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## 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

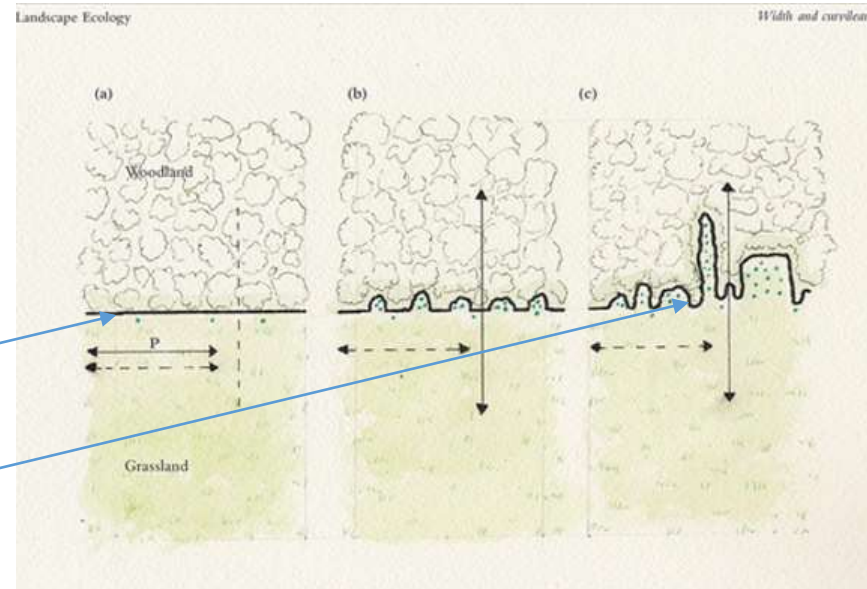


roughness of the coral reef measured with a rope

(2) Rugosity landscape ecology (valid theory !)

(Forman, 1995) -> habitat boundaries  
straight boundary -> less habitat

curved boundary -> more habitat

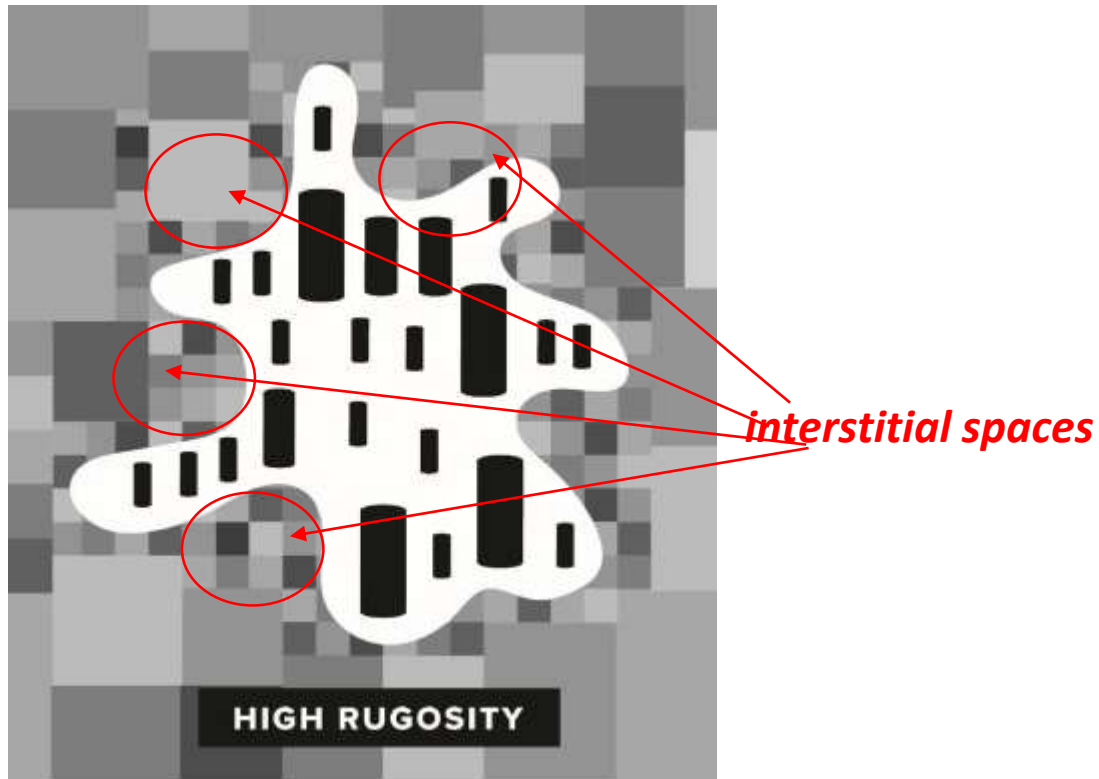


Wildlife usage and movement relative to boundary curvilinearity

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

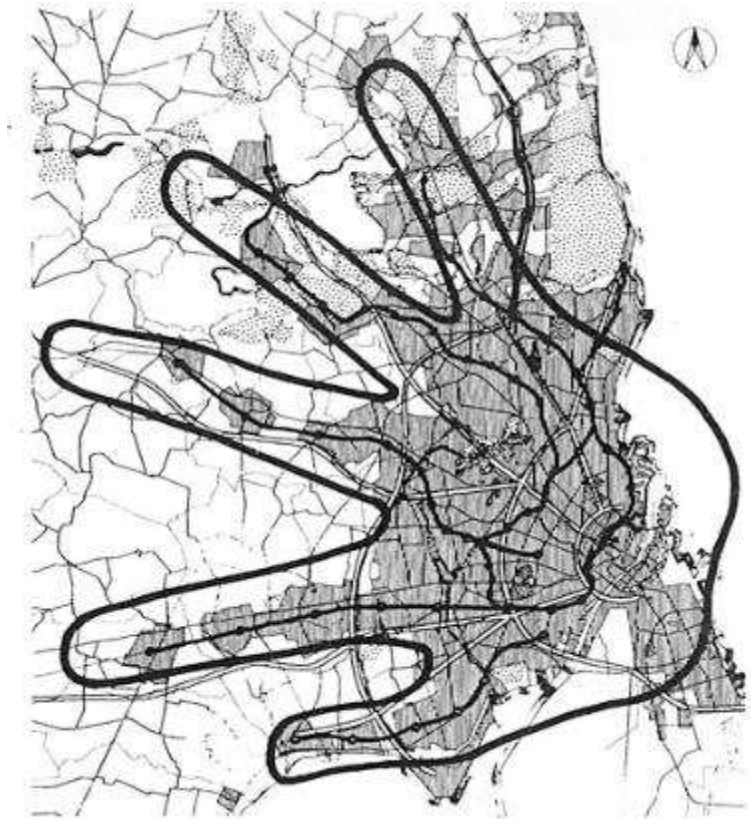


“Higher densities on the urban interface are associated with smaller agricultural plot sizes and **greater diversity of production.**” (Catherine BRINKLEY)

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

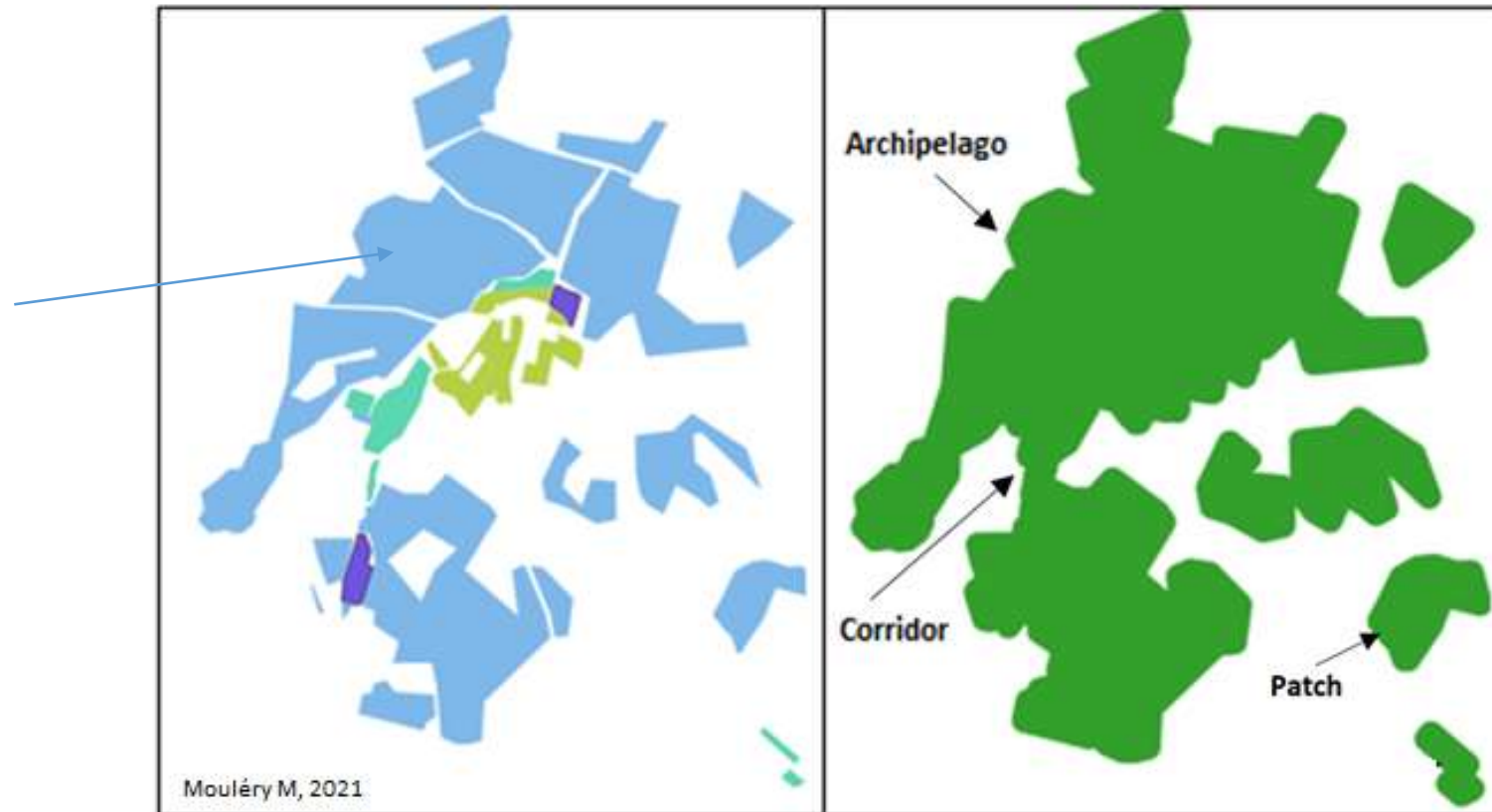


**H1: Does the **rugosity** of the urban boundary have a positive effect on the orientation of agricultural production towards local markets (in urban and peri-urban areas) ? **Work in progress ....****

**(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)**

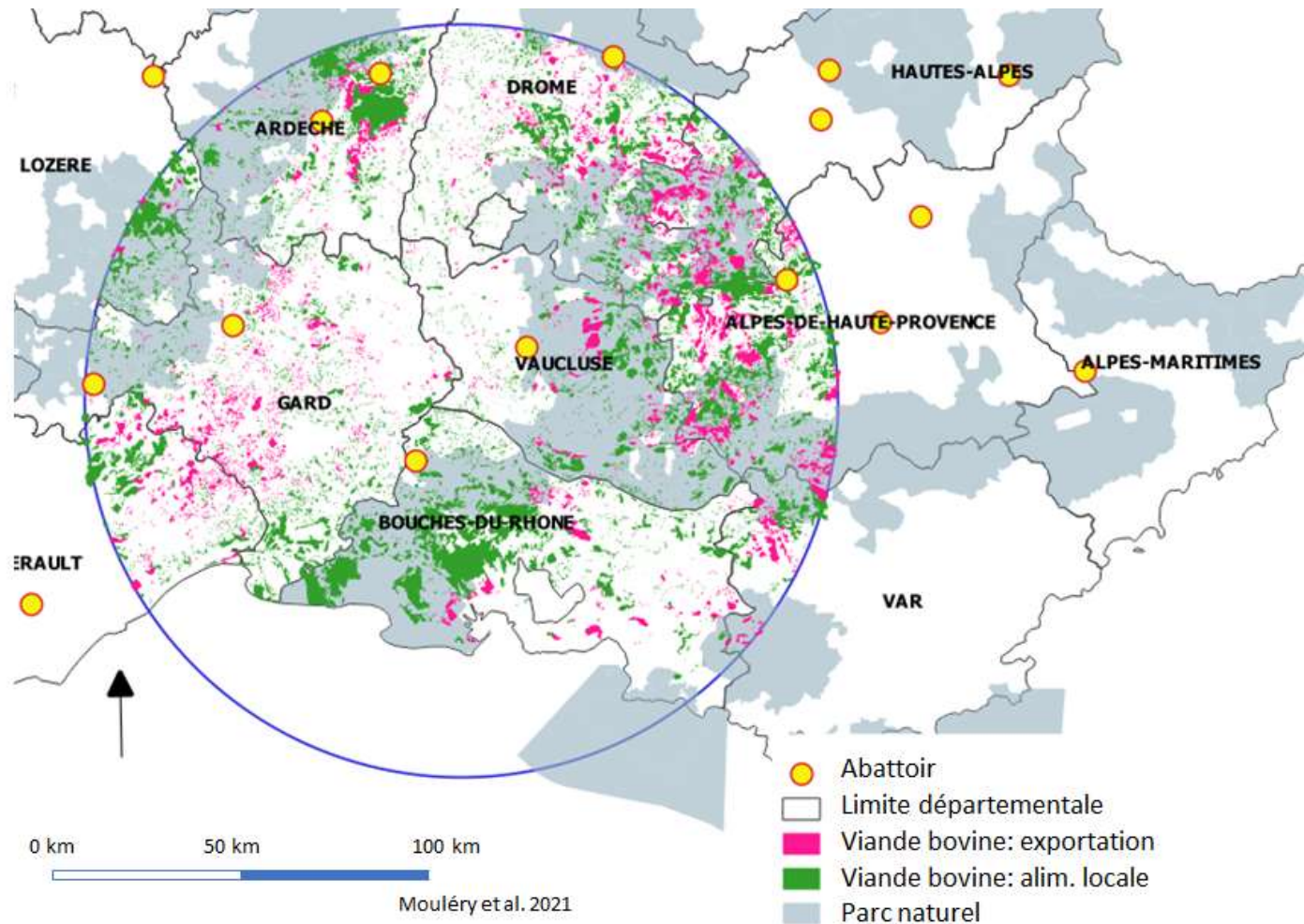
Pastoral  
zone



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.; Mouléry, 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, mathematics, 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?