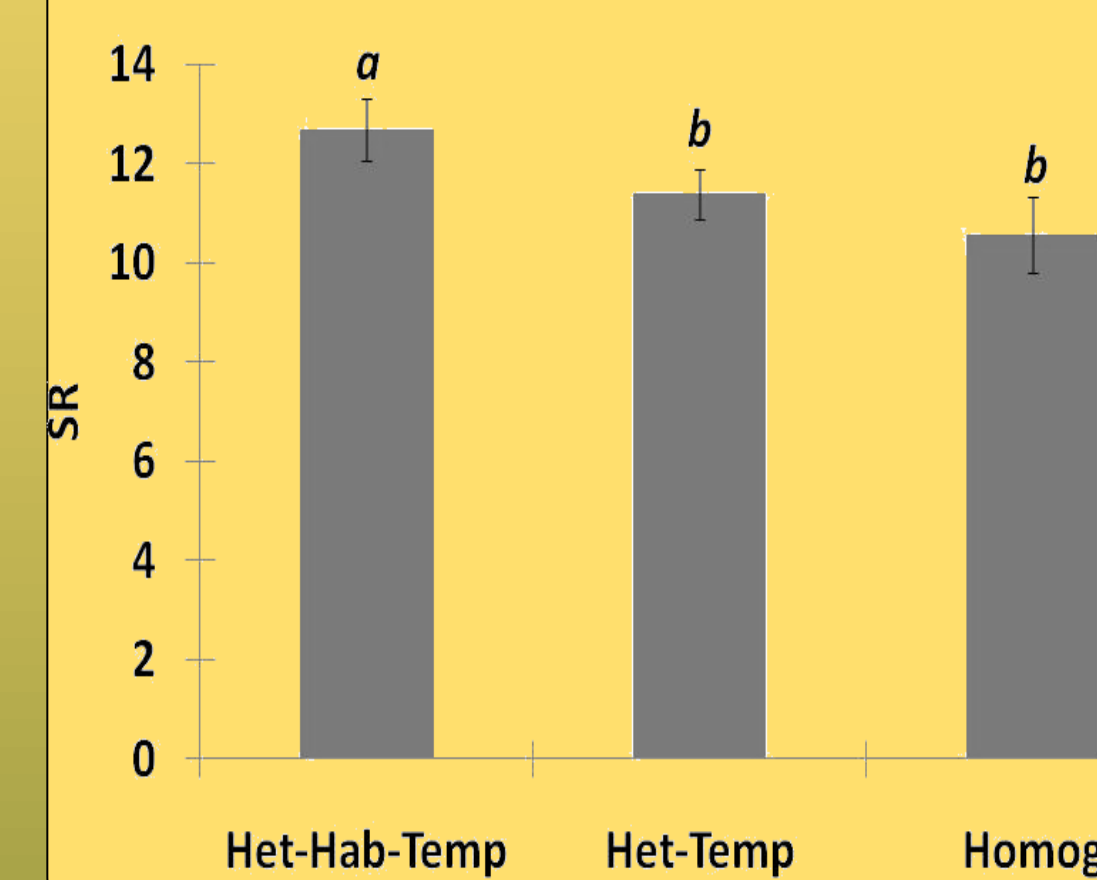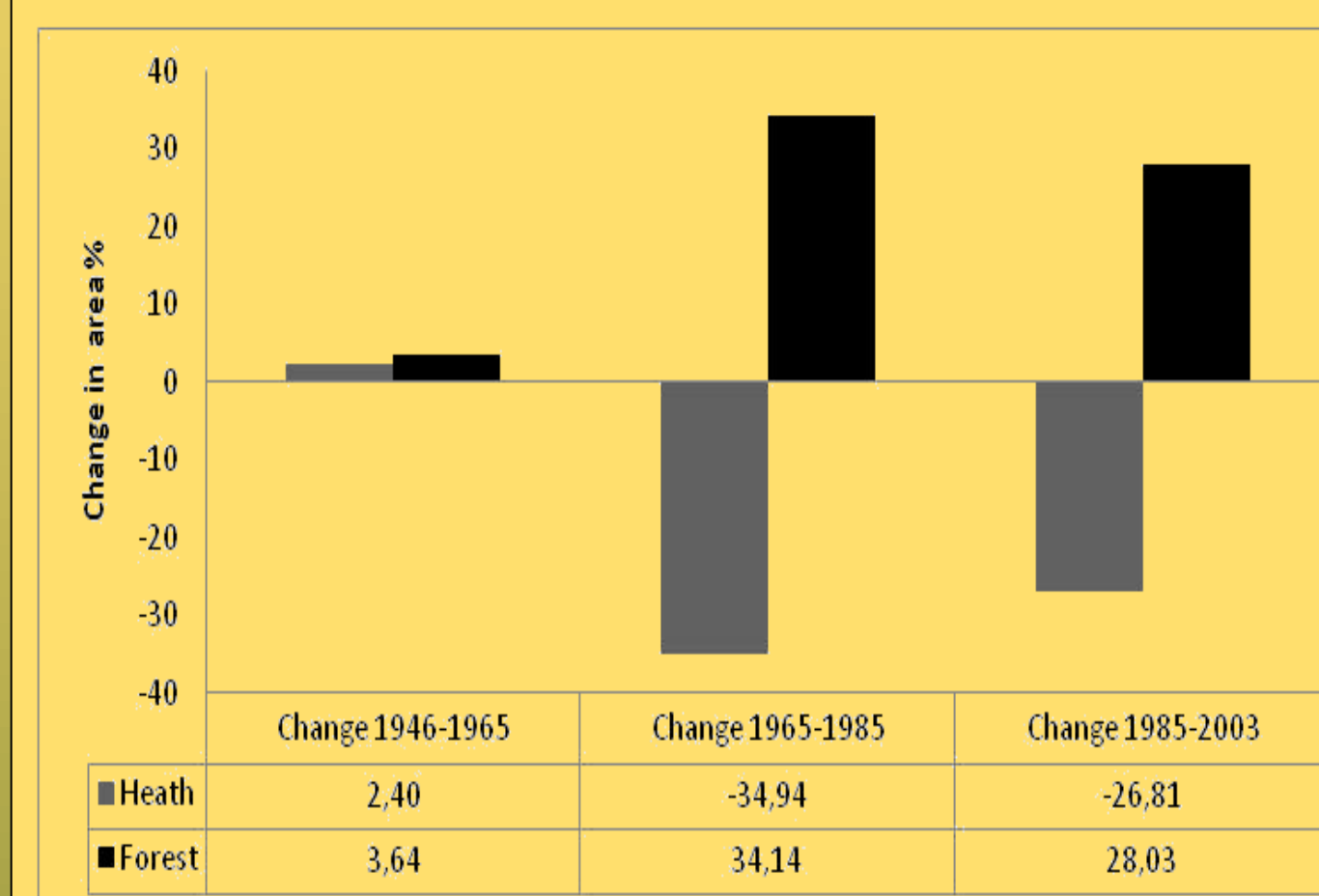
The result of the statistical test (Kruskal-Wallis) and the mean comparisons (Bonferroni) showed that the biodiversity indices were higher in spatio-temporal heterogeneous area.

GIS Use To Assess The Loss Of Open Habitat

The natural colonisation of the open areas was studied by the analysis of old aerial photos on three sites (1 km² each) situated in Fontainebleau.

1946
1965
1985
2003

Legend

Heathland	Conifer dense forest
Deciduous woodland	Mixed thin forest
Deciduous thin forest	Mixed dense forest
Deciduous dense forest	Lawn
Conifer woodland	Sand
Conifer thin Forest	Water

Mares aux Joncs (Ma)   Chanfroy (Ch)   Cul du Chien (Cl)

Diachronic habitat maps

|	Change 1946-1965	Change 1965-1985	Change 1985-2003
Heath	2.40	-34.94	-26.81
Forest	3.64	34.14	28.03

In our study sites, the forest had colonised 60% of open heathland since the 1940's

The Use Of Diachronic Spatial Approaches Predictive Modelling To Study The Vegetation Dynamics In Managed Habitats

This study focuses on a 4.4 ha of managed heathland, in this site the managers aim to maintain heathlands by cutting the new growth of the woody species individuals.

We conducted vegetation surveys in 2000 and again in 2008 using a grid of 440 quadrat (10x10 m)
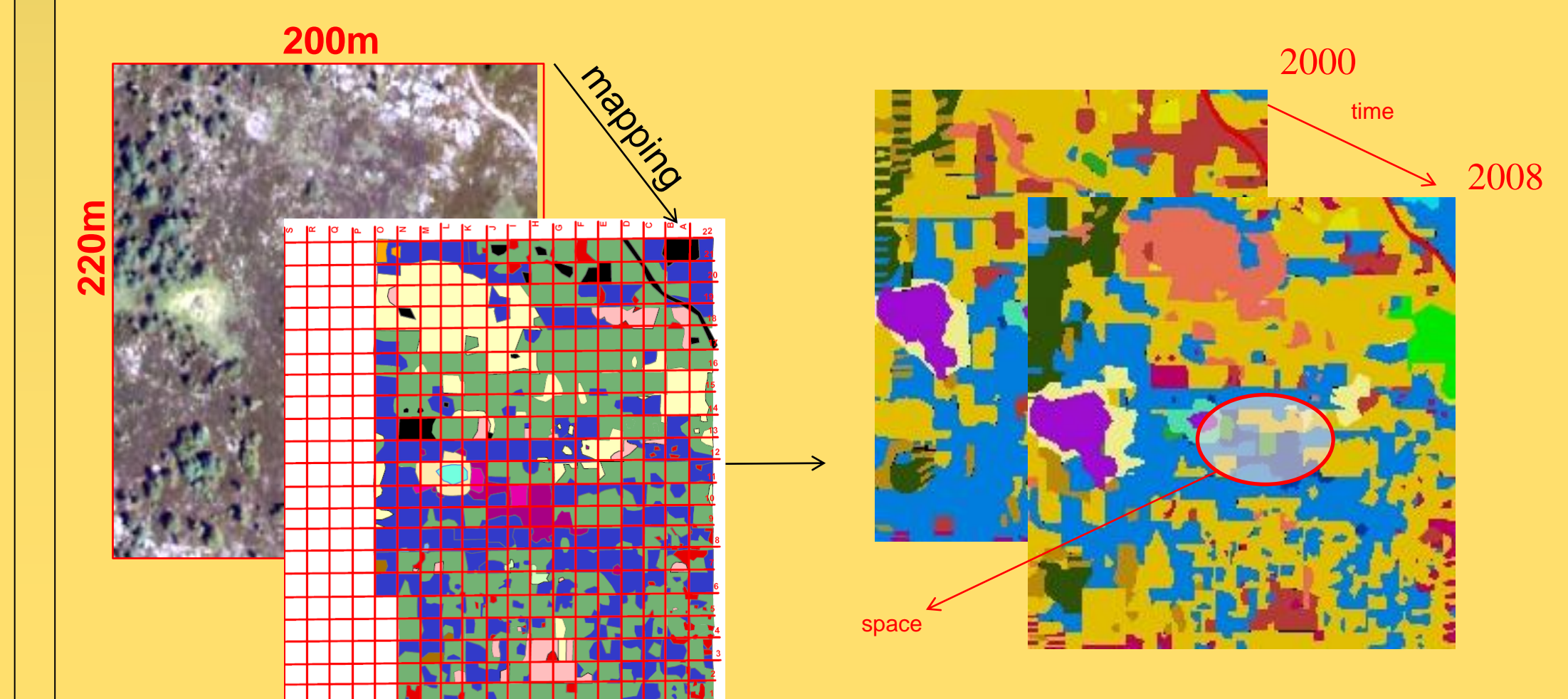
We used the Geomatics GIS models for the simulation of the vegetation dynamics: the Markov chains with memory is used for the temporal aspect and cellular automata for the spatial dependence by assigning priority to contiguity .

2000   2008   Model   2016   2024   2032
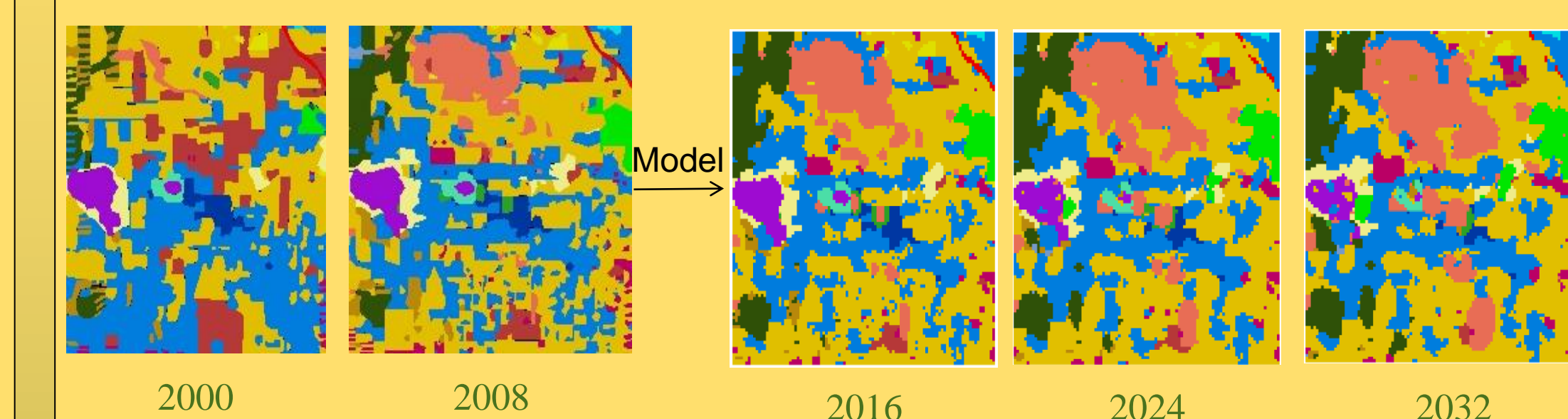
The general trend of predicted changes to the studied heathland is primarily the expansion of Grasses at the expense of Heather despite the application of measures to maintain this habitat.

MOBAIED et al. Biodiversity and Conservation (2011) 20 (1):73–88

Conclusion

Conservation management has to take the spatial conditions into account, but also the temporal development of different environmental characteristics that affect the habitat. In our study sites, we observed the constantly spontaneous reforestation of open habitat.
The remaining heathland patches are embedded in the centre of a dynamic forest, the simple management methods that have been used until today have become inefficient under these conditions. A revision of the management methods is now required deal with the new spatial conditions. New techniques are also necessary to maintain mosaics of woodland and heathland habitats. This spatial approach has given us the opportunity to identify the correlation between the dynamics of heathland and the spatial variability of soil and of local physiographic factors . Our previous studies demonstrate how spatial methods can used to identifying and monitoring vegetation change and contribute therefore, to the design of reliable management methods of habitats such as the heathlands and other open habitats.