Animal communities and populations in changing mediterranean landscapes

from patterns to processes

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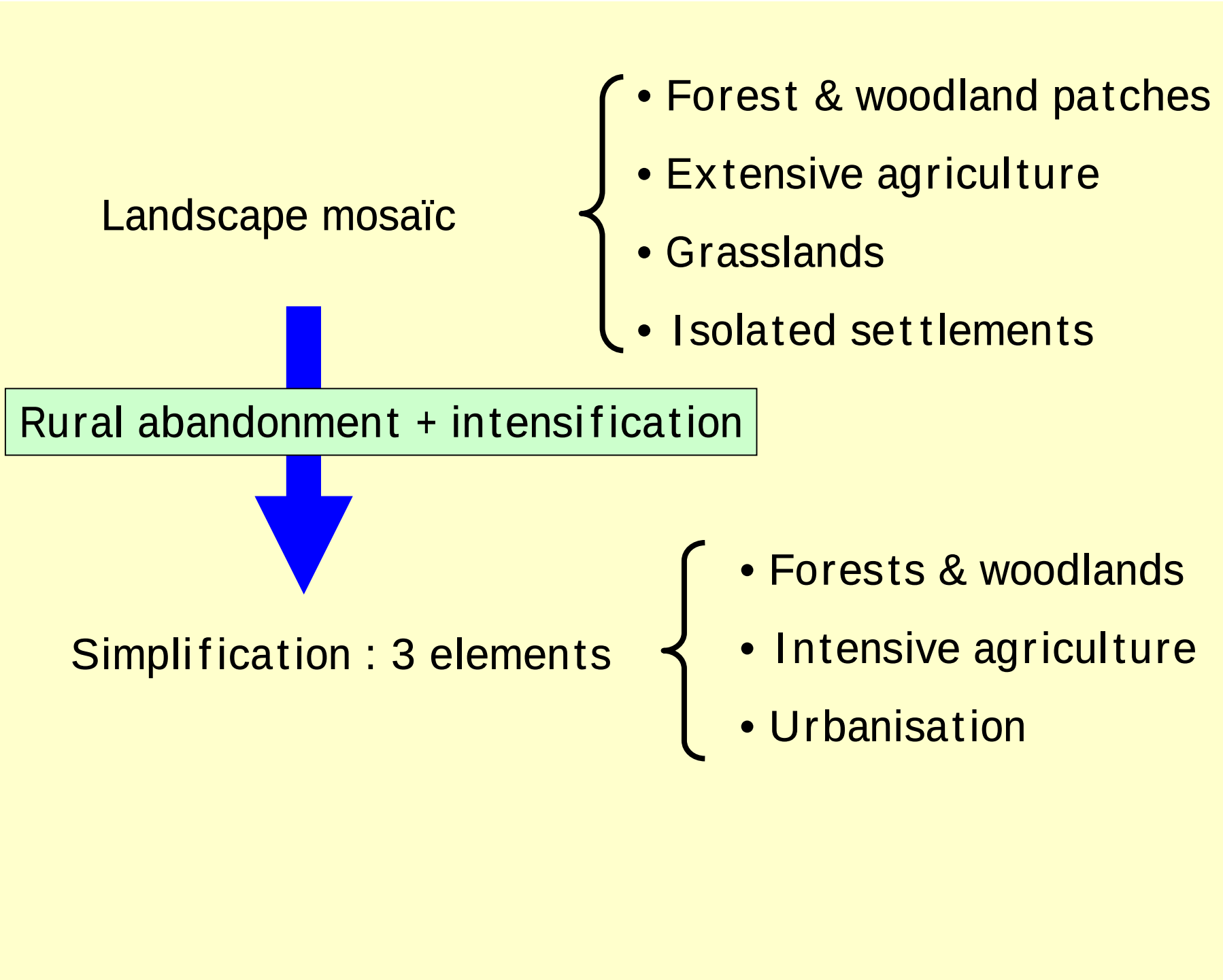
UMR CEFE/CNRS; CEEP

Introduction

- Land use change is one of the major changes induced globally by human activities
- Intensification and land abandonment
- Both ultimately lead to simplification at regional and landscape scales
- But can also promote complex structural responses at both the landscape and habitat scales


Landscape mosaïc
• Forest & woodland patches
• Extensive agriculture
• Grasslands
• Isolated settlements
Rural abandonment + intensification
Simplification : 3 elements
• Forests & woodlands
• Intensive agriculture
• Urbanisation

QUESTIONS

How do animal species and communities respond to these changes ?

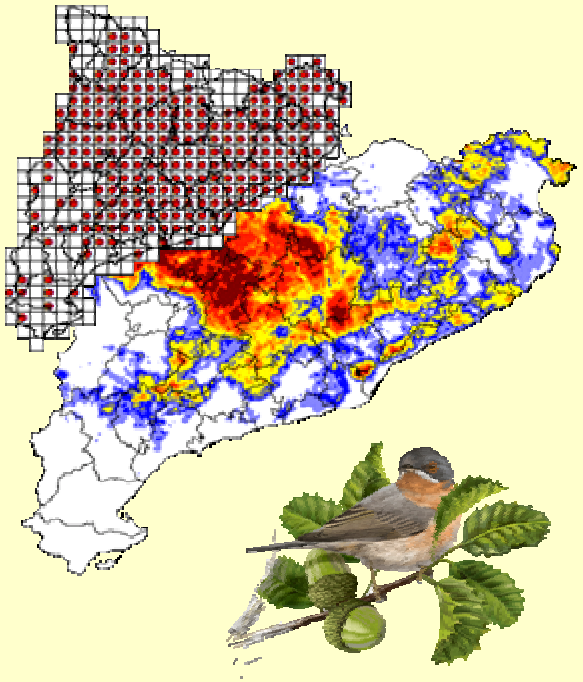
What are the mechanisms involved ?

What lessons for management ?

I. Identifying and predicting change at a regional scale

2 examples based on “distribution atlases”

Ex 1: Assessing changes in woodland bird distribution



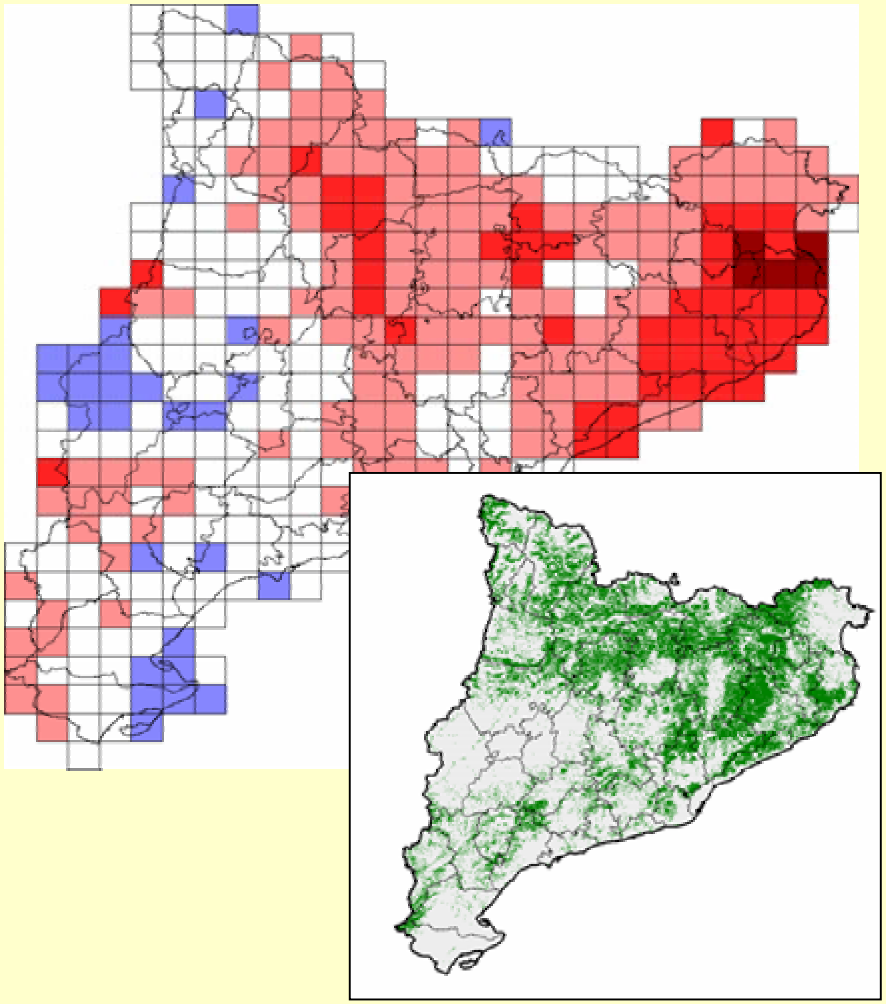
the Catalan Bird breeding Atlas

2 periods: 1980 and 2000

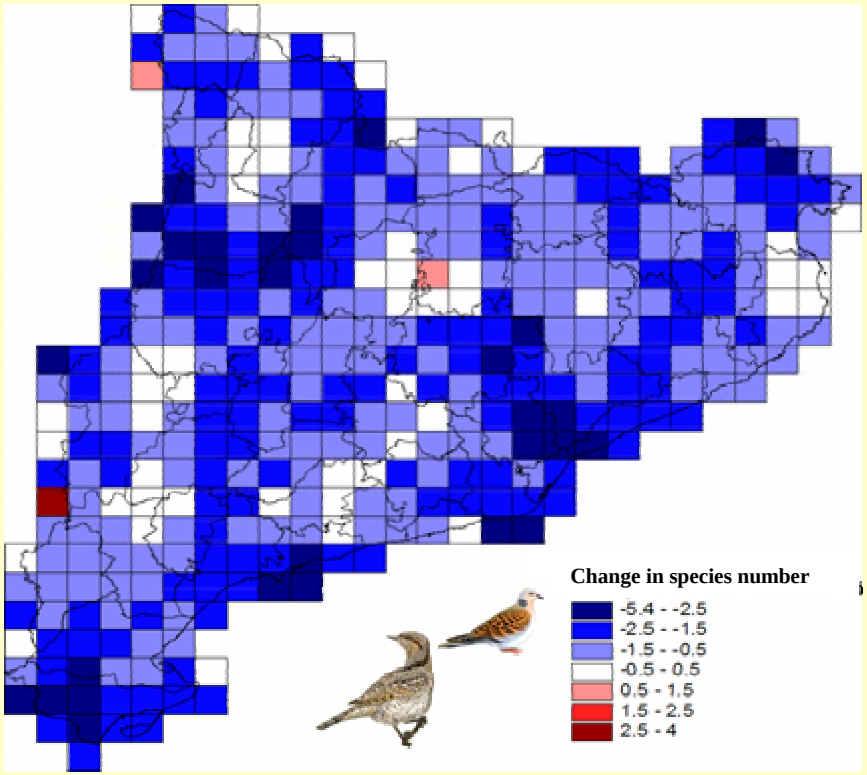
Institut Català d'Ornitologia

Contrasting responses

Increases:
Species from continuous forests



Decreases:
Species from heterogenous woodlands



Ex 2 – Can we predict the consequences of intensification?
Steppe bird distribution


Circus pygargus

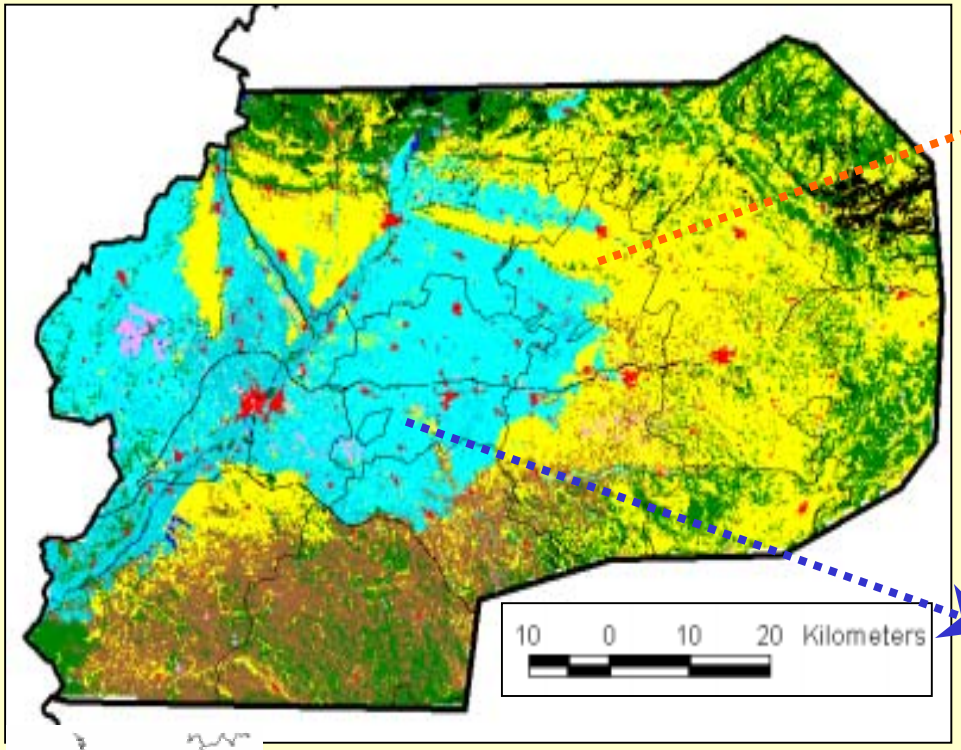

Tetrax tetrax

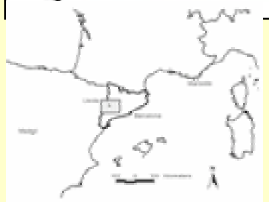

Burhinus oedicnus


Melanocorypha calandra


Coracias garrulus

5 indicator species

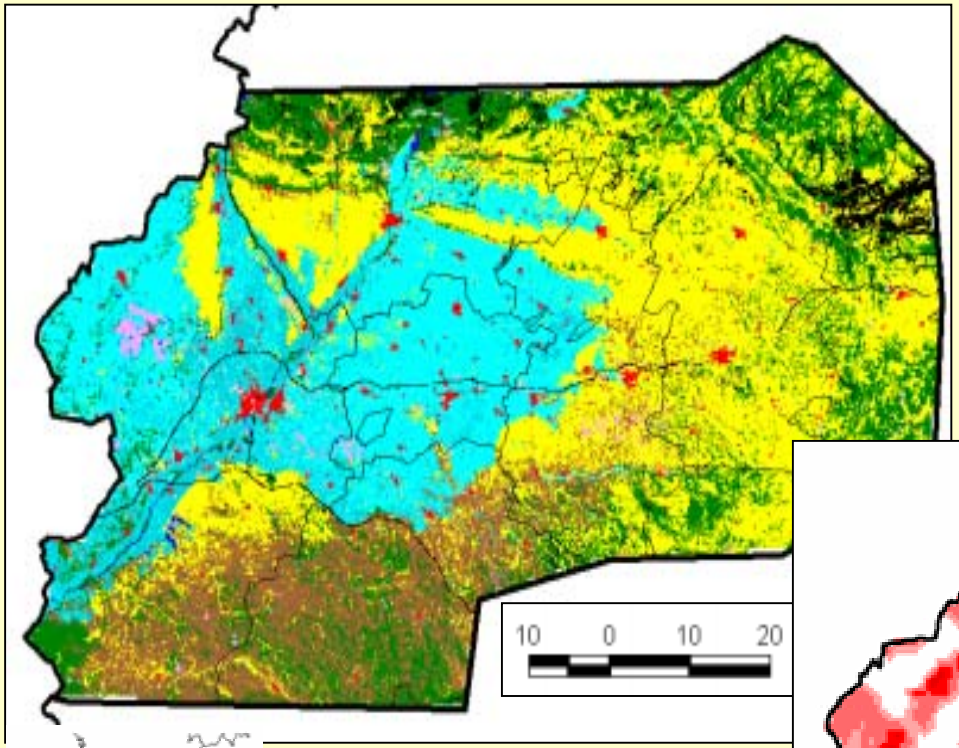


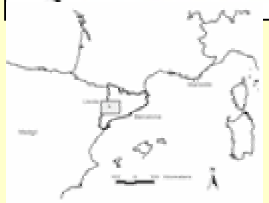


“Plana de Lleida”

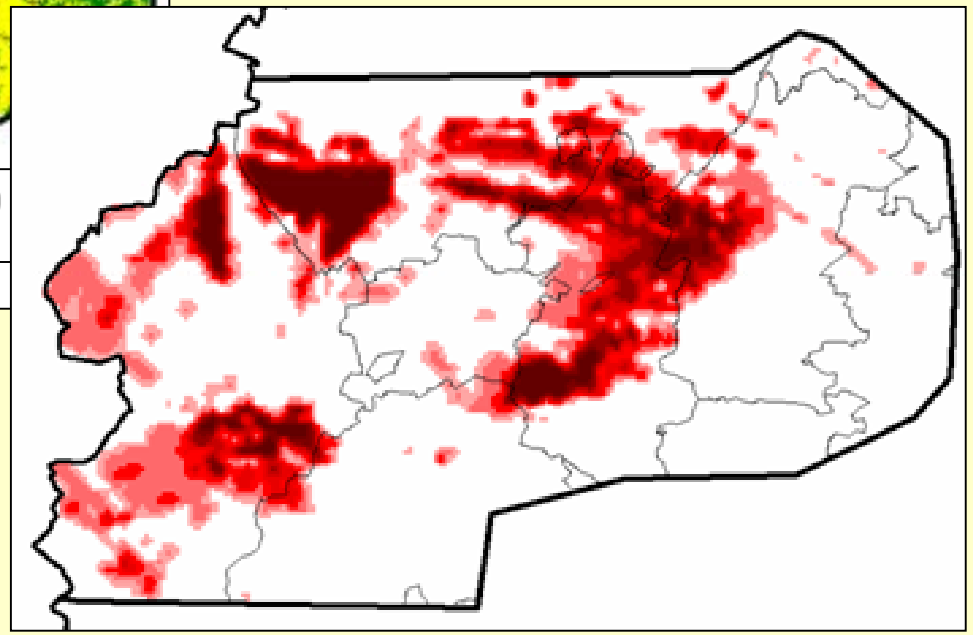
Herbaceous dry crops

Irrigation areas (fodder, mais, fruit trees) 1x1km





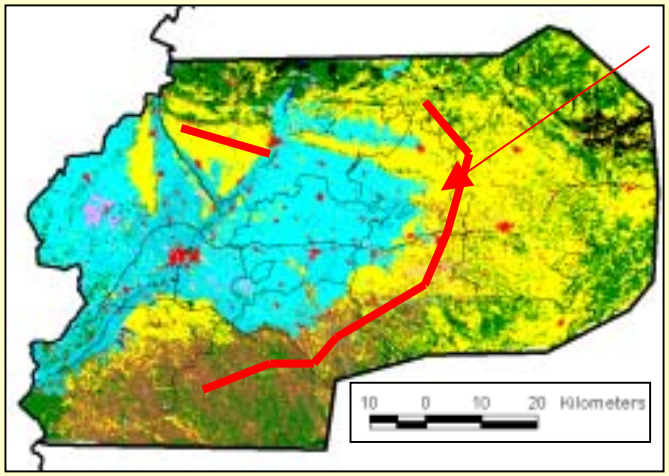
“Plana de Lleida”

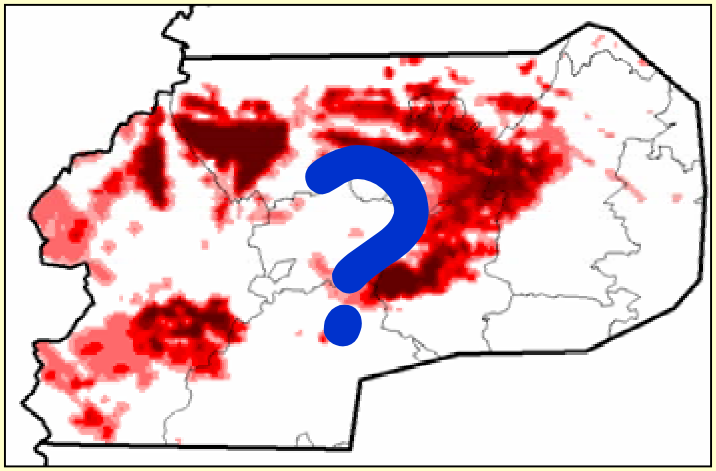


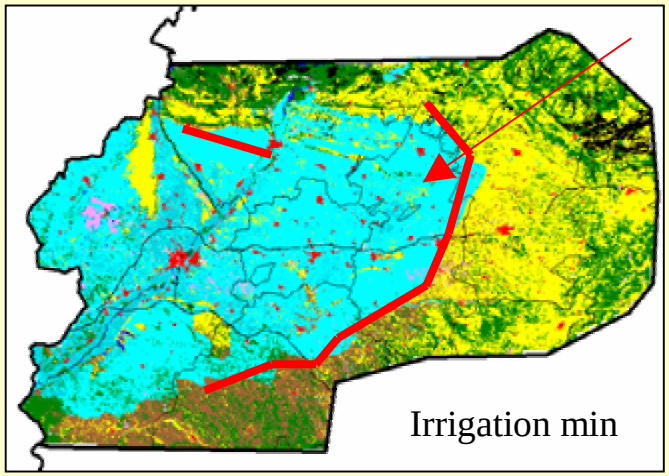
Sum of the potential presence of the five steppe indicator bird species

Combine:
irrigation scenarios and distribution models

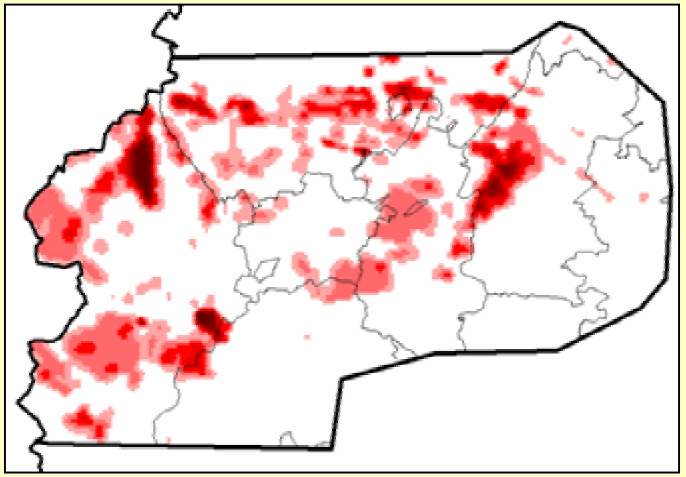
Lleida







Land uses



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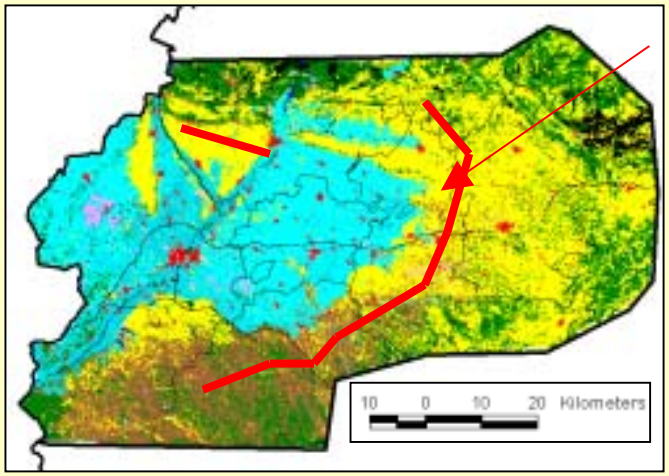
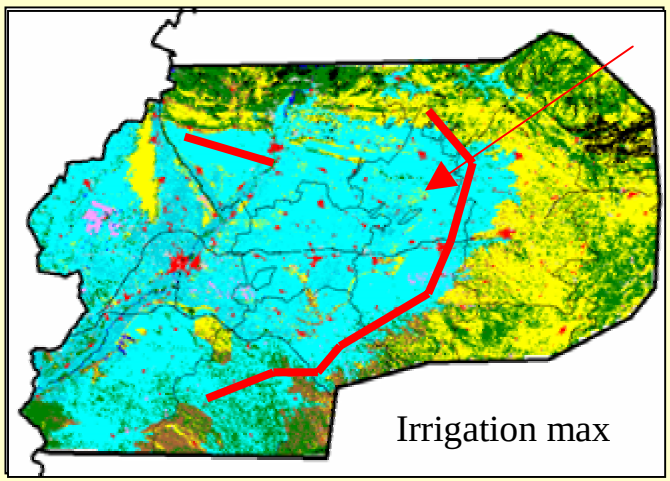
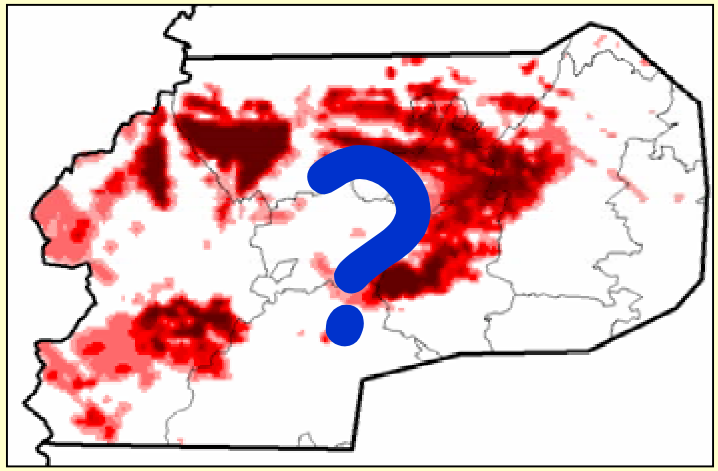
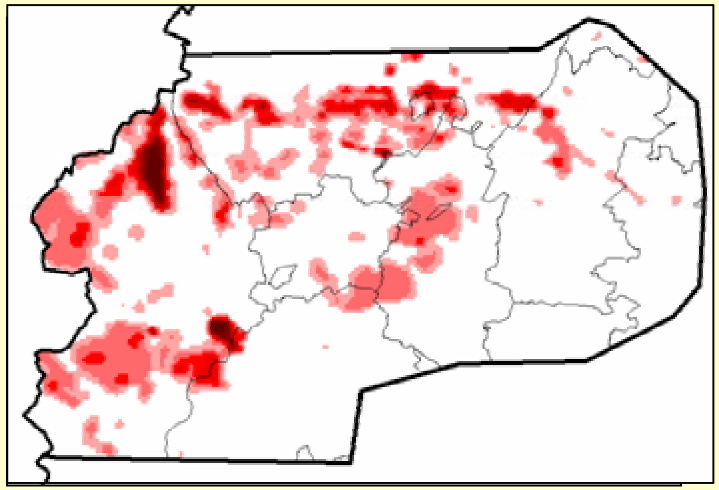




Land uses





Sum of the potential presence of the five steppe indicator bird species

Lessons at the regional scale

To document changes and generate future distribution scenarios at the regional scale there is good potential in combining:

- Long term monitoring of species distribution and abundance, often done by amateurs,
- With academic « exercices » that are based on the use of GIS and modelling.

To interprete these changes we have to :

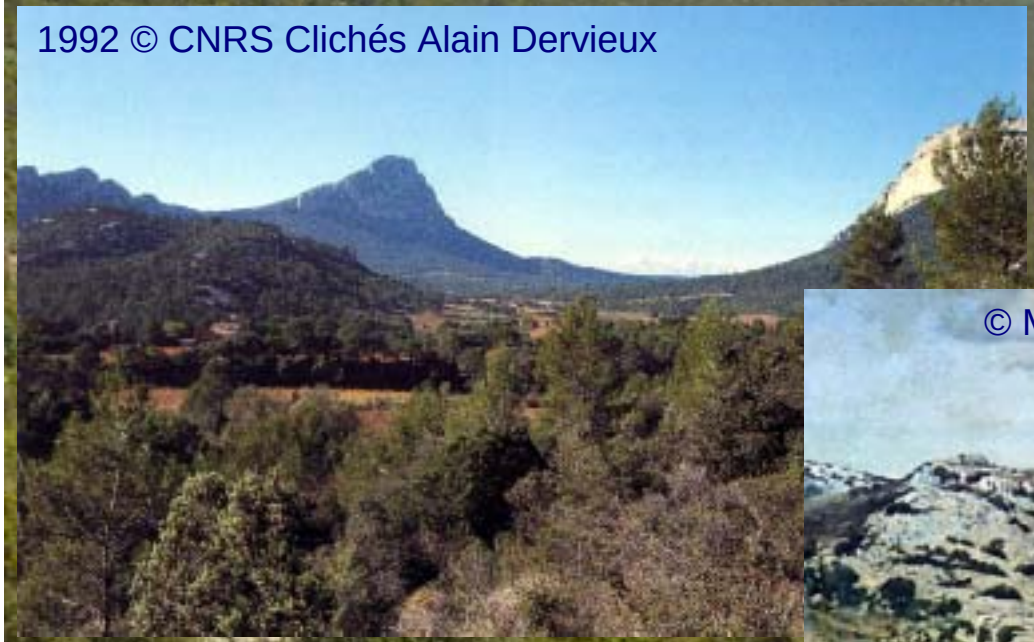
- Be able to pose the hypotheses at the scale of landscapes or ecological units
- Know the biology of the species or systems of concern

II – Identify and predict responses at the landscape scale

2 examples

Ex 1 – Decreasing grazing pressure and changing avifaunas

Pic Saint Loup today…



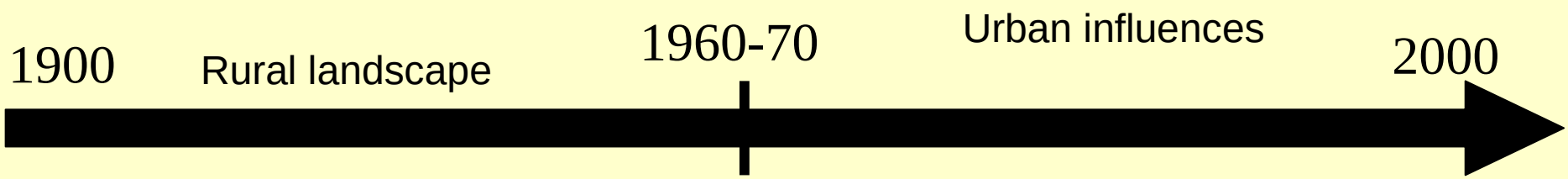
1992 © CNRS Clichés Alain Dervieux

…and in 1859!

© Musée Fabre Montpellier (peinture de E. Castelnau)

Land-use changes during the 20th century

Frédérique Larinier & Jean-Paul Cheylan



End of traditional land use

Traditional uses

New uses

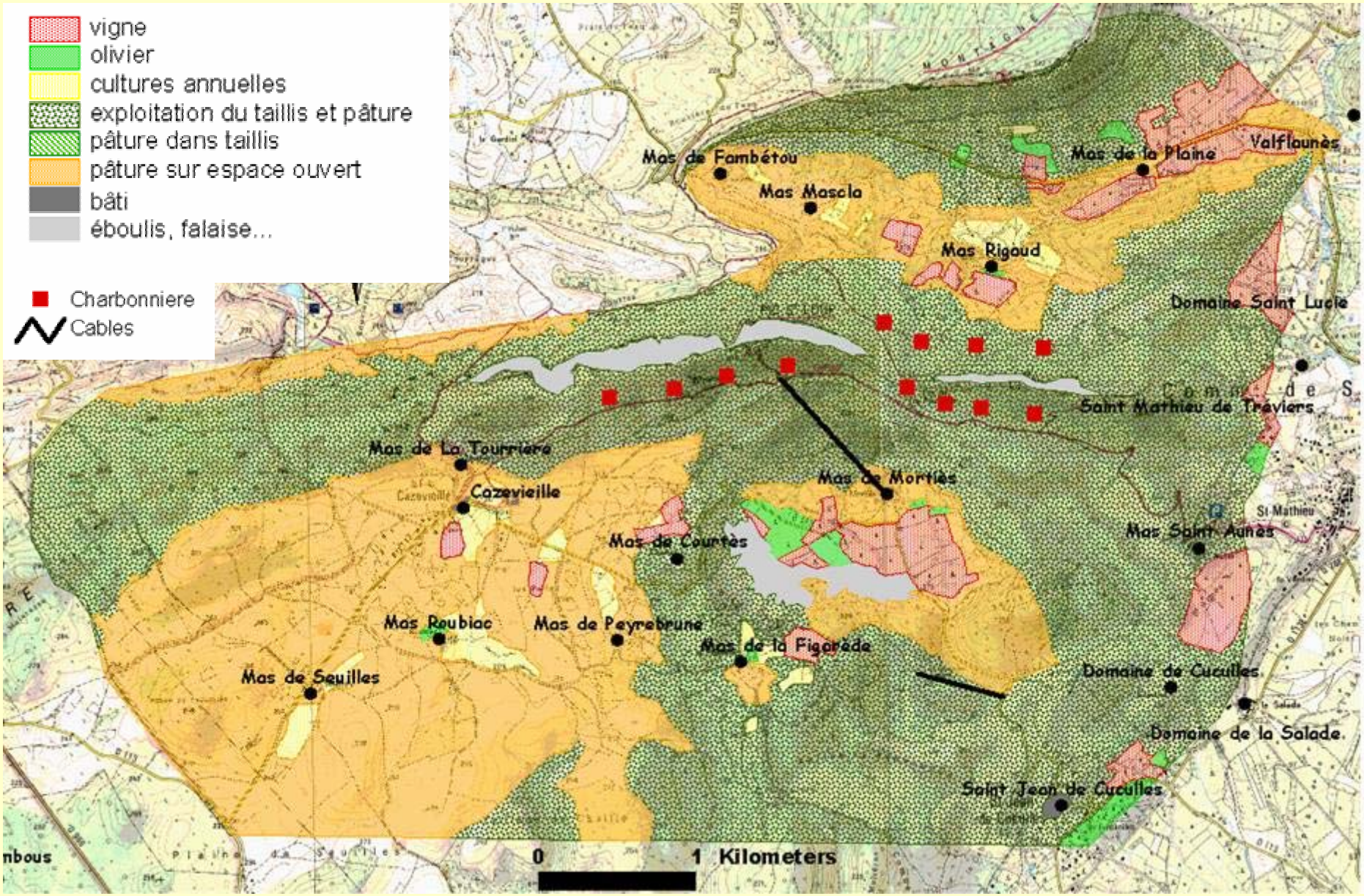
Demographic changes

Grasslands – open woodlands - cultivation

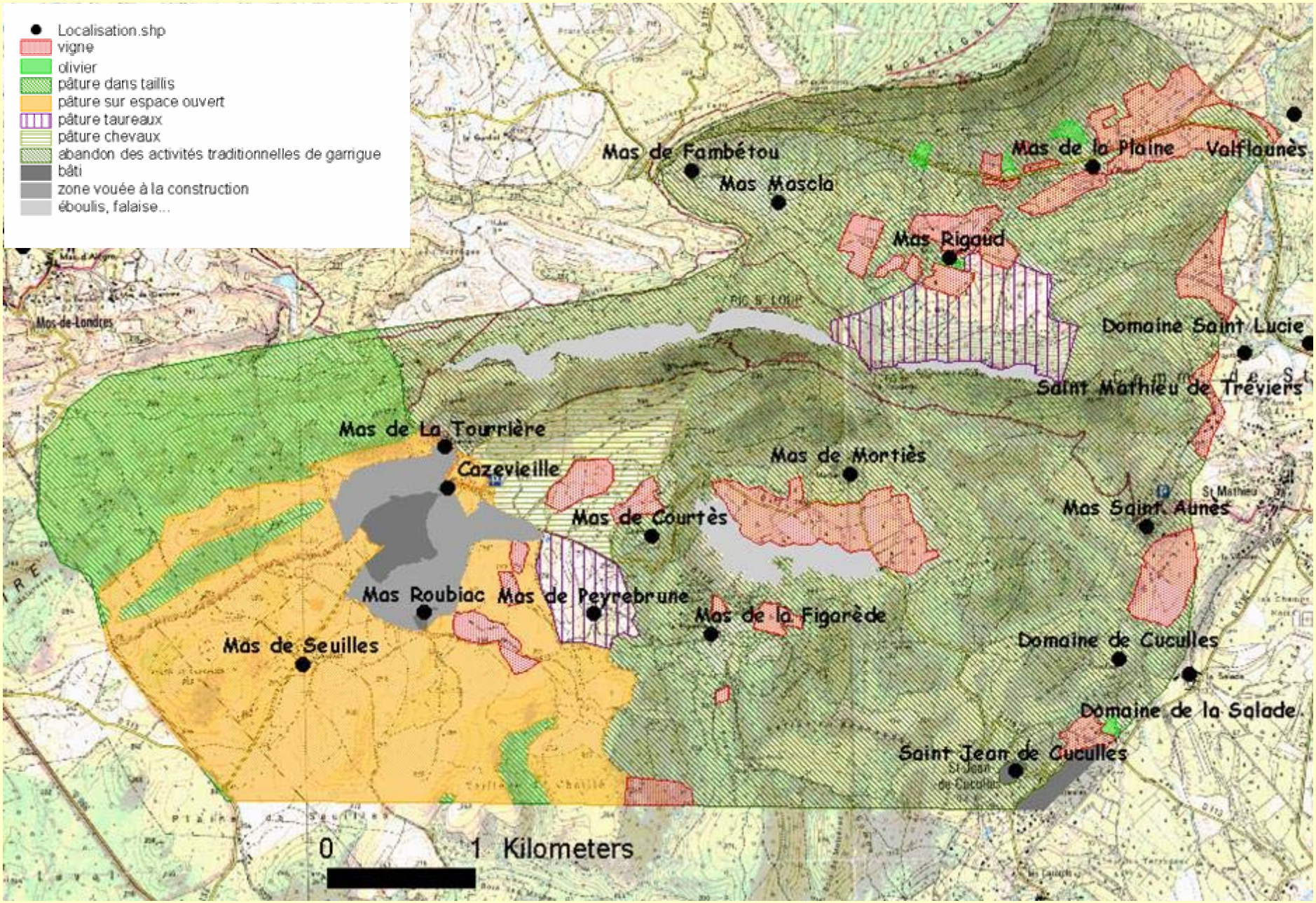
Closed woodlands – wine growing – urban development

The different land uses in the 40s

Frédérique Larinier & Jean-Paul Cheylan; CIRAD/CNRS



Current land uses



Cazevieille in 1978…

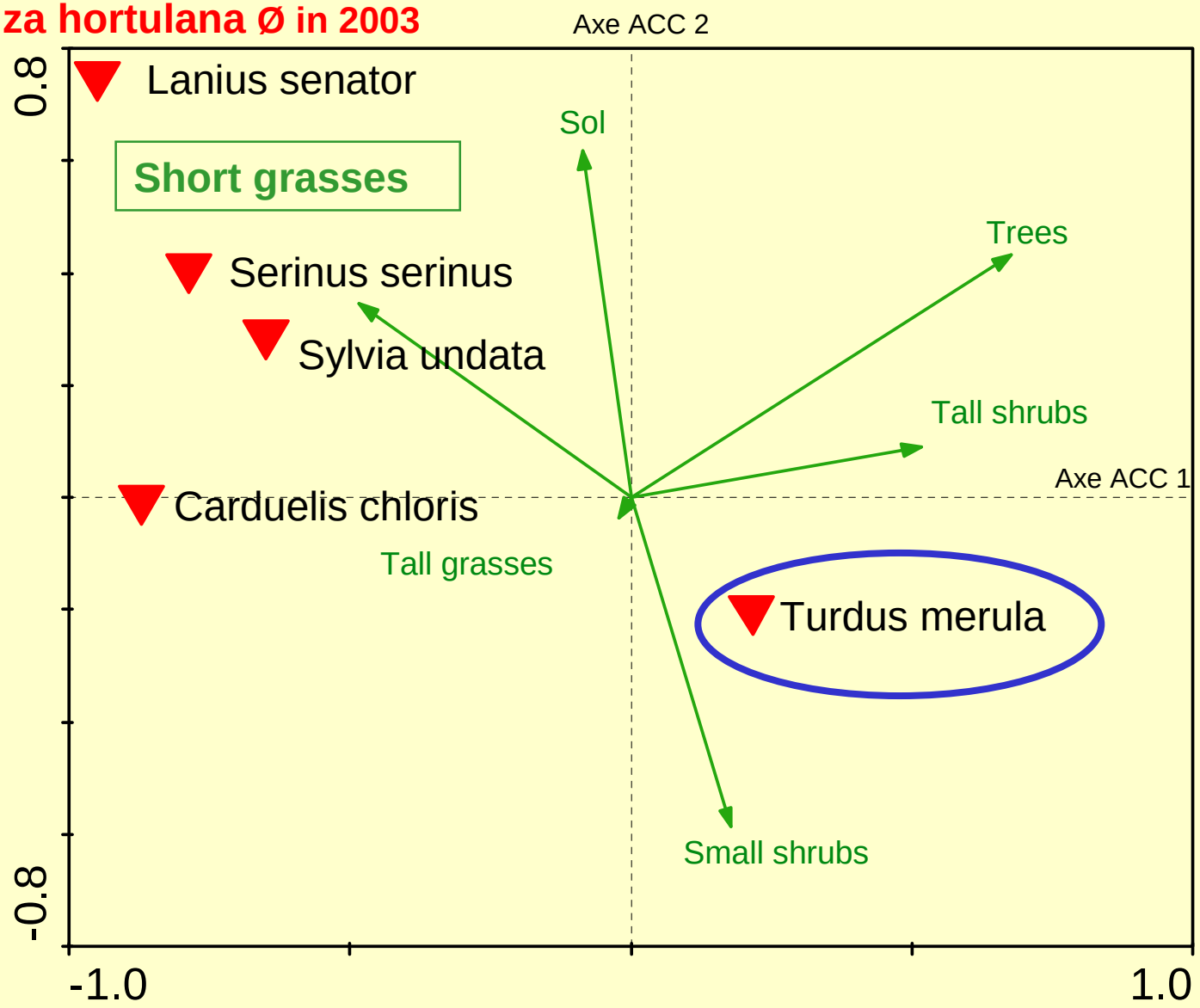
Cazevieille in 1978…in 1992…

Cazevieille in 1978… in 1992… and in 2003!

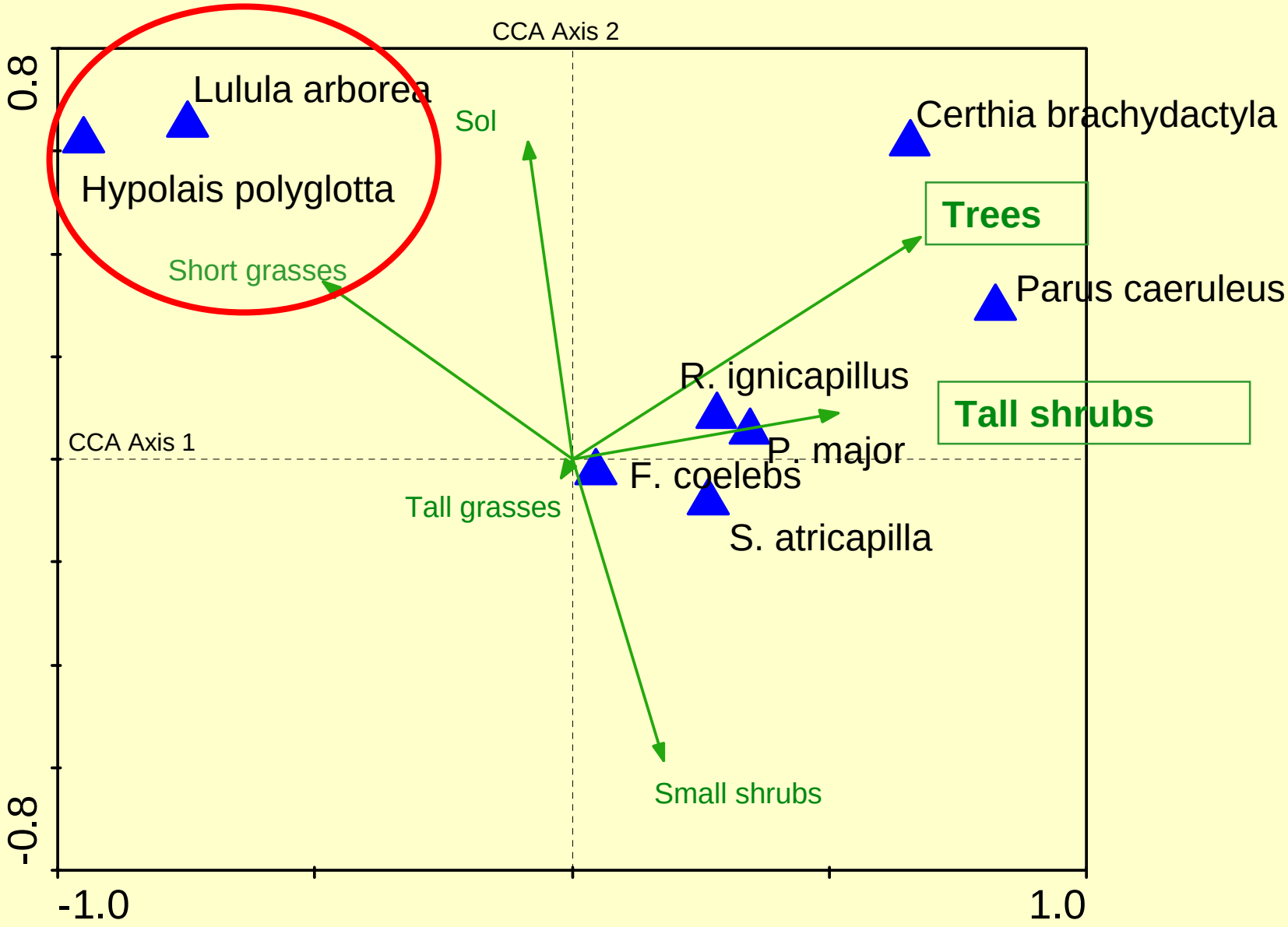
Changes in the avifauna 200 point counts sampled in 1978, 1992, 2003

Species that decrease

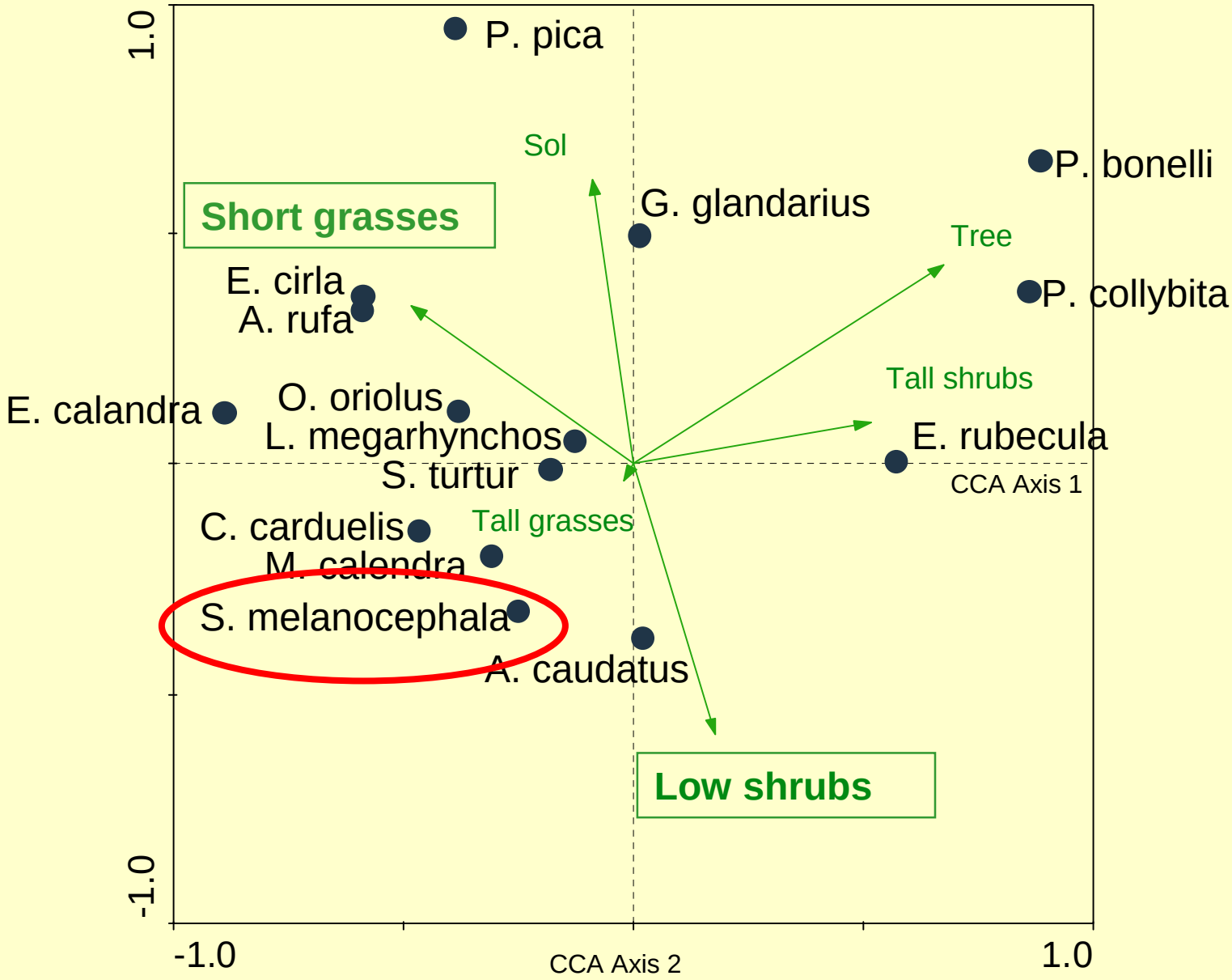
Emberiza hortulana Ø in 2003



Species that increase

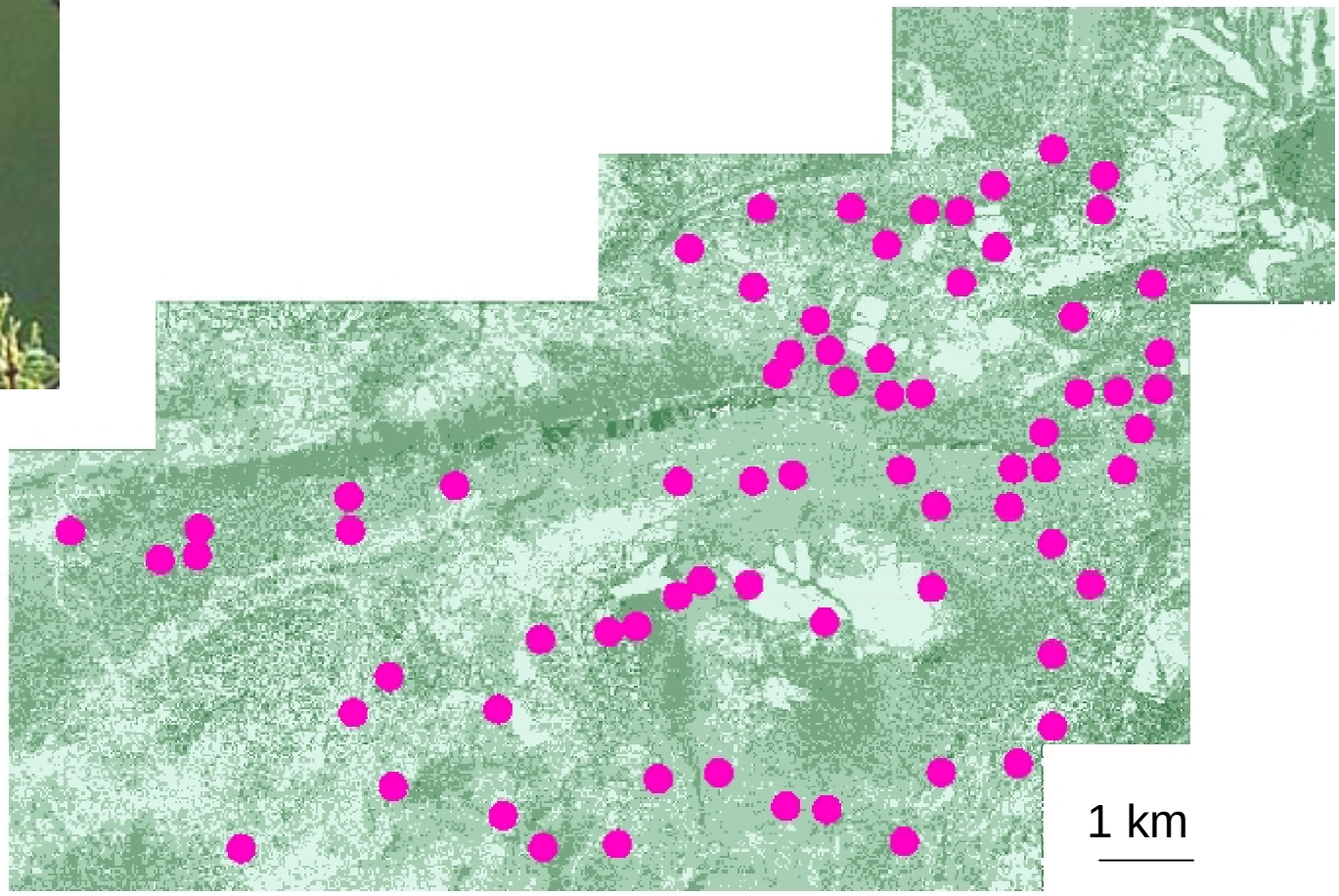


Species that are stable



Sardinian warbler

78



76 stations

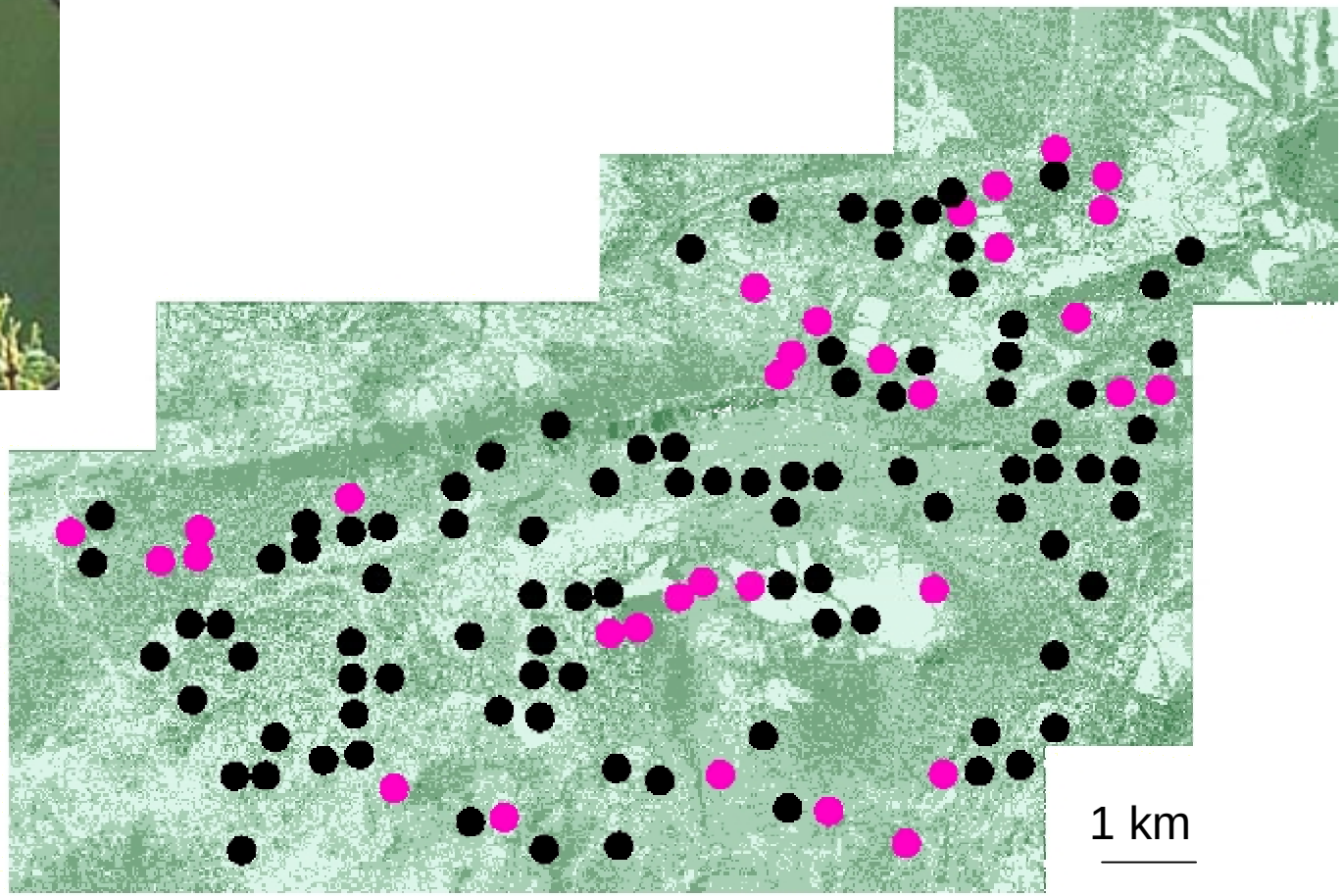
Low occurrence around Cazevieille

Sardinian warbler

78 92

87 stations

Has colonized the area around Cazevieille



Beyond expected trends such as :

- The decrease of species tied to open landscapes
- The increase of species tied to dense vegetation

The responses of individual species can contrast from species to species

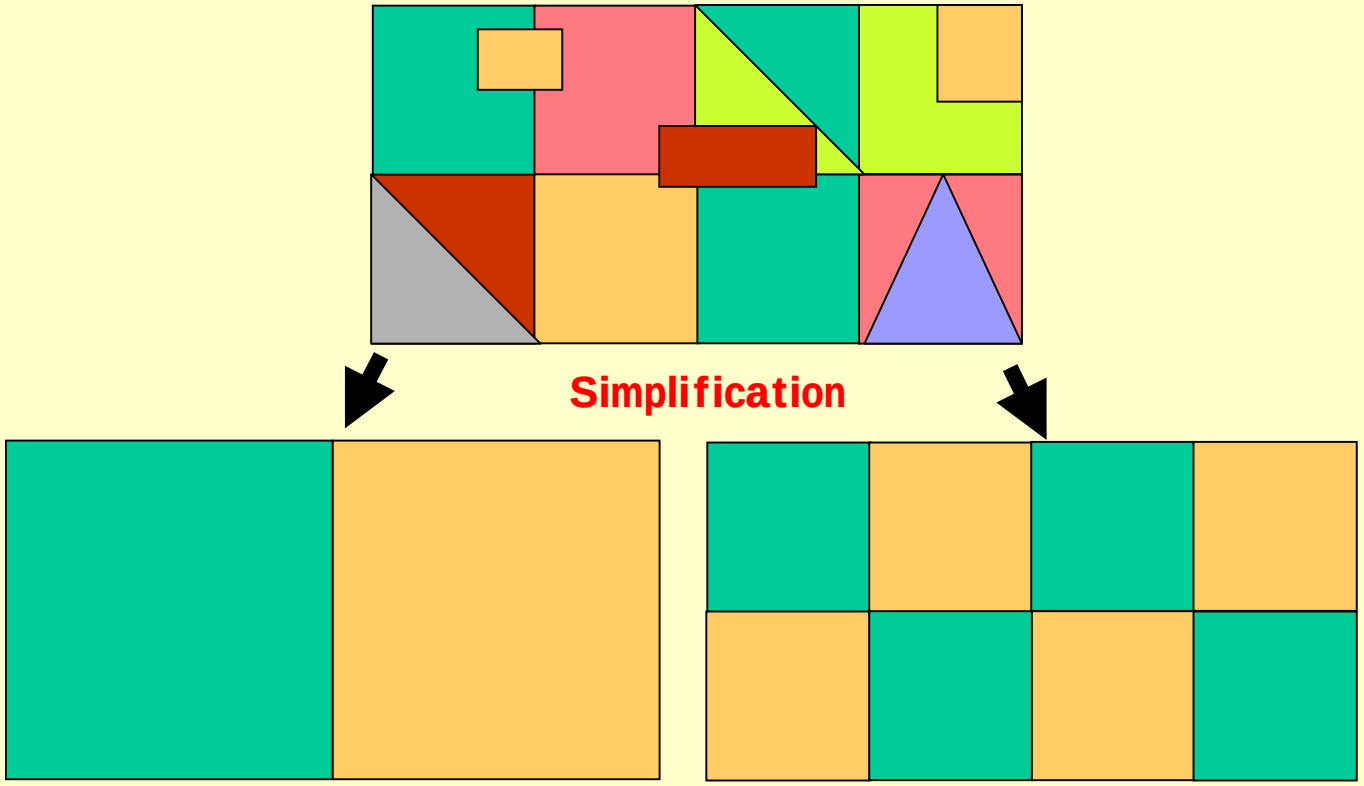
Lessons for management:

The challenges of species centered and community centered management can be contradictory

If species centered we have to be able to understand the mechanisms that drive the response of species to changes in landscape structure

III. Looking at mechanisms

Landscape simplification can be more or less « complex »



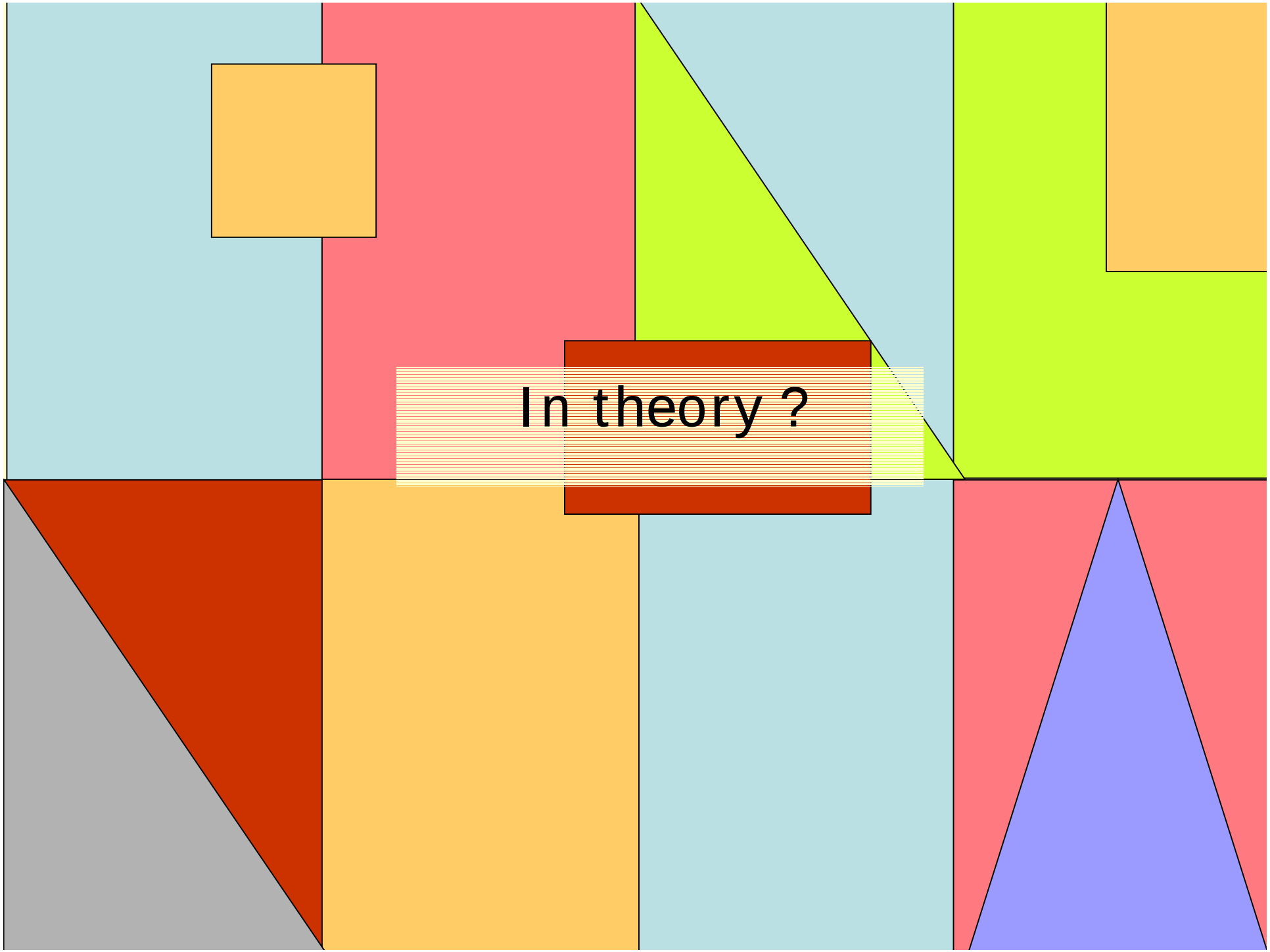
Homogenous

Less edges

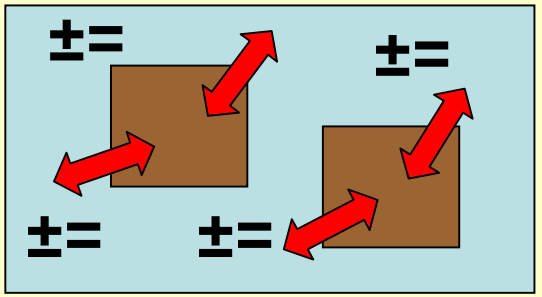
Mosaïc

More edges

1 - Do mosaics matter ?


In theory ?

Loss and fragmentation of focal habitat

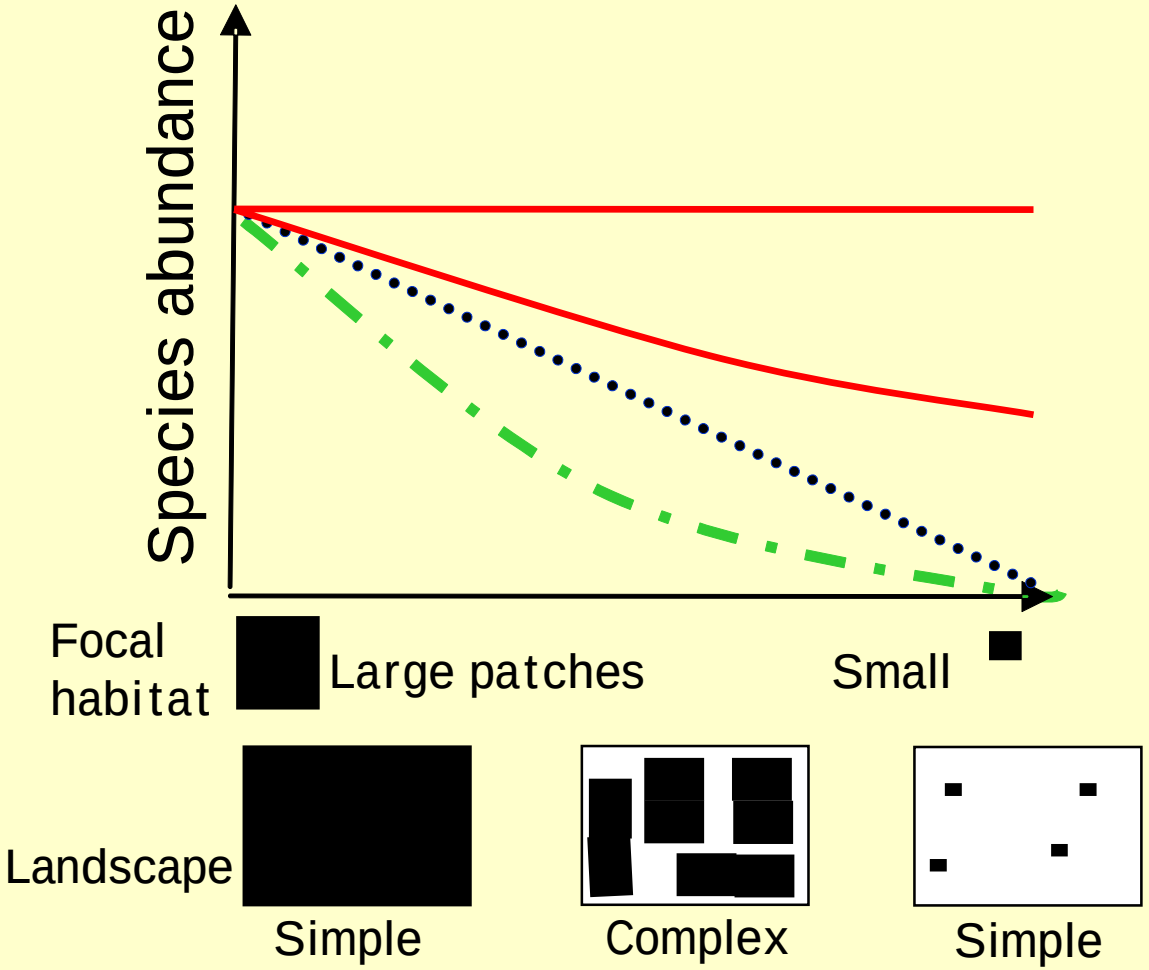


Complete

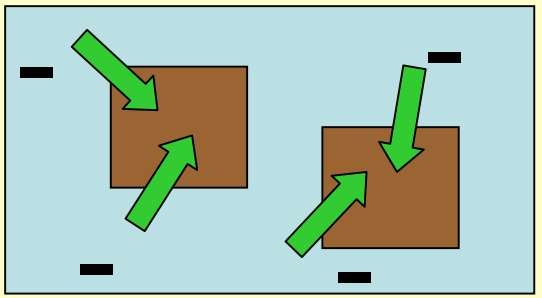
Compensation hyp.

Partial

Effect of area loss

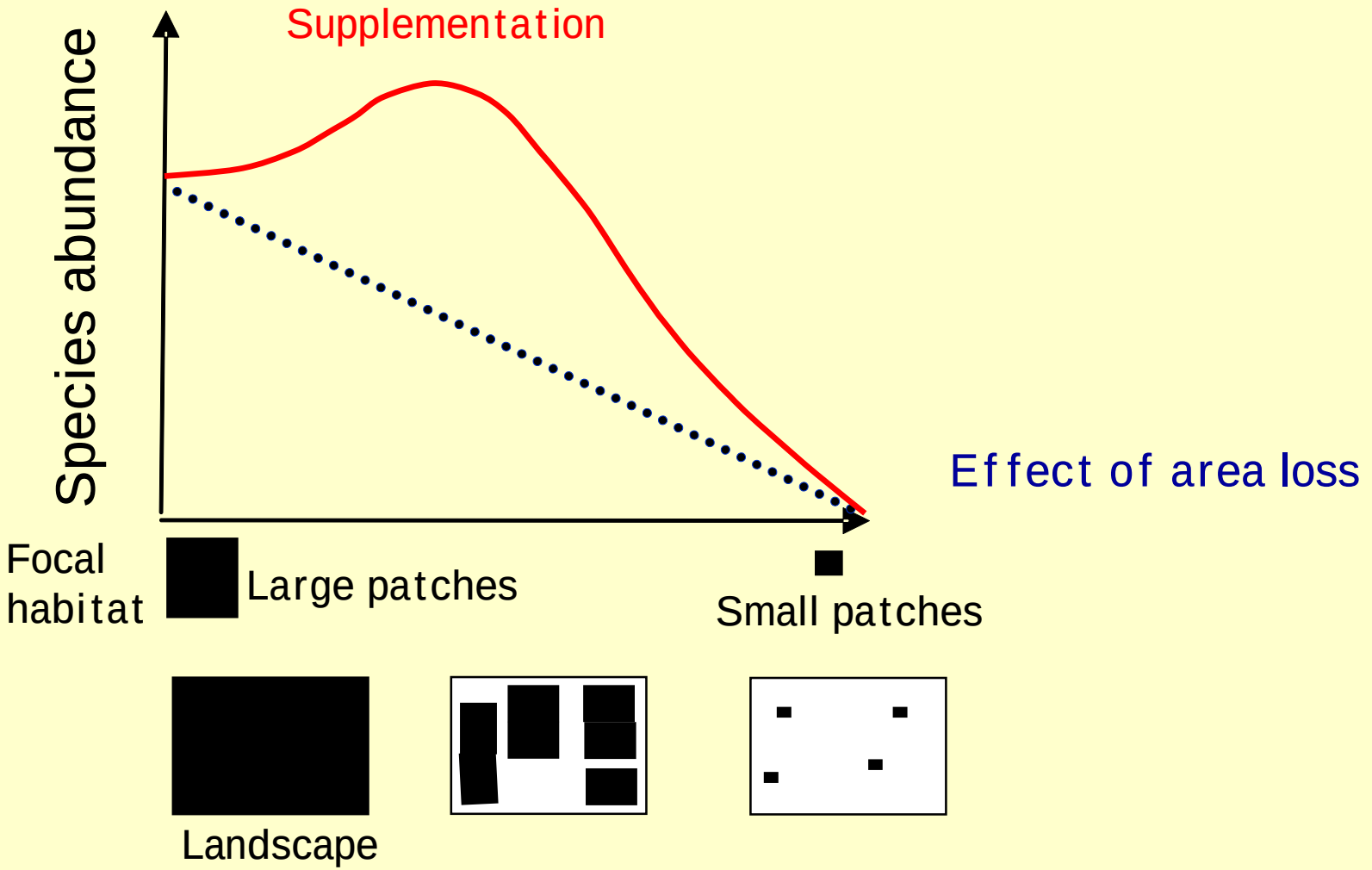


Negative effects of frag. (neighbourhood hyp)



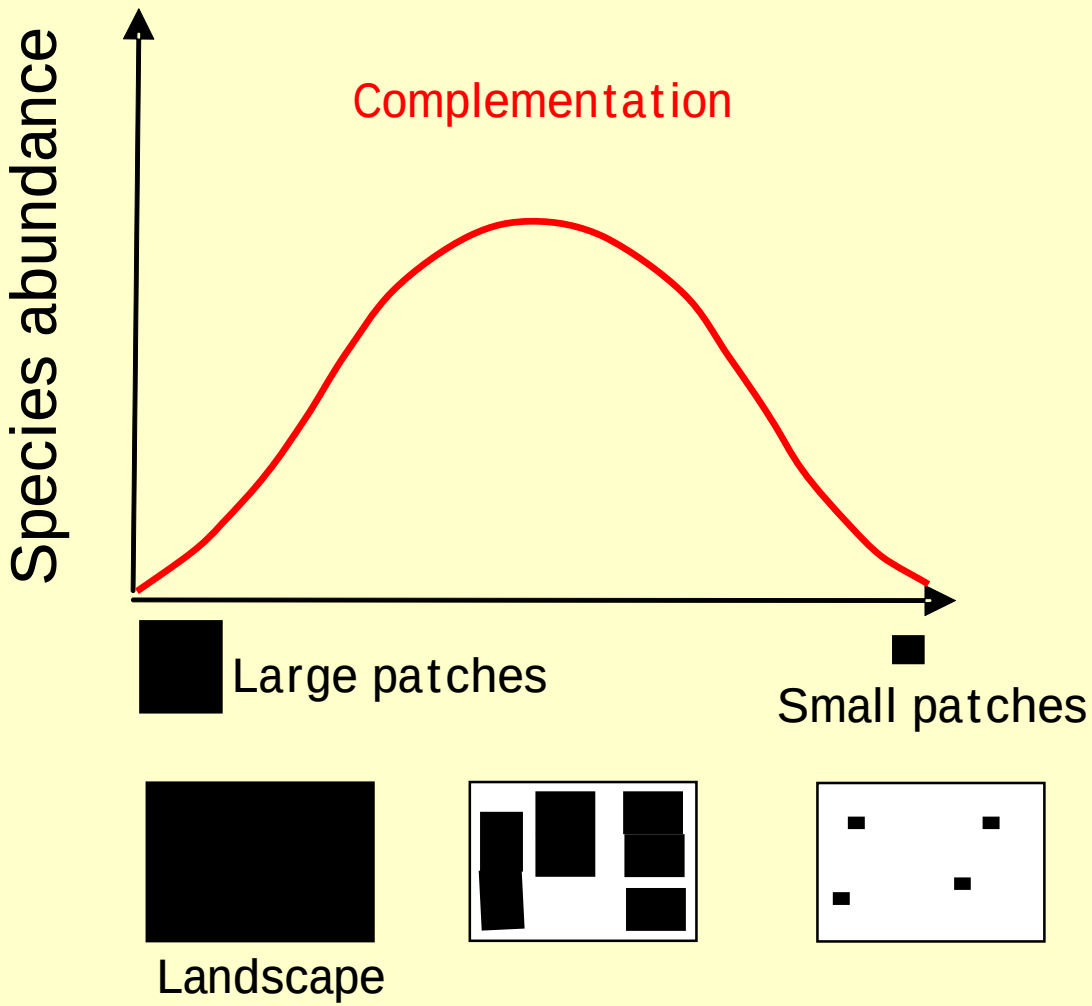
from Andren et al. 1997

Supplementation of the focal habitat



from Andren et al. 1997

Complementation: only the mosaïc matters



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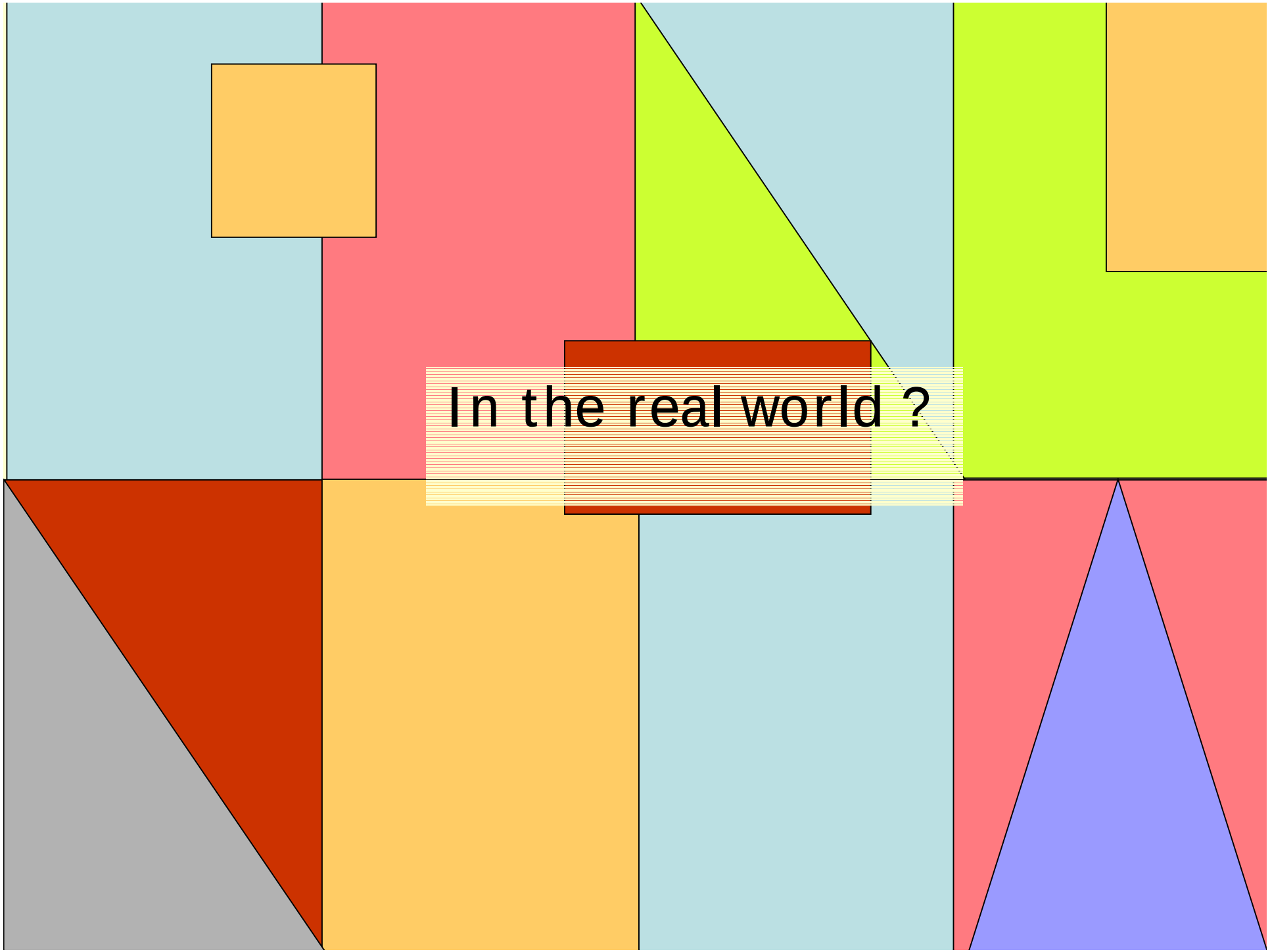
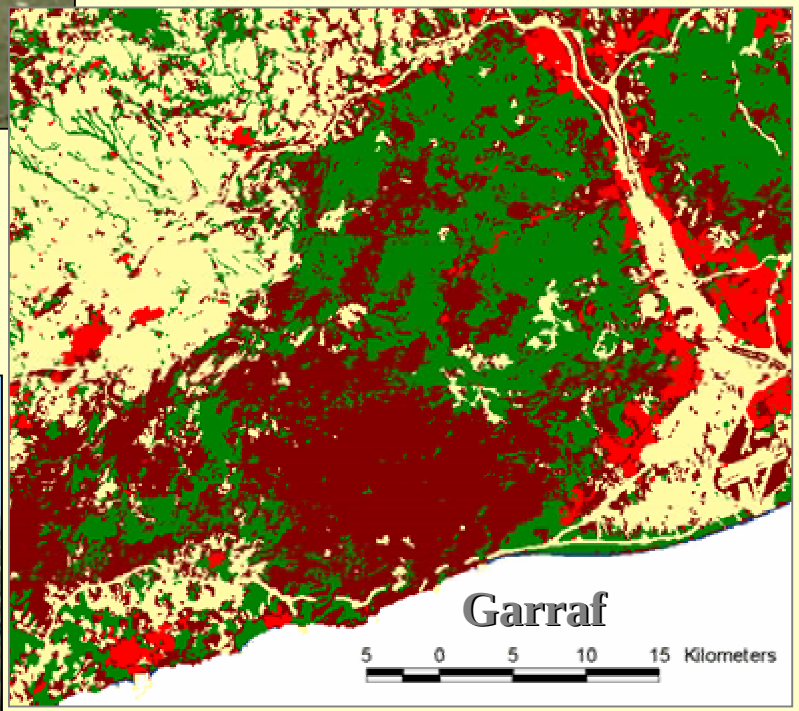

In the real world ?

Complementation & supplementation: 2 examples

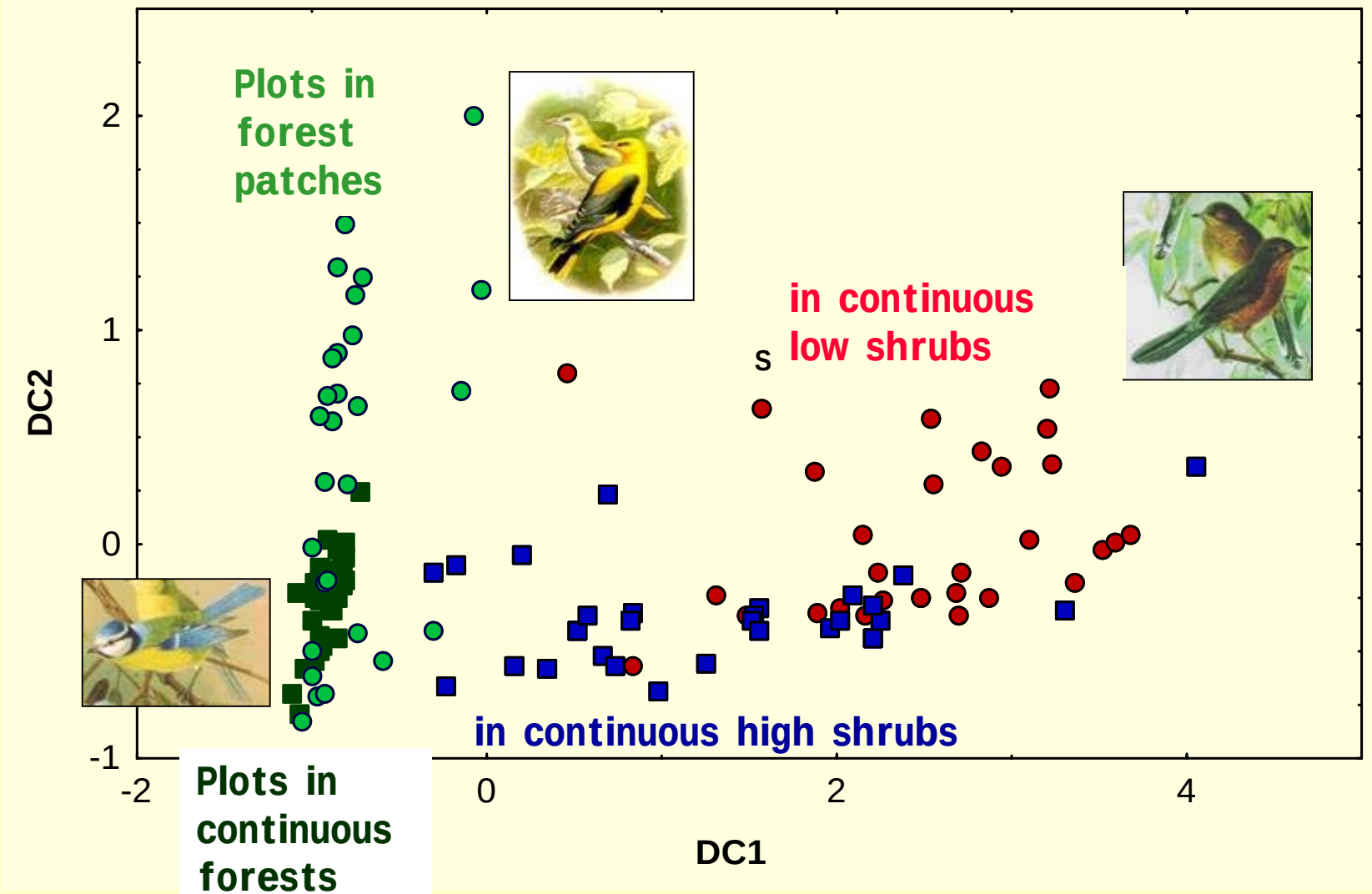
Ex 1 – Forest fragments resulting from forest fires

Continuous forests



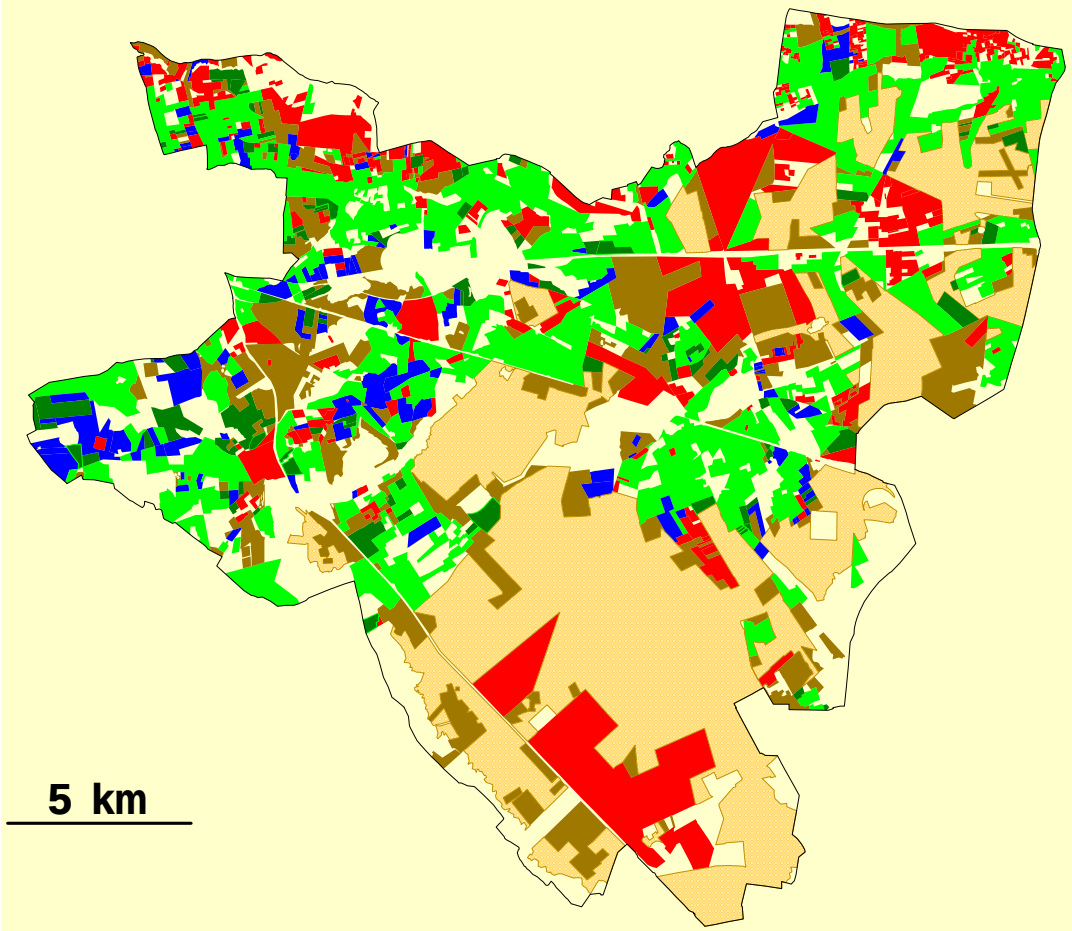
Continuous shrublands

Forest fragments



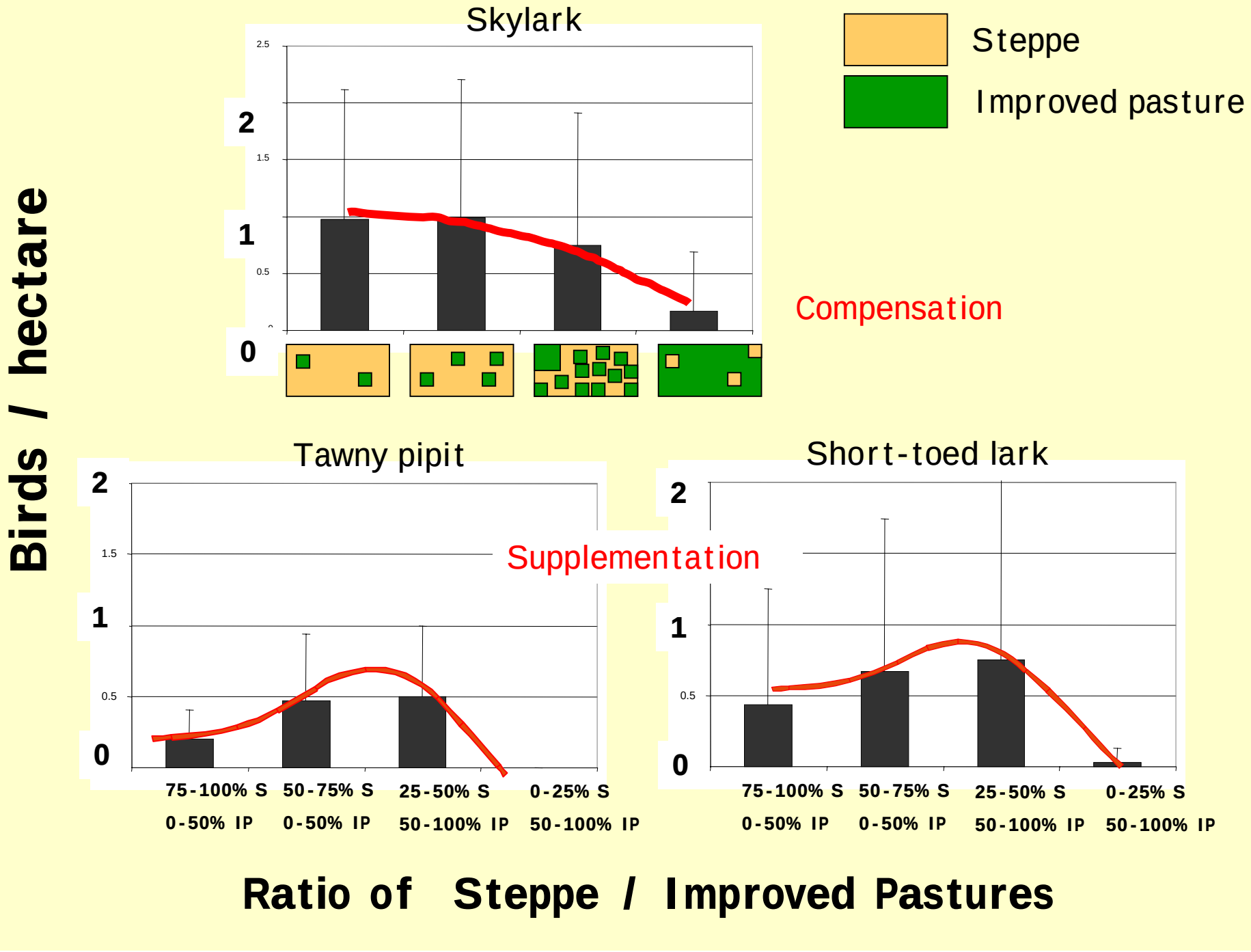
Complementation & supplementation

Ex 2 – Steppes & agricultural matrix: passerines in the Crau

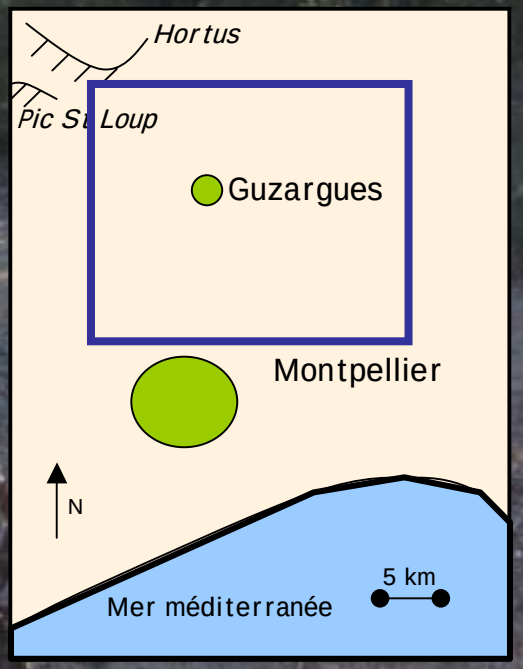


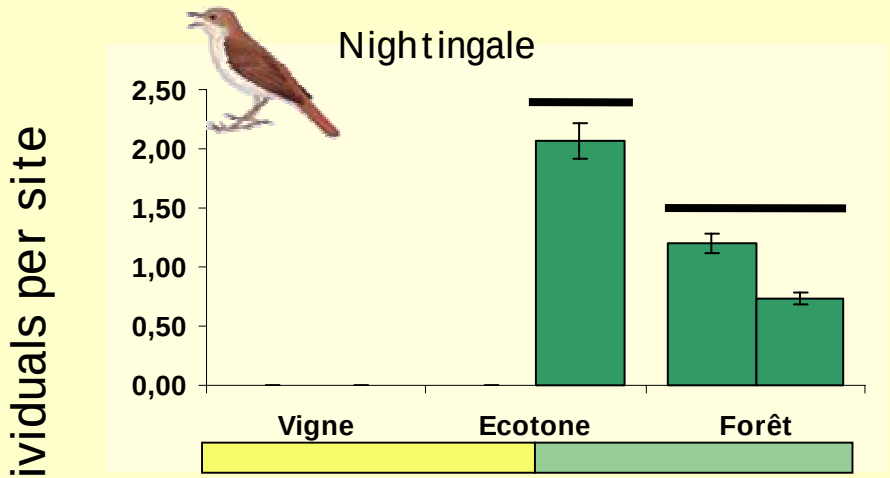
Cover area (km²)	
Steppe	102
Agriculture	196
INTENSIFICATION ↓	
Fallow and set-aside	*23 %*
Grazed crops, legumes	*6 %*
Hay meadows	*39 %*
Grain crops	*7 %*
Orchards, greenhouses	*25 %*
Other and not recorded	78
TOTAL	376

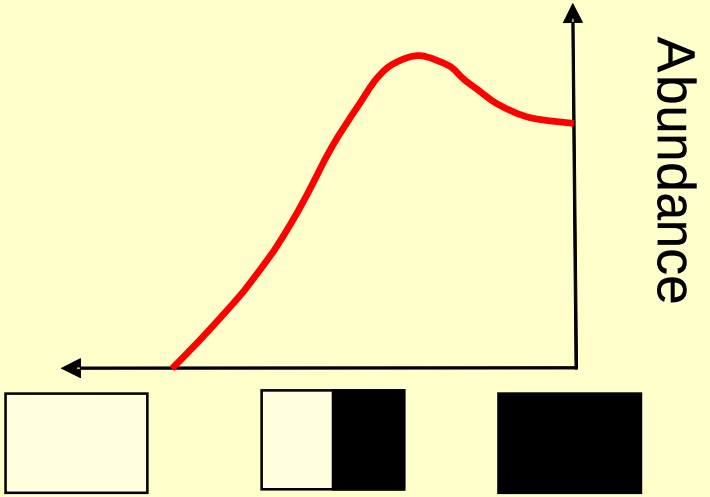
Land uses spring 1998


Skylark
Steppe
Improved pasture
Compensation
Birds / hectare
Tawny pipit
Short-toed lark
Supplementation
2
1.5
1
0.5
0
75-100% S 0-50% IP
50-75% S 0-50% IP
25-50% S 50-100% IP
0-25% S 50-100% IP
Ratio of Steppe / Improved Pastures

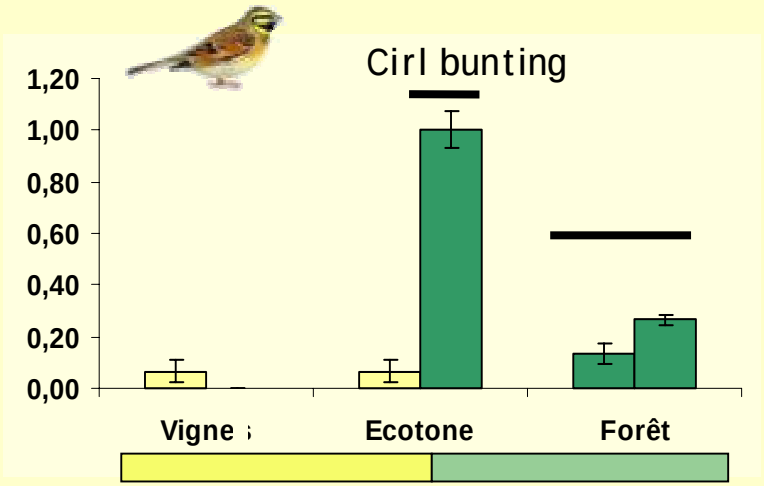
2. Do edges matter ?

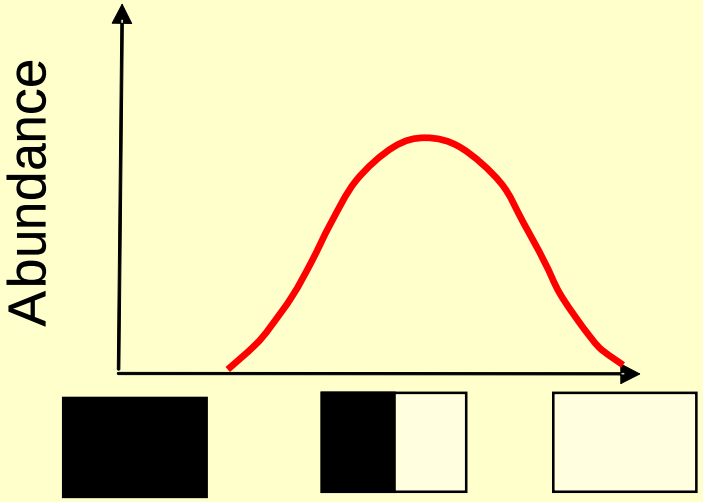






Average number of individuals per site





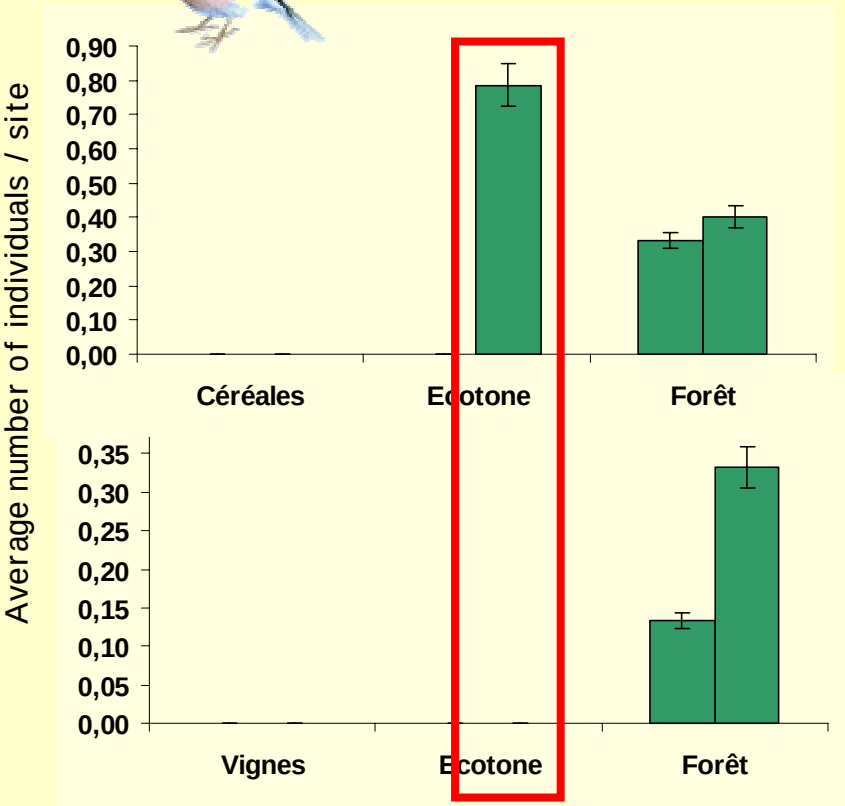
Supplementation & complementation

Does edge quality matter ?

Sites with « cerals »

Sites with «vineyards »

Chaffinch



Lessons and conclusions

– Need to understand and recognise the importance of the ecological processes that link the different elements of a landscape.

- Need to include heterogeneity (spatial distribution of patches and quality of edges) explicitly in the management of mediterranean landscapes

- Need to define what type of heterogeneity will be critical to favor the conservation value and/or other services of an area.

Merci