

INRA Junior researcher permanent position

Position title : Digital representation and design of landscape patterns for optimising agroEcosystem services

Host research unit : UMR LISAH 2 place Viala 34060 Montpellier (www.umr-lisah.fr)

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Education:

pHd or equivalent
Training in agronomy, physical geography or landscape ecology
Experienced in numerical spatial and/or temporal modelling
Initiated into scientific calculation methods
skills in spatial statistics will be appreciated

Position description :

Optimizing the spatial allocation of agricultural practices and of landscape management features (e.g. for hydraulic, anti-erosive or water quality purposes) within a cultivated territory is now acknowledged as a potential way to make a balance between the productive uses (including nonagricultural) and ecological services that are expected from agricultural landscapes. From this perspective, the successful candidate will develop a numerical approach of landscape pattern design that will aim to identify the best scenarios of spatial allocation satisfying a multicriterion quantitative objective (agricultural production, environmental impact, workforce...) assigned to a territory.

The recent progresses in the digital representations of the spatial structures and dynamics of the cultivated landscapes make now this approach possible. New knowledges on the interrelationships between the different components of cultivated landscape and on the determinants and logics of stakeholders deciding their allocation will have to be acquired and integrated into these landscape representations. The optimization objectives will be formulated using physically-based models of mass fluxes in the landscape now available in landscape modelling platforms. The coupling of the digital representations of landscape with the models of fluxes will be the core of the approach.



This research should initiate the development of landscape management tools that could take into account the specific spatial arrangements of landscape components and the flux processes that affect agricultural productivity and environmental impacts.

The successful candidate will be member of the LISAH team "spatial structures and dynamics of soils and landscapes" with a close interaction with the LISAH internal transverse program "modelling and simulating of fluxes in cultivated landscapes". The research will deal first with the Mediterranean vine growing case study where wine production objectives (quantitative and qualitative) need to be reconciled with the expected protections of soil and of water resource in a changing climatic and agro-economic context. The research will therefore get the benefit of data collected in the observatory of research in environment OMERE (<http://www.umr-lisah.fr/omere>) and the past research results on the wine production, the water resource (quantity, quality) and the soil erosion. He or she will also exploit the spatial databases that has been built over the study area by the LISAH for the various landscape features impacting the water resource.

The successful candidate will benefit the skills and the tools of his(her) team regarding methodologies of digital mapping and simulation of landscape features (soil, linear features, agricultural practices) and of representation of stakeholders decisions for developing realistic scenarii to be submitted to the numerical optimisation. The latter will be undertaken within the landscape modelling platform OPEN FLUID (<http://www.umr-lisah.fr/openfluid>) developed by LISAH and therefore will have the benefit of the knowledge of the hydrological modelling specialists involved in this platform. External collaborations will be to establish, in particular on the tools of optimization and constraint solving algorithms.

The successful candidate will have in the long term to take responsibility in developing collaborative research projects on the design of landscapes and the prospective analysis of landscape behaviours.

Reference papers in relation with the proposed position :

- Bailly, J. S., P. Monestiez, P. Lagacherie (2006). Modelling spatial variability along drainage networks with geostatistics. *Math Geology*, 38 (5), 515-539
- Bailly, J.S., Millier, C., Lagacherie, P., Puech, C. Kosuth P. (2008) Agrarian landscapes linear features detection from LiDAR elevation profiles: application to artificial drainage network detection *Int.J. of Remote Sensing*. In press.
- Bailly, J.; Biarnès, A. & Lagacherie, P. (2008), Spatial simulation of agricultural practices using a robust extension of randomized classification tree algorithms, *in* A. Ruas & C. Gold, ed., 'Headway in Spatial Data Handling', Springer: Berlin Heidelberg, Montpellier, pp. 91-108.
- Bailly, J.-S. ; Biarnès, A. ; Lagacherie, P. Semi-virtual spatial simulations of land management practices in Languedoc Vineyards: a way to deal with incomplete knowledges of spatial distributions in cultivated landscapes.
- LandMod 2010: International Conference on Integrative Landscape Modelling 
- Fabre, J.-C. ; Louchart, X. ; Colin, F.; Dagès, C.; Moussa, R.; Rabotin, M.; Raclot, D.; Lagacherie, P.; Voltz, M. OpenFLUID : a software environment for modelling fluxes in landscapes. LandMod 2010: International Conference on Integrative Landscape Modelling 
- Lagacherie, P., McBratney, A.B., Voltz.,M. (2007) Digital Soil Mapping :an introductory perspective. *Developments in Soil Science*, vol. 31. Elsevier Amsterdam 400 pages Amsterdam, Elsevier
- Lagacherie, P., Diot, O., Domange, N., Gouy, V., Floure, C., Kao, C., Moussa, R., Robbez-Masson, J.M. & Szleper, V. (2006). An indicator approach for describing the spatial variability of artificial stream networks with regard to herbicide pollution in cultivated watersheds. *Ecological Indicators* 6(2): 265-279.
- Lagacherie, P., Rabotin, M., Colin, F., Moussa, R., Voltz,M., 2010. Geo-MHYDAS: A landscape discretization tool for distributed hydrological modeling of cultivated areas. *Computers and Geosciences* 36 1021 – 1032