



HAL
open science

Cartolis : vers un outil géomatique pour identifier et caractériser les segments de lisières forestières

Audrey Alignier, Philippe Espy, Marc Deconchat, Sylvie Ladet

► To cite this version:

Audrey Alignier, Philippe Espy, Marc Deconchat, Sylvie Ladet. Cartolis : vers un outil géomatique pour identifier et caractériser les segments de lisières forestières. Conférence internationale de Géomatique et Analyse Spatiale SAGEO'10 (Spatial Analysis and GEomatics 2010) Outils, Méthodes et Modèles en Géomatique pour la production de connaissances sur les territoires et le paysage, Nov 2010, Toulouse, France. hal-02755125

HAL Id: hal-02755125

<https://hal.inrae.fr/hal-02755125>

Submitted on 3 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

CARTOLIS: towards a geomatic tool to identify and characterize the segments of forest edges

Alignier A.; Espy P.; Deconchat Mr.; Ladet S.

UMR DYNAFOR INRA- University of Toulouse/ENSAT

"Dynamic and Ecology of agricultural & forested landscapes"

F-31326 Castanet-Tolosan cedex

Sylvie.Ladet@toulouse.inra.fr



Conference SIGMA 2010,
November 17- 19, 2010, Toulouse



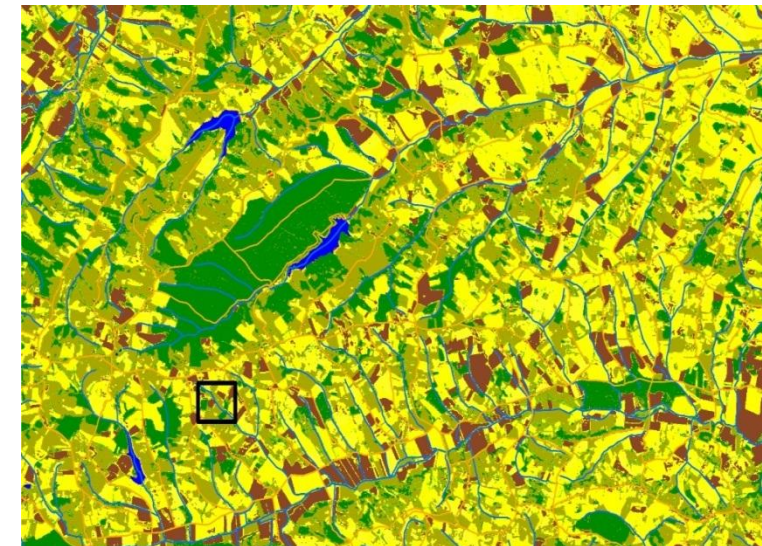
Importance of forest edges

(1/2)

- Forest edges are **key elements of landscapes** (habitats and resources for many animal and plant species)
- Edges are very **diverse and have consequences** on the biodiversity and land management
- The ecologists can apprehend this diversity at local scale or around a wood but not at the landscape scale → **question to the geomaticians**



With the scale
- of an edge
- of a wood
- of a landscape



*Extract of land cover map
(SPOT5; Barrussaud, 2008).*

Question

(2/2)

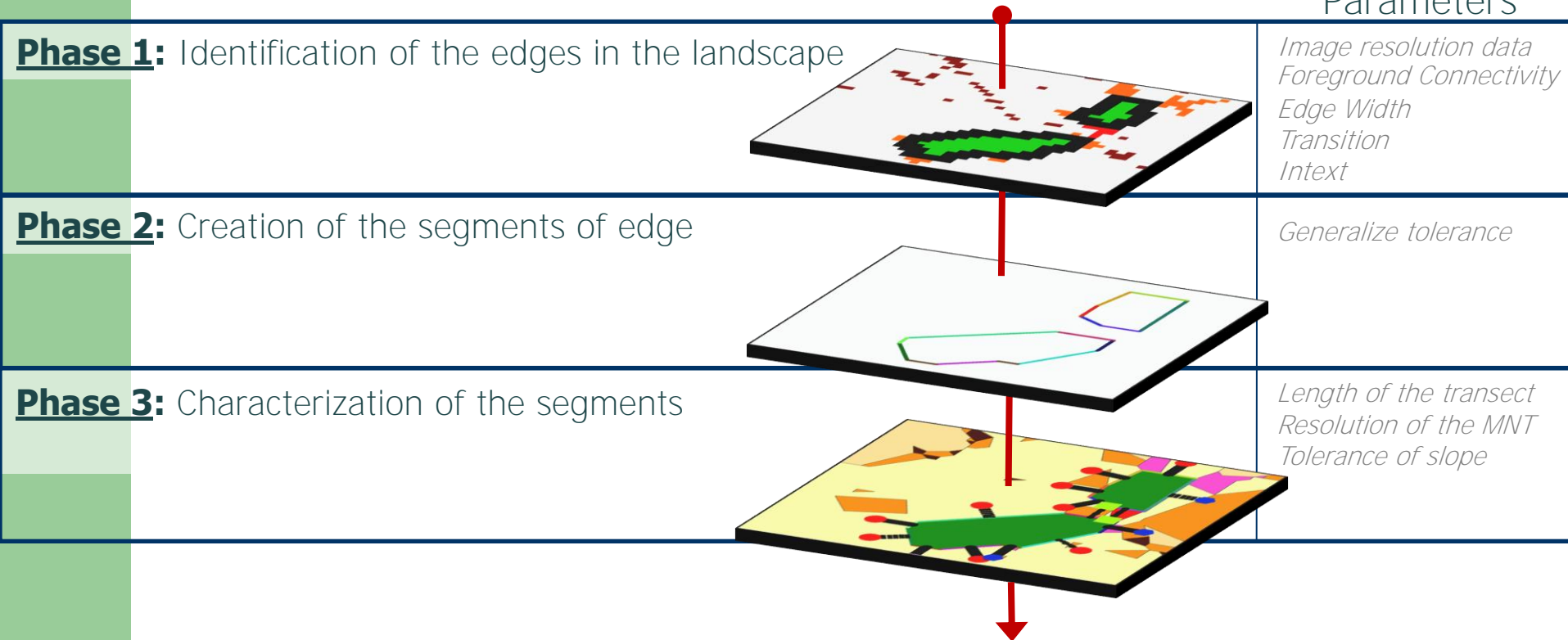
How to localise and quantify the diversity of forest edges at a landscape scale?



- **To search for or to create** a tool to take into account the diversity of edges, on a large spatial extent.
- **CARTOLIS**, to build a geomatic tool to meet ecologists needs to identify and characterize edges.
- **Line** = choice of the data model of CARTOLIS
“the edges are then seen like a set of segments”.

Conceptualization of the method

- Combination of preexistent tools with an adaptation of script
- Installation and test of **model of treatment**



Sequence of operations (including inputs, outputs, and parameters of treatment) **with methodological choices and formalization of the questions of ecologists**

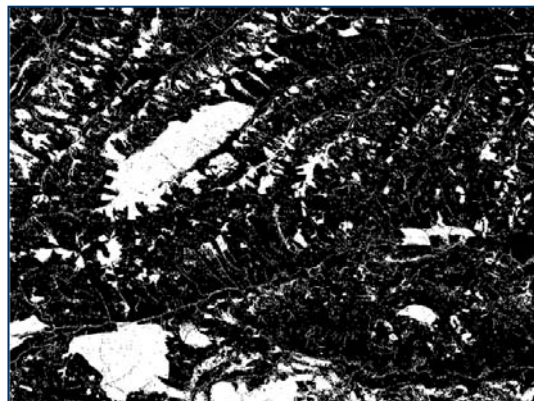


Phase 1: Identification of the edges



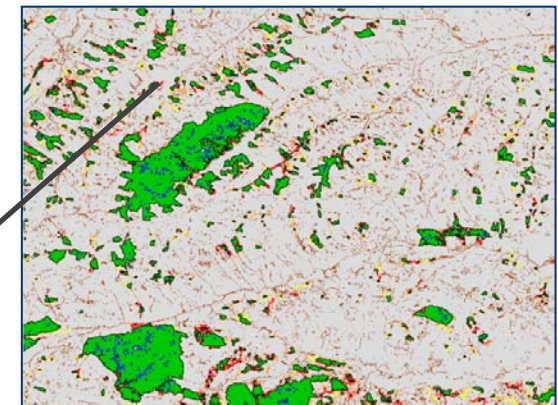
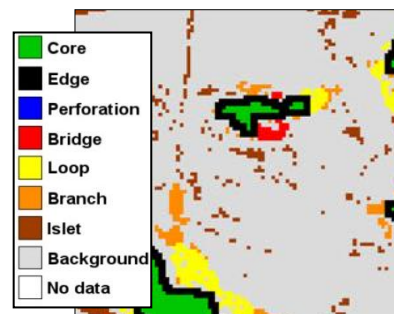
How to separate the edges on an image?

- **Localization of the edges using software GUIDOS. Why?**
 - **Graphical User Interface** for the **Description** of image **Objects** and their **Shapes**
 - **Standard Tool** for characterization of forest fragmentation, created by the EU
 - Open source
 - Allows to distinguish in a landscape from broad extent, the **class of the edges**
- but in an undifferentiated way**



Input data:
binary image
wood/not wood

MPSA
with Edge width=20m (2 pixels)



Output data:
classified image of the various wooded
elements in 7 classes

Phase 2: To identify the segments of edges

(1/2)

How to approach the perception of the ecologists by building rectilinear edges?

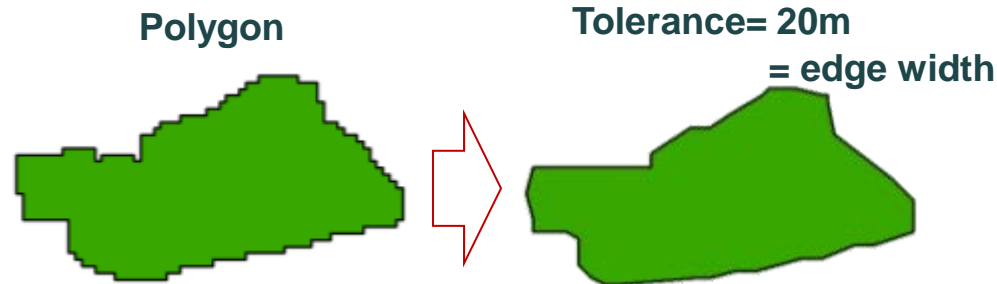


- Two important steps:

- **Simplification of the contour of wood**
- **Extraction of the segments of edges**



**Raster To Vector
GENERALIZATION
SEGMENTATION**



- GENERALIZATION: **Use of the function "Generalize" (ET GeoWizards):**
 - Douglas-Peucker algorithm :

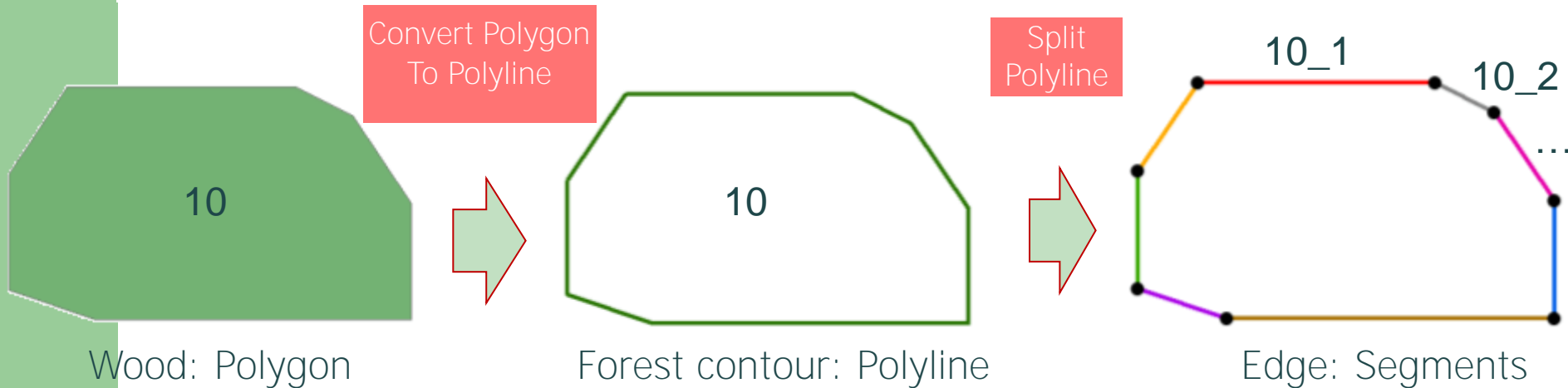
Simplification of the shape of the polygons by reducing their number of sides while preserving their topology

 - Parameter of tolerance (T)

Phase 2: To identify the segments of edges

(2/2)

How to cut out the edges by keeping genealogy?

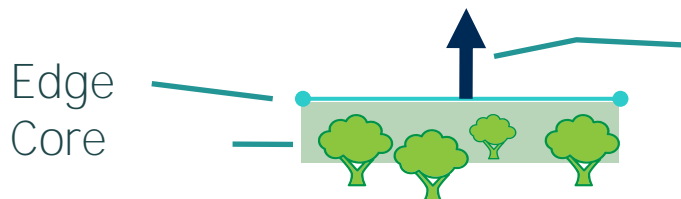


- SEGMENTATION: **Use of the function "Split" (ET GeoWizards):**
 - Algorithm of segmentation
 - Split in all vertices
- Logical LABELLING:
 - Array of pairs of co-ordinates
 - Concatenation of identifiers

Phase 3: Characterization of the segments

(1/2)

- **Calculation of attributes**, saved in database
 - **Intrinsic variables** on the segment
 - **Extrinsic variables** from other dataset
- Choice of a new objet= **Transect** and interrogation by spatial jointure
 - In conformity with methodological choices in Ecology where many studies are based on transects
 - Allows to cross with Raster or Vector data



TRANSECT=Perpendicular at the central point of each segment, Directed outside wood, length=40m

- **Use of script "PerpendicularLine " (ESRI Inc):**
 - Parameter setting in language python

Phase 3: Characterization of the segments

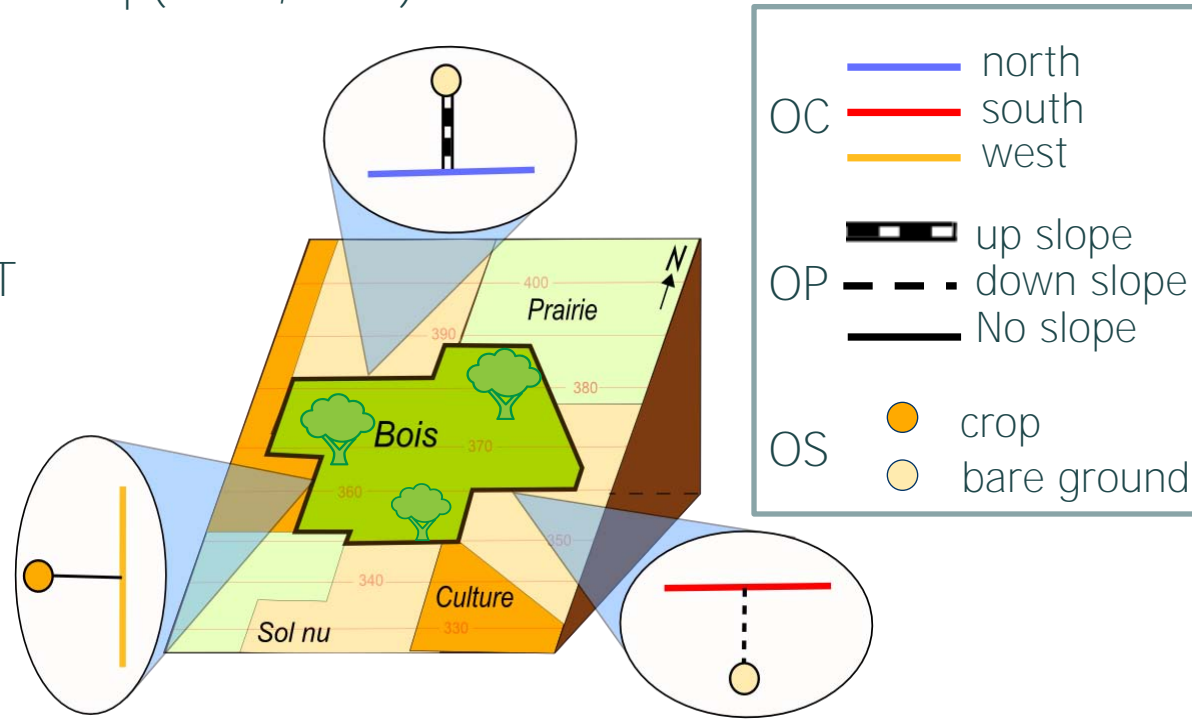
(2/2)

- **Cardinal orientation (OC):** Intrinsic; continue (0 to 360)
 - exposition of the edge compared to wood to which it belongs
- **Slope orientation (OP):** Extrinsic; discontinuous (3 Cl.)
 - Use of the MNT (TOPO database, 25m)
- **Land Cover occupation (OS):** Extrinsic; discontinuous (11cl.)
 - Use of the land cover map(INRA, 10m)



All calculated indices depend on the grain (MNT 25m) and typology (11 classes of land cover)
- Definition of an original symbology

CartolisSymbol



Statistical results from CARTOLIS

(1/3)

- Quantification tool: on ~200km²:

Phases	Process	Statistics
1	Classification	Water= 13,38%
		crop= 34,72%
		Meadow = 32,24%
		bareground = 10,3%
		Other = 0,63%
	Treatment under Guidos: analyze morphological MPSA	Core= 8,77%
		Edge = 4,61%
2	Vectorization	Other wooded elements = 8,74%
		109 woods
	Generalization	11.194 edges
		101 wood
	4921 edges	
3	Calculation of the variables	OC= Southern in maj.
		OP= no slope in maj.
		OS= meadow in maj.

Statistical results from CARTOLIS

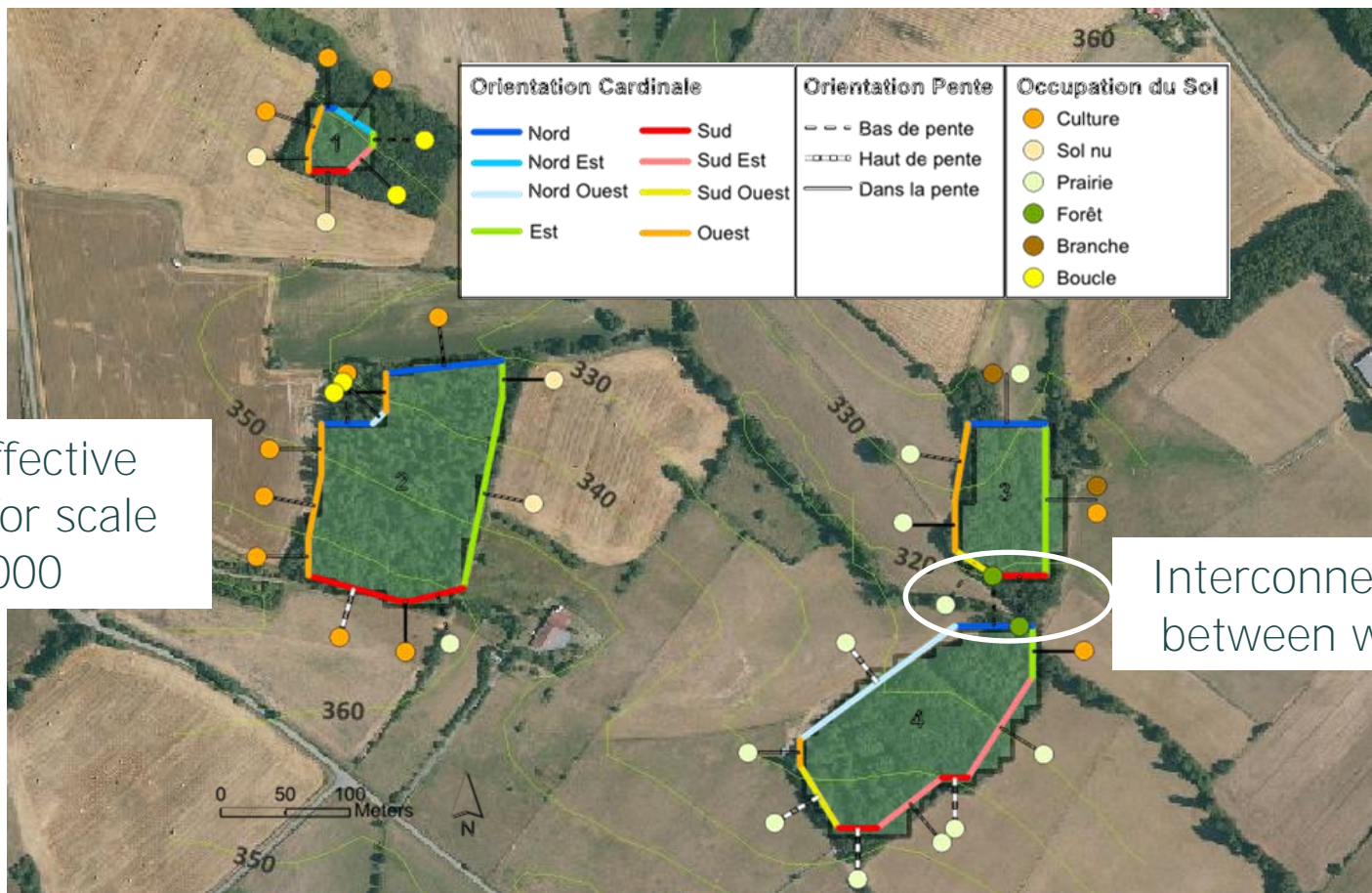
(2/3)

- Wood have an average surface of 20 ha and an average perimeter of 1.9 km
- 197 km of segments of edges in our landscape
- The average length of a segment is 40m
- Density of the segments of edges = $1\text{km}/\text{km}^2 \rightarrow$ very fragmented landscape compared to the national statistics
 - **“South/no slope/Meadow”**: the most current combination with 8.8 km of cumulated edges

Cartographic results from CARTOLIS

(3/3)

• Visualisation tool



zoom for effective
symboly for scale
<1: 10000

Interconnection
between wood

Conclusions

- **Construction of a method for 2D analysis** with functional (geomatic aspect) and relevant (ecological aspect) outputs .
- **Adaptability of the developed method** with explanation of implementation detail of each phase (parameter setting, choice of the variables).
- **Improvements** : computing time, determination of the relevant parameter setting via integration the sensitivity analysis; IHM.
- **Prospects for comparative applications** between sites of long-term studies (synchronic approach).

Contribution to Landscape Ecology

- Participation to the definition of **new metric based on the segments**
- **Complementarity** with metric based on the polygons (Patch metrics Fragstats)

Utilities of edge-based metrics for studying landscape fragmentation

Hui Zeng^a, X. Ben Wu^{b,*}

Computers, Environment and Urban Systems
29 (2005) 159–178

Thank you for your attention



Financial support of the department of research "Sciences for the Action and the Development" of INRA