PhD PROPOSAL FOR THE DOCTORAL SCHOOL « Ecologie, Géosciences, Agronomie, ALimentation »

GENERAL INFORMATION

Thesis title: Effects of microclimatic variability on urban wildlife in the context of climate change
Acronym: MICROCLIM
Disciplinary field 1: Ecology **Disciplinary field 2:** Select an element
Three keywords: Climate change, urban heat island, biodiversity
Research unit : UMR CNRS 6553 ECOBIO
Name of the thesis director HDR (Habilitation thesis to supervise research) required: BERGEROT Benjamin **Email address of the thesis director:** benjamin.bergerot@univ-rennes1.fr **Name of the thesis co-director (if applicable): HDR (Habilitation thesis to supervise research) required:** QUENOL Hervé **Email address of the thesis co-director (if applicable):** herve.quenol@univ-rennes2.fr **Name of the thesis co-supervisor 1 (if applicable):** **Email address of the thesis co-supervisor 1 (if applicable):** **Name of the thesis co-supervisor 2 (if applicable):** **Email address of the thesis co-supervisor 2 (if applicable):**
Thesis grant (funding origin and amount): MRT (50%) + ARED (50%)
Contact(s) (mailing address and E-mail): Benjamin Bergerot, Université de Rennes 1, 263, Avenue du Général Leclerc, Campus de Beaulieu, Bâtiments 14B, 35042 RENNES Cedex, FRANCE
Recruitment process: Recruitment process depends on thesis funding. To select the corresponding recruitment process, please visit the EGAAL website here. This information is needed for proposal publication. ☒ **Doctoral school contest** ☐ **Interview** ☐ **Other (indicate) :**

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All sections must be filled. Once filled, please save the proposal form in pdf format using the following naming: Supervisor Name_Unit_Subject Acronym_EN.pdf

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SCIENTIFIC DESCRIPTION OF THE PhD PROJECT

Socio-economic and scientific context : (10 lines)

Many studies show that variables such as land cover or species interactions are important in explaining species distribution patterns at large spatiotemporal resolutions. Climatic variables are also often found to be important in predicting species range boundaries at large scales. While the analysis of flora distribution patterns in relation to urban heat islands has been the subject of many research, few studies have linked urban heat island microclimates to fauna. However, microclimatic contrasts on fine spatial scales (a few hundred meters) and temporal scales (annual) are strong in urban environments and are therefore likely to have a strong impact on wildlife. To date, few urban sites have been sufficiently instrumented to highlight the impacts of these microclimates on fauna. The city of Rennes offers these particular study conditions because the city presents a dense network of microclimatic sensors since 2014 to obtain fine-scale microclimatic information.

Assumptions and questions (8 lines)

The scientific questions addressed by this thesis will allow a better understanding of the impact of microclimatic effects on animal biodiversity patterns in cities. The objectives of this thesis at the interface between climatology and ecology are to provide innovative knowledge (1) by relating spatial temperature variability at a fine scale (a few tens of meters) to the distribution patterns of animal species in the city, (2) to analyze the consequences of this spatial variability of the local climate on the dispersal processes of animal species, (3) to make projections of species distributions in relation to the urban heat island and future climate change scenarios

The main steps of the thesis and scientific procedure (10-12 lines)

The main steps are:

1) Analyze how microclimates help to explain the distribution patterns of different animal species based on datasets (climatic and faunal) already acquired and which will be complemented by additional sampling during the thesis. We assume that the sensitivity of species to microclimatic effects will depend on their dispersal abilities. Therefore, species with high dispersal abilities such as birds or chiropterans will be less sensitive to microclimatic changes than ectothermic invertebrates with lower dispersal capacities such as spiders or carabids.

2) To analyze how faunal dispersal processes are influenced by microclimates generated by urban heat islands in order to explain and predict species distribution patterns. Indeed, if more and more results allow to estimate and model the connectivity in urban environments in relation to fragmentation and land use, very few results exist on the impact of microclimates on this connectivity, and even less on urban fauna due to the lack of fine scale data. In this thesis, we will analyze in situ movements of individuals by capture-mark-recapture methods of different taxonomic groups known to be sensitive to microclimatic changes (e.g. carabids, spiders, etc.).

3) To develop predictive scenarios of fauna distribution according to microclimatic change models at the scale of a city undergoing major changes such as Rennes.

Methodological and technical approaches considered (4-6 lines)

- Analysis of species distribution patterns in relation to the microclimatic envelopes generated in the Rennes. This part will be based on the analysis of existing biodiversity datasets and climatological data already acquired.

- Sampling of different taxa to determine the distribution patterns of species (batbox, Barber traps...).

- Estimation of species dispersal capacities by capture-mark-recapture method

- Analysis of functional traits

Scientific and technical skills required by the candidate

The candidate will have a Master in Ecology or an engineering degree (specialization in ecology and environment). Skills in statistics and modeling (R software, etc...), knowledges in entomology appreciated. Taste for field work, setting up experimental protocols (e.g. participatory sciences, etc...) and interactions with professional actors. Organizational skills, autonomy and rigor.

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THESIS SUPERVISION[1]

Unit name:	**Team name:**
UMR CNRS 6553 ECOBIO	Paysabio
Unit director name:	**Team director name:**
Joan van Baaren	Christophe Piscart
Mailing address of the unit director:	**Mailing address of the team director:**
joan.van-baaren@univ-rennes1.fr	christophe.piscart@univ-rennes1.fr

Thesis director

Surname, first name: BERGEROT Benjamin

Position: Associate professor

Obtained date of the HDR (Habilitation thesis to supervise research): 11/12/2020

Employer: Université de Rennes 1

Doctoral school affiliation: EGAAL

Rate of thesis supervision in the present project (%): 50%

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 50%

Number of current thesis supervisions/co-supervisions: 0/2

Thesis co-director

Surname, first name: QUENOL Hervé

Position: DR CNRS

Obtained date of the HDR (Habilitation thesis to supervise research): 2011

Employer: CNRS

Doctoral school affiliation: STT

Rate of thesis supervision in the present project (%): 50%

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 50%

Number of current thesis supervisions/co-supervisions: 1/2

Thesis co-supervisor 1 (if applicable)

Surname, first name:

Position:

Habilitation thesis to supervise research ☐ yes ☐ no If yes, date diploma received:

[1] **In EGAAL Doctoral School, if only one scientist in thesis supervision = 100% of supervision rate; if 2 people involved in thesis supervision = from 50% to 70% of supervision rate for the director; if 3 people involved in thesis supervision = 40% / 30% / 30% of supervision rate distribution among supervisors.**

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Employer:

Doctoral school affiliation:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

Thesis co-supervisor 2 (if applicable)

Surname, first name:

Position:

Habilitation thesis to supervise research ☐ yes ☐ no If yes, date diploma received:

Employer:

Doctoral school affiliation:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

Private partner (if CIFRE funding, private funding,…)

Surname, first name:

Position:

Employer:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

International partner (if Cotutelle thesis)

Surname, first name:

Position:

Employer:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

Professional status of previous PhD students supervised by both director and co-supervisors (from 5 years)

Please provide the following information for <u>each</u> PhD students supervised

Thesis supervision : Alice Meyer-Grandbastien

Professional status and location : Octobre 2016 - Décember 2019, ECOBIO

Thesis supervision: B. Bergerot, F. Burel et E. Hellier

Contract profil : Plantes et Cités (fixed-term)

Publications:
- Meyer A., Burel F., Hellier E. & Bergerot B. Characterizing perception of landscape heterogeneity by visitors within urban green spaces: a step towards enhancing their ecological and social benefits. Submitted.
- Meyer A., Burel F., Hellier E. & Bergerot B., 2020. A step towards understanding the relationship between species diversity and psychological restoration of visitors in urban green spaces using landscape heterogeneity. Landscape and Urban Planning, 195:103728

Thesis supervision: **Etienne Neethling**

Professional status and location : oct. 2012 – Déc. 2016, LETG

Thesis supervision: H. Quénol, G. Barbeau

Contract profil: MCF ESA (Angers, permanent)

Publications:

Neethling E., Barbeau G., Bonnefoy C. et Quénol H., 2012: Evolution in climate and berry composition for the main grapevine varieties cultivated in the Loire Valley. Climate Research, 53, 89-101.

Barbeau G., Neethling E., Ollat N., Quénol H., Touzard JM., 2015 : Adaptation au changement climatique en agronomie viticole. Revue AE&S vol.5, n°1, 9p.

Neethling E., Petitjean T., Quénol H. and Barbeau G., 2017: Assessing local climate vulnerability and winegrowers' adaptive processes in the context of climate change. Mitig Adapt Strateg Glob Change. 22(5), 777-803.DOI 10.1007/s11027-015-9698-0

Neethling E., Barbeau G., Julien S., Le Roux and Quénol H., 2017: Local-based approach for assessing climate change adaptation in viticulture. Oeno One, 1-10.

Neethling, E., Barbeau, G., Coulon-Leroy, C., Quénol, H. 2019: Spatial complexity and temporal dynamics in viticulture: A review of climate-driven scales. Agricultural and Forest Meteorology, 276, 107618.

Thesis supervision**: Mercedes Fourment**

Professional status and location : oct. 2012 – Juil. 2016, LETG

Thesis supervision: H. Quénol, M. Ferrer (Uruguay), co-tutelle

Contract profil : MCF Université de la République à Montevideo (Uruguay, permanent)

Publications:
Fourment M., Ferrer M., González-Neves G., Barbeau G., Bonnardot V. and Quénol H., 2013: Spatial variability of temperature and grape berry composition at terroir scale in Uruguay. Ciência y Técnica Vitícola, 28, 1, 329-334.

Fourment M., Ferrer M., Quénol H., 2013 : Vitis vinifera L. cv. Tannat: respuesta a la variabilidad climática. Agrociencia Uruguay [online]. 2013, vol.17, n.2, pp. 45-54. ISSN 1510-0839.

Fourment M., Bonnardot V., Planchon O., Ferrer M. et Quénol H., 2015 : Circulation atmosphérique locale et thermiques dans un vignoble côtier : observations dans le sud de l'Uruguay, Climatologie, 2014, p. 47-64.

Fourment M., Ferrer M., González-Neves G., Barbeau G., Bonnardot V., and Quénol H., 2017: Tannat grape composition responses to spatial variability of temperature in a Uruguay's coastal wine region. International Journal of Biometeorology, 1-12.

Fourment M., Ferrer M., Barbeau G., Quénol H., 2018: Is phenological behavior of Tannat (Vitis vinifera L.) affected by temperature variability in the coastal wine region of southern Uruguay? Acta Horticulturae, 1-8.
Fourment M., Ferrer M., Barbeau G. and Quénol H., 2020: Local perceptions, vulnerability and adaptation responses to climate variability in a wine region in Uruguay. Environmental Management, https://doi.org/10.1007/s00267-020-01330-4.

Thesis supervision**: Renan Le Roux**

Professional status and location : oct. 2014 – dec. 2017, LETG

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Thesis supervision: H. Quénol, C. Van Leeuwen

Contract profil : CIRAD (post-doc)

Publications:

Le Roux R., de Rességuier L., Corpetti T., Jégou N., Madelin M., Van Leeuwen C., & Quénol H., 2017: Comparison of two fine scale spatial models for mapping temperatures inside winegrowing areas. Agricultural and Forest Meteorology, 247, 159-169. https://doi.org/10.1016/j.agrformet.2017.07.020

Le Roux R., de Rességuier L., Katurji M., Zawar-Reza P., Sturman A., van Leeuwen C. et Quénol H., 2017 : Analyse multi scalaire de la variabilité spatiale et temporelle des températures à l'échelle des appellations viticoles de Saint-Émilion, Pomerol et leurs satellites. Climatologie, 14, 1-17.

Le Roux R., Katurji M., Zawar-Reza P., Quénol H. and Sturman A., 2018: Comparison of statistical and dynamical downscaling the WRF model. Environmental Modelling and Software, 100,67-73.

Le Roux R., Katurji M., Zawar-Reza P., Quénol H. and Sturman A., 2019: Analysis of spatio-temporal bias of wrf temperatures based on weather pattern classification. International Journal of Climatology. 39, 89-100.

Thesis supervision**: Igor Sirnik**

Professional status and location : oct. 2013 – oct. 2019, LETG

Thesis supervision: H. Quénol, Manzano Juarez Juan de l'université polytechnique de Valence en Espagne, co-tutelle

Contract profil : Wageningen University (post-doc)

Publications:

Sirnik I., Quénol H., Jiménez-Bello M.A. and Manzano J., 2015: Spatial-temporal variability analysis of temperature in two viticulture sites in Spain and in Slovenia. Agriculture and Forestry, 61(4): 221-230.

Sirnik I., Quénol H., Jiménez-Bello M.A., Manzano J., Le Roux R., 2018: Viticulture under climate change impact: future climate and irrigation modeling. In E3S Web of Conferences (Vol. 50, p. 01041). EDP Sciences.

Sirnik, I., Quénol, H., Jiménez-Bello, M. Á., Manzano, J., Rodríguez, C. M. W., Martínez, C. A. O., & Le Roux, R., 2018 : Cambio climático en viticultura : modelización futura del clima. Sustentabilidad, 175.

Thesis supervision**: Perrine Loussert**

Professional status and location : oct. 2014 – dec. 2017, LETG

Thesis supervision: S. Corgne, H. Quénol

Contract profil : GEOSYS (permanent)

Publications:

Loussert P., Baup F. Corgne S., Quénol H., and Ortega A., 2016: Analysis of SAR and optical temporal signatures of grapevine over a heterogeneous vineyard landscape. 26-29 September 2016, Edinburgh.dx.doi.org/10.1117/12.2241755

Thesis supervision**: Jean Nabucet**

Professional status and location : jan. 2016 – dec. 2018, LETG

Thesis supervision: L. Hubert, H. Quénol

Contract profil : IE CNRS (permanent)

Publications :

Nabucet J., Hubert-Moy L., Corpetti T., Launeau P., Lague D., Michon C. and Quénol H., 2016: Evaluation of bispectral LIDAR data for urban vegetation mapping, 26-29 September 2016, Edinburgh.doi:10.1117/12.2241731.

Five main recent publications of the supervisors on thesis subject:

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THESIS FUNDING

Origin(s) of the thesis funding: MRT + ARED
Gross monthly salary: 1769€
Thesis funding state : Partly acquired (co-funding)
Funding beginning date/Funding ending date: October 2021 – September 2024

Date: 16/03/2021

Name, signature of unit director:

Joan VAN BAAREN
Directrice de l'UMR Ecobio

Name, signature of team director:

Name, signature of thesis project director: