

A wide river, likely the Seine in Paris, flows through the center of the frame. In the distance, a multi-arched bridge spans the river. The left bank is lined with trees and a large, illuminated boat is docked. The right bank features historic buildings with domes and spires. The sky is filled with soft, grey clouds, and a single bird is visible in flight in the upper right. The overall atmosphere is calm and scenic.

jardin ouvert



serit arbores quae alteri seculo prosint

*He plants trees for the
benefit of another age
—Caecilius Statius*

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concept



Commitment to 21st century standards of sustainability and resilience is expected now of the world's foremost urban centers. Paris is no stranger to the environmental movement with its various citizen greening initiatives. Yet, with limited green space and air pollution reaching gasping peaks in 2016, the city still has much to improve upon. As a member of international climate co-operations (e.g. C40 and 100 Resilient Cities), a contender for the 2024 Olympic Games, and the namesake of the latest international climate agreement, Paris stands on the world stage looked upon for inspiration and leadership.

A model of public and environmental health, *Jardin Ouvert* is a network of

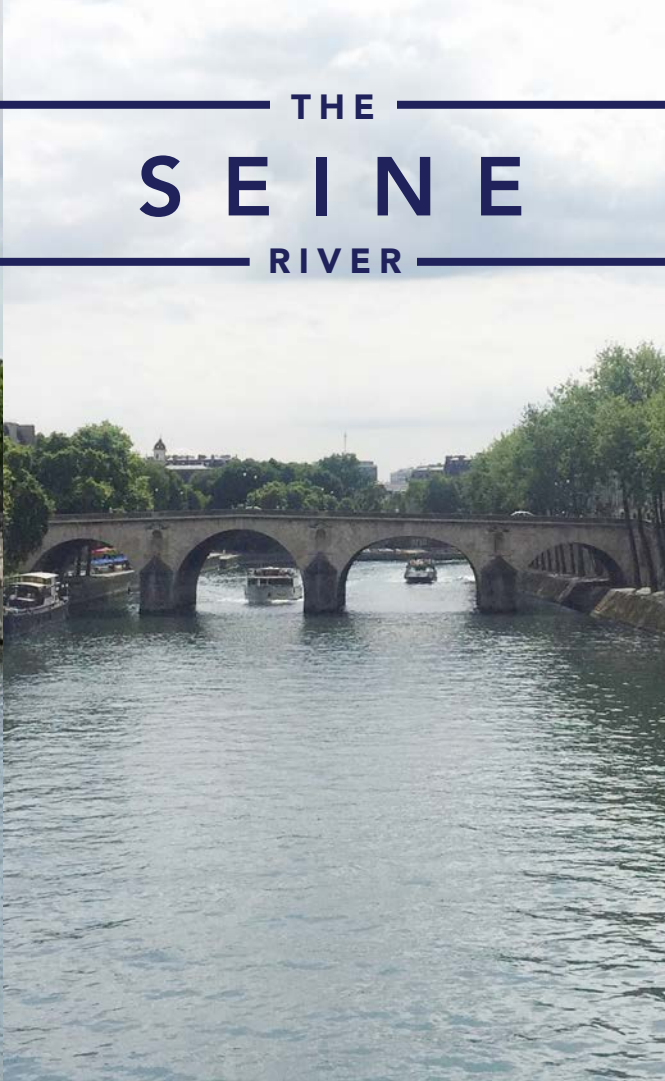
green walls and open planter beds that will line key locations along the Seine in Paris. Our integrated vertical and horizontal garden arrives at the confluence of a need for a greener, cleaner Paris and the absence of bond between people and their natural world. The vertical structures, irrigated by water pumped from the Seine, will mitigate air pollution, reduce urban heat, and filter pollutants out of the Seine. The horizontal gardening part will provide public green space where people can learn about plants and actively experience a connection with nature that immutable public parks cannot cultivate. A replacement for the destructive Love Locks, *Jardin Ouvert's* interactive hori-

zontal gardening component will allow people to testify their love with greening instead of locking.

Jardin Ouvert reconnects the river to the city and people to nature, while embodying Paris' sustainable development strategies. Gardening advice, visits, and workshops will complement the installation. From crafting seed paper to learning to garden, *Jardin Ouvert* will become a vibrant green place of creative expression and environmental benefit. With activities suitable and enjoyable for children and adults, tourists and natives, novices and experienced, *Jardin Ouvert* will help shape the relationship that the current, past, and future generations have with nature.

abstract

THE
S E I N E
RIVER



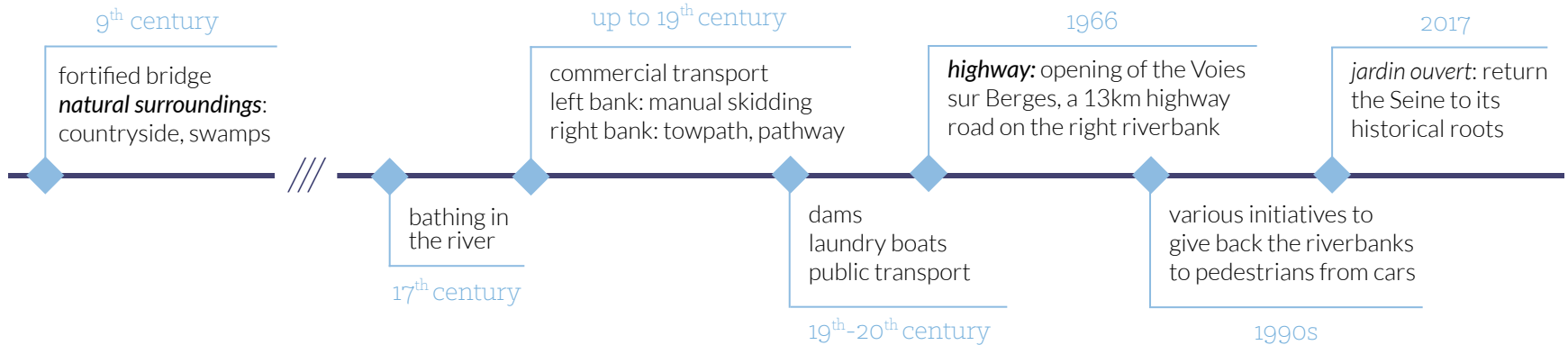
la seine

As the essence of Paris and its people, the Seine River is an instinctual origin point for Jardin Ouvert. The Seine is a magnet with cultural and geographic poles that attracts people from all over Paris; in a way, the Seine reaches back out to the city too.

Central to the Parisian experience, the Seine carves its way through the city, forming a winding environ of bridges, stone embankments, and towering walls. It is, geographically and historically, at the hearth of Paris. Transport, resources, daily activities used this axis and made it the point of origin of Paris' urban development. Nearby monuments and the riverbanks' layout make the Seine an iconic Parisian symbol, a monument unto itself, partially under UNESCO protection.

However, the implantation of the voies sur berges in the 1960s broke the link between inhabitants and the city's core. Today, the pedestrianization of those voies emphasize Paris' interest in re-envisioning the Seine as a dynamic hub in which Parisians have a sense of ownership. More than ever, the river is a cultural and social magnet that affords incredible potential for addressing the social and environmental issues facing Paris. And as a gathering point in the city, it will allow us to bring nature to where a large majority of people live and frequent.

timeline of the seine





history

BATHING

Bathing in the Seine started in the 17th century, at first improvised, then supervised according to specific boats and rules. In 1923, bathing was forbidden due to health concerns, yet Parisians continued to do so until the 1960s.

LAUNDRY BOATS

In the 19th and 20th century, Parisians washed their clothes on designated laundry boats located along the Seine. Laundry boats disappeared when running water came to houses and simplified the laundering process.

BOUQUINISTES

Bouquinistes, sellers of old and used books, opened on the high docks. They face the city and turn their backs on the Seine. Although they are part of the Seine scenery, they accentuate the river's isolation from the city in a way.

PUBLIC TRANSPORT

Water transportation briefly existed between the 19th and 20th century. Now the service that exists, Batobus, pertains more to tourism than public travel needs. A new service, Voguéo, was tested (and failed) in the late 2010s [1].

the present

The riverbanks of the Seine are very popular places for Parisians and tourists alike. This is the perfect place to hangout, stroll around, have dinner with a beautiful view of Paris. However, despite the Seine's pedestrianization, the riverbanks retain the feeling of a highway. Current attempts to naturalize the Seine riverbanks have been inconspicuous, quite static, and lacking in vivacity.



existing conditions



*Les berges de Seine rive droite piéton-
nisées visent à devenir un lieu majeur
pour le rayonnement, l'attractivité et
l'identité de Paris, et un nouvel es-
pace public de 4,5 hectares améliorant
la qualité de vie des habitants dans le
respect du classement au patrimoine
mondial de l'UNESCO de ce site.*

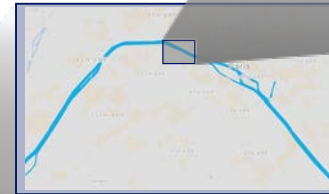
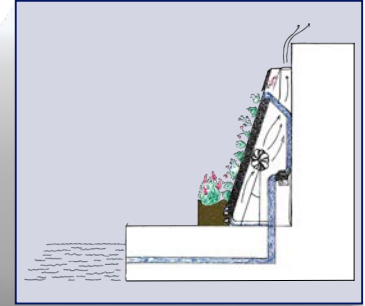
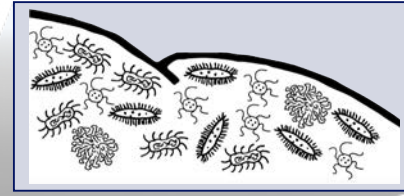
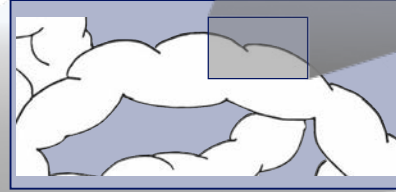
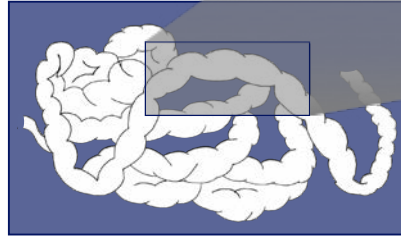
—paris.fr [2]

“

*The pedestrianized banks of the Seine
rive are intended to become a major
place for the radiance, attractiveness
and identity of Paris, and a new
public space of 4.5 hectares improving
the quality of life of the inhabitants
while respecting its classification as
UNESCO World Heritage Site.*

(english translation)

biological analogy



biological analogy

From east to west, passing the Eiffel Tower and the Louvre, the Seine wraps around the vital organs of Parisian iconography and is itself a transporter of people and ships. The Seine was once a potent source of nourishment for the body of Paris, and indeed possessed a vibrant ecology. In view of Seine's poor water quality, pollution, and lack of vegetation along its banks, the river has lost its biotic vigor. The Seine is, like the intestines are to the human body, essential to Paris. The healthy human intestine is home to fields of mutualistic microflora (literally *little flowers*), just as the Seine was once a healthy river with tremendous biodiversity on its banks.

But now, the Seine resembles the same loss of natural ecology and the same growth of pollution and harmful bacteria that is seen in humans with gut microbiome deficiency. A disease characterized not only by the loss of microbes beneficial to human life but also by the growth of those harmful to it, gut microbiome deficiency harms people's ability to digest food, contributes to obesity, compromises people's immune systems, and cultures harmful bacteria that lead to a host of infections and other diseases.

Microbiome therapy is the replacement of beneficial microbes to the gut where they kill bad bacteria and restore people's immune and digestive systems to normal. *Jardin Ouvert* is the microbiome therapy for the Seine—a means of returning the Seine to a healthy, more natural state capable of

cleaning the air and water, reducing the bloatedness of the urban heat island effect, and shielding Parisians from the adverse health impacts of living in a dense city. The

Jardin Ouvert is the microbiome therapy for the Seine—a means of returning the Seine to a healthy, more natural state.

positive impact *Jardin Ouvert* will have on revitalizing the Seine will be equivalent to the tremendous restorative power microbiome therapy has on a person's health.



○ — the main objective of *Jardin Ouvert* is to help Paris evolve as a *smart city*



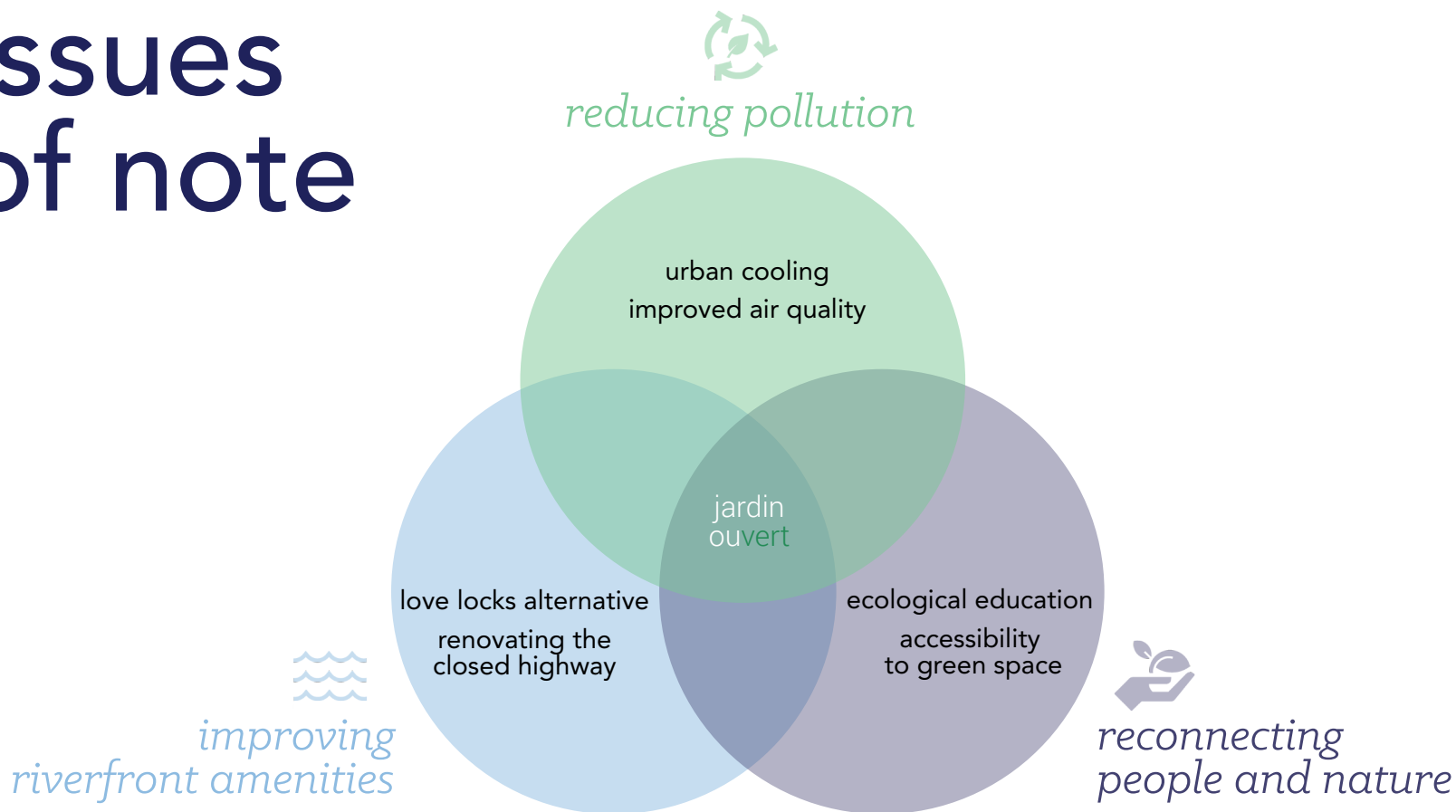
SDGs

UNITED NATIONS
SUSTAINABLE DEVELOPMENT GOALS [3]

background & issues



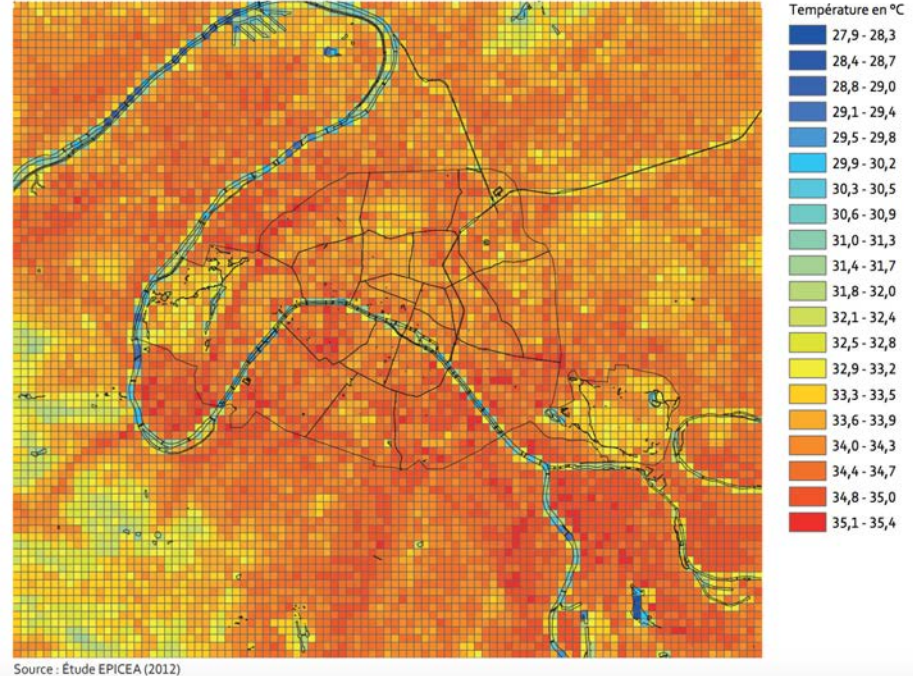
issues of note



urban heat island effect

The heat island effect (HIE) is the amplification of temperature increase in an urban context. It comes from the artificial nature of the city's features: the size and sprawl of roads coatings, buildings blocking wind flow, the lack of vegetation and bodies of water to cool surrounding areas, and high rates of energy consumption.

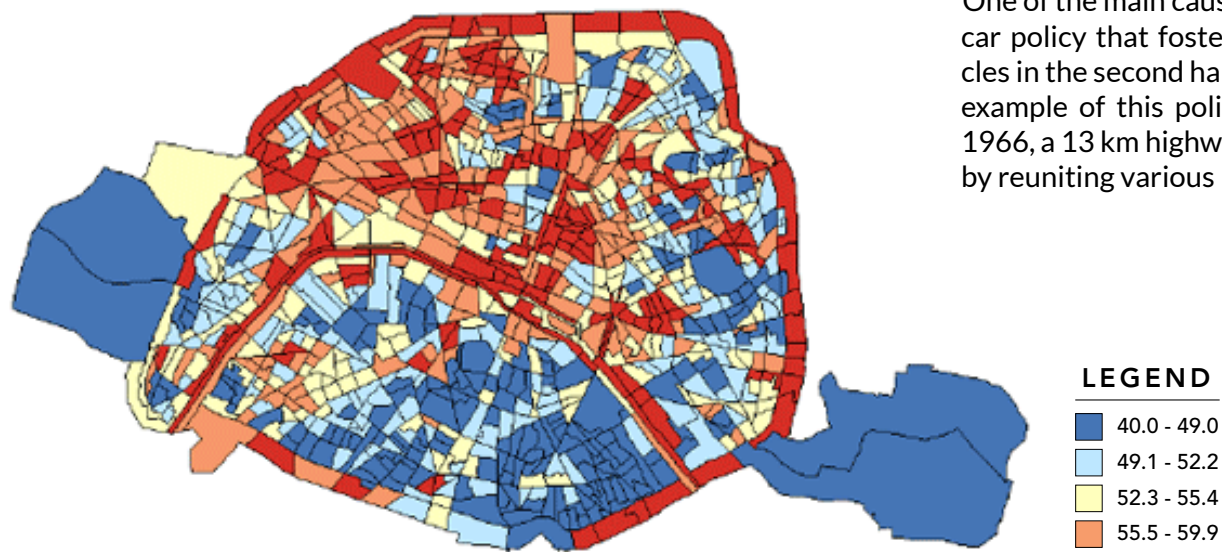
Paris suffers from the urban heat island effect. However, the Seine, as a massive quantity of water, benefits from thermal inertia. During heat waves, its temperature is lower than the atmosphere's, allowing the river to absorb some heat from the air. This air cooling phenomenon impacts an area up to tens of meters on each side of the river. The Seine is the only element in the city that has this impact on Paris, as canals do not represent the same volume of water, and have a much lower flow [5].





air pollution

One of the main causes of air pollution in Paris is the car policy that fostered the use of motorized vehicles in the second half of the 20th century. A striking example of this policy concerns the riverbanks. In 1966, a 13 km highway was built on the lower docks, by reuniting various portions of road [6].





love locks

Love Locks is a phenomenon common among tourists who aim to seal their love with a padlock fixed to a bridge, gate, or other public structure. Couples are compelled by the romanticism of leaving a permanent testament to their love in the city, and although their sentiment is seemingly harmless, the rapid proliferation of these locks has rendered them a threat to the preservation of the heritage and integrity of city infrastructure in Paris [7, 8].



PONT DES ARTS

This pedestrian bridge over the Seine River was the primary destination for declarations of love in lock-form until part of the bridge collapsed under the total weight of nearly 45 tonnes of locks.

ANTI-LOVE LOCKS

In response, the city called for the mass-removal of locks and installed glass panes to protect the bridge, encouraging individuals to express their love without the litter and vandalism of love locks.

FUTURE LOCKS

Although the trend has slowed, love locks have not completely disappeared. The sentiment behind love locks can be redirected in a productive manner that does not degrade city infrastructure [9].

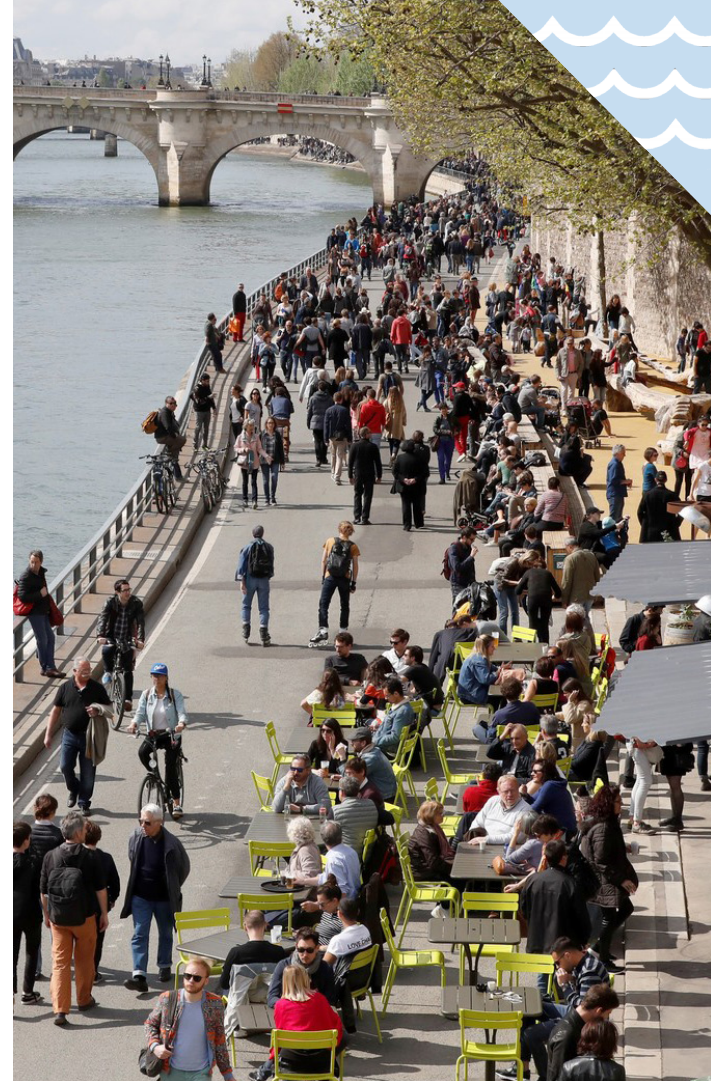
closed roads

parc rives de seine

Following previous ephemeral closures—no cars on Sundays since the 1990s, Paris Plage annual edition since 2002—a large portion of the right riverbank did not reopen to motor vehicles after Paris Plage 2016. Coupled with the left riverbank area, similarly closed since 2013, these two pedestrian sections became the Parc Rives de Seine in April 2017. Though constrained by flooding prevention, which requires furniture to be removable, the park is a reservoir of potentialities in urban planning.

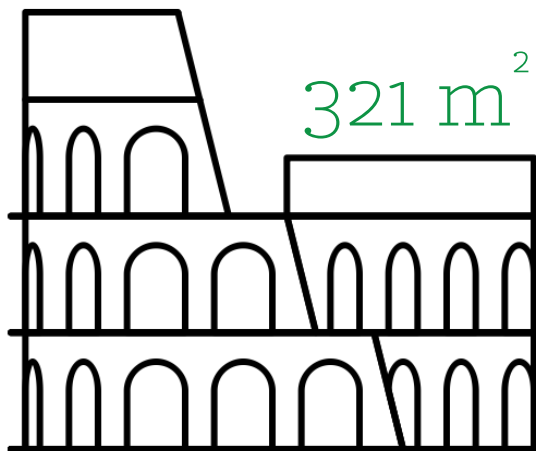
Some developments have already been made, such as playing areas for kids, floating gardens, climbing walls,

benches, board game tables, restaurants, sports facilities, etc. City Hall also wants to add an environmental dimension to the park, providing some potted plants, creepers on walls, and biodiversity through nesting boxes for birds and bats. However, the park still feels in many places like a road. Coated in asphalt, furnished with sidewalks and traffic lights, the old nature of its features could be less visible. In other words, despite turning highway to walkway, the feeling of highway, of a stony landscape, of nature's absence has not left the Seine. This is where *Jardin Ouvert* interjects and will support the City's desire to go further into park development.





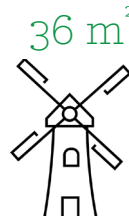
accessibility to green spaces



ROME
2,232 people/km²



LONDON
5,590 people/km²



AMSTERDAM
4,908 people/km²



PARIS
intra-muros
21,000 people/km²

Paris is the densest capital city in Europe, and it has the lowest green space per capita. The largest green spaces in France are Bois de Vincennes and Bois de Boulogne, which are removed from central Paris and usually not even depicted in maps of the city. Apartment dwellers have little opportunity to garden. Most lack the time to commit to the limited community garden space in Paris and there is little incentive for or impact from Paris' recent allowance of random greening wherever people see fit. The values depicted in green below represent green space per capita [10].



ecological education

- 1** Education about environment and the challenges raised by human activities is part of the French primary school curriculum. Teachers are invited to organize **field trips** in their respective local natural settings so that children can experiment and observe their surroundings [10].
- 2** The Charte des Petites Mains Vertes for example, enables **partnerships between schools and shared gardens** (currently 28 schools and 15 gardens). The children work throughout the year with the help of city gardeners and experts from the “Maison du Jardinage” [11].
- 3** The City hopes to provide **gardening kits** to every school. The kit helps schools to build a pedagogical garden that will teach children “patience, respect for the environment and others’ work, to better understand climate, to master the balanced water management, to discover the city’s biodiversity, and tackle food and sustainable consumption through an innovative approach” [12].

Le Jardinage, [...] il s'agit d'apprendre aux petits Parisiens la patience, le respect de l'environnement et le travail des autres, de leur permettre de mieux comprendre le climat, de maîtriser la gestion raisonnée de l'eau, de découvrir la biodiversité en ville, et d'aborder l'alimentation et la consommation durable sous un angle innovant.

—paris.fr [12]

“

Le Jardinage, [...] it is a question of teaching the young Parisians patience, respect for the environment and the work of others, to enable them to better understand the climate, to master the reasoned management of the water, to discover the biodiversity in the city, and to approach food and sustainable consumption from an innovative angle.

(english translation)

A photograph of the Notre-Dame de Paris cathedral, viewed from across the Seine river. The cathedral's iconic spire and flying buttresses are visible, partially obscured by lush green trees. In the foreground, a long, light-colored stone wall runs along the riverbank, with ivy growing on its surface. The sky is overcast and grey. The word "audience" is written in a large, black, serif font, positioned on the right side of the image, overlapping the sky and the wall.

audience

CITY OF PARIS

Jardin Ouvert helps to fulfill the environmental objectives of the City. We will improve the proportion of vegetation in Paris, which implies a positive change of the air quality. Adding green in the capital provides a pleasant ambience.

FLOWER SHOPS

The project will bring value and customers to flower shops. It can be done via partnerships with botanical companies or by people who purchase plants from flower shops to bring to *Jardin Ouvert*.

TOURISTS

We propose an alternative to the touristic love lock tradition. At *Jardin Ouvert*, tourists can plant messages on seed paper and follow the growth of their plants on Instagram. They are encouraged to leave a positive impact on Paris and appreciate a greener perspective of the city.

PARISIANS

We offer an opportunity to Parisians to experience a moment of gardening in their day, learn more about their environment and green walls, and have contact with nature. Children will have direct exposure to the earth through organised workshops and learn about biology, agriculture tools, and sustainable development in an engaging environment.

beneficiaries

tourism

Paris is one of the most visited city in the world with 36.5 million tourists in 2016 in the Grand Paris. Tourism generates 8 billion euros of economic value in Ile-de-France every year.

However, only 53% of foreigners view Paris as a green city (Enquête sur l'image et les freins de la destination Paris 2015 OTCP + BVA) which could be a deterrent for tourism. It is even worse for people from Northern Europe (who represent more than 27% of the tourists in Paris), where 74% of the population thinks that Paris is not a green city [13].

53%

of foreigners view
Paris as a *green city*.

74%

of Northern Europeans *do not*
view Paris as a *green city*.

A photograph of a large, multi-arched metal bridge spanning a river. The bridge's structure is made of dark metal beams and arches, supported by stone piers. In the background, a large, ornate building with a prominent dome is visible. A blue and red boat is on the river in the foreground. The sky is overcast.

previous
approaches

voies sur berges



1990s /

Since the 1990s, the City of Paris has made efforts to reduce the presence of cars and welcome pedestrians on the riverbanks.

1994 / Following an initiative from the Ministry of Environment, the riverbanks are closed to cars on two Sundays. The operation is a huge success.

1995 / Every Sunday, the Voies sur Berges is closed to cars so that pedestrians, cyclists, and rollers are free to enjoy the space [14].

paris plage

An aerial photograph of the Paris Plage area, showing a sandy beach with several large blue umbrellas and people relaxing. The beach is situated along a riverbank, with a concrete wall and trees visible in the background.

2002-present /

The first edition of Paris Plage took place 2002, transforming the riverbanks into an artificial beach. Since then, parts of the lower docks (including the highway) and some other Parisians sites are closed for about a month and furnished with summer-themed equipment: potted palm trees, deckchairs, swimming pools, sand, games, and refreshment bars. Most significantly, the highway did not reopen to cars after Paris Plage in 2016 [15].

jardins partagés



ongoing /

There are 111 community gardens (“Jardins partagés”) in Paris. These community gardens are local initiatives, backed by dedicated associations and are meant to bring together generations, neighbors, and cultures. Usually established on city-owned land, the community garden initiative requires approval from City Hall and needs to adhere to the “Main Verte” charter: involve the neighborhood inhabitants, use environment-friendly techniques, be open to the public at least twice a week, and benefit from the City’s expertise (via workshops, documentation, and advice) [16].

project
design



jardin ouvert

The Seine's popularity and centrality positions the region as the perfect medium for change in the la ville de Paris. As a hotbed of tourist activity, venue for a diversity of night-life, and recreational destination for Parisians, the Seine holds tremendous potential for transformation. It's current pedestrianization presents an opportunity for implementing an advanced, multi-layered environmental and public health initiative that is our proposed project: Jardin Ouvert.

design

Part active living wall, part planter bed, *Jardin Ouvert*'s overarching design concept addresses both the environmental and social aspects of re-connecting the city of Paris to nature. The vegetated mat wall vertical component, hydroponically nourished and watered, filters air pollutants, reduces the urban heat island effect, and increases biodiversity along the Seine. Meanwhile, the horizontal planter bed portion, watered by the purified runoff water from the modular but connected living wall, will be canvas for tourists and native Parisians—a place where they can not only learn about and work with plants but also find green alternative to Love Locks.

OVERVIEW OF DESIGN SECTIONS

design diagram

digital rendering

map of target areas

target area analysis

love locks alternative

vertical garden

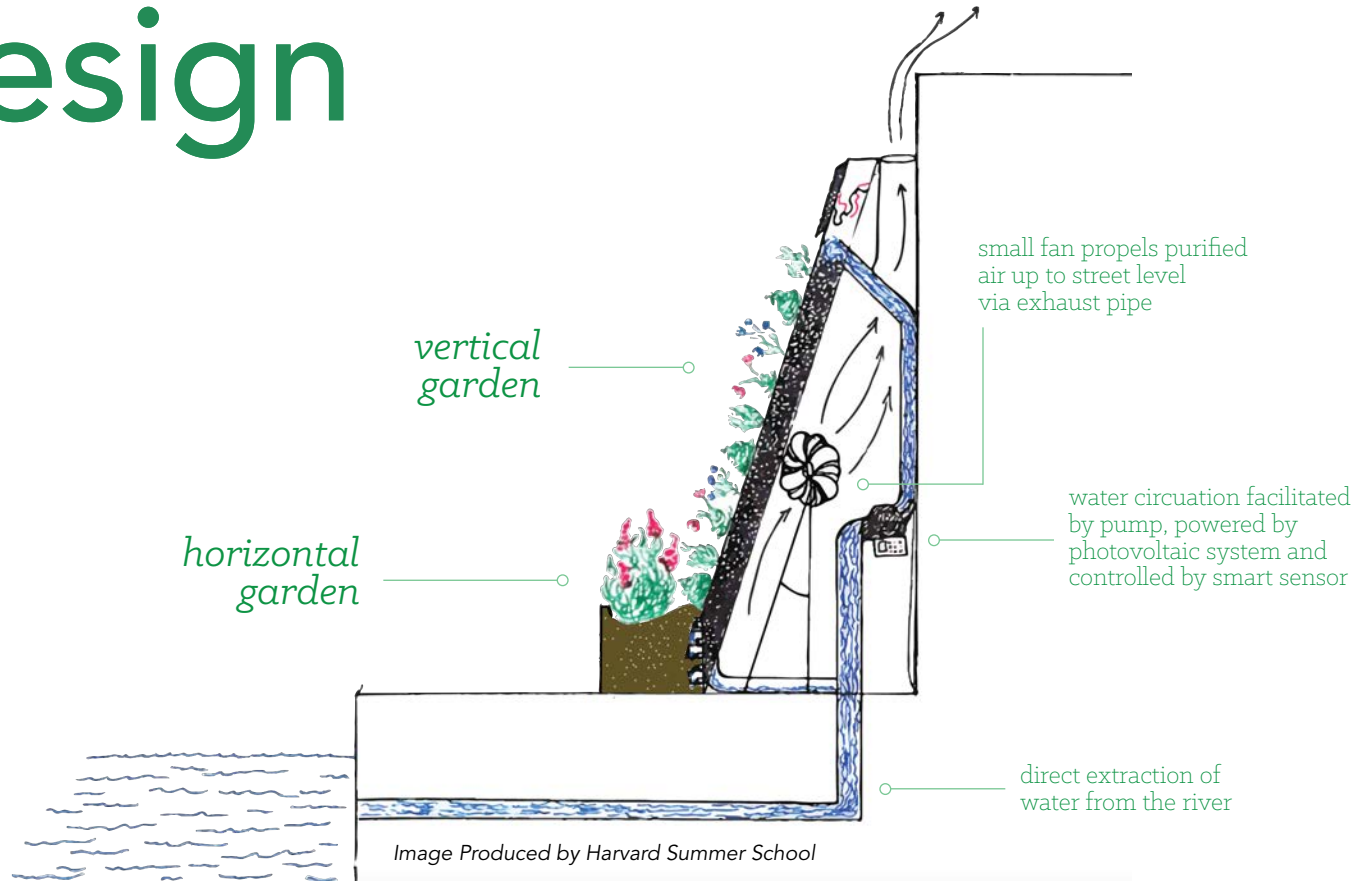
prospective plant list

horizontal garden

education

water system

design





digital rendering of garden

Projected appearance of the riverbanks once *Jardin Ouvert* is installed.

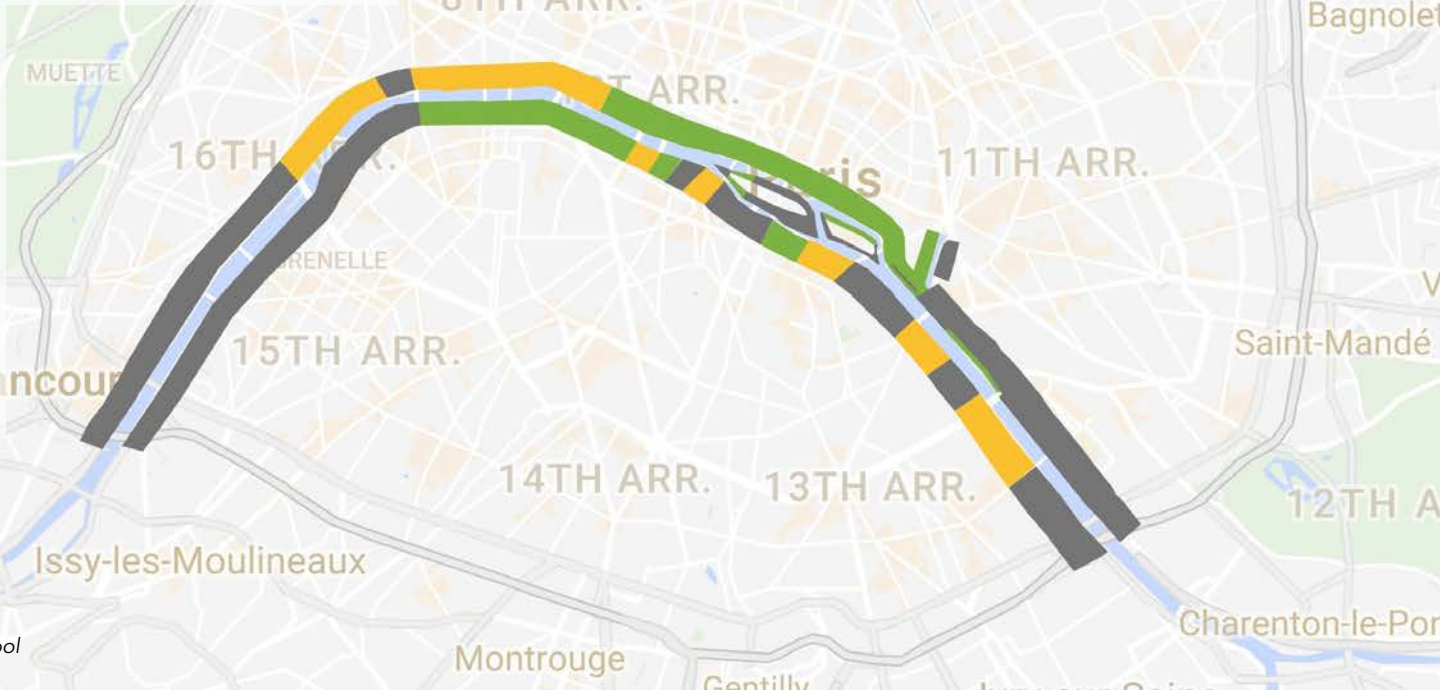
Image Produced by Harvard Summer School

map of target areas

LEGEND

- OPTIMAL (27.5%)
- POSSIBLE (16.5%)
- UNUSABLE (56%)

The percentages are given in terms of the cumulative distance of the Seine riverbanks, 31.55km.





OPTIMAL

The optimal category shows perfect conditions for installing *Jardin Ouvert*: wide bank, high and regular walls, long distance between trees or no trees, easily accessible to pedestrians, ideally facing south, etc.

POSSIBLE

The possible sections are close to the optimal but miss the classification because of one or more specific shortcomings: irregular walls, narrow bank, nearby parking lot, vibrant nightlife, etc. Building *Jardin Ouvert* here is not impossible, but it will necessitate some modifications of the design to adapt to the particular space.

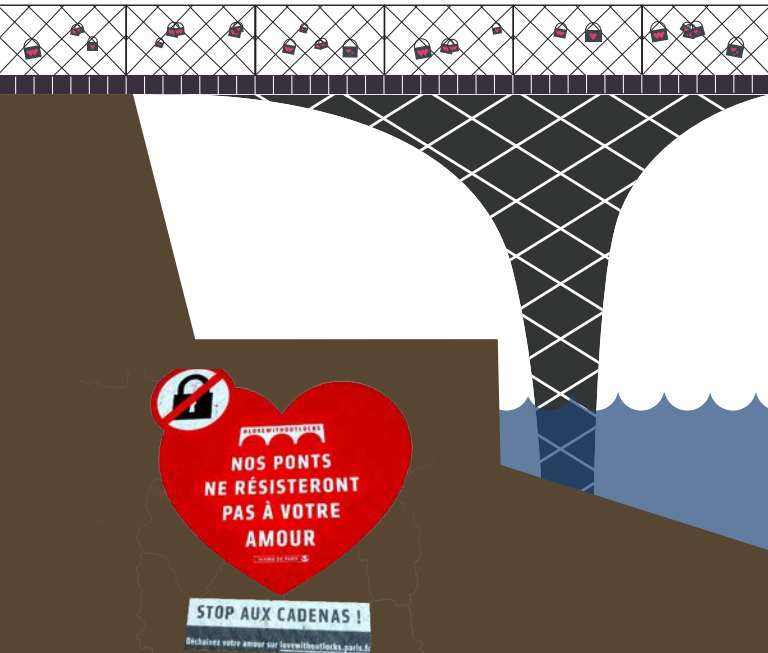
UNUSABLE

The unusable category indicates locations where green walls absolutely cannot be built, either because a building, a road, an industry prevents us from it, or because a green area (e.g. public park) already exists.

target area analysis

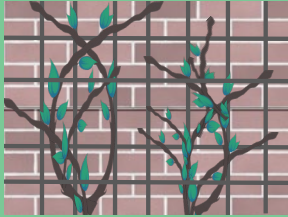
love locks alternative

Due to Love Locks' destructive impact on bridges' structural integrity, the city of Paris has outlawed the practice. Public reaction is two-sided. Some find new locations to attach their locks. Conversely, a website, entitled Passion Locks, allows people to make virtual Love Locks. *Jardin Ouvert's* interactive horizontal planting bed can be the alternative to Love Locks that tourists and the city of Paris have sought. *Jardin Ouvert's* social component offers biodegradable seed paper to write messages of love and the space for couples to label their plants with these testaments of love. This process is creative and environmentally beneficial—a paradigm shift that will transform the image of love in the City of Love hereafter [7, 8, 9].



Instead of locking love on a bridge that ultimately snaps under all the love, why not grow the love organically and on the banks of the most iconic rivers in all of Europe?

GREEN
FAÇADE



MODULAR
LIVING
GREEN
WALL



CONTINUOUS
LIVING
GREEN
WALL



Our green wall will average 3 meters high and 2.5 meters wide across all locations.

vertical garden

The vertical part of *Jardin Ouvert* is an active, living green wall. The vertical garden consists of two layers of *felt*, with pockets that support installation of plants and subsequent development of root mass between the felt layers into the growing medium. Watered by a *hydroponic system*, roots of the vertically grown plants will acquiesce pollutants and nutrients alike from the Seine water, thereby purifying it. A *waterproof membrane* beneath both felt layers and the root matrix will prevent internal flooding of the system and protect the Seine walls from any water damage. A *fan*, positioned behind the vertical wall will help draw inward external polluted air, through the mat where air purification occurs, and into the interior of the wall where it is expelled as healthy “exhaust” to the city streets above.

Jardin Ouvert's green wall is *continuous*, indicating the use of felt-layers instead of metal cages or gabions with rocks or sphagnum. This technique is less expensive, has a lifespan generally of 10 to 15 years, occupies less space, and weighs less. The structure will be *sustainably constructed*, so we will use felt fabrics from recycled materials like plastic water bottles. The fan component and pump will be powered by small *photovoltaic cells* at the top of the walls. Among green walls (Murs Végétaux), two classifications differentiate approaches: the *living green wall* (LGW) and the green façade (passive green walls). *Jardin Ouvert* employs the former because it allows more diversity of plant species, offers more aesthetic opportunities, and is more efficient at reducing air pollution and heat island effect [17, 18, 19, 20, 21].

prospective plant list

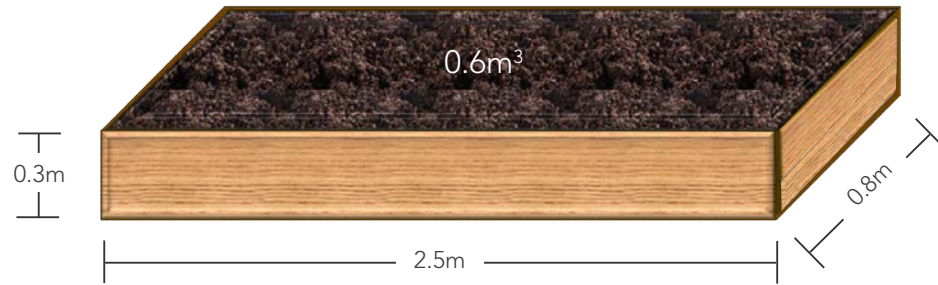
Species for Vertical Wall	Characteristics	Perennial	Shade Tolerant	Native to Europe
Alumroot <i>Heuchera spp.</i>	Attract dipteran pollinators.	Yes	Yes	No
Assorted succulents: <i>Echeveria spp., Sedum spp., Sempervivum spp.</i>	Drought tolerant and varied colors offer marketing/promotional plant design opportunities.	Yes	Yes	Some
Begonia <i>Begonia spp.</i>	Attracts bees and other pollinators.	No	Yes	No
Bracken Fern <i>Pteridium spp.</i>	Phytoremediation of heavy metals common to the Seine, including copper, lead, arsenic and nickel.	Yes	Yes	Yes
Brake Fern <i>Pteris spp.</i>	Phytoremediation of arsenic.	Yes	Yes	No
Bromeliad <i>Bromeliaceae</i>	Variety of colors offer marketing/promotional plant design opportunities.	No	No	No
Bugleweed <i>Ajuga spp.</i>	Low, sprawling coverage plant with candelabra blue flowers.	Yes	Yes	Yes
Dwarf Lilyturf <i>Ophiopogon japonicus</i>	Evergreen with blue berries.	Yes	Yes	No
Foamflower <i>Tiarella spp.</i>	Decorative foliage offers marketing/promotional plant designs opportunities.	Yes	Yes	No
Indian Mustard <i>Brassica juncea</i>	Phytoremediation of cadmium and lead.	No	Yes	No

Species for Vertical Wall	Characteristics [22, 23, 24, 25, 26]	Perennial	Shade Tolerant	Native to Europe
Moneywort <i>Lysimachia nummularia</i>	Coverage plant with petite yellow flowers and distinctive foliage.	Yes	Yes	Yes
Peace Lily <i>Spathiphyllum spp.</i>	Waxy cuticle on foliage and flower as well as variety of color can provide marketing/promotional plant designs. Phytoremediation of formaldehyde.	No	Yes	No
Philodendron <i>Philodendron spp.</i>	Filler plant with phytoremediation of formaldehyde.	No	Yes	No
Plantain Lilies <i>Hosta spp.</i>	Large flowering attractor of pollinators.	Yes	Yes	No
Spider Plant <i>Chlorophytum comosum</i>	Phytoremediation of trichloroethylene (TCE), common to older manufacturing processes, lead, formaldehyde, and particulate matter.	Yes	Yes	No
Spiderwort <i>Tradescantia pallida</i>	Purple foliage offers marketing/promotional plant designs opportunities. Phytoremediation of volatile organic compounds (VOCs).	Yes	Yes	No
Stone Plants <i>Delosperma spp.</i>	Carpeting growth path and conspicuous flowers offer marketing/design opportunities.	No	No	No
Sunflower <i>Helianthus spp.</i>	Phytoremediation of heavy metals common to the Seine, including nickel, arsenic, cadmium, zinc, copper, and lead.	No	No	No
Wave Fern <i>Asplenium nidus</i>	Phytoremediation of particulate matter.	No	Yes	No

horizontal garden

canvas for creativity

The interactive half of the *Jardin Ouvert* system, the horizontal planter beds allow for a public green space that can be altered and crafted by the citizens of Paris, unlike a public park. Just as graffiti and pop-up gardens showcase great creativity from citizens, so too will the open canvas of the horizontal garden encourage a deep sense of ownership that completely city-controlled installations cannot achieve.



MODEL SOIL BED
WITH DIMENSIONS

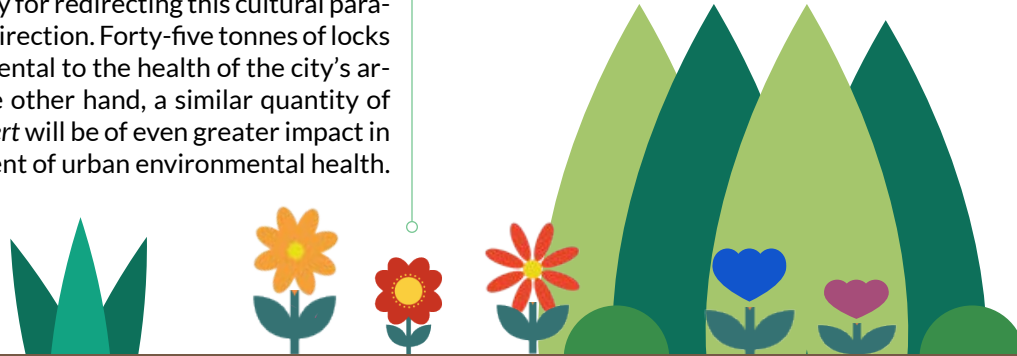
horizontal garden

“love plants”

A cultural bridging point lies with Love Locks, the banning of which invites an opportunity for redirecting this cultural paradigm in a more productive direction. Forty-five tonnes of locks on a bridge is highly detrimental to the health of the city's architectural heritage; on the other hand, a similar quantity of plants as part of *Jardin Ouvert* will be of even greater impact in the enhancement of urban environmental health.

social media

Within specific sections of *Jardin Ouvert*, dedicated social media accounts will publish photos of the plants when they are fully grown. This will allow tourists to follow the journey of their plants as well as participate in the promulgation of a green Paris, even and especially after they have left the city.



horizontal garden

Planting plants purchasable from nearby flower shops and nurseries can be the substitute for the now illegal practice of Love Locks. These shops may also establish temporary pop-up stands along the riverbanks for the convenience of passerbys.

seed paper

Biodegradable seed paper (to be written on with non-toxic ink) will be offered for the purpose of writing personal messages and testaments of love. As the paper decomposes the seeds, sown by the bond of love, will germinate and unmask their message unto the public in a way more beautiful and organic than Love Locks can be.

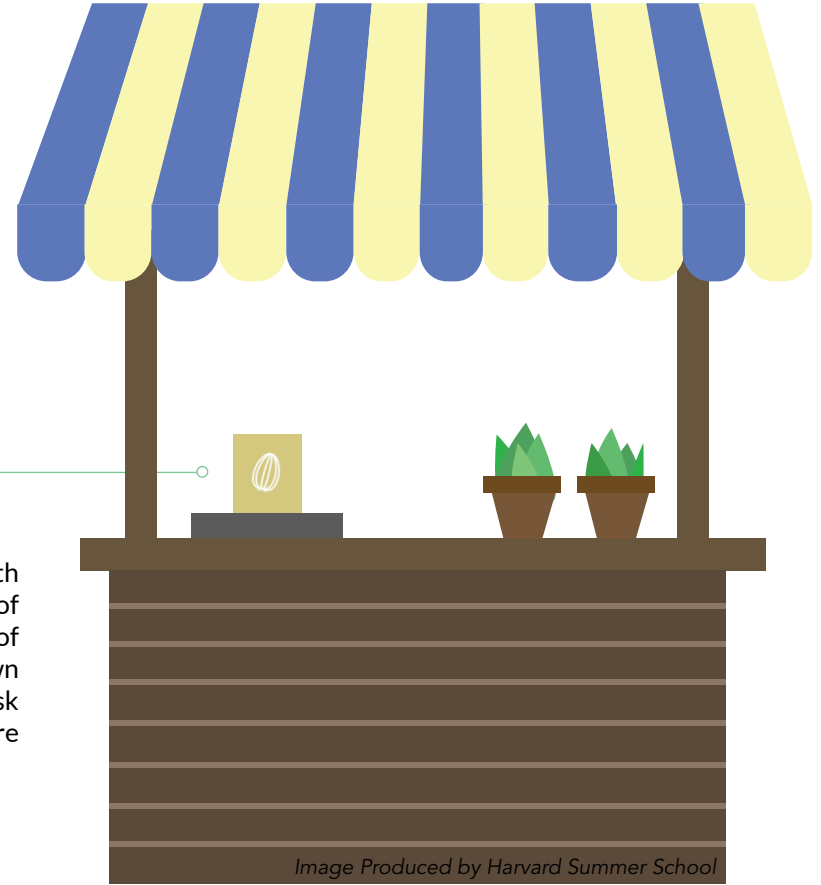


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education

The project itself has high pedagogical potential in addition to environmental benefit. Information panels and interactive set-ups will provide the pedestrians with explanations of the wall's functions, its composition and mechanisms, and the impact it has on the city. Other interfaces will indicate real-time measures of temperature, humidity, pollution, saturation, and more.

hands-on learning

Class visits, dedicated workshops, and specialized areas provide a potential for integrating *Jardin Ouvert* into curriculums to enable youngsters to connect to nature in an impactful way. Mental awareness and physical association with nature is as easily applied to children as to adults and, indeed, transcend nationalities and cultures. Green initiatives, therefore, have an unmitigated educational opportunity on which *Jardin Ouvert*'s touristic and widespread location will capitalize.



Image Produced by Harvard Summer School

active visitor involvement

The project's active educational arm involves participation from visitors. Workshops, led by either civil servants of the city or employees of *Jardin Ouvert*'s presiding organization, will be regularly held on the riverbanks. Workshops might alternatively fall under the purview of and partnership with educators from Maison de la Nature or Maison du Jardinage. Even outside workshops times, *Jardin Ouvert* is designed to be accessible any time, allowing experimentation and self-guided learning.

water system

Jardin Ouvert employs a hydroponically irrigated, no soil, vertical vegetated mat wall. A small pump will draw up water and circulate it through the garden as needed. An auto refill approach will be facilitated by a remotely controlled smart sensor and controller to monitor, start, and stop water flow.

The pump draws up water from the Seine in order to adequately hydrate plants and provide them with the nutrients and pollutants, e.g. heavy metals and pesticides, present in the Seine that must be absorbed to improve the river's water quality. Depending on location and construction challenges, an alternate rainwater catchment system can be employed in lieu of Seine water extraction. Each pump, capable of producing 700 kilopascals of pressure with 100 to 200 watts of power, will cover 5 units of the design.

Powered by solar cells, the pump delivers water to a manifold pipe system at the top of each unit. Water percolates through the two layers of fabric, nourishing the root structures therein contained, reaches the horizontal planter at the base, and then proceeds, now bio-filtered, back into the Seine.

business plan



execution plan

1

CONSTRUCTION + INSTALLATION

until May 2018

Initially engineer prototype and test in designated locations. Hire specialists in green walls and construction to manufacture and install design in suitable and legally permissible areas along the Seine River.

2

BUILDING THE SERVICE

Summer 2018

Establish periodic stations, staffed during specific hours on specific days by civil servants or employees from *Jardin Ouvert's* presiding organization. Staffers will serve as clerks, educators, and vendors.

3

MEASURING EFFICACY

end of Summer 2018

Take recordings of air and water filtration, online traffic to associated websites, and rough counts of citizen participation to measure efficacy of the gardens.

4

PROLIFERATION OF DESIGN

2019 and onwards

Pending on results of measurements and assuming resiliency of the design, begin expansion of design to cover all suitable and permissible regions of the Seine embankments. Design could also be implemented elsewhere in the world.

revenue streams + partners

1

CORPORATE FUNDING

Companies want to bolster their image in the 21st century through the reputational capital of acting environmentally aware. Capital flows into Corporate Social Responsibility to devote profits to new sustainable technologies and promotional opportunities. Firms will obtain reputational capital, manifested in small plaques, signs, or insignia, for sponsoring segments of the river's greening. Such partnerships, which require only an increase in brand image value and not liquid capital, are now common in the business world. This also applies to public institutions, such as the Louvre, located on the Seine. The specificity of our project's ambition and its central location will help us stand out among other projects.

2

FLOWER SHOPS

Flower shops and nurseries local to Paris, per the city's permission, would create temporary shops on or near the Seine to sell plants to passersby for the use along the horizontal public garden plots. In exchange, a small flat rate fee for vendor rights in the area combined with a small percentage of profit per plant sold will be owed to *Jardin Ouvert*.

3

CITY HALL

The project needs to be integrated in the development plans of the riverbanks with the help of city planners and the go-ahead of city politicians. Our partnership with City Hall also will encompass experts from *Maison de la Nature* and *Maison du Jardinage*.

products + services

1

BIODEGRADABLE SEED PAPER

Seed paper is one method by which *Jardin Ouvert* replaces Love Locks. The biodegradable seed paper is for people to write messages on, which then turn into degrade into a botanical incarnation of people's messages. *Jardin Ouvert* will charge a small price for the seed paper for a small profit.

2

RESERVATIONS

Enjoying *Jardin Ouvert*'s basic services like planting will of course be free and open to any bypasser. The use of *Jardin Ouvert*'s gardening tools, housed in periodically positioned cabins, will be subject to a rent agreement. Bringing personal tools will evade this charge, and subsidized prices can be given in specific situations, such as schools. Benefiting from experts' advice, attending specialized workshops, and sectioning off a specific location for yourself will require making a reservation online or in-person.


3

WORKSHOPS + BOOTHS


The workshops and booths are at the heart of the foundational educational component of *Jardin Ouvert*. Staff for these workshops and booths which could potentially be found among the employees of existing structures such as Maison de la Nature or Maison du Jardinage. To support its education initiatives, *Jardin Ouvert* could also involve volunteer university students studying botany, urban planning, sustainability, or related fields. A more civic-social approach for obtaining staff would be the service civique opportunity.

maintenance


To ensure the continued security and functionality of *Jardin Ouvert*, maintenance will be needed once every three months during winter and once every month the rest of the year, the equivalent of 8 inspections per year [27, 28].



pruning and cleaning the plants;
removing and replacing any dead plants




testing the pH of the water, ensuring it remains between 5.5 and 6.5



frequent inspection and cleaning of the water filtration and pump system



testing the electroactivity of the water



adding nutrients to soil if necessary to promote plant growth

capital budget

These estimates represent the cost of materials in euros (€) required for one unit of *Jardin Ouvert* (including the vertical and horizontal garden). The additional cost of installation and maintenance still needs to be estimated [29, 30, 31, 32, 33].

COST PER UNIT

1 UNIT (7.5m²)
3×2.5 m

1800



Estimated average market price: 400€/m² (cost of materials: 60% of total cost) via Jardins de Babylone, Ooreka, Mur Mure Vegetal, abc Green

SMART SENSOR

200

WATER SYSTEM
pump
pipng
solar panels

180



Cost of 900€ per 5 units
Between 700 and 1100€ for a solar pump Shurflow, 12 V/24 V, 100-200 W, ~ 7 bar, 150 to 400 litre/hour

FAN

100

SOIL (0.6m³)
2.5×0.3×0.8 m

14



Estimated average market price of soil: 23€/m³

TOTAL

2294

future of the project



short-term objectives

SOCIAL/CULTURAL

Our short-term objectives capture the duality between the people of Paris and nature: bringing people closer to nature as well as bringing nature directly to the people. We hope to foster a sense of community rooted in the shared value of education and ecological awareness.



GREY TO GREEN

Although difficult to truly measure, it is our objective to increase awareness of people's urban environments and the kinds of activities they can do to enhance it. A tracking of environmentally related projects that spin off *Jardin Ouvert*, analyzing google searches of "jardin ouvert," and an analysis of physical space along the Seine made green by the proliferation of the design over time will create a clear vision of the impact *Jardin Ouvert* has on both physical space and public interest.



CIVIC ENGAGEMENT

Collection of website analytics for reserving planting spots, figures from the sale of seed paper and gardening supplies, and records on attendance at workshops will be tracked over time to determine the efficacy and reach of the project's various social components. The influx of people on the green riverbanks ultimately aligns with our park-like vision for the future of the Seine.

long-term objectives

ENVIRONMENTAL

Our long-term objective is to make a positive environmental impact by reducing air pollution and mitigating the urban heat island effect. These factors can be quantitatively measured with regards to the validity of our proposed objective, an ancillary, yet important, impact of Jardin Ouvert will be not only increasing botanical diversity along the Seine, but also providing suitable habitat for urban species of insects, birds, and other ecologically important organisms.



AIR AND WATER POLLUTION

Our project does not claim to completely solve the problem of air and water pollution, but at the very least, we hope the proliferation of plants along the Seine will have a sizeable role in absorbing pollutants. We can use existing data on pollution levels along the Seine and compare those values with measurements taken after our gardens have come into effect. Measurements taken over time will help reveal larger trends in pollutant concentration and determine the effectiveness of *Jardin Ouvert* on reducing air and water pollution.



URBAN HEAT ISLAND EFFECT

Since the Seine itself naturally provides a cooling effect, the garden structure serves to amplify the cooling phenomenon and combat urban heat island effect. We can measure temperatures along the Seine and surrounding areas to compare temperature changes pre-intervention and post-intervention. If temperatures are indeed lower post-intervention, the open gardens will have been successful in mitigating the heat island effect.

A wide-angle photograph of a river in Paris, likely the Seine. A green bridge spans the river in the middle ground. The left bank is lined with trees and buildings, including a prominent church spire. The right bank is also lined with trees. Several boats are visible on the water. The sky is blue with large, white clouds. The text "works cited" is overlaid in the center of the image.

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