

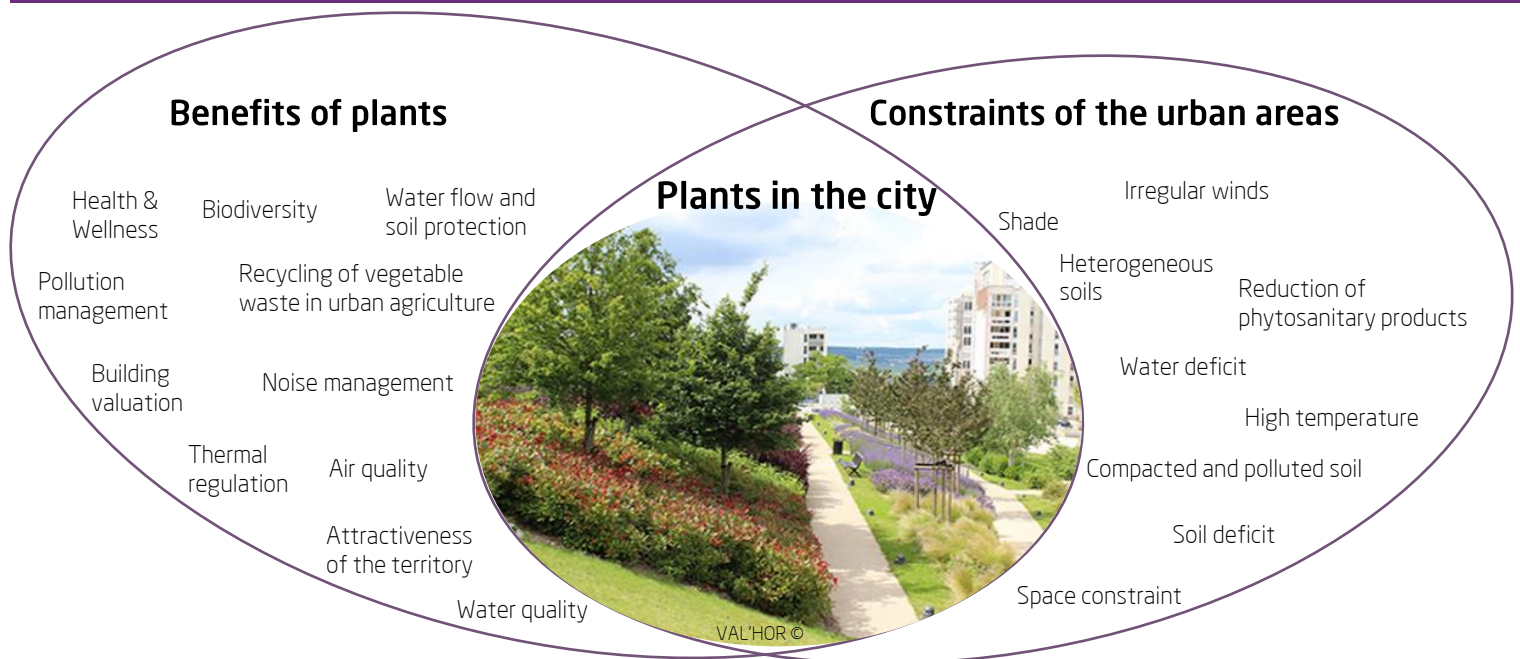


The innovation box of Objectif Végétal is a series of 4-page issues on **different topics** ; they enable to discover or better know the research laboratories of the Région Pays de la Loire, France. **This tool aims to encourage collaborations between companies and researchers.** You will find in it current or recent projects, key results, useful contacts and **partnership opportunities**.

Find all the issues in the Innovation section of our website
<http://www.objectifvegetal.univ-angers.fr>

n°10

For the success of plants in urban areas!



Last update: June 2018

Plante & Cité talks about it !



Caroline Gutleben

Director of **Plante & Cité** (National technical center for green spaces and landscape)

For a « plant » urban genius.

The effects of climate change and the evolution of our relationship to nature are opportunities to give back all its place to plants in urban areas.

First, we must consider the **ecosystem services** of **nature-based solutions**, both physical health, urban microclimate or biodiversity, which contribute to improve the quality of living environment, a vital issue in the city. With landscaped roofs, green roofs and walls, the reopening of urban rivers, alternatives to the mineralization of the city are flourishing, in place of the conventional gray infrastructure of urban engineering.

But the benefits of plants in urban areas do not arise exclusively from their physiological functions. Plants also have a symbolic function that brings man and nature closer together, through a unique sensory mediation whose benefits on **psychological health** are well established.

Finally, it is essential to **choose the right nature-based solutions** according to the context and local constraints. The city is not a favorable environment: degraded soils, air pollution, spatial constraints and urban networks... There are sometimes limited margins of maneuver for the urban planners. **Sustainable plant establishment** therefore requires **specific knowledge, creativity** and **ingenuity**; many reasons for companies to develop projects based on the academic skills presented in this issue of "**The Innovation Box of Objectif Végétal**."

A research topic in full expansion in Pays-de-la-Loire region

Plants in urban areas is a research area that is the subject of work in several academic laboratories in **Angers**.

The urban environment being a highly anthropised and constrained system ; it disrupts, in the medium term, the ability of plants to provide the expected **ecosystem services**. A **better knowledge and understanding** of urban ecosystems will make it possible to propose ways of adapting, managing and making these **ecosystems more sustainable**.

- **EPHor¹** laboratory seeks to understand and model the mechanisms of **water and heat transfer** in the soil-plant-atmosphere continuum, and to characterize the **biochemical-physical properties** of these soils. This laboratory also models, on a continuum scale, the contribution of plants to urban **thermal regulation**.
- **IRHS²** teams bring their expertise on the **functioning of plants** in urban environments: measuring and understanding the impact of the urban environment on plant physiology, plant improvement, protection against biotic stress, contribution of plants to the health and well-being of urban dwellers.
- **GRAPPE³** laboratory studies **consumer** perception, expectations and behaviour when buying and using ornamental plants and develops specific methods to answer these questions.



STRATège

Towards **new technical and marketing strategies** to better meet the expectations of the **urban horticultural market**.

In 2017, **ASTREDHOR⁴**, **Agrocampus Ouest**, **Inra** and the **University of Angers** launched the **STRATège Joint Technology Unit** that has been labelled by the French Department of Agriculture, Agri-Food and Forestry. This collaborative platform is dedicated to :

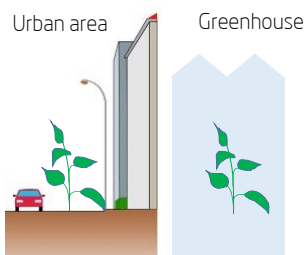
- ✓ understanding **consumer** needs, expectations and behaviours,
 - ✓ **adaptation** of plant products to the urban market.
- Expected results:**
- ✓ the implementation of **production and marketing strategies**,
 - ✓ the identification of **genetic and environmental factors** in the ability of plants to develop in urban areas.



philippe.morel-chevillet@inra.fr

Towards plants adapted to stress conditions in the city

❑ Impact of the urban environment on plants



OBAUC project (2016-2017) – funds from the RFI Objectif Végétal program

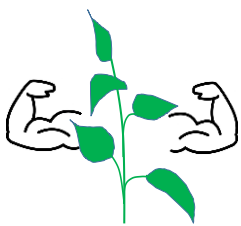
The Arch-E (**IRHS²**), **EPHor¹** (**Agrocampus-Ouest**) and **LEE⁵** (**IFSTTAR⁶**) teams sought to check the possibility to simulate in greenhouse the major abiotic constraints of the urban environment (shading related to the presence of building, water restriction, soil compaction) and to quantify their effects on the development and physiology of an ornamental plant.

- **Results:** The **urban climate could be simulated in a greenhouse** but with a time lag. The rose bush has adapted its physiology and development mainly in response to **water stress**.



lydie.huche-thelier@inra.fr

❑ Acclimating plants before planting in the city



EPICLONES project (2017-2019) – funds from the RFI Objectif Végétal program

This project is performed by the **IRHS²** teams (Arch-E, EPICENTER and Bioinformatics). The researchers assess the possibility of acclimating plants, before planting, to the stressful conditions of the urban environment by carrying out several cycles of vegetative propagation under stress and selecting the most resistant plants at each cycle.

- **Objective:** Find out **whether increased resistance can be achieved and whether it is due to stable epigenetic changes** initiated by prolonged stress. Such a strategy could apply to any species vegetatively propagated.



nathalie.leduc@univ-angers.fr

Innovative plant production for the urban market



IRRADIANCE project (2018-2021) – funds from CasDar and VAL'HOR

This project is performed by **IRHS²** in collaboration with **ASTREDHOR⁴**. It aims to adapt horticultural plants to the spatial constraint of city dwellers, while maintaining the "quantitative sustainability" of products.

- **Objective:** Develop a compact and branched horticultural crop production system to better meet the emerging urban market.



laurent.crespel@agrocampus-ouest.fr
philippe.morel-chevillet@inra.fr

¹EPHor: Physical Environment of Horticultural Plants research Unit (Agrocampus-Ouest)
²IRHS: Institute of Horticulture and Seeds (Inra, Agrocampus-Ouest, University of Angers)
³GRAPPE: Research Group on Food Products and Processes (Esa-Inra)

⁴ASTREDHOR: French Technical Institute of Horticulture
⁵LEE: Water and Environment research unit (IFSTTAR)
⁶IFSTTAR: French Institute of Science and Technology for Transport, Development and Networks

Building fertile soils in the city



In heavily waterproofed urban areas, **plants that grow in planting pits do not return organic matter to the soil.**

EPHor¹ research unit is particularly interested in the role played by **exogenous inputs of organic matter from urban activity** and by **roots**, on the **agronomic properties** of soils.

laure.beaudet@agrocampus-ouest.fr

□ Fertile soils from dam sediments



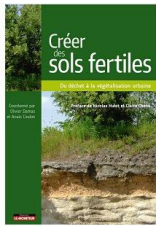
Gaëtan Fourvel

Gaëtan Fourvel completed his **thesis** under Cifre modality (2015-2018) with **EDF R&D**, with the academic supervision of the **EPHor¹** research unit. His research project analyzed and optimized the physical fertility of urban soils built from **dam sediments**.

➤ **Results:** Environmental and agronomic **criteria** have been proposed to **direct sediments** towards **soil construction** and to propose **suitable uses**.



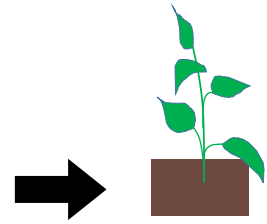
□ Fertile soils from recycled urban materials



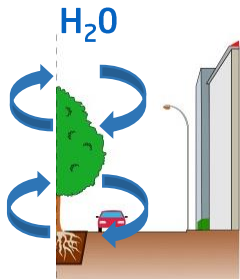
SITERRE project (2011-2015) – *funds from ADEME and partners*

Driven by **Plante & Cité**, this project has involved many partners, among them **EPHor¹** research unit.

➤ **Results:** Fertile soil construction processes have been developed, using **innovative materials that replace topsoil and quarry aggregates**.



Effects of trees on local urban climate



Rue canyon project (2016-2021) – *funds from ADEME, Région Pays-de-la-Loire, Ministère de l'Agriculture*
EPHor¹-IFSTTAR⁶-LEE⁵-ISGS collaboration aims to quantify the transfer of water and energy in the soil-plant-atmosphere system in urban areas. It is based on an experimentation phase conducted in a **1/5 scale canyon street** and modelling using a distributed climate approach.

➤ **Objective:** Understand the impact of the plant on the climatic conditions in the city, more particularly under water restriction conditions, in order to **optimise the cooling of urban heat islands** while restricting watering.



pierre-emmanuel.bournet@agrocampus-ouest.fr

Towards more greenery and well-being in the city



Nature4Cities project (2016-2020) – *funds from the European program H2020*

This project gathers 26 partners including 5 entities in Pays de la Loire (**Nantes University**, **IFSTTAR⁶**, **Agrocampus-Ouest**, **Plante & Cité**, and **CEREMA⁷**)

➤ **Objective:** Create a **web platform** that will help European cities reintroduce nature into urban planning.



patrice.cannavo@agrocampus-ouest.fr



URBiNAT project (2018-2023) – *funds from the European programme H2020*

This project gathers 26 European and non-European partners.

➤ **Objective:** regenerate and integrate **disadvantaged neighbourhoods** through **"health corridors"** and the co-creation of **social and environmental nature-based solutions**. Nantes is one of the 7 pilot cities selected to test new urban development models.

□ Effect of plant mediation on the psychological health of inhabitants



Bastien Vajou

Hired by **Plante & Cité**, **Bastien Vajou** is working on his Cifre **thesis** (2018-2021) with the **IRHS²** and **LPPL⁸** research units. His work consists of an analysis of the relationships between urban green spaces and the psychological health of the inhabitants.

➤ **Objectives:** Develop a method for evaluating the effect of these green spaces on the health of city dwellers (*e.g.* anxiety) ; Explain the process that leads to **improved psychological health** when in contact with nature spaces.



gilles.galopin@agrocampus-ouest.fr

⁷**CEREMA** : Center for Studies and Expertise on Risks, Environment, Mobility, and Urban and Country planning

⁸**LPPL** : Psychology Laboratory of Pays de la Loire

Collaborate with research

- Take advantage of ...
- scientific expertise,
 - advanced equipment,
 - a network of collaborators,
 - innovative ideas



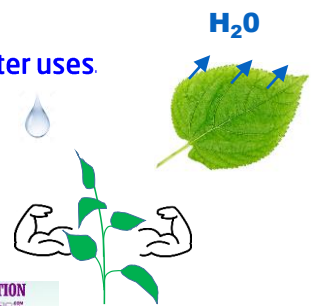
- Reinforce your R&D team with...
- Master trainees
 - PhD students under [Cifre modality](#)
 - << Young >> PhD graduates

➤ Contact us to help you build your projects and support them:



Examples of possible collaboration topics

- Diagnose and propose **construction** solutions for **fertile urban soil**.
- Evaluate the **bio-physicochemical quality of urban soils** (in place or built) to provide **better uses**.
- Improve **irrigation management** in a constrained context.
- Characterize plant **transpiration** in urban climatic conditions according to the uses to define the services provided.
- Develop **cropping routes** to **precondition the plant** to urban constraints.
- Understand **the barriers to the purchase** of plants by urban youth (generation Y) and identify **levers for action for distributors**.



Impression Service Reprographie UA

Training for professionals

- Adaptation of plants to soil and climate in urban areas
- Better integrate the tree into the urban planning projects
- « **Engineering of urban green spaces** » (*Spécialisation de Master 2, open to professionals*)
- The city and the urban ecosystems
- The ecosystem services of plants in the urban area
- Innovations and plant management in the city



gilles.galopin@agrocampus-ouest.fr
laure.beaudet@agrocampus-ouest.fr



⚠ Also remember to recruit alternating students (professionalisation contract or apprenticeship contract).

Prestations de services

- Diagnosis of quality of urban soils,
- Analysis of air and water flow in plants
pierre-emmanuel.bournet@agrocampus-ouest.fr
- Integrate sensory methods, better understand and improve the perceived quality of your products
c.brasse@groupe-esa.com
- Therapeutic gardens design
- Contribution to responding to calls for tender from local authorities
gilles.galopin@agrocampus-ouest.fr
- Expertise to ensure that your plant innovations meet consumer expectations
nancy.biard@vegepolys.eu



Objectif Végétal, Research, Training & Innovation in Pays de la Loire is a regional program (2014-2019) promoted by the Pays de la Loire Region which involves higher education and research institutions ([Université d'Angers](#), project leader, [Agrocampus Ouest](#), [ESA](#), [Inra](#), [Université de Nantes](#)) as well as the [Végépolys](#) competitiveness cluster.

Objectif Végétal aims to increase the visibility of upstream research, increase the attractiveness of the training center and its links with companies and strengthen the economic value of the results of academic research.

Contact **The innovation Box Objectif Végétal** :

Tanegmart Redjala, Business developer, Objectif Végétal - tanegmart.redjala@univ-angers.fr - www.objectifvegetal.univ-angers.fr

Maison de la Recherche, Campus du Végétal, 42 rue Georges Morel - CS 60057, 49071 Beaucouzé Cedex - 02 49 18 04 59



THIS PROJECT IS CO-FUNDED BY THE EUROPEAN REGIONAL DEVELOPMENT FUND