ADAPTING TO CLIMATE CHANGE

WORKING WITH NATURE TO TRANSITION OUR URBAN ENVIRONMENTS

Central Park New York city © Ols C.

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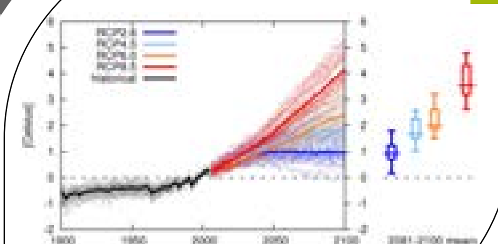
CLIMATE CHANGE & URBAN HEAT ISLANDS: THE SCIENCE SAYS, PLANT MORE

Climate change will make extreme heat events increasingly frequent. How can we predict and mitigate overheating in our urban environment? Can planting help cool our cities? Two recent publications from the Ecoville and URBIO research programmes bring new elements to thee question.

The overheating linked to urban heat islands will get worse as extreme heat events associated with climate change increase. The impacts are many, ranging from physical discomfort to health risks. The lack of cooler conditions at night, associated with the higher temperatures, raises the risk of excess deaths in vulnerable groups. However, micro-climate conditions within a built-up area may vary enormously from street to street, depending on aspect, shade and nearby planting. To better understand these effects, urban climatologists measure and model temperatures at various scales, from a single building to a whole district. Drawing upon several scientific concepts, this article presents various methods and practices that can effect urban cooling. ■

Trees cool the urban environment through shade and evapotranspiration. / Guérin M., Plante & Cité

GLOBAL WARMING AND MORE FREQUENT EXTREME WEATHER EVENTS



Temperature increases in the IPCC's 4 main scenarios / KNMI

In the 5th report of the Intergovernmental Panel on Climate Change (IPCC), published in 2014, climatologists predicted that the increase in temperatures recorded since the beginning of the 20th century would continue throughout the 21st century. Under different greenhouse gas and aerosol emission scenarios, the most likely climate warming is between 1.8 and 3.4 °C by the end of the 21st century. Climate change models predict simultaneous increases in temperature, sea level and the frequency and intensity of extreme weather events (heavy rain, heat waves etc.). The number of abnormally hot days in France will increase in future, with over 100 additional days annually of high temperatures by 2100, according to the IPCC's intermediate scenario. Southern and eastern regions of France are expected to be worst affected by these extreme heat events. Heavy rain events will increase the risks of urban flooding due to overloaded drainage systems and flooding of underground infrastructure. Even though IPCC scenarios agree in predicting that average winter temperatures will be warmer, periods of devastating cold such as in 1956 or 1987 are not out of the question.

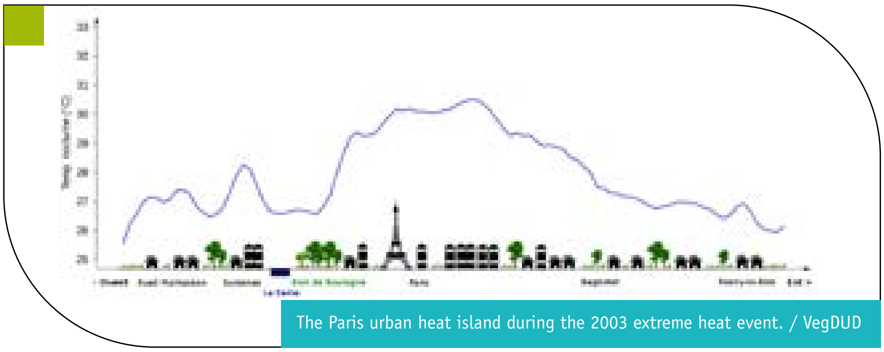
URBAN OVERHEATING: SOME DEFINITIONS

The urban heat island effect

The urban heat island phenomenon is one of overheating which specifically affects urban areas. An urban heat island is characterised by localised temperature increase observed in the urban environment with respect to surrounding rural areas and average regional temperatures. Where a 2 to 4°C higher urban temperature would be seen on a normal summer night, that difference can reach 8°C during extreme heat events (recorded in Paris in 2003). The urban heat island effect is related to various factors:

- surface type: the high proportion of impervious artificial surfaces to that of natural surfaces reduces evapotranspiration levels and increases the amount of heat retained in the materials. Inorganic materials (roads, buildings, roofs) store the heat of the day, releasing part of that back at night.
- morphologies: the density and form of the urban fabric trap solar radiation and reduce air movement.

• human activity: air-conditioning, the heating of buildings, and vehicle traffic all release heat into the atmosphere.



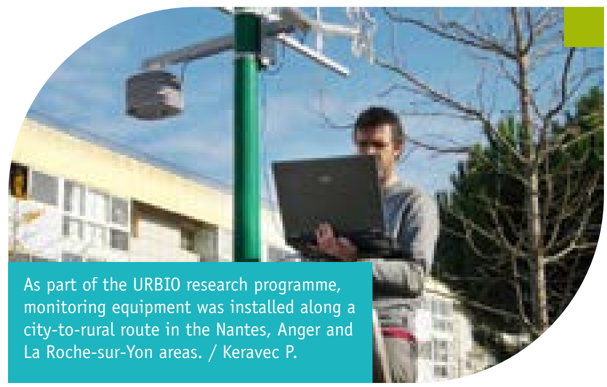
The Paris urban heat island during the 2003 extreme heat event. / VegDUD

Thermal comfort

Thermal comfort corresponds to a condition where the exchange of heat between the human body and its environment causes no discomfort (sweating, shivering) or, more simply, one where the individual feels neither too hot nor too cold. Thermal comfort depends on physiological factors (metabolism, activity) and on physical factors in the surrounding urban environment, the most significant ones being solar radiation, surface temperature, air temperature, the speed of air movement and ambient humidity. These various data can be used to obtain an indication of an "equivalent temperature" to the thermal sensation experienced. ■

MEASURING AND MODELLING THE URBAN CLIMATE

Urban climate modelling enables the study of the spatial and temporal evolution of the urban heat island phenomenon, and the testing of different change scenarios: spatial evolution such as the environment density of the built and temporal changes such as global warming over time. Modelling is based on data recorded on the ground. For urban micro-climatology, sensors located in the city record environmental data such as the wind speed and direction, air temperature, overall solar radiation, relative humidity, atmospheric pressure and total cloud cover. The variability of measurements is explained by temporal or spatial variables during the calibration stage of the model. The model is then validated by researchers comparing outputs from the model against past actual observations. ■



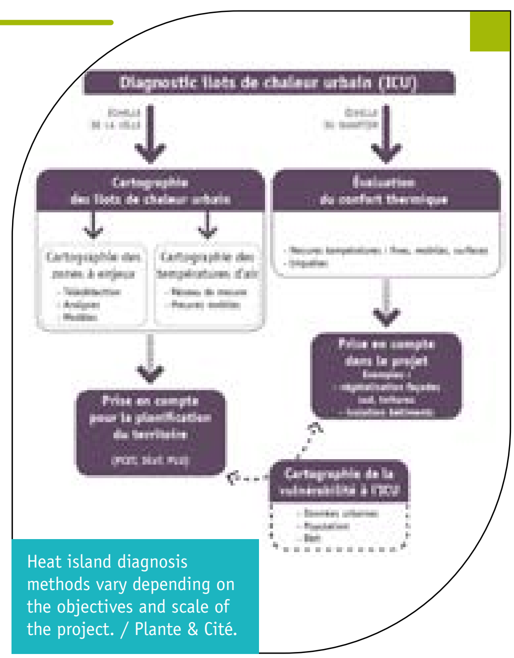
As part of the URBIO research programme, monitoring equipment was installed along a city-to-rural route in the Nantes, Anger and La Roche-sur-Yon areas. / Keravec P.

URBAN HEAT ISLANDS DIAGNOSIS: A SCIENTIFIC AND PRACTICAL TOOL

Urban heat island diagnosis relies on both observed data and modelling. This allows the impact of the heat island to be estimated at various scales in order to plan adaptation or mitigation measures. The roll-out of this diagnostic tool, already implemented by several local authorities, allows the urban heat island effect to be estimated. Their objective is to identify the main areas needing cooling, and the most appropriate solutions. These diagnostics can be performed at the scale of a district, a suburb, or one public space to facilitate appropriate planning. While particularly useful for raising awareness amongst local authority actors and public space users, they nonetheless require scientific and technical support to set-up the monitoring program and use the model.

Modelling at city scale contributes to improving the precision of the diagnostics. Maps showing vulnerability to heat islands can also be produced by combining climatological and sociological data. The results can then be re-used in the creation of regional planning documents.

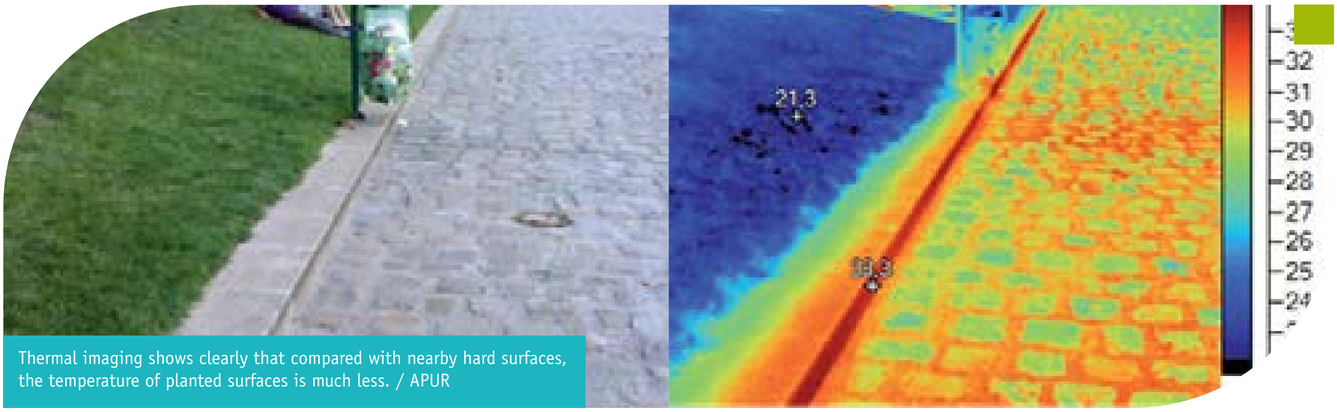
At suburb or street scale the diagnostic is used to estimate thermal comfort. Depending on the time and means available, several tools may be deployed for monitoring thermal comfort: temporary or permanent measurement of air or surface temperature (thermal imaging) or qualitative surveys of inhabitants' and users' experience of thermal conditions and their activities in the area. ■



Heat island diagnosis methods vary depending on the objectives and scale of the project. / Plante & Cité.

USING PLANTING TO IMPROVE THERMAL COMFORT

Planting is recognised as an effective way to refresh the urban climate: plants improve thermal comfort by absorbing more of the sun's radiation than do hard surfaces; trees provide shade, and plants transpire water vapour. For example, a planted area absorbs almost 70% of solar radiation and, thanks to evapotranspiration, heats up significantly less than surfaces with no planting receiving the same solar radiation. Thermal imaging of a planted area clearly illustrates this effect. What about the effects of other planting arrangements?



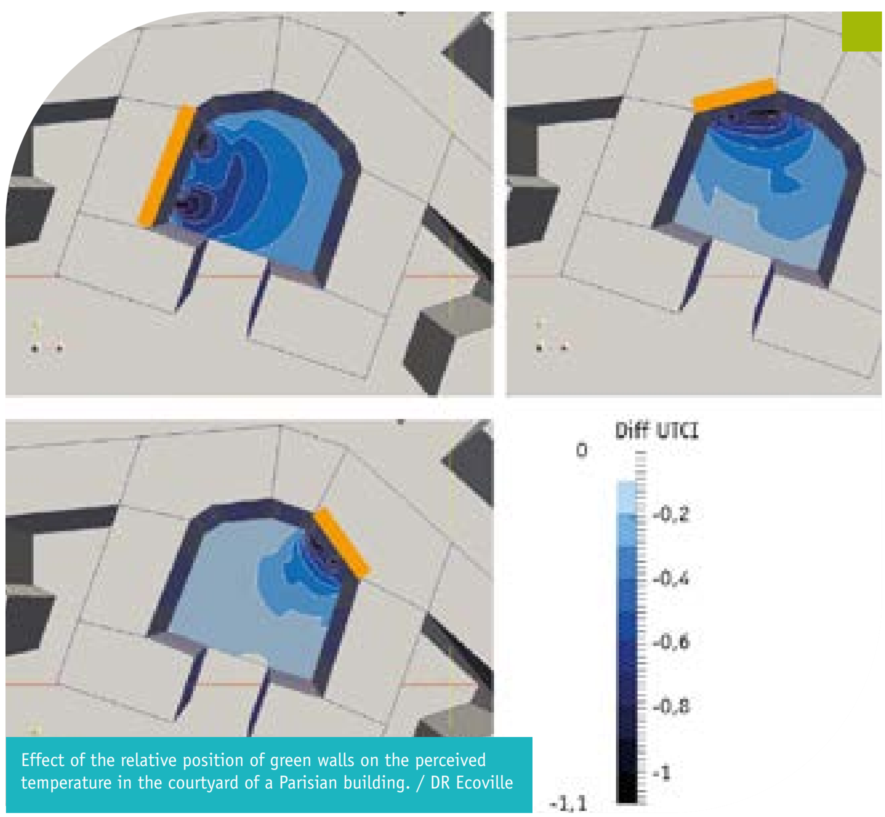
Thermal imaging shows clearly that compared with nearby hard surfaces, the temperature of planted surfaces is much less. / APUR

Influence of urban form and the function of planting

The VegDUD programme [researching the role of planting in sustainable urban development] used modelling and monitoring to study the role of different planting arrangements in different urban forms. Evapotranspiration, solar radiation and heat exchange in an urban micro-climate vary according to the planting arrangements and urban form (dense inner cities, suburban area, commercial zones, housing projects). Trees remain the best regulators of the urban climate, although depending on the project and context there are many other landscaping solutions able to improve thermal comfort and the living environment: planted areas, roofs, green walls, landscaped swales are all options. The urban form dictates in particular the position and effectiveness of planting and its cooling ability. In highly built-up areas for example the aspect and shade of buildings affect the cooling provided by a tree. The climatic impact of planting also depends partly on the water available to plants to use, since without water, evapotranspiration is very limited. Improvements in micro-climate modelling assist in understanding the role played by planting, but many parameters remain complex to integrate into the model: soil type, management, water availability, combinations of planting arrangements.

Green walls: contrasting effects depending on the arrangements

Researchers on the Ecoville programme [research program into biodiversity in a dense urban environment] used experiments and modelling to simulate the effect of several forms of green wall on thermal comfort both inside a building and in the nearby outside spaces.



Effect of the relative position of green walls on the perceived temperature in the courtyard of a Parisian building. / DR Ecoville

So far as interior thermal comfort was concerned, while green walls were generally effective under high temperatures for non-insulated and non-air-conditioned buildings (power consumption fell by 20% to 30%), the thermal balance depended on the type of planting. The effect was greatest when a substrate was in place. Studies showed that climbing plants on walls reduced summer temperatures by 0.9 °C on an east-facing wall and by up to 11 °C on a west-facing wall, in Mediterranean climate conditions. Modelling showed that a combination of green roofs and green walls increased the cooling effect on the building.

Green walls also improved thermal comfort in a street or in an interior courtyard during high-temperature summer periods. In an outside space, the more confined and planted the space is, the greater the effect of evapotranspiration and convection (lowering of air temperature). In a very open space, only the "cool wall" effect (infra-red heat exchange) is perceived. This however remains a significant factor because the human body is very sensitive to infra-red heat. ■

Depending on their aspect, walls planted with climbing plants improve summer thermal comfort both inside and outside a poorly insulated building. / Laïlle P., Plante & Cité

TOWARD PLANTING-BASED CLIMATE STRATEGIES

Optimising the thermal regulation that nature can bring to towns and cities requires fuller understanding of how planting actually functions. The temperature lowering effects depend on many factors, such as the species used, where planted (streets, parks), ambient temperature, time of day and the amount of planted surfaces. Reducing the area of hard surfaces and increasing that of urban planting (at ground level and on buildings) offer promising solutions to counter urban overheating, lowering temperatures by between 2 and 4 °C. Innovative architectural projects are able to leverage new techniques for vertical plantings to increase planted areas. However, these solutions will not replace the benefits provided by natural in-ground plantings and by urban trees. At the urban scale, indicators such as the experimental canopy index in Montreal allow the extent of shade provided by trees to be assessed and quantitative objectives to be set.

In parallel with these temperature lowering goals, adapting to climate change requires sensible water management which combines rainwater infiltration with the conservation of this resource. Preservation and development of in-ground planted spaces will improve the permeability of urban soils and allow rainwater to better enter the soil. Swales and rain gardens delay the flow of rainwater into drains and so limit the risk of flooding. Selecting ranges of drought-resistant plants also reduces or removes the need for watering during dry periods. A planting-based climate strategy thus inspires the design of resilient landscaped spaces resilient to climate uncertainties. A climate change adaptation strategy must provide for coordinated action between urban development and the inclusion of nature within that. ■

Damien Provendier,
Landscaping and biodiversity

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THE SOIL, A STRATEGIC AND LITTLE UNDERSTOOD ALLY IN ADAPTING TO CLIMATE CHANGE

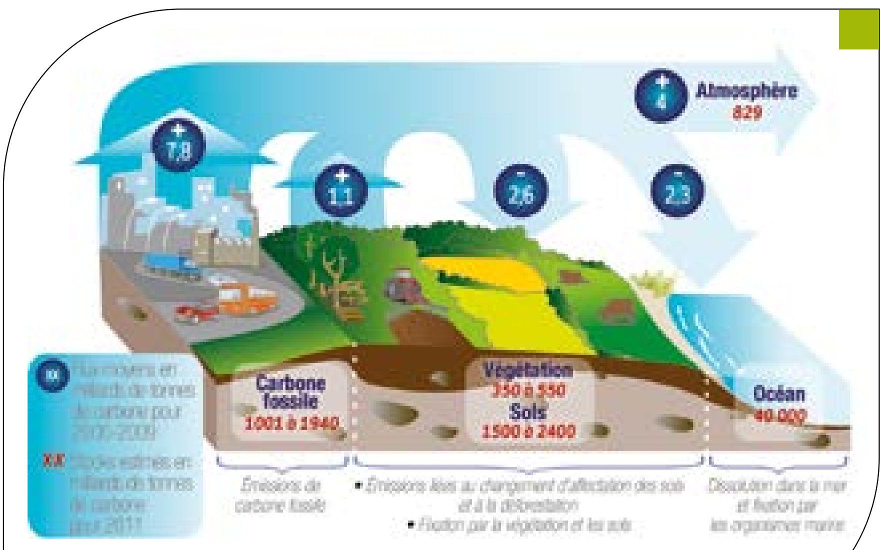
When carbon sequestration in green spaces is mentioned, planting, and in particular trees, tends to be the first thought. However, a much more powerful lever exists. It's right in front of our eyes, and under our feet.

The soil stores enormous quantities of carbon. / Damas O., Plante & Cité

SOILS ARE AN ENORMOUS CARBON STORE: THE FACTS

Soils provide the second largest carbon storage on the planet, exceeded only by the oceans, and store a similar amount to that held in the form of fossil fuels. This storage, in the form of organic matter, is two to three times greater than that in atmospheric carbon, and four to five times the amount stored in planting.

The first metre of the world's soils holds between 1,500 and 2,400 billion tonnes of organic carbon. These stores fluctuate and move between the earth's different reservoirs. For soils, the challenge for adapting to climate change lies in balancing the losses and gains in carbon stored, with the emphasis on maximising this storage. It's with this goal in mind that the 4 per 1000 R&D initiative emerged. Increasing annually the sequestration of organic carbon at this rate (0.4% per year) will compensate for the annual global greenhouse gas emissions from the burning of fossil fuels. ■



Global storage and flows of carbon in soils (source IPCC 2013). / G. Castagnon in ADEME, 2014

SOILS DON'T JUST SEQUESTER CARBON!

As well as sequestering carbon, note that soils also represent excellent allies in mitigating the effects of some of the consequences of climate change, most notably during extreme weather events. Thanks to their water retention ability, particularly with vegetation coverage, soils limit flooding by reducing rainwater run-off, absorbing the water and gradually releasing it either downstream or locally via drainage or evapotranspiration. The same evapotranspiration cools the ambient air, helpful in urban areas for improving the thermal comfort of residents.

STABILISATION MECHANISMS FOR CARBON STORAGE IN SOILS

The measurement of soil carbon stabilisation mechanisms is complex. / Damas O., Plante & Cité

Stabilising organic matter in soils relies on simultaneous and linked mechanisms which store and release carbon. There are two types of mechanism:

• biotic mechanisms in which vegetation acts as the primary source of carbon (especially root systems), micro-organisms (bacteria and fungi) and larger soil fauna (earthworms, ants etc.)

• abiotic mechanisms, which are related to the soil structure and spatial arrangement of the soil's components, and to the nature of mineral constituents, which may hold more or less organic matter within the aggregates.

These mechanisms operate at a fine spatial scale. Given this, the main proposed indicators for predicting changes in organic carbon stores in soils are focus on the proportion of clay and fine silt (< 20 µm). Given the current state of scientific knowledge however, to date no indicator has been proven effective. Studies of the impact of agricultural practices on these organic carbon storage and release mechanisms in soils (long-term field surveys) reveal them to be simultaneously extremely complex and highly variable, both with soil and climate conditions, and with time, for a given site. There is a real need to discover more. ■

URBAN SOILS AND GREEN SPACES: RESEARCH GETS UNDERWAY

Carbon stores vary significantly according to land use, soil type and climate. The amount stored in urban soils and green spaces is very little understood, even though they currently represent 9% of the planet's continental soils. Aurélie Cambou's thesis on her research into this (2015-2018) contains much new data. A collaboration between Agrocampus Ouest and the University of Lorraine, and financed by ADEME [the French Environment and Energy Management Agency] and the Pays-de-la-Loire region, this thesis aims to measure and characterise organic carbon stores in different urban soil types, then characterise and model the dynamics of these stores depending on soil use and pedoclimatic context, related to the specifics of urban soils. These results will be disseminated by Plante & Cité, inter alia. ■

MAIN CONCLUSIONS FOR ACTORS

In the context of adapting to climate change, soils comprise a key resource which at the same time is both little known and quantitatively significant.

In regional planning and development, the integration of soils' carbon storing capacity should begin with characterising and mapping the soils, in order to limit the surface area lost to artificialisation while preserving the soils with the most stored carbon.

In terms of the maintenance of green spaces, current trends towards eco-management are entirely in keeping with an increase in soil carbon stores (notably by the practice of planting in non-compacted and healthy soils, and returning organic matter to the soil). ■

Olivier Damas, Plante & Cité

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USING LOCAL PLANT SPECIES: GENETIC DIVERSITY IMPROVING ECOSYSTEM RESILIENCE

Seed and plants bearing accreditation from Végétal local [a French organisation promoting the use of locally indigenous plants in urban environments] are gathered locally in natural environments, guaranteeing conservation of the resource and taking into account local diversity. A favourable factor in adaptation in the context of climate change.


Required traceability in Végétal local's technical standard. / DR

THE PROJECT'S ORIGINS

Growing demand from project owners

The development of public policies promoting sustainability and the requirements for environmental mitigation to be included in development projects have contributed to a rapid rise in eco-engineering projects. Development guidelines are evolving to better take into account biodiversity, and with it support of ecosystem health alongside the new needs for planting with indigenous species. However, the use of indigenous species does not necessarily imply the use of locally-sourced plants. Plants can be sourced very far from the planting site and have genetic characteristics (their genotype) not adapted to local environmental conditions, with an adverse effect on germination and plant health in the long term.

Lack of traceability

A project owner's choice of plants and their origin is guided by the purpose and ecological value of each project (restoration of the natural environment, landscaping, plantings within a built environment, etc.). Other than for the certification of certain fodder crops and forestry species for plantations (Scheme for the Certification of Forest Reproductive Material), French law does not require the source of wild plants to be traceable.

Introducing a range of locally-sourced wild plants would ensure they were traceable back to the natural site from which they were collected. The collective approach was built around Végétal local to address that need. ■

A COLLECTIVE APPROACH FOR LOCAL INDIGENOUS SPECIES SUPPLY CHAINS

Végétal local is a single collective trademark now held by the French Agency for Biodiversity (AFB). It's the result of a 2011 call for proposals from the Ministry responsible for ecology under the umbrella of the national strategy for biodiversity, entitled 'Conservation et utilisation durable d'espèces végétales indigènes pour développer des filières locales' [Conservation and sustainable cultivation of indigenous plant species for developing local supply chains]. This call for proposals resulted in a collaborative project involving over 150 scientists, producers and users of plants. Two years were needed to define the collective's objectives and tools, and to agree the framework for the collection, production and traceability of the plants. The Végétal local brand is underpinned up by a technical standard and collectively-agreed usage regulations. Since its creation in 2015, the brand has been managed by three organisations representing all the institutional and professional bodies involved: the Conservatoire Botanique National Pyrénées Midi-Pyrénées [French National Botanic Conservancy for the Pyrenees and mid-Pyrenees regions], l'Afac-Agroforesteries [French association promoting forestry and hedging] and Plante & Cité. ■

WHY USE LOCALLY-SOURCED WILD PLANTS?

Maintaining healthy ecosystems

A self-sustaining ecosystem is built on the plant and animal species forming it, and their interactions within the environment over time. At the species population level, the individuals with the genotype best adapted to the local conditions will be the ones to survive by natural selection. Some genetic traits will be expressed in physical and biological characteristics which themselves determine inter-species interactions (for example, the concurrent flowering of a plant species with the relevant phase in the life cycle of its pollinating species). The conservation of these genetic traits adapted to the local conditions (soil, climate, range of plant species) relies on ensuring that there is no cross fertilisation with other genotypes of the same species that have evolved differently. This is why local plant populations and their inherited genetic adaptations are put at risk if plants sourced from a different area with different conditions (climate, soil, flora) are used in development projects.

Collection rules specify that plants be sourced in a natural environment to ensure that the resource and local genetic diversity are preserved. / Gilles Coueron, CBNPMP

The use of locally sourced wild plants therefore helps preserve the ecological health of the planted area (verges, ski slopes, hedgerows, meadows etc.) and its integration into a functioning green corridor. This also encourages plant-insect interactions and so preserves the biodiversity of local flora and fauna. The quality of resulting ecosystem services (soil stabilisation, water quality, yield etc.) is optimised, as are the chances of meeting the objectives of the development project.

Improving adaptation to climate change

Changes in the environment and climate tend to weaken the functioning of ecosystems. Numerous scientific publications report complex and diverse adaptive responses. Genetic diversity of individuals, and in the same way within a population, is a factor in adaptation over the long-term. The preservation of original genetic heritage is a founding principle of the Végétal local initiative. The initiative therefore subscribes to a dynamic vision for biodiversity, in tune with the adaptation processes being observed in response to environmental changes. ■

MANAGING INDIGENOUS FLOWERING SPECIES TO PROMOTE PLANT-POLLINATOR INTERACTION

As part of the Urbio research program into urban biodiversity, surveys of planted areas were undertaken to establish which plant types were visited by wild bees. Wild bees are essential to the pollination of both wild and cultivated plants. They are known to be highly effective pollinators and the diversity of species is essential to this. The surveys of the flora and of bees' foraging preferences in meadow areas (extensively managed) showed that bees forage a wide range of plant species. Regionally indigenous species were however favoured over exotic or horticultural species. The range of plant species present in a green space, as well as their abundance and their distribution, is determined by now the space is managed. Wild bees have varied nutritional requirements and therefore need appropriate food sources near to their nests. A wide variety of plant species ensures continuous and prolonged supply of plants in flower, and in turn promotes the diversity of bee species.

For more information:
www.plante-et-cite.fr/ressource/fiche/477

THE PRINCIPLES OF VÉGÉTAL LOCAL

Végétal local supports the creation of supply chains extending from the collector in the natural environment through to the distributor.

Collection adapted to the conservation of local genetic heritage

In order to preserve those genetic traits adapted to local conditions, the Végétal local working group defined zones from which plants must be sourced and within which plants must be used. Zones were so defined that any exchange of genes would not be detrimental to the preservation of the genetic diversity of the local flora. This approach, inspired by similar projects in other countries including Switzerland and Germany, resulted in the identification of 11 biogeographical regions within mainland France. Each region corresponds to a collection zone (or source zone) which is also the zone in which these plants can be used. It was essential during the development of the source zones to take into account operational criteria for obtaining buy-in from collectors and plant producers to the approach (the number of zones corresponding to the creation of markets, the number of collection sites compatible with traceability management etc.).

The conditions set by Végétal local for collection and propagation ensure the preservation of genetic variability in individuals, a factor in adaptation over the long-term. In order to maintain the genetic diversity of batches right through to planting, selection is limited at

Map of the source and distribution regions of the species accredited under Végétal local in January 2018. / AFB

every stage of collection, propagation and production. Plants, shrubs or trees having different characteristics are not rejected, whether that be for reasons of size, speed of growth, or early or late fruiting.

A list of species for each source zone

The plant material itself (seeds, cuttings, plants etc.) is accredited for a given source region. Accredited operators obtain the right to use the species of plants on a given list (woody, herbaceous, semi-aquatic) for the source region concerned. The right of use is granted by a mixed committee which meets twice a year. Two controlled brands are associated with it:

- Vraies messicoles [arable plants], focused on arable companion species such as cornflowers, corncockle and delphiniums, species which are in decline in France.
- Végétal local, which includes all French indigenous plant species, that is all species which occur naturally including species introduced before the end of the 15th century (termed archaeophytes).

Protected indigenous plants and plants which are considered by botanical experts to be locally rare or endangered are not collected.

The scientific and technical framework established for the Végétal local mark allows it to respond to different regional needs: conservation of local biodiversity, in areas such as in Corsica where the endemic flora has been weakened by the massive introduction of other species; or the ongoing need in the Massif Central for woody plants adapted to the local dry conditions and hedges able to thrive at altitude. ■

* *cf. définitions p. 21*

Marianne Hédont, Plante & Cité

SUPPLY TO MEET DEMAND

To date, 48 accredited providers offer a Végétal local or Vraies Messicoles range: 20 collectors of seed and woody species cuttings, 29 producers of woody species, 2 producers of aquatic plants and 11 collectors and producers of herbaceous species. Since December 2017 almost 480 different species are offered by these trademarks, and more than 1,800 combinations of species, region and producer. Regional initiatives providing locally-collected wild plants are beginning to spring up. Predicting the needs of developers and construction managers is an important factor in planning accredited plant stocks. Setting-up propagation contracts is an appropriate way to ensure the demands of construction projects are met, and will also guarantee sales for producers. A recommendations guide has been published to assist public procurement.

For more information:
www.vegetal-local.fr or sandra.malaval@cbnpmp.fr

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WHICH FORMS OF **URBAN AGRICULTURE** PROMOTE **FOOD SELF-SUFFICIENCY?**

From self-sustained community gardens to vertically farmed hydroponic vegetables, urban agriculture has both enthusiasts and critics. Current trends aside, how can it contribute to greater urban food security?

If we're talking agriculture, we're talking food. A primary purpose of agriculture is precisely that: feeding people. However, that isn't all that agriculture provides. Landscape improvement, biodiversity, economic activity, water management and fostering communities - and not just in towns and cities. Several of these services can contribute to mitigating the effects of climate change (flood management, green corridors and healthy biodiversity, community solidarity etc.). Here we'll concentrate on the question of food security, as a factor in resilience.

Food production on the *Terre de Mars* in Marseilles. / Augustin Tempier

WHAT DO WE MEAN BY URBAN AGRICULTURE?

The term means different things to different people (urban planners, associations, local authorities, farmers, researchers). In this article we take 'urban agriculture' to mean the whole range of vegetable and animal production activities, whether commercial or not, occurring in urban areas (as defined in France by the National Institute of Statistics and Economic Studies). Entrepreneurs and amateurs undertake these activities for different reasons; primarily food, but also for environmental, recreational and social reasons.

ORIGINATING IN FOOD AUTONOMY...

Agriculture and town life developed together some 8,000 years ago. From the first human settlements until the Middle Ages, most food was produced close to where people lived because of the lack of transport and effective techniques for processing and conserving. That said, from ancient times and even before there is evidence of land and sea commercial routes indicating the existence of trade around the world, sometimes significant in certain foods that could be preserved for a long time (spices and condiments, drinks etc.).

Over the centuries, developments in food technology and the economy led to the loosening of the relationship between agriculture and town. In France, agriculture progressively became an organised industry, with strong political influence, particularly during the Industrial Revolution. This was when workers' gardens, ancestors of the allotment, first appeared in towns with the aim of improving families' economies by growing food. Initiated by l'Abbé Lemire through the Ligue du Coin de Terre et du Foyer [league of smallholders and householders], they developed in numerous towns and cities as a social movement but also in response to the World Wars and economic crisis. The main reason for the existence of these urban vegetable gardens was to provide food. With the growth of urban living, the period 1945 to 1975 saw rapid decline in urban allotments and also in agricultural holdings (often specialised) on land around urban centres, which came to be considered as land reserves.

Since the 2000s, awareness of food miles, food supply and urban green spaces has resulted in a rebound in urban agriculture. Nowadays, the term community garden has come to include the many forms of urban garden spaces (allotments, community gardens, social and therapeutic gardens) with the recognition that gardens offer wider benefits than simply food production. Increasingly the maintenance of multi-purpose agricultural activity is becoming a focus for urban actors, in collaboration with the agriculture industry.

... STILL AS TRUE TODAY AROUND THE WORLD

Urban agriculture is practised in both developed and developing countries, across both hemispheres. Urban growing is even more widely found in southern hemisphere countries, where land use planning is less regulated. Essential to populations practising it, this provides supplementary income and even full-time employment (often in a parallel market economy), and above all improves, or is even fundamental to, diet.

Globally, as town and city populations grow rapidly, urban agriculture primarily concerns the very large number of poorer inhabitants, helping to improve food security for these vulnerable groups.

Some pioneering cities have recognised the importance of urban agriculture, and its role in food security for the local population, and have engaged with it to ensure its sustainability; examples include Antananarivo in Madagascar, Rosario in Argentina, Kampala in Uganda, Havana in Cuba and more.

In parallel entrepreneurial high-tech models are also emerging in industrialised nations such as Japan, Singapore, the United States and Canada. While only a small part of the agricultural market, investors are being drawn to the ultra-fresh food niche market, which often has high added value and attracts a wealthy customer base.

In addition, local leaders world wide are supporting the movement: over 100 cities around the world signed-up to the Milan Urban Food Policy Pact at Expo 2015. Starting from the premise that this scale of action is essential in the context of an increasingly urban population, they are committing to the development of inclusive and resilient systems for sustainable, healthy, and varied food production. ■

An urban farm in Chicago / Elise Fargetton, ASTREDHOR

LACK OF NUMERICAL DATA IN FRANCE

As of today there is no exact data at national level on the number of agriculture initiatives in urban areas.

Various local authorities such as Paris Region, the major cities of Rennes and Montpellier in France and Montreal in Canada, have attempted to measure or estimate the level of food self-sufficiency in their community. All have concluded that food self-sufficiency is impossible to fully achieve in their area.

However, increased self-sufficiency is possible if production methods are improved, if land in public parks, private gardens and woodlands is converted into productive land, and if eating habits are changed, for example by reducing meat consumption. In every case certain products such as tea, coffee, chocolate, bananas etc. cannot be produced locally, and in addition local production is also dependent on soil characteristics so entailing huge disparities in production in different areas.

More recently, a study by the Utopies consultancy undertook modelled the food self-sufficiency of 100 of the largest urban areas in France. They reported the average level of food self-sufficiency is 2%, while the potential level is 54%. The figures show large differences by urban area and type of product. ■

SCOPE FOR ACTION?

Since the passing in France of the Act for the future of agriculture, food supply and forestry (Loi no. 2014-1170 of 13 October 2014), primary responsibility for food supply policy rests with government through its national plan for food supply, its regional variations and the legal framework for regional food productions projects (PAT - *projets alimentaires territoriaux*).

However, local authorities can act at local level in support of food supply within their mandate which includes, variously, urban development, waste disposal, health, the local economy, the environment and also their general mandate to govern their communities. ■

At local level

Among other actions possible at local level, municipalities can raise residents' awareness of, and encourage involvement in, agricultural and food supply issues either directly or through support for citizen initiatives. They are also well placed to support the implementation of various forms of community gardens within their area.

They can also take action through their involvement in urban projects, in partnership with other public or private actors (funding partners, developers or companies) by ensuring that agriculture is included early in the planning process; this could include for example urban agricultural zones with commercial farms, growing spaces for tenants, public spaces planted with edible species etc.

With regard to urban planning, local authorities can also ensure that agricultural land is sustainably managed through their local development plan and include in their planning urban agricultural concepts which promote productive and functional landscapes.

Finally, they can support community catering projects, food waste reduction and waste management, support which can combine raising residents' awareness, training actors and making appropriate calls for tenders.

Over 170 hectares of public land in Strasbourg has been converted into a diverse range of shared gardens to suit all needs: allotments, community gardens, small plot allotments, orchards and school gardens. / Lecuir G., ARB Ile-de-France

At regional level

To ensure action is sustainable, a change of scale is required toward a more regional agricultural and food policy. This is really the level at which regional projects need to be built if they are to be successful over the long-term. The best tool for this is a regional food supply framework, intended to give structure to the agricultural economy and in concert with that, create a regional food supply system, addressing all aspects including environmental, economic, educational, social, cultural and health.

Even if every actor is committed, the political will of elected officials remains essential to an ambitious approach able to cover all the aspects. The development of a form of governance involving all actors (state, economic actors, civil society and research) and including the participation of inhabitants is therefore necessary, along the lines of the food policy councils found in a number of cities around the world. Like a landscaping project, food supply policy should be based on analysis and assessment, should recount the history of the region and plan for its future: such a 'food plan' can then bring all actors together around a common goal. Given the diversity of topics and complexity of the issues, the design of these projects must take a long-term view. To succeed, they must translate into in concrete action at local scale. ■

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ADAPTING TO CLIMATE CHANGE

Extract

This document is an extract of the french publication N°4 - 2018:

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https://www.plante-et-cite.fr/Ressource/fiche/491

Plante & Cité, 2018, Angers, 68 p.

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