spatial analysis using landscape ecology concepts

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Symposium
General thematic of landscape ecology and public action
INRAE Ecodeveloppement 21/11/2021

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https://iale.uk/functional-ecological-units-ambitious-approach-conservation-meres-mosses

2 recent research studies with theories of **landscape ecology**

- First research : Hypothesis of my PHD (relationship urban/agriculture)

- Second research : Food Systems Study

PHD in quantitative geography (spatial analysis) using **landscape ecology concepts**

Comitee : (Ecodeveloppement ,UMR ESPACE - university of Avignon)

Context: How to (re)connect agriculture near the city to local markets, problem of this generation -> (environmental issue, making the city autonomous in the face of hazards (Covid), preservation of agricultural land, problem of urban sprawl  (loss of nature, agriculture) , employment opportunities)

H1: Does the **RUGOSITY** of the urban boundary have a positive effect on the orientation of agricultural production towards local markets (in peri-urban areas) ?

++ urban form are complex (rugosity) , ++ relationships exist with the local agriculture !!

(1) Rugosity : initial term in marine ecology (valid theory !)

Scientists calculate the reef rugosity index to estimate the marine biodiversity

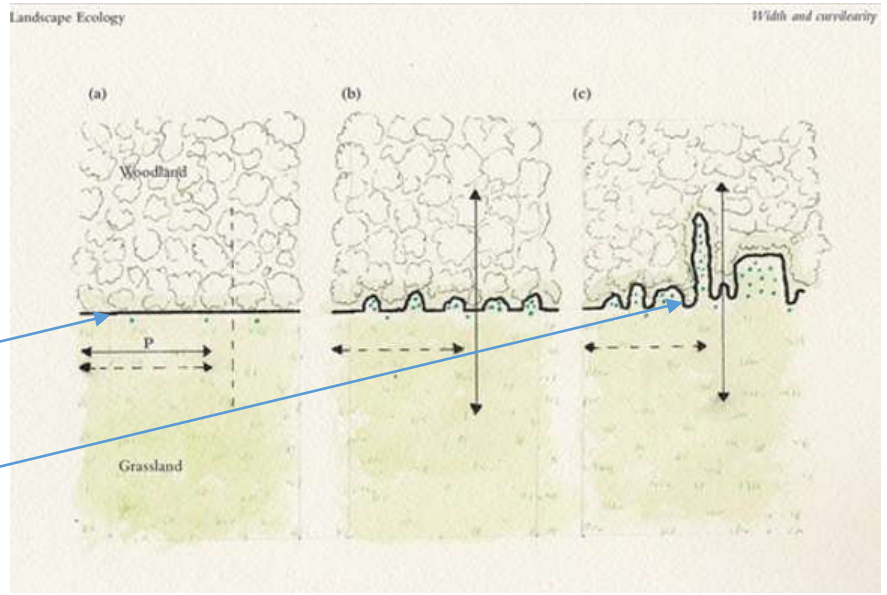
roughness of the coral reef measured with a rope

(2) Rugosity landscape ecology (valid theory !)

(Forman, 1995) -> habitat boundaries

straight boundary -> less habitat

curved boundary -> more habitat

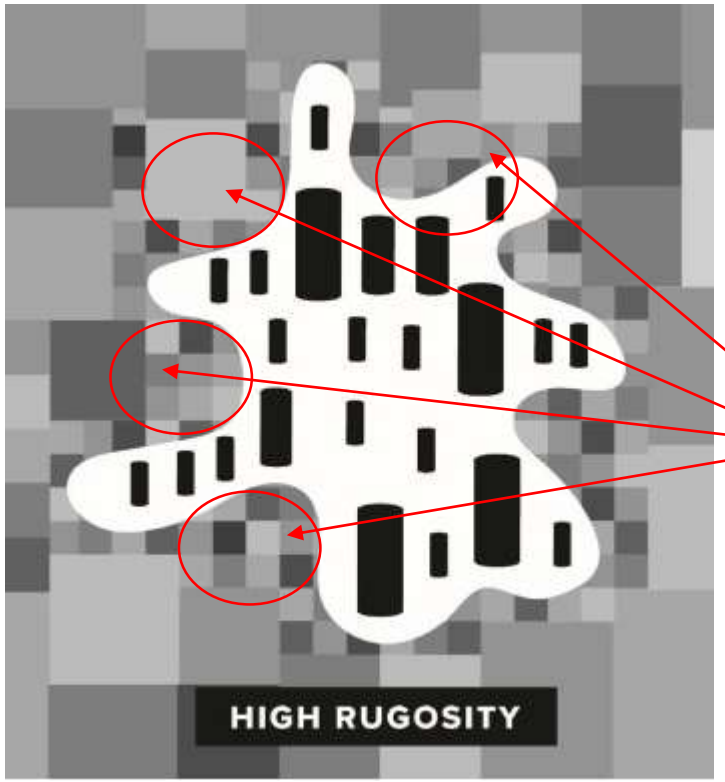


Wildlife usage and movement relative to boundary curvilinearity

There is a theoretical link between form and function (Moreno 2012, Batty 1991;Béjan,Ledezma 1998) and not all forms have the same functional properties

Valid rugosity theory of landscape ecology can be applied to the urban form

Rugosity -> urban interface/agriculture



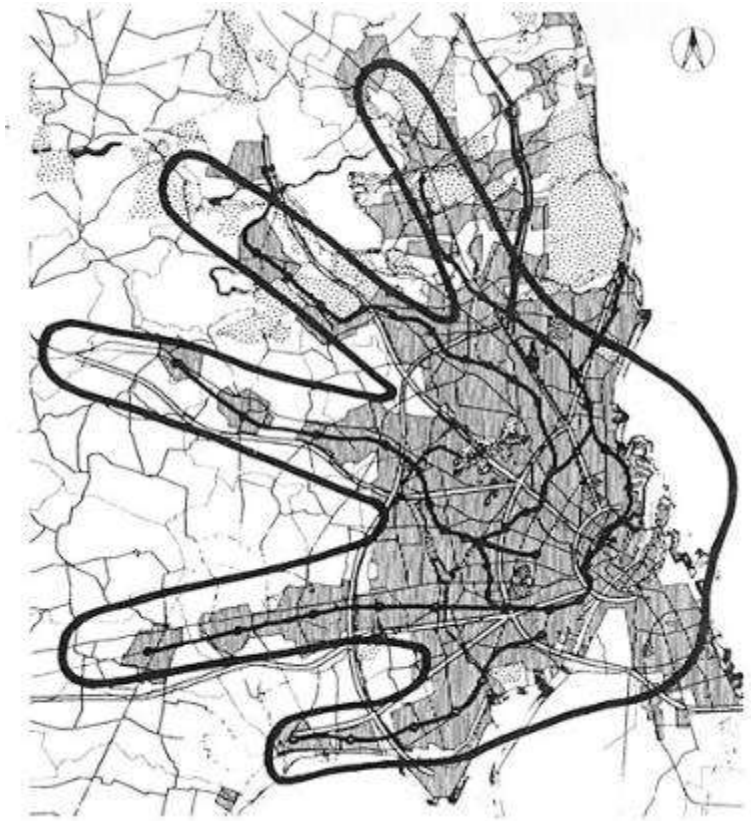
interstitial spaces

"Higher densities on the urban interface are associated with smaller agricultural plot sizes and ***greater diversity of production." (Catherine BRINKLEY)***

Image created by Nicole Martin of the Center for Regional Change.

Rugosity -> urban interface/nature

Rugosity with elongated urban branches "Copenhagen" (nature)



http://danishdesignreview.com/townscape/2017/9/3/the-finger-plan-at-70

(The shape of the city is integrated in the planning document In 1947)

With the rugosity Sustainability of the urban form and preservation of nature

In my PHD

1) Thinking a methodology to create this rugosity indicator (urban form) in the Vaucluse -> crops fruit and vegetable -> urban spatial signature

2) Thinking a methodology to explain the agriculture spatial signature (local food), different variables (agriculture (farm), socio-economic, public policy etc ... -> and study the landscape (notion of landscape ecology) -> quantify the landscape with the landscape metric of McGarigal (fragmentation, isolation, connectivity, diversity ...)

The spatial signature of multifunctional agriculture connected to the city is more fragmented -> (communication roads, plot sizes irrigation and drainage channels, hedges and field borders ,small area) -> Defontaines,Forman

Proximity (diversified landscape)

Intensive mono-specific agriculture -> far to the city -> large area -> isotropic space (Otthoffer and Arrojo, 2012; Sanz Sanz, 2012) -> WHEAT (intensive agriculture)

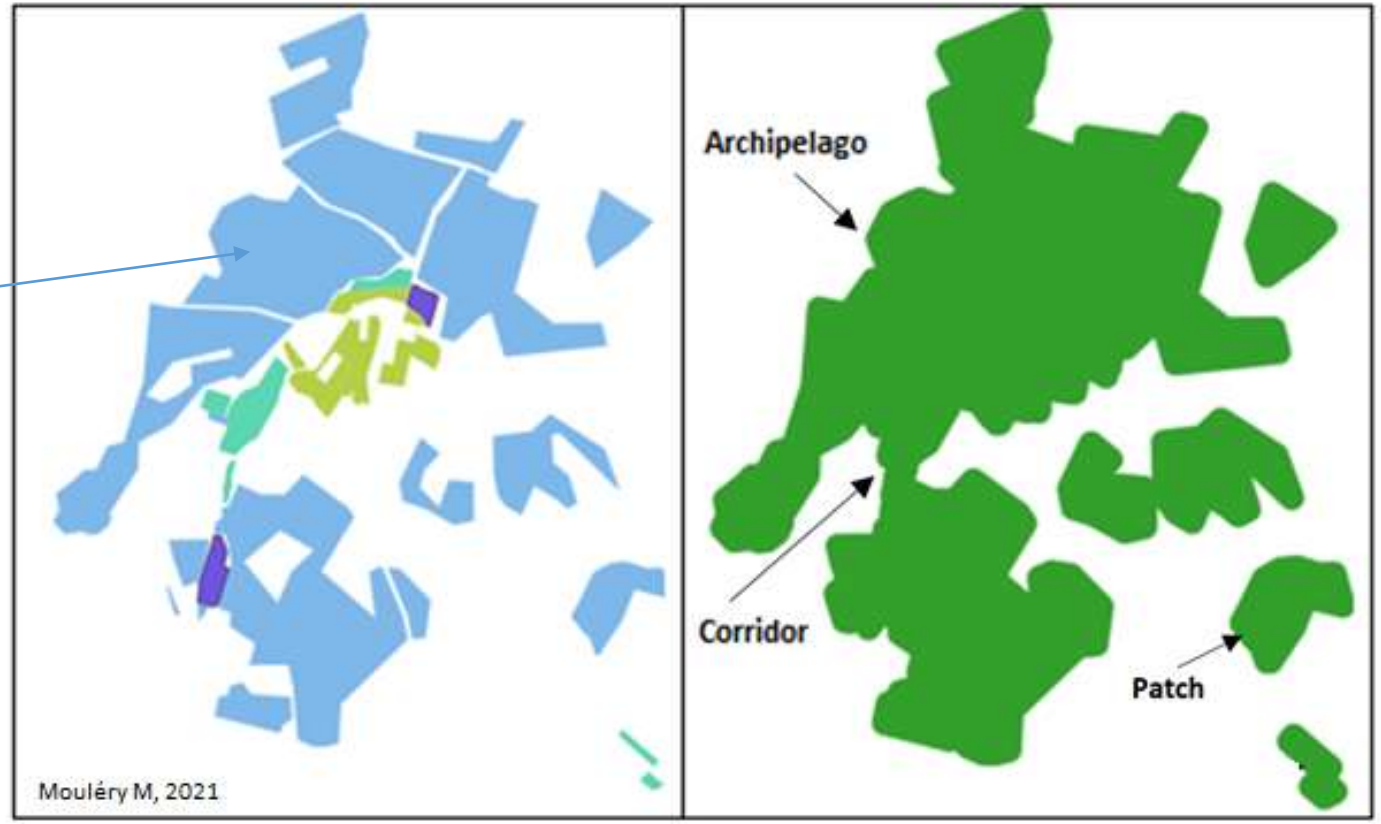
Far to the city
Wheat

H1: Does the rugosity of the urban boundary have a positive effect on the orientation of agricultural production towards local markets (in urban and peri-urban areas) ? Work in progress ….

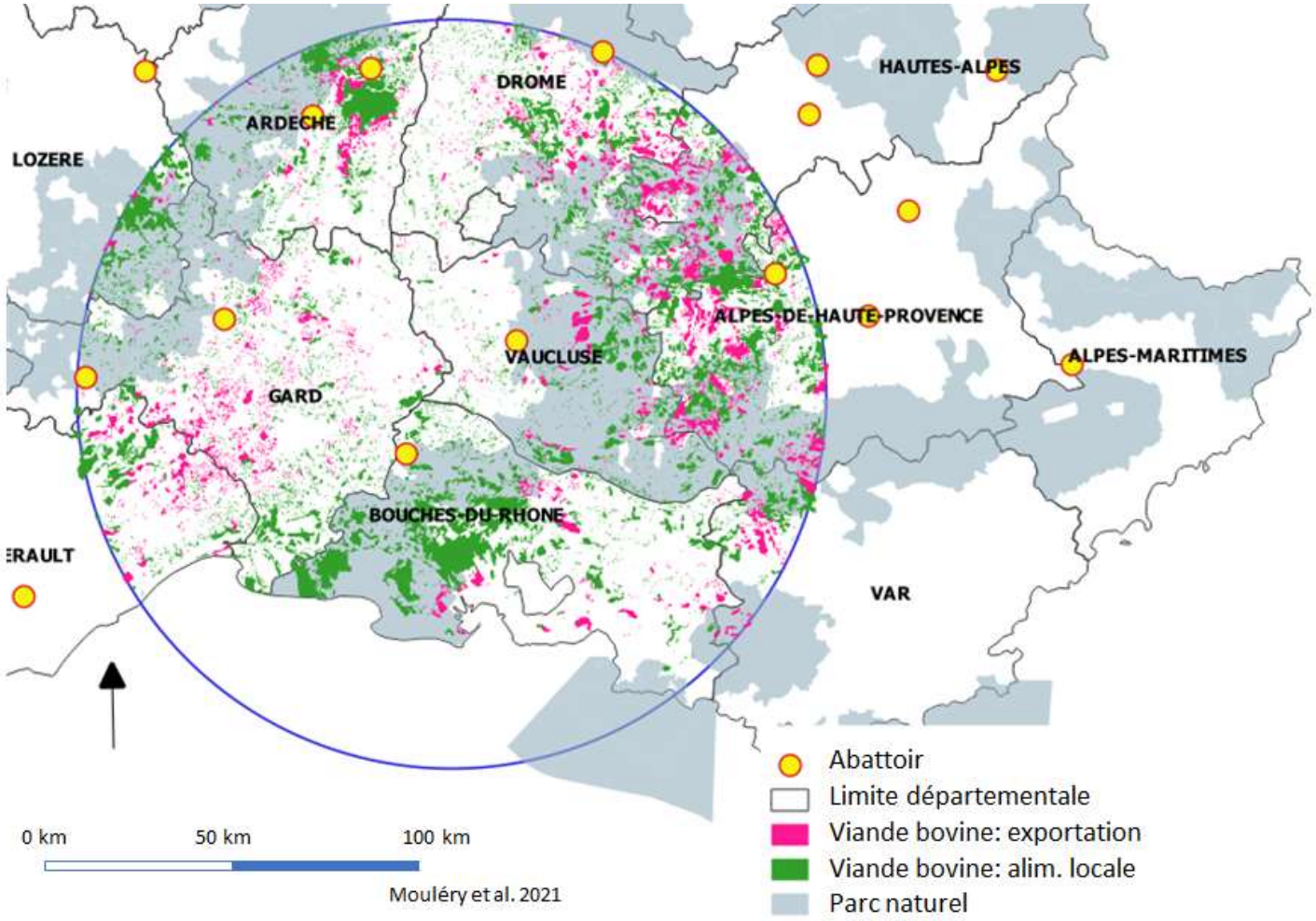
(FOODSHED) Research 2 (Sanz Sanz Esther & Napoléone Claude) : spatial modelling:
Food systems study (based on the archipelago theory of landscape ecology -> metaphor)

- Identification of the pastoral zones within a 100km radius of Avignon that can meet the demand for 'meat' products to supply the school canteen.
- Notions of Landscape ecology : archipelago , connectivity, patch , corridor , (source , sink)

Pastoral zone



Before Dilation – Erosion Dilation /erosion (creation of the archipelago)



Location of **the archipelagos** within a 100 km radius with the city of Avignon (center)

Self-sufficiency assessment: Defining the livestock foodshed spatial signature of short supply chains

Mouléry M, Sanz Sanz E, Debolini M, Napoléone C, Josselin D, L Mabire, Vicente-Vicente (in progress)

Vicente-Vicente, J.L.; Sanz-Sanz, E.; Napoléone, C.; Moulery, M.; Piorr, A. Foodshed, Agricultural Diversification and Self-Sufficiency Assessment: Beyond the Isotropic Circle Foodshed—A Case Study from Avignon (France). *Agriculture* **2021**, *11*, 143. https://doi.org/10.3390/agriculture11020143

2 quick examples to show (in our work) you that landscape ecology can be (re)adapted to the urban/agriculture issue

In the past we used the landscape ecology to explain the Land use change with 6 countries In Mediterranean and understand the landscape (another study among many others)

E. Marraccini, M. Debolini, M. Moulery, P. Abrantes, A. Bouchier, J.-P. Chéry, E. Sanz Sanz, T. Sabbatini, C. Napoleone, Common features and different trajectories of land cover changes in six Western Mediterranean urban regions, Applied Geography,Volume 62,2015,Pages 347-356,ISSN 0143-6228, https://doi.org/10.1016/j.apgeog.2015.05.004.

Concept, theory of landscape ecology can be reused in other disciplines such as geography, economics, agronomy, mathématics, which makes it a powerful discipline…

THANK YOU FOR YOUR ATTENTION

Organized by Rodolphe Sabatier

Morning: Presentation of the partners
10:00-10:20: General introduction (Sabatier) + presentation of the participants (everyone)
10:20-10:30: Presentation of the lab (Sabatier)
10:30-11:25: Presentation of the work of F. Morelli and Y. Benedetti + discussion
11:25-11:35: Break
11:35-12:30: Presentation of the work of K. Wiegand and Ecosystem Modelling lab + discussion

12:30-14:00: Lunch + Coffee

Afternoon: Some possible connections with our projects
14:00-14:30: Spatial patterns of urbanization (Géniaux)
14:30-14:45: spatial analysis using **landscape ecology concepts (**Mouléry Michel)
14:45-15:15: Ecological compensation (Sabatier and Napoleone)
15:15-16:15: General discussion: what options for future collaborations?