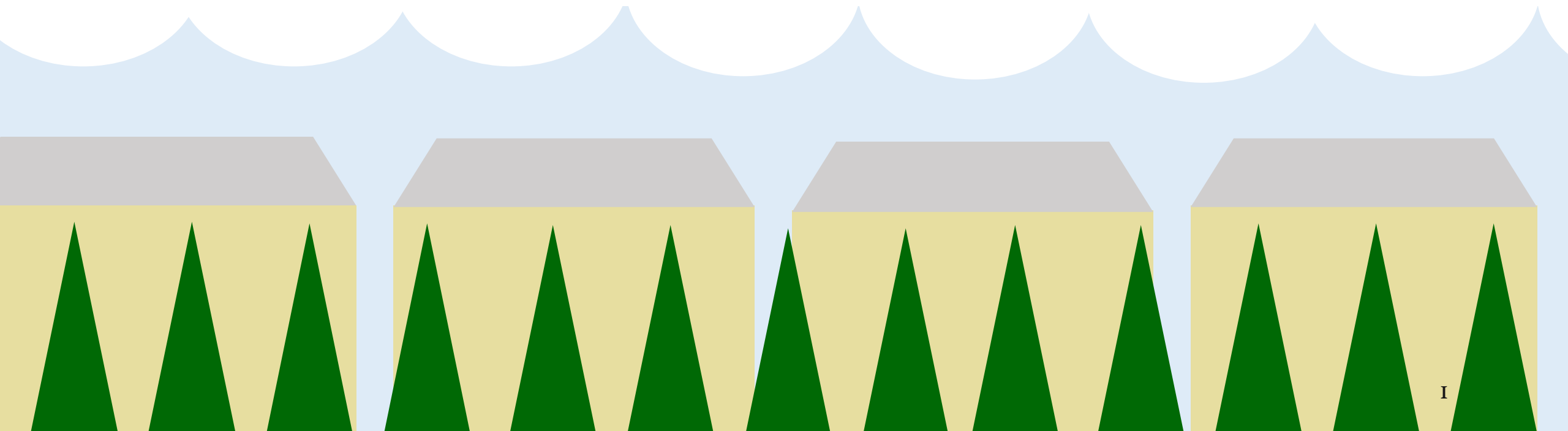


BioCité





Biology, Innovation, and the Twenty-First Century Smart City

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Foreword

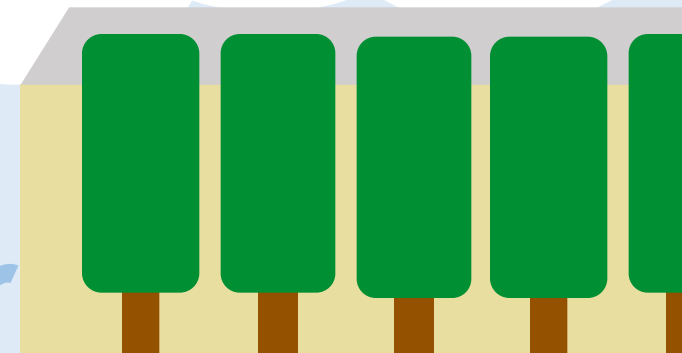
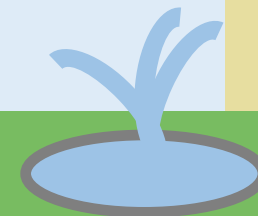
Our ideation process originated with a conversation that imagined a future when driverless cars made parking places obsolete in dense urban areas like Paris. Cities would be suddenly faced with unused space on nearly every street. How might we take advantage of this opportunity in the near future? We believe that a network of green transportation corridors could stretch across the city, improving the urban fabric and environment. Although this radical transition is still years away, our subsequent research shows that our bold proposal can feasibly and aggressively challenge looming environmental and social issues in Paris today.

Abstract

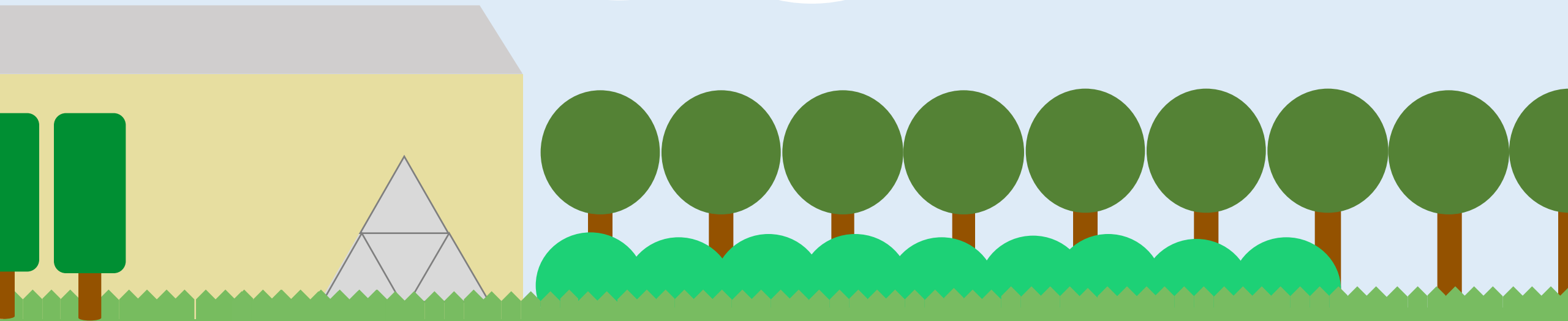
While the city of Paris contains many parks and gardens, these green spaces exist as fragmented entities and are not well-integrated into the city. The creation of a coherent city ecosystem – where green space complements urban infrastructure – faces many problems, including an unhealthy reliance on private cars.

BioCité aims to address this problem by introducing a system of pedestrian-friendly green corridors, built over unused street space, that connects the green space of Paris into one large network. This project deviates from current endeavors because it is immediately implementable, flexible, and scalable, and seeks to incorporate already-existing green space. Such a project contains many benefits, including improved pedestrian accessibility, health, and carbon-emission reduction.

Funded by both private and public sources but with a cost offset by citizens' savings, this project will be considered successful if it increases the percentage of walking and biking trips in contrast to driving, but only if quality of life improves for all Parisians regardless of socio-economic status.



Introduction



The Importance of Green Space

The BioCité Project is inspired by several of the UN Sustainable Development Goals, which highlight our cities' reliance on healthy, sustainable ecosystems. Although many people view cities as the antithesis of nature, urban green space improves quality of life. Properly placed green space can address pollution, ecosystem fragmentation, and other localized issues specific to densely-populated areas. Because biodiversity is integral to the stability of a resilient ecosystem, designing habitats for local wildlife ensures the perpetuation of these environmental benefits. Most importantly for this project, optimizing a relatively small area of green space for sustainable transportation such as walking and cycling can have outsized effects for both the global environment and standard of living.

>>> BioCité addresses these SDGs:



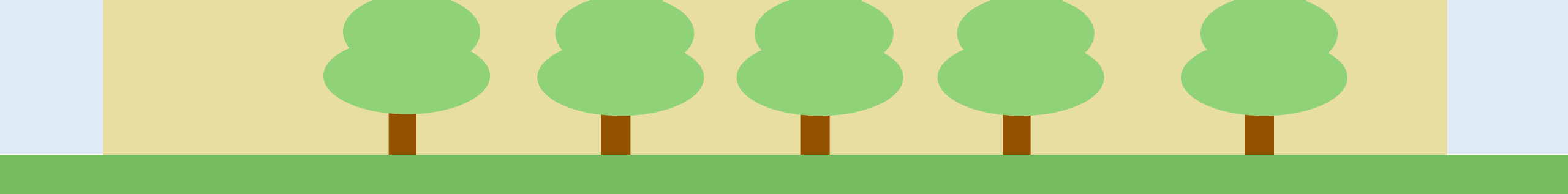
A History of Parisians and their Parks

Paris has a long and varied history with urban green space. In the Middle Ages, when most of the city lived in squalid conditions, the aristocracy and clergy maintained large parks and gardens for their own use. Common peasants, however, lacked adequate access to green zones for leisurely use.

Limited access to green space continued into the Renaissance, with the creation of Paris's oldest existing park in 1564 – the Jardins des Tuileries, a royal garden limited to French nobility.^[2] Indeed, it was another century until the first Parisian park was opened to the public, the Jardin des Plantes.^[3]

Most of these so-called public parks that were created, however, were in reality only *selectively* open to the public; most parks were concentrated in the wealthier center of the city and thus intended for richer patrons. Urban street trees were relatively sparse,^[4] whereas the first tree-lined streets, along razed city walls, were mostly intended for the urban elite.^[5]





The grandest attempt to expand the accessibility of Parisian green space to the common man occurred under the reign of Napoleon III. Between 1853 and 1870, Napoleon entrusted a massive renovation of the city to Baron Haussmann, a plan that included the construction of more green space for Parisians of all backgrounds to enjoy. Haussmann eventually constructed four large parks at the cardinal points of the city.^[6] He also introduced the concept of airy, tree-lined boulevards throughout the city, thus providing a bit of green space even away from the city's main parks.^[5] Today, Haussmann's efforts are heralded as a valiant attempt to make the city more livable by bringing its residents a taste of nature.

Since then, subsequent leaders of France have introduced hundreds of new parks and public gardens to Paris.

However, even though green space now covers nearly 10% of Paris, most of it is fragmented and non-contiguous.^[7] Thus, those in heavily-built areas cannot fully enjoy it. Our project seeks to further the democratization of greenery into the twenty-first century.

Losing Touch with Nature

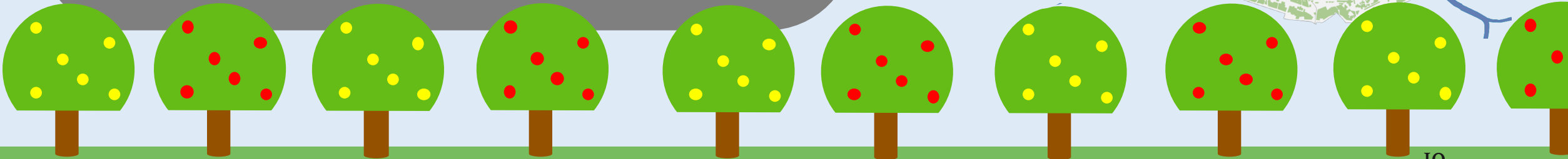
In Paris, a disconnect exists between the “gray Paris” of buildings and roads and the “green Paris” of parks and gardens. Nature is distributed throughout the city but is not integrated into it; the city and nature are not a coherent and inclusive ecosystem.

Consequently, lots of Parisians are underexposed to nature. Even those who live next to green spaces experience a separation between the Paris of daily life – offices, stores, restaurants – and the Paris of parks and gardens. This physical fragmentation of green space, then, also breeds mental fragmentation in the minds of Parisian citizens.

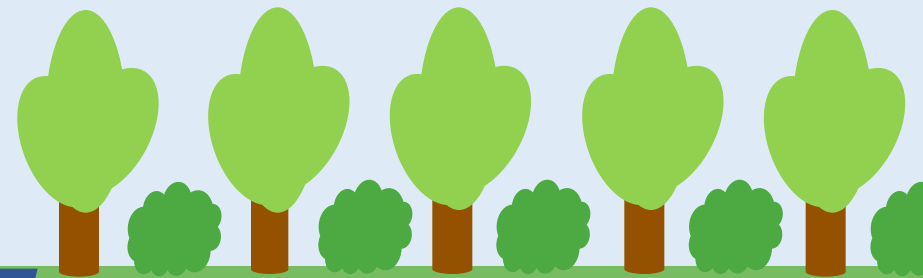
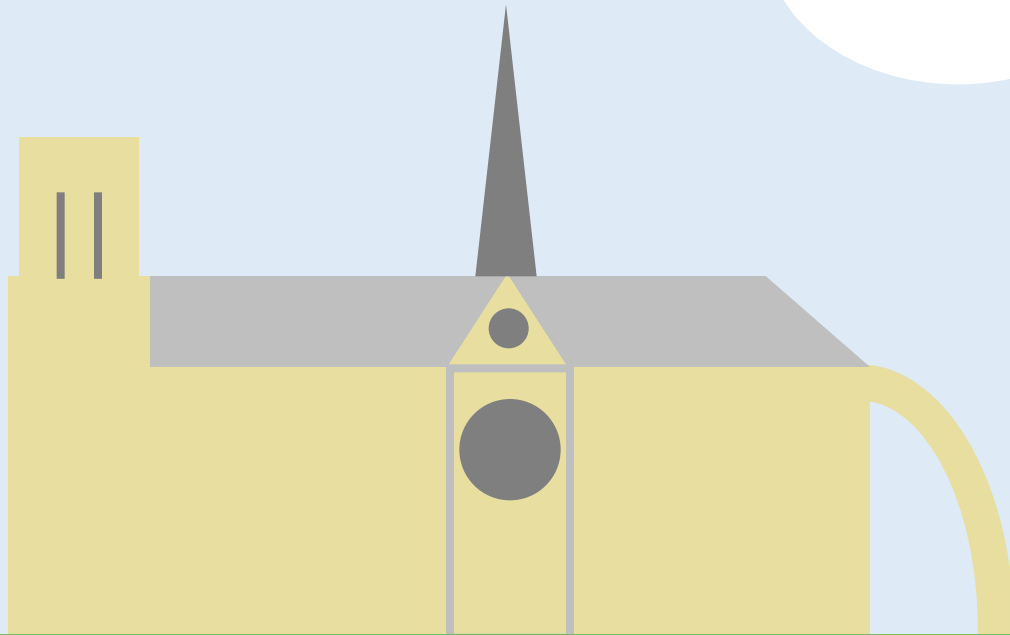
A fully functional Smart City should break down this distinction and create a new ecosystem where the urban and the natural can coexist and complement each other: a **BioCité**.

Next, we look at issues related to the development of the BioCité and current initiatives in Paris to address these issues.

A Map of Green Spaces in Paris

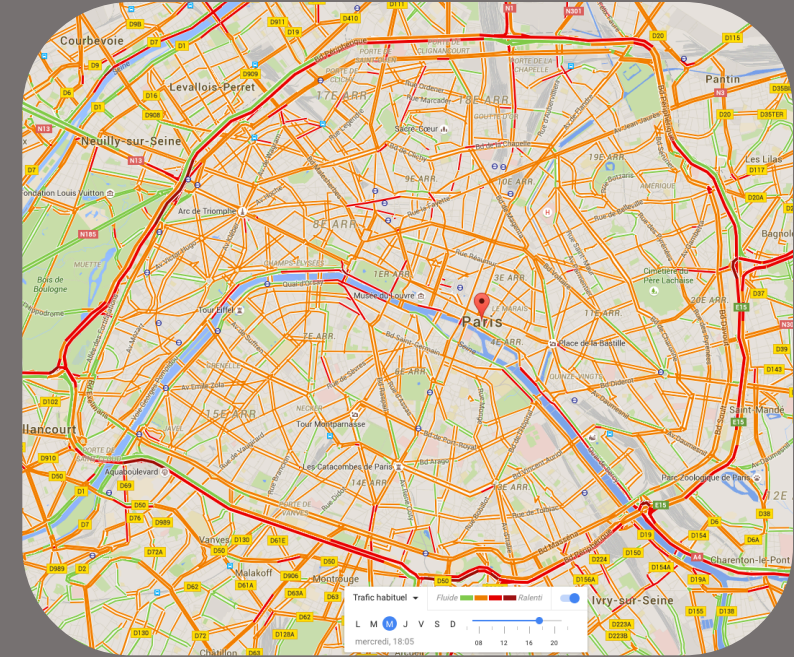


Issues



Reliance on Cars

The most persistent obstacle that stands in the way of achieving sustainability is the reliance on cars in Paris. Biking remains difficult, and walking is not attractive enough for many. The map on the right shows the problem of traffic congestion for drivers, in this case on a Wednesday evening.



Air pollution in Paris

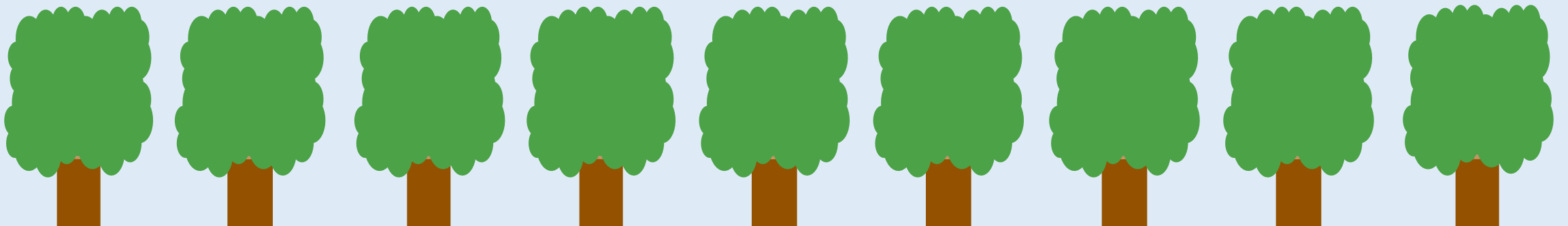
But the challenges posed to the environment surpass human convenience. In Paris, vehicles are the primary contributors to greenhouse gas emissions and air pollution.^[8] Fortunately, an alternative to driving exists in public transit such as buses, trams, and the metro. However, Paris has the greatest opportunity to improve in easing biking and walking.

Initiative : Reduce Cars, Increase Mobility

The city of Paris is attempting to bring vehicle usage under control by a variety of means. Orienting the city away from a reliance on cars involves two major components: restricting vehicles and improving transit alternatives. By 2020, every street except major roads will be a “30 Zone”, where the speed limit is 30 km/hr, or a 20 km/hr pedestrian/vehicle zone.^[9] This is one method to achieve the goal of reducing car use in vehicle kilometers by 25%. Furthermore, after 2020, the most severely polluting vehicles will be banned.^[10]

However, there are still well over 100,000 on-street parking places in the city, and reducing parking has been shown elsewhere to decrease car usage.

To provide adequate alternatives, the city has created new trams, local bus routes, and 700 kilometers of bike lanes. Seven major plazas like Place de la République, currently surrounded by lanes of traffic, are being converted into pedestrian areas.^[11]

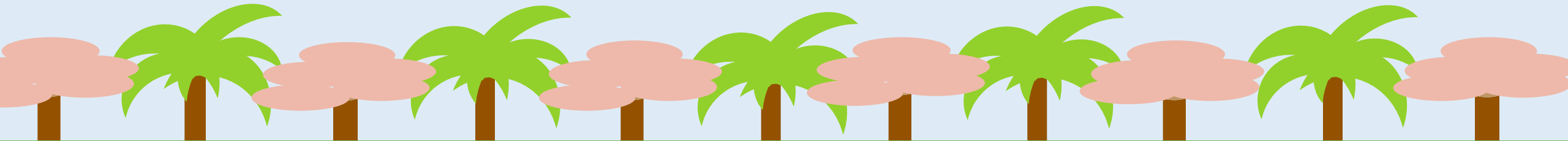


Habitats and Biodiversity

In the Paris region, there are 580 hectares of public park land amenable to wildlife, but it is scattered into 650 disconnected sites.^[12] This limits the degree to which populations can truly thrive.

Biodiversity inexorably decreases both at the city and global scales despite site-specific conservation efforts. This is in part due to habitat fragmentation, which occurs at a larger scale. Intensive land use, such as in Paris, divides and shrinks many species' habitats. Disrupting one link in an ecosystem chain has far-reaching consequences beyond jurisdictional limits.

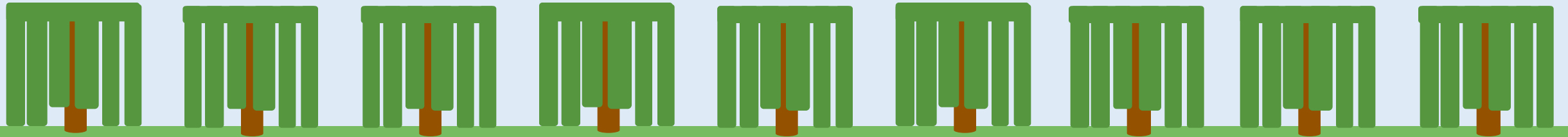
But healthy ecosystems both supplement and are intrinsically associated with human life. The United Nations Environment Programme (UNEP) also recognizes that green space which shelters biodiversity is “important in urban settings for wildlife and for people”; for example, it reduces the cost of water infrastructure, energy, and climate change mitigation.^[12] Paris should provide space for flora and fauna because it benefits from taking action.



Initiatives for Green Space

Increasing the amount of parks is already a priority for the city of Paris. To meet its aspirations, the government has proposed certain goals for boosting vegetation. The plan, published in 2014, proposes creating 30 hectares of new parks, planting 20,000 trees, supporting participative projects, and increasing green/agricultural roofs and walls on new and existing buildings. In addition, Paris is trying to involve citizens by granting permits that allow citizens to plant and maintain vegetation in public spaces.^[13]

Paris has set precedents for itself to improve biodiversity through green space. The “Trame Verte et Bleue” is a plan at a larger scale for the greater Ile-de-France region to provide green corridors around Paris. On a smaller scale, the “Promenade Plantée”, a 4.5 kilometer green walkway in Paris from Place de la Bastille to Porte de Montempoivre, is an early successful example of a project to convert abandoned space (a discontinued railway) into a park for both natural and human facility.^[14]



Our Proposal

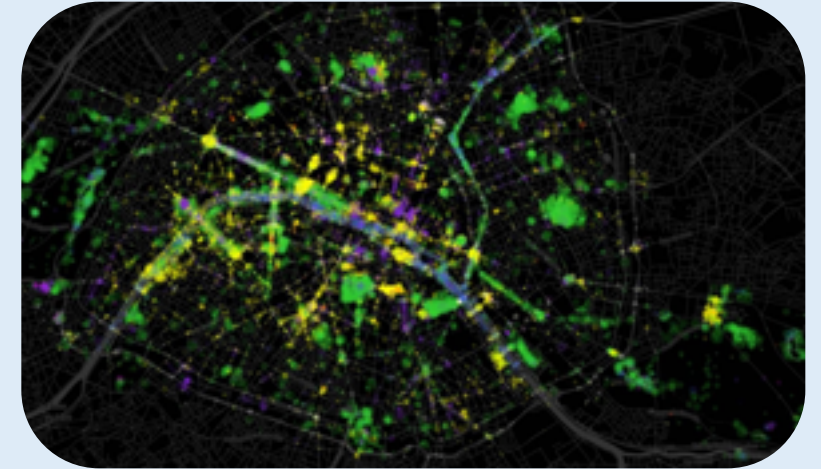


Biologically Inspired

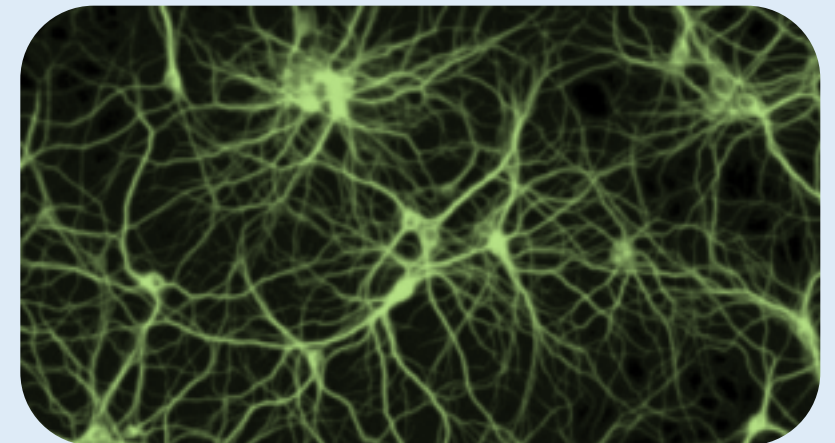
Inspired by the biological concept of a neural network, we plan to target these issues – reliance on cars, habitat fragmentation and loss of biodiversity, lack of green space – through a single comprehensive project.

The brain has billions of neurons -- each connected to thousands of other neurons -- whose main purpose is to transmit electrical signals to each other. Collectively, this system of connected neurons, each of which has the ability to fire, forms a neural network capable of performing incredibly complex tasks despite using such a simple building block.^[15]

Map of the green spaces in Paris



Billions of interconnected neurons form a neural network.



By examining the workings of a neural network, we derived a few key principles (the “three C’s”):

Connectivity. The key to a neural network’s success lies in the billions of connections between its neurons, which allows it to form a chain of communication.

Continuity. Signals in a neural network are transmitted from one neuron to another seamlessly, so that these signals can easily be transferred from one neuron to another continuously.

Cooperation. Despite being composed of an essentially binary neuron, which can either fire or not fire (no “firing gradient” exists), a neural network is still able to accomplish complex tasks far greater than the sum of its parts.

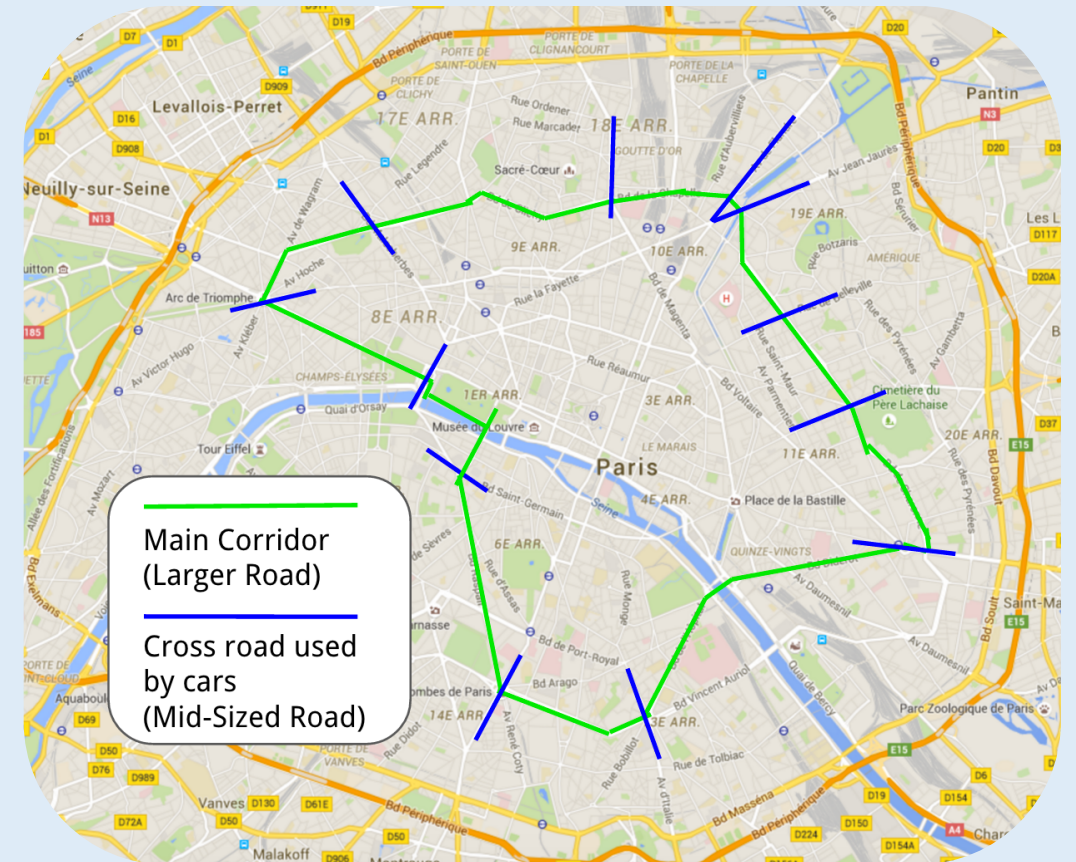
Our plan is to collectively form a green network of corridors and parks throughout the city. Just like how neural networks consist of neuron cell bodies that are linked via axons, dendrites, and synapses, our plan consists of a similar series of parks connected via green and blue corridors. Both models contain central hubs linked by cohesive parts, wherein each hub cooperates to form a larger, and better, whole — a neural network in humans, and a larger and pedestrian-friendly ecosystem in Paris.

Design

Like a neural network, we propose to connect the different green zones of Paris through a network of pedestrian-friendly walkways. This network would be composed of the following parts:

Main central ring. This ring, composed of large boulevards, would be the major green artery in our network. Each of these boulevards would be transformed from heavily car-oriented streets into pedestrian-friendly green walkways. In addition, the intersections allowing cars to cross the boulevards of this central ring would be eliminated, with the exception of twelve major intersections that should be kept open. Cars trying to cross this pedestrian-friendly ring must do so at one of the twelve intersections, limiting the discontinuity in the walkway but still allowing circulation to continue.

Proposed layout of green network. The central ring is outlined in green, while the car intersections are outlined in blue.

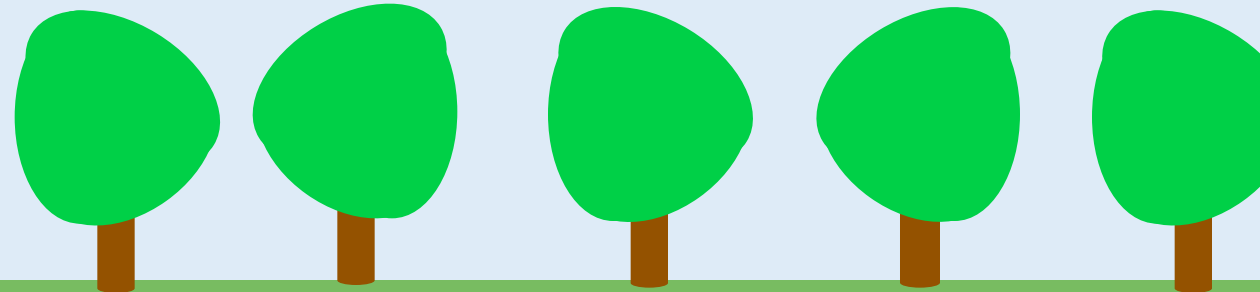


Connecting tendrils. Because this main central ring does not directly connect most of the parks in Paris, medium-sized roads would branch off to connect nearby parks to the central ring. These roads would be converted to pedestrian-friendly walkways.



Neighborhood branches. In order to reach the greatest breadth, we also envision smaller, pedestrian-only green roads diffusing off the network into local neighborhoods. Much of the design of these small roads, such as what amenities to include and whether or not to include a community garden, would be left to the locals. Thus, locals have a stake in the maintenance of the green corridor, reducing the burden on the municipal government.

This network would diffuse throughout the city, integrating green space into the buildings and streets of urban Paris.



Catalogue of Roadways and Recommendations

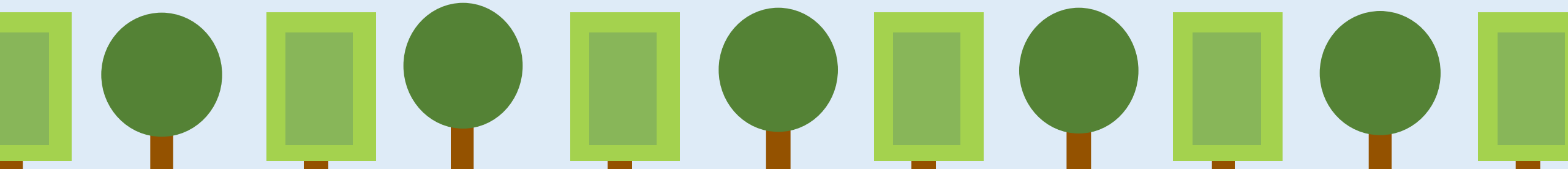
Instead of an exact plan detailing the specific streets through which we plan to implement our project, we offer here a catalogue of the types of roadways our plan can be implemented on and recommendations for each type of roadway. In addition, we include a stage-by-stage implementation plan for the project.

This way, our plan can dynamically adapt, offering enough specificity to be implemented and enough generality to fit the needs of a constantly changing city.

Throughout the plan, we kept in mind the “three C’s” we learned from neural networks -- connectivity, continuity, and cooperation.

Throughout the plan emerge a few common themes:

- **Replacing parking lanes**
- **Reusing current infrastructure**
- **Using adjustable infrastructure**
- **Encouraging continuity**

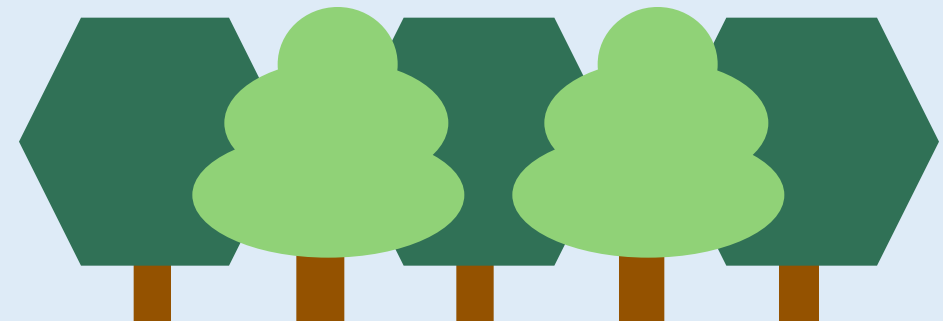


Replacing parking lanes. In order to free up space for our green corridors, we plan to remove parking lanes and turn them into either driving lanes or green space. Given that the Paris municipality already plans to reduce car usage, this action does not harm car users any more than plans that are already in the works – and it simultaneously gives back public space to pedestrians.

Reusing current infrastructure. Because our project focuses on repurposing rather than construction, the first stages of it can be implemented as soon as today. For each street, we will keep the sidewalk and most lanes, only modifying where we need to in order to establish greenery.

Using adjustable infrastructure : Adding participatory accessories such as furniture, games, and public art helps the BioCité adapt to the will of inhabitants and to constraints such as weather.

Encouraging continuity : According to R.T.T. Forman (Landscape ecologist), “*linear, continuous landscapes are more environmentally productive [...] than disparate patches of park land*”.^[16] Thus, our plan will be to connect the biggest parks of Paris in order to maintain this ecological continuity. Like how signals in neural networks are able to seamlessly transfer from neuron to neuron, pedestrians will be able to transfer from park to park.



Large Roads

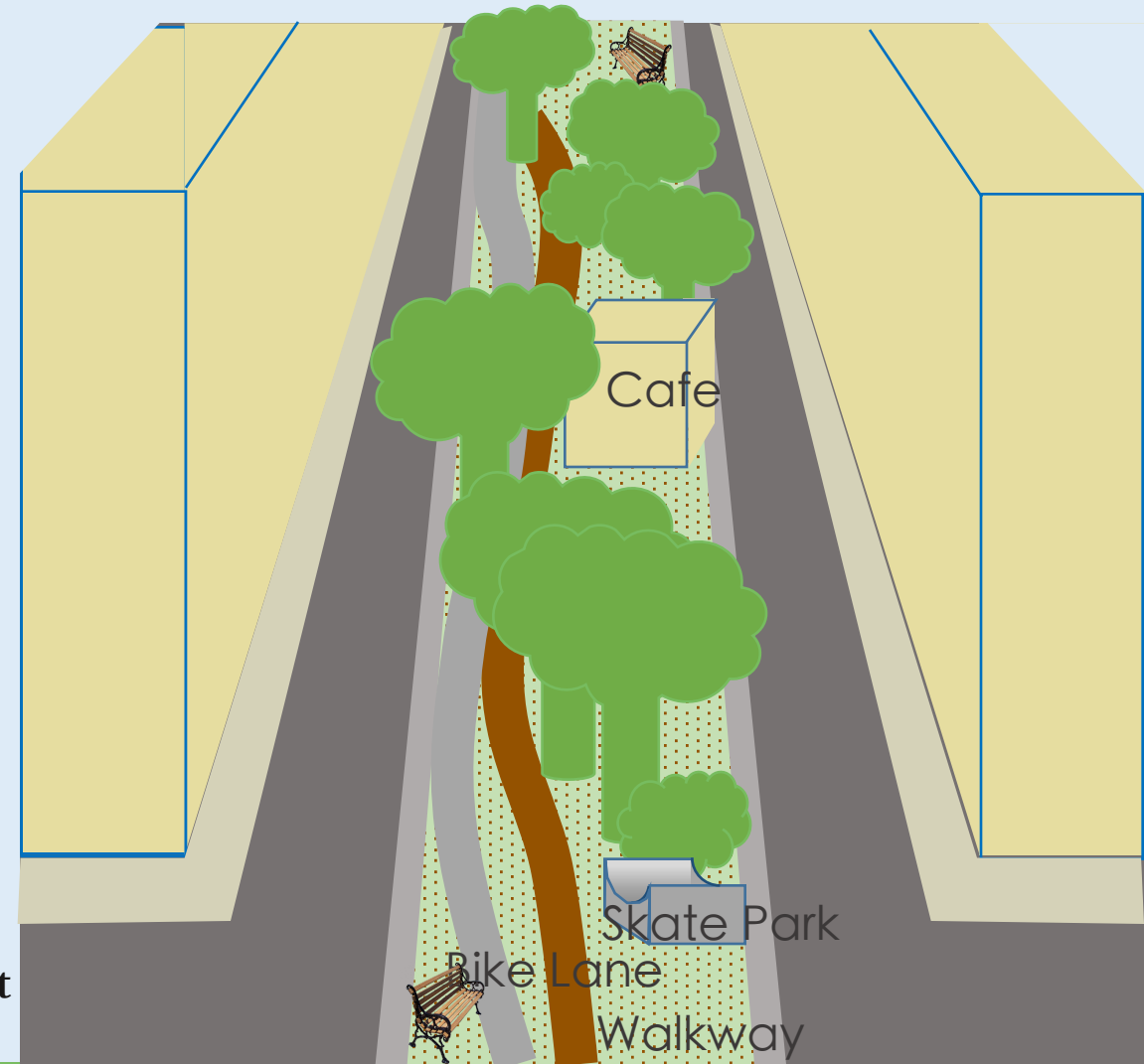
Paris has many large boulevards as wide as 25 meters across. Many already have pedestrian walkways in the middle.

Implementation Recommendations:

A wide corridor could be created in the center of large roads, which would provide the greatest space for large trees and the most habitat for biodiversity. In addition, space could be set aside for cafes and other amenities. A one-way road on each side could replace parking spots.



Ex. Boulevard
de Rochechouart



Medium Roads

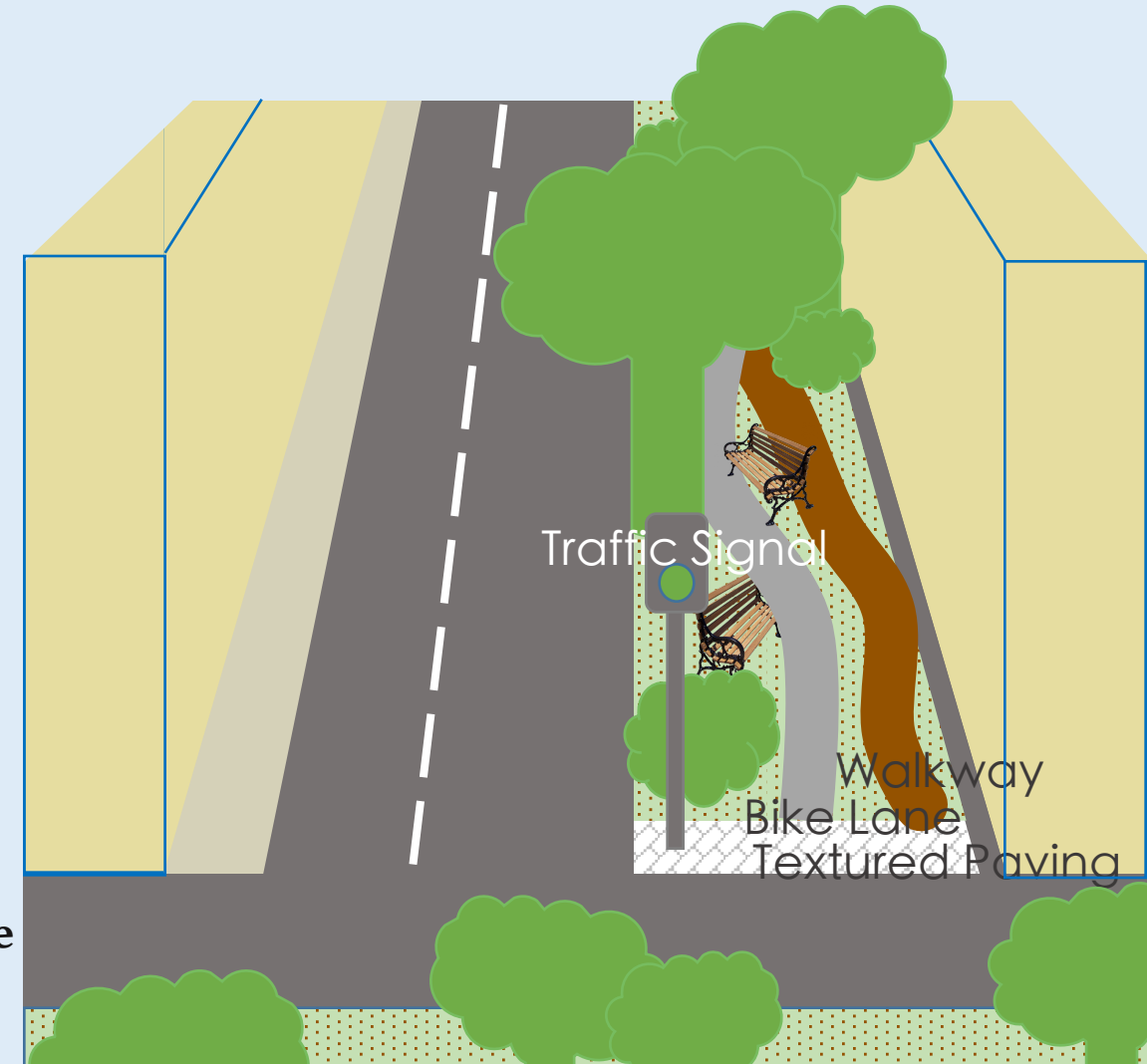
Most streets in Paris which approach large boulevards are medium-sized, between 10 and 25 meters wide. Streets with more traffic, such as Avenue Jean Jaures, would divide large corridors, while those with less traffic would approach but not bisect them.

Implementation Recommendations:

One side of the 30 km/hr street could be transformed into a green corridor, and one lane of traffic and one lane of parking on the opposite side could be reserved for vehicles.



Example : Avenue
Jean Jaures



Small Roads

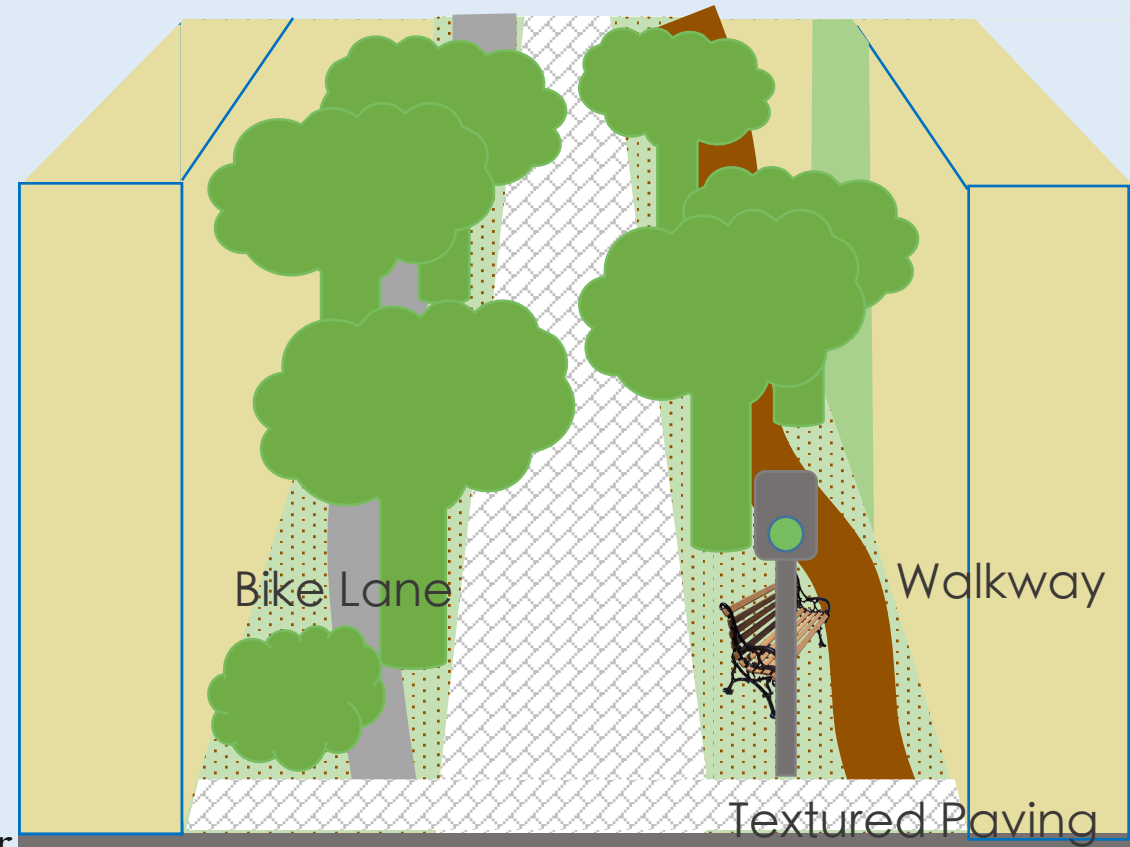
On side streets with little traffic, pedestrians, cyclists, and cars can effectively share the same space, creating a more residential feel while boosting safety.

Implementation Recommendations:

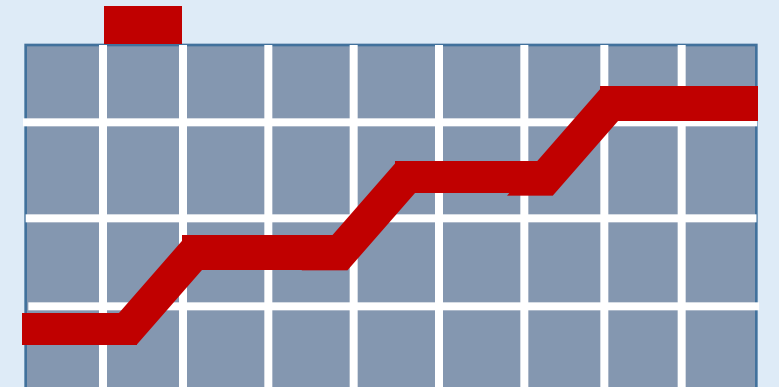
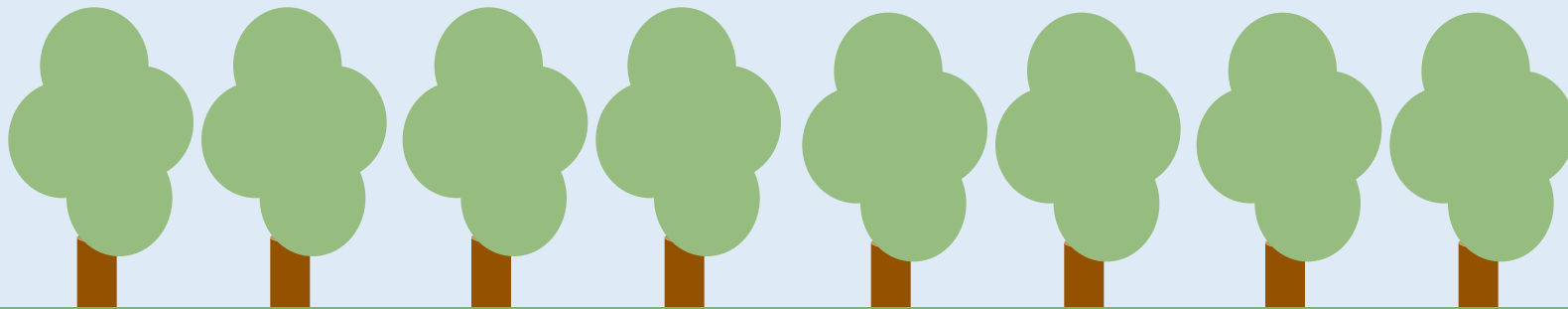
A 20 km/hr zone would be placed upon the brick or cobblestone area. Trees on both sides would replace some parking, especially in non-residential areas. These areas have the greatest opportunity to be specifically tailored to the neighborhood.



Ex. Rue Vicq D'Azir



Business Plan



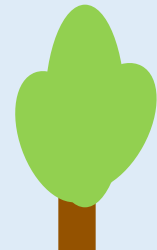
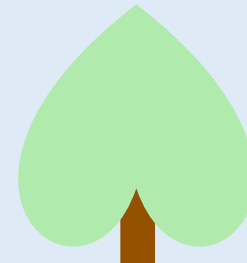
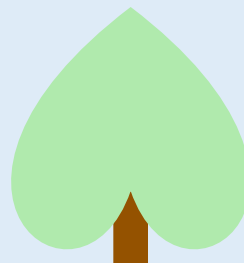
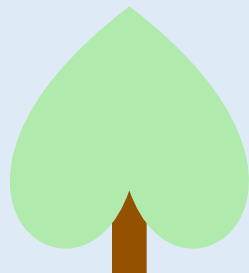
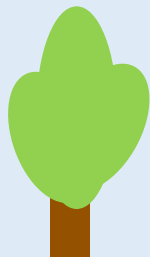
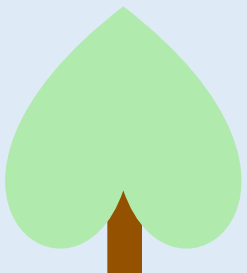
Implementation

The realization of the BioCité plan should be broken down into several sub-sections pursued simultaneously (Phases 1–3). However, the plan would be implemented in different arrondissements at different dates, starting with those that expressed interest in the project. Before any physical construction can occur, project managers must obtain some of the necessary funding from public and private sources and gain authorization from the responsible authorities.

Phase 1: Establish Main Ring

1.1: Establish the main ring around the city along large boulevards. Because the plan involves the disruption of important thoroughfares, the undertaking of such a project must occur in phases to minimize disruption to traffic and city life. A longer duration of time would, however, give more time for drivers and residents to adjust to reduced on-street parking. Jurisdiction over this process should be distributed to each arrondissement for greater administration.

1.2: Once the ring is complete, the efficacy and success of the first part of the process should be measured and any adjustments made during a short buffer period.

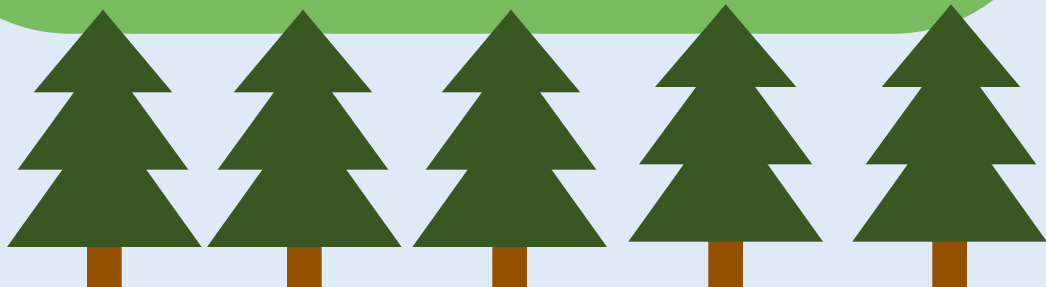


Phase 2: Establish Medium-sized Corridors

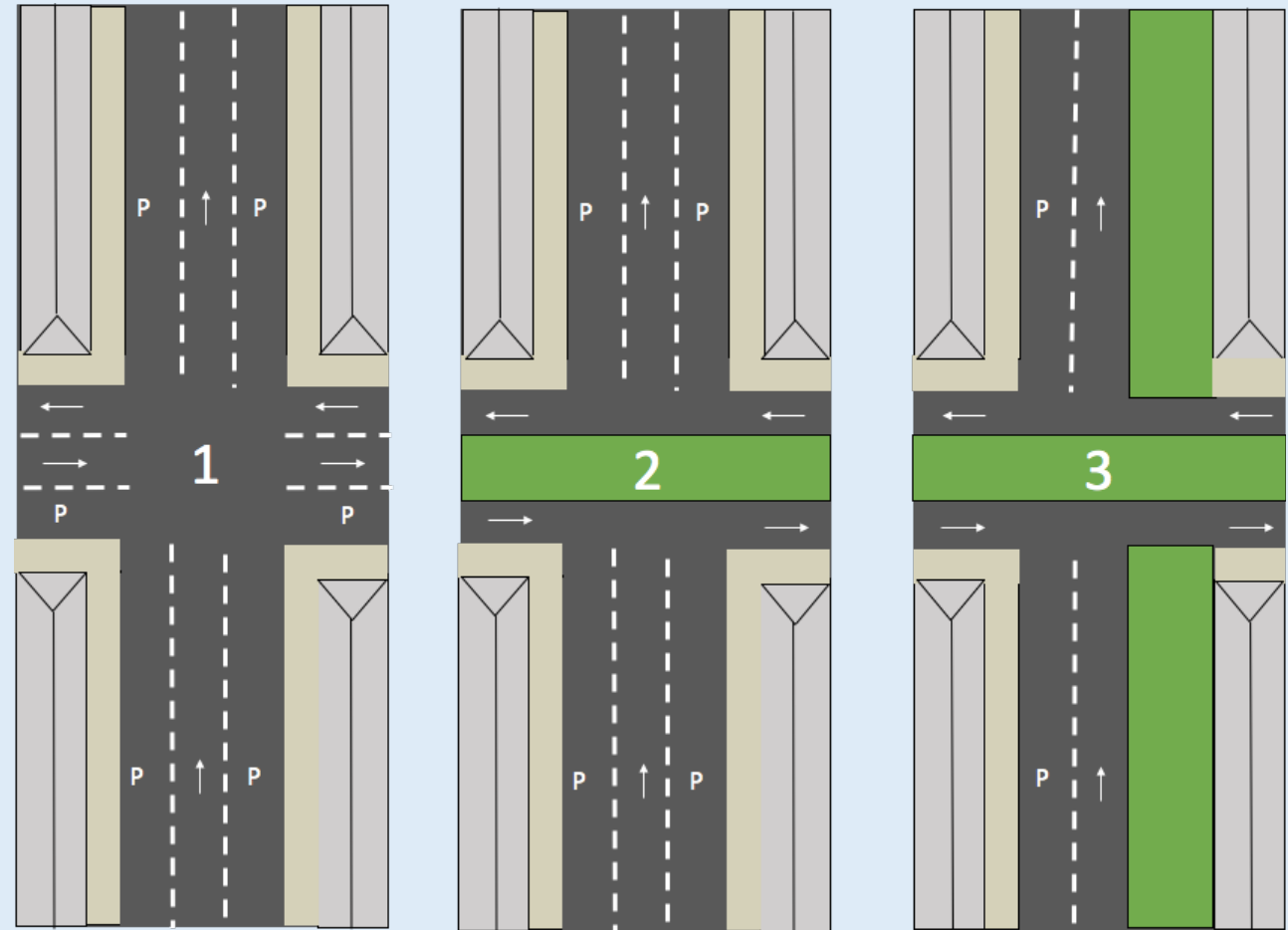
2.1: Identify which streets would be most-suited to green restoration

2.2: Construct green corridors and remove on-street parking on mid-sized streets between the main ring and nearby parks. Because this phase affects lesser-used streets, these green corridors can be implemented simultaneously across the city, reducing the length of time needed.

Stage 2.3. As in stage 1.2, a brief buffer period should be allowed for feedback, assessment, and adjustment.



Three-step diagram for establishing medium-sized corridors



Phase 3: Establish Small Corridors

3.1: Identify which neighborhoods are most in need of green space and/or most receptive to the plan. Contact local neighborhood organizations to gauge interest and feasibility.

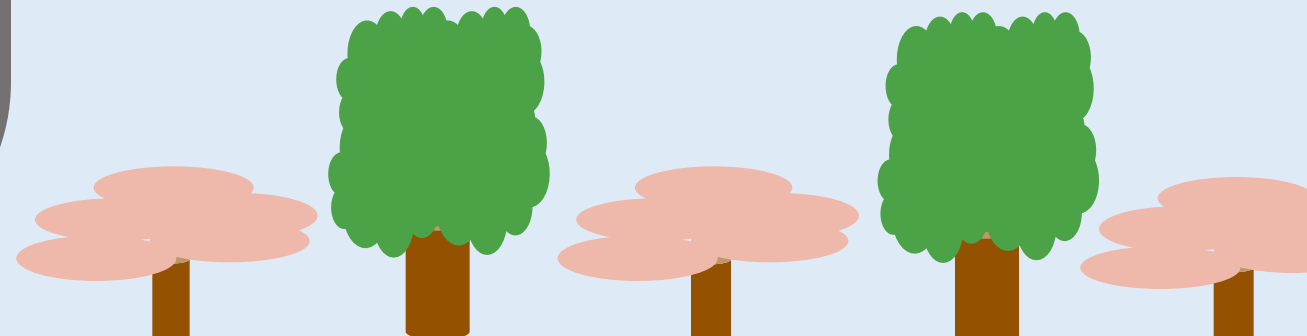
3.2: Allow local organizations and officials to direct corridors' implementation and maintenance with oversight. A survey for feedback on neighborhood needs could inform design and facilities.

3.3: Construct green corridors at a smaller scale, creating combined pedestrian/bike/car zones.

3.4: Assess success and gather feedback for the entire project and sustain local and centralized management.

Future Steps

After the completion of the intercity green corridor network, the next step could be to connect the BioCité network to parks outside the main ring, improving the flow of people in and out of the city center. Later, the network could be extended beyond the Périphérique to the banlieues. Bridging the gap between the city and its suburbs via green corridors is a revolutionary solution to socioeconomic disparities.



Financing and Cost

We see this project being mostly funded by the French and Paris administrations, with some funding from other public and private sources such as Climate-KIC.

If the plan is implemented successfully, much of this public cost will be offset by anticipated savings in health care, electricity, and reduced storm-runoff savings. Precise numbers are unknown, but a similar 17km linear park project in Cali, Colombia is expected to cost \$120 million. Under this cost model, our ~25km proposal would cost \$175 million.



Climate-KIC

The city of Cali recently received funding for its green corridor from Climate-KIC, a public private partnership supported by the European Union.

To receive this funding, the Green Network project would be evaluated for an adequate contribution towards reaching the Sustainable Development Goals. More information on this program, called “Result Based Finance for Cities”, will be released at the end of 2016. The amount of international funding available for urban sustainability projects is rapidly growing.^[17]

Artist rendering of Cali green corridor

Sources for Finance and Maintenance

Since our project seeks to address various goals from several ministries, funding could come from sources which search for projects that transcend departmental divisions. Our project is related to the Ministry of Social Affairs and Health, Ministry of the City, Ministry of Youth and Sports, and the Ministry of the Environment.

Privately, ways to obtain funding include:

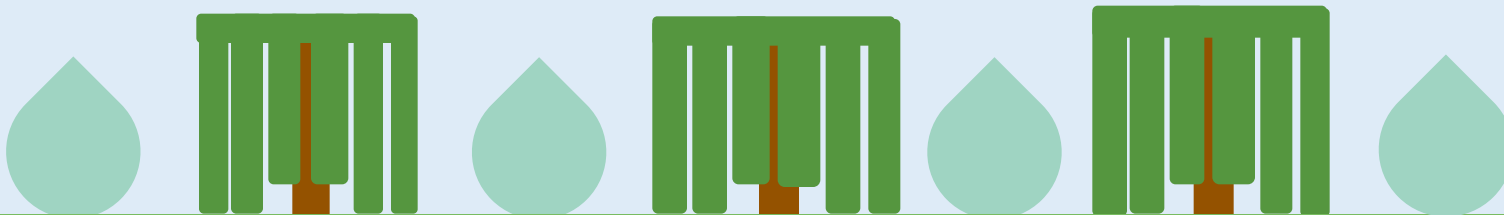
Honorary naming: Individuals could purchase the naming rights to a bench, large tree, etc. in honor of loved ones.

Rents: Vendors could rent land from the city to provide food along certain sections of the green corridor.

Allocation: Our project can progress via Parisians' support. In Paris, 500 millions euros are allocated to finance projects voted on by the Parisian.^[18]

NGOs and volunteer/community groups can contribute time and labor, raise funds, and encourage community development and local ownership of urban green space. The cost of maintenance could be lowered by community gardening.

'The evidence clearly shows that the success of funding models is inextricably linked to the physical, political and social context within which the green space is located, and the assets and resources available'.^[19]



Assessment

Assessing the success of the BioCité project will rely on a combination of measures.

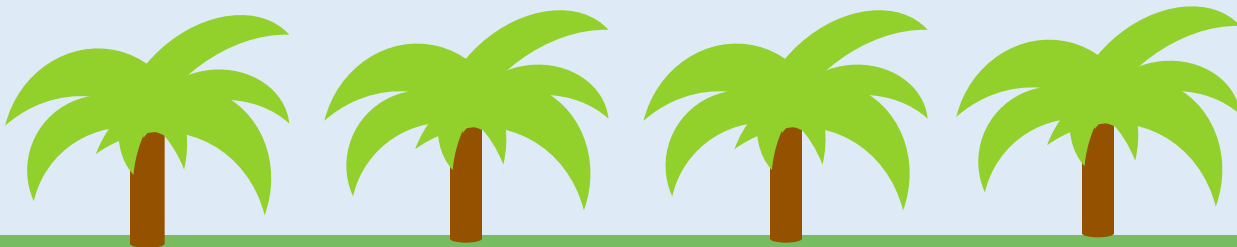
Financial

One way to calculate success is by quantifying the fiscal savings by citizens and the carbon savings after the implementation of the green network. Economists should use environmental management accounting, recognizing the savings from reduced health care, vehicle ownership, and other indirect expenditures.^[20]

Sociological

Quantitative analysis should compare the current number of people using sidewalks and parks to the number of pedestrians and cyclists in the same space after project implementation, using new technologies for crowd flow measurements. It is also important to know if preexisting parks retain prior visitor numbers. Administrators and scientists should agree on performance measure goals for pollution reduction and traffic patterns.^[21]

It is also important for a diversity of people to use the green network. The goal is to attain more mixing of people within spaces, so an accurate assessment of data about where BioCité users live would be helpful. Because this is a more qualitative factor, neighborhood focus groups and interviews could be a viable solution for determining local effects of the project.

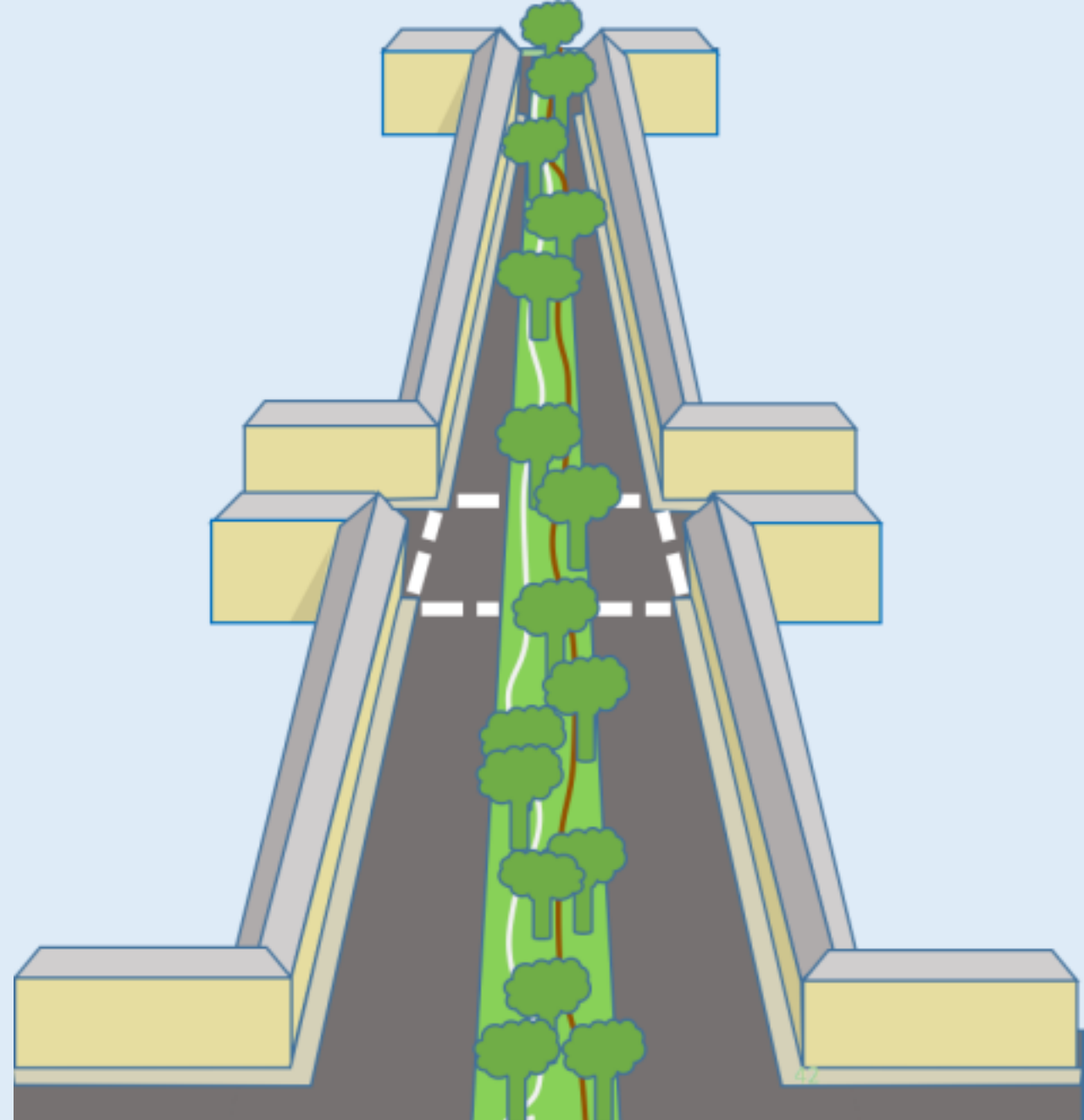


Environmental

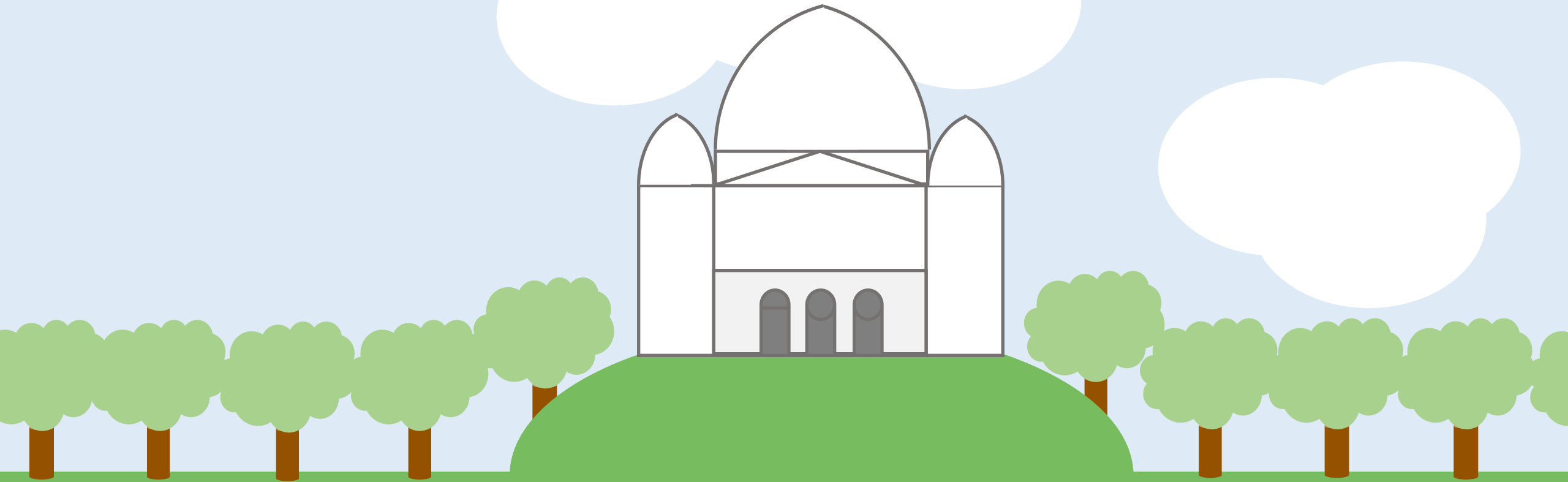
Local environmental organizations would likely be interested in keeping track of changes in urban biodiversity in the corridors and parks. Their findings could help inform best practices for landscape management to boost numbers of native species. Partnerships could be made with local universities to provide further research on environmental effects such as the urban heat island effect and air pollution.

An increase in “permis de végétaliser”, permits for Parisians to take responsibility for outdoor plants and gardens, would indicate a boost in public interest for the greening of the city.

Finally, the city can measure the rate of private vehicle ownership and use in the city. Hopefully, the number of private vehicles on the street will decrease.



Benefits



Improved Pedestrian Access

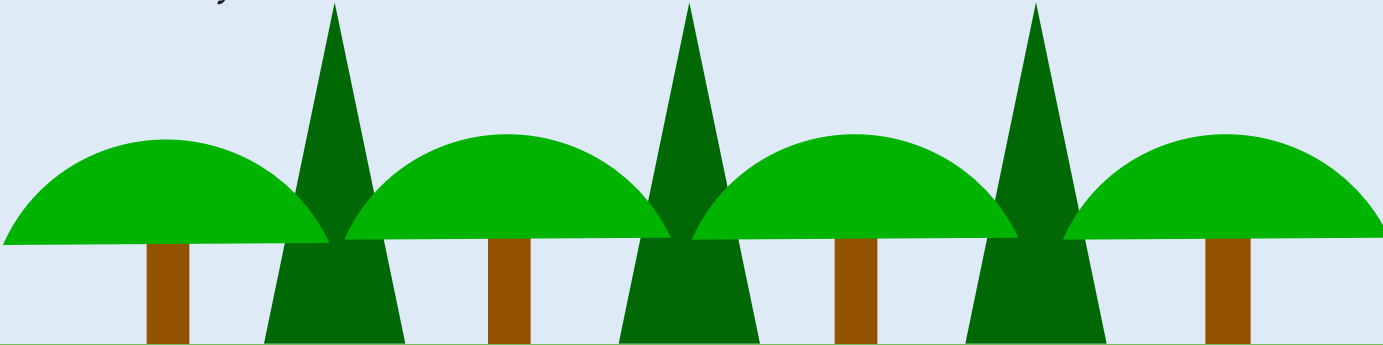
A completed network of updated green corridors would facilitate pedestrian access to the city and provide an accessible, enjoyable, and beneficial alternative to the metro or cars.

By establishing these streets within newly-created Zone 30 areas we seek to improve the safety of both pedestrian and bikers who will be partially separated from the main road. This will conduct to a gain of space, of security and fluidity. In Zone 20 areas, the greater integration of all three modes of transport in the same space actually improves safety.^[22]



Example of a pedestrian-friendly Parisian street.

La Coulée Verte is an example of an elevated green corridor in Paris.



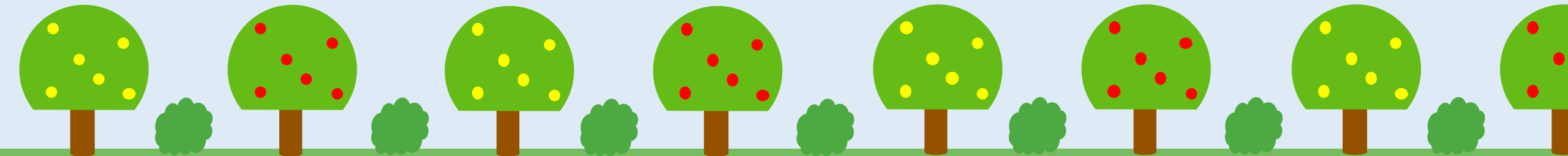
Improved Biodiversity

Our project is beneficial for the quality of biodiversity in the Ile-de-France region. Urban green corridors have been proven to be a refuge for small organisms such as birds, insects, small mammals, and native plants.

It should be noted that a narrow corridor cannot serve as a fully functioning ecosystem, but rather an edge habitat. To achieve a semblance of the “wild”, as Stockholm did, a corridor must be at least 500 meters wide. There is no scientific consensus on whether routes like this project actually help organisms move and spread across a landscape.^[16]

Despite these limitations, environmental scientists still highly recommend projects such as ours for improving urban ecosystems. In fact, green corridors usually come up against opposition when residents fear that buildings and houses will be altered; a narrower solution which reuses land will be more successful.

Overseers must consider environmental strategies when designing and implementing corridors such as preventing invasive species, preparing for specialist species (i.e. butterflies) and pollinators.



Improved Neighborhoods

Walking initiates greater interaction between neighbors and promotes integration and connection between neighborhoods of different socioeconomic status. Moreover, pedestrian areas can be places of leisure where people can enjoy a walk or run while enjoying street life. Exposure to nature from all five senses has been shown to improve mental health.



According to economic research, employment density near a greenway is increased within an area twice as wide as near a freeway. This is especially true for office sectors, thus “amenity- oriented public investment” like the project would improve the economy.^[23]

The green corridors would also be home to a new community space: amenities for skate boarding, pétanque, tables, benches, chess boards, public art, cafés, and community gardens are possible.

The “Berges de Seine” project seeks to give back the Seine to Parisians as a new leisure space with facilities for art, sports, food, and mobility.^[24]

Improved Health

Introducing green space in a city has also been shown to have significant health benefits by reducing air pollution and heat levels.

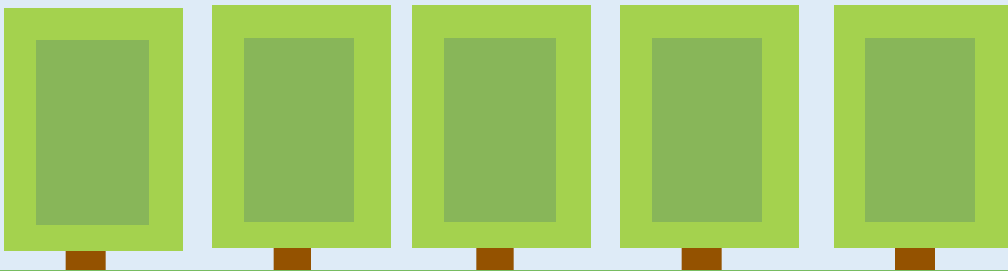
Air Pollution

Air pollution has been documented to have numerous negative health effects, ranging from alveolar inflammation to lung disease to heart disease.^{[25][26]} The term “air pollution” is normally used to encompass a range of pollutants, including particulate matter (PM) and nitrogen oxides (NO_x).^[27]

Air pollution is thought to contribute to approximately 42,000 premature deaths in France.^[28] Paris in particular has high pollution levels – especially of PM₁₀ and NO₂ – that substantially exceed the EU limits, affecting over 10 million inhabitants of the Paris region.^[29]

Green space has been shown to reduce pollution in an urban environment. Plants absorb pollutants like carbon dioxide and nitrogen dioxide and trap microscopic particulate matter in their leaf hairs.^[30] Studies in other cities indicate that a 10 percent increase in tree cover can reduce particulate matter by several percentage points.^[31]

Our project will reduce air pollution in Paris in two ways; first, by introducing greenery that can absorb pollutants from the air; and second, by reducing the number of cars in the city.



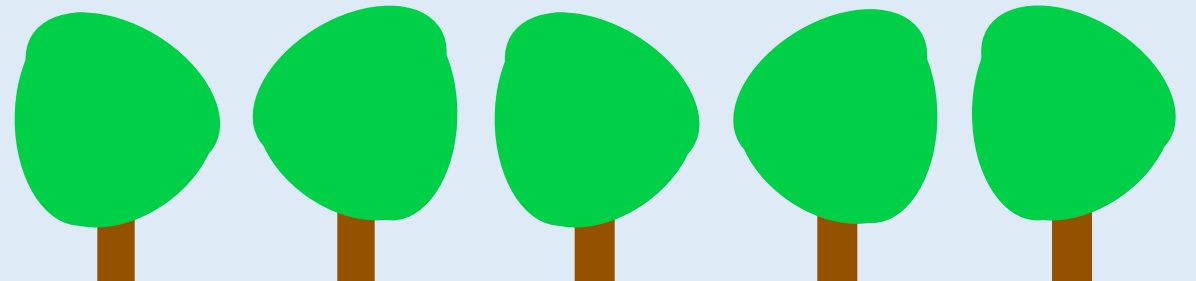
Heat

Cities like Paris are prone to higher temperatures than their surroundings, a phenomenon called the urban heat island effect (UHI). UHIs are warmer due to reduced vegetation, greenhouse gas emissions, and buildings with a high thermal capacity, among other causes.^[32]

Like air pollution, heat also contributes to a variety of harmful health effects, such as fatigue and heat stroke. Rising heat levels are statistically correlated with rising mortality rates, especially for elderly populations.^[33] During the 2003 European heat wave, nearly 20,000 people died in France due to heat-related causes worsened by the UHI effect.^[34] In addition, high temperatures are uncomfortable for city residents and reduce overall quality of lifestyle, especially during the summer months.

Green space has been shown to have a significant cooling effect in an urban environment, cooling the heat of nearby urban heat islands by a couple degrees.^[35] Connected parks have been shown to be particularly effective at cooling nearby urban areas, more so than non-contiguous singular parks.^[36]

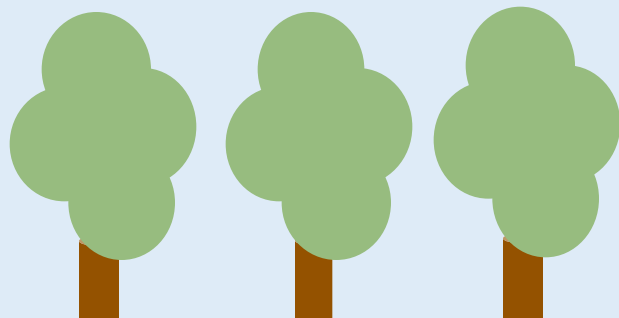
Thus, our plan of building a large network of connected parks and corridors -- thereby introducing thousands of trees and hundreds of hectares of green space -- may be able to significantly cool the city, mitigating the harmful health effects that urban heat islands cause.



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Works Cited

- ¹ "SDGs: Sustainable Development Knowledge Platform." United Nations, n.d. Web. 26 July 2016.
- ² "Collections, Départements Et Domaine Jardins Du Carrousel Et Des Tuileries." Jardins Du Carrousel Et Des Tuileries. Louvre Museum, n.d. Web. 27 July 2016.
- ³ "Unknown Parks in Paris." KLM.com. KLM, n.d. Web. 27 July 2016.
- ⁴ "Green Space Health." Green Space Health. N.d. <<http://www.greenspacehealth.com/2013/03/27/the-history-of-urban-trees-in-europe-part-iii/>>
- ⁵ Lawrence, Henry W. "Origins of the Tree-Lined Boulevard." *Geographical Review* 78.4 (1988): 355-74. Web.
- ⁶ Aran, Sue. "The Genius of Haussmann: Paris Urban Planning in the 19th Century." *Bonjour Paris*. N.p., 24 July 2015. Web. 27 July 2016.
- ⁷ "Paris." World Cities Culture Forum. Mayor of London, n.d. Web. 27 July 2016.
- ⁸ France. Urban Ecology Agency. Mairie De Paris. Paris Biodiversity Plan. N.p., 12 Oct. 2011. Web.
- ⁹ Van Eeckhout, Laetitia. "A Paris, La Moitié De La Voirie Sera En « zone 30 » à l'été 2017." *Le Monde.fr*. N.p., 06 July 2016. Web. 27 July 2016.
- ¹⁰ Van Eeckhout, Laetitia. "Tout comprendre à l'interdiction des véhicules polluants à Paris." *Le Monde.fr*. N.p., 01 July 2016. Web. 27 July 2016.
- ¹¹ "Paris Réaménage Ses Grandes Places." *Paris.fr*. Mairie De Paris, 5 July 2016. Web. 27 July 2016.
- ¹² *Ecosystems and Biodiversity: The Role of Cities*. Nairobi: United Nations Environment Programme and United Nations Human Settlements Programme, 2005. Sept. 2005. Web.
- ¹³ "Végéталisons La Ville." *Paris.fr*. N.p., n.d. Web. 27 July 2016. <<http://www.paris.fr/duvertpresdechezmoi>>
- ¹⁴ "Coulée Verte René-Dumont (ex-Promenade Plantée)." *Les Parcs Et Jardins*. Mairie De Paris, n.d. Web. 27 July 2016. <<http://equipement.paris.fr/coulee-verte-rene-dumont-ex-promenade-plantée-1772>>
- ¹⁵ Roberts, Eric. *Neural Networks - Biology*. N.p., n.d. Web. 27 July 2016. <https://cs.stanford.edu/people/eroberts/courses/soco/projects/neural-networks/Biology/index.html>
- ¹⁶ "Do Urban Green Corridors 'work'?" *The Nature of Cities*. N.p., n.d. Web. 27 July 2016.
- ¹⁷ *Result Based Finance Supporting Sustainable Development Goals: The Green Corridor, Cali, Colombia*. Issue brief. The Gold Standard Foundation, South Pole Group, WWF, ICLEI, 26 Jan. 2016. Web.
- ¹⁸ *Paris Budget Participatif*. N.p., n.d. Web. 27 July 2016. <https://budgetparticipatif.paris.fr/bp/#>

¹⁹ *Paying for Parks: Eight Models for Funding Urban Green Spaces*. Rep. London: Commission for Architecture and the Built Environment, 2006. Web.

²⁰ *Environmental Management Accounting: Policies and Linkages*. Rep. New York: United Nations, 2001. Print.

²¹ "Measuring Performance." *Smart Growth America*. N.p., n.d. Web. 27 July 2016.

²² ITF (2012), *Pedestrian Safety, Urban Space and Health*, OECD Publishing. <http://dx.doi.org/10.1787/9789282103654-en>

²³ Jang, M., and C.-D. Kang. "The Effects of Urban Greenways on the Geography of Office Sectors and Employment Density in Seoul, Korea." *Urban Studies* 53.5 (2015): 1022-041. *Sage Journals*. Web.

²⁴ "Les Berges Rive Droite Rendues Aux Piétons à La Rentrée 2016 ." *Paris.fr*. N.p., 27 May 2015. Web. 27 July 2016. <http://www.paris.fr/berges>

²⁵ Seaton, A., D. Godden, W. Macnee, and K. Donaldson. "Particulate Air Pollution and Acute Health Effects." *The Lancet* 345.8943 (1995): 176-78. *ScienceDirect*. Web.

²⁶ *How Air Pollution Contributes to Heart Disease*. Publication. Physicians for Social Responsibility, 2009. Web.

²⁷ "Pollution: Composition/sources." *European Lung White Book*. European Respiratory Society, n.d. Web. 27 July 2016.

²⁸ "The Air Pollution Is Responsible for 9% of Mortality in France." *Archy World News*. N.p., 20 June 2016. Web. 27 July 2016.

<<http://archyworldys.com/the-air-pollution-is-responsible-for-9-of-mortality-in-france/>>

²⁹ *Air Quality in Paris Region: Summary 2015*. Rep. AIRPARIF - Paris Regional Air Observatory, June 2016. Web.

³⁰ AccessScience Editors. "Urban Tree Leaves Remove Fine-particulate Air Pollution." *AccessScience*. McGraw-Hill Education, 2014. Web. 28 July 2016.

³¹ Tallis, Matthew, Gail Taylor, Danielle Sinnett, and Peter Freer-Smith. "Estimating the Removal of Atmospheric Particulate Pollution by the Urban Tree Canopy of London, under Current and Future Environments." *Landscape and Urban Planning* 103.2 (2011): 129-38. *ScienceDirect*. Web.

³² Oke, T. R. "The Energetic Basis of the Urban Heat Island." *Q.J Royal Met. Soc. Quarterly Journal of the Royal Meteorological Society* 108.455 (1982): 1-24. Web.

³³ Zupancic, Tara, Claire Westmacott, and Mike Bulthuis. *The Impact of Green Space on Heat and Air Pollution in Urban Communities: A Meta-narrative Systematic Review*. Rep. David Suzuki Foundation, Mar. 2015. Web.

³⁴ BAMAT, Joseph. "France Takes Steps to Avoid Repeat of Deadly 2003 Heat Wave." *France 24*. N.p., 01 July 2015. Web. 28 July 2016.

³⁵ Bowler, Diana E., Lisette Buyung-Ali, Teri M. Knight, and Andrew S. Pullin. "Urban Greening to Cool Towns and Cities: A Systematic Review of the Empirical Evidence." *Landscape and Urban Planning* 97.3 (2010): 147-55. *ScienceDirect*. Web.

³⁶ Doick, Kieron J., Andrew Peace, and Tony R. Hutchings. "The Role of One Large Greenspace in Mitigating London's Nocturnal Urban Heat Island." *Science of The Total Environment* 493 (2014): 662-71. *PubMed.gov*. Web.