RIVERSCAPE IN BASEL REGION

FLOWSCAPES
Infrastructure as Landscape, Landscape as Infrastructure
Graduation LAB Landscape Architecture 2014 – 2015

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RIVERSCAPE IN BASEL REGION
SWITZERLAND - GERMANY - FRANCE

MASTER THESIS
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INTRODUCTION
Looking to the relation between humans and nature, we can see that during time humans have been trying to control the natural environment in order to get protection, from the strong forces that its elements have, and to take advantage of its sources. During the past decades and centuries humans have achieved a power over some elements of the natural environment, such as the rivers. We have used the rivers as a way of transportation from the beginning of our times until nowadays. Also, they have also been used as sewage system; situation that is changing from some years ago and we have reclaimed terrain from the flood areas for the agriculture development.

All these new ways of using the rivers have transformed this element. When we talk about the rivers we not only refer to the stream of water, we refer to the stream and the areas surround by it, which is known as the riparian zone. This zone is interconnected to the river stream in many ways so they both protect and evolve together. Over time the control of the rivers by humans took us to modify the riparian zones and by extension the streams of the rivers.

Based on the case of the Rhine River we will see how the river had changed by humans interventions. Focusing on the region of Basel we will expose more in detail how the river borders have been transformed leading us to adjust our view over the way we treat the river. The connection of the river and riparian zone had change and created an imbalance, increasing potentials for people and nature is becoming limited. New opportunities, planes and strategies need to be address to provide a balance and to look forward for more potentials in the future.
The natural environment refers to all the living processes occurring naturally without being interfered by human activities. Humans are part of the natural environment and they have exploited their environment to create a new one, the built environment.

The built environment includes all the human interventions, all the transformations made to create our habitat incorporating physical and cultural elements. The built environment provides a scenery for human activities such as living, working, and recreation. This built environment has been consuming the natural environment, and it can be reflected in the case of the Rhine where most of the natural processes had decreased to accomplish different types of functions.

The catchment area of the Rhine River involves nine countries of Europe including Germany, France, Switzerland, and The Netherlands. The river begins in the Swiss Alps and goes to the North Sea in The Netherlands; it has a “length of about 1250 km long with a drainage area of about 185,260 km2 and an average discharge of 2300 m3/s,” (Tockner, K. et al, 2009).
The Rhine nowadays is used for transportation, power generation, industrial development, drinking water and agriculture making of the river a model of a multiuse waterway. The Rhine River has become one of the most important rivers in Europe, it is one of the principal economical waterways and it has been gaining more power over the years. Since the first human settlements the borders of the river had been changing from natural to build, we have converted the river into one of our most important economic tool.

The region of Basel becomes of great interest when we see it as the point of the fragmentation of the river. From Basel to the Alps the river function as a natural element and from Basel to the North Sea the river functions as a built element. The natural fragment of the river keeps its natural borders but has had some interventions that had alter its natural qualities, and the built fragment of the river does not have natural border in order to provide a better situation for the human activities.

The area of Basel had become as an example of the complexity of some areas in the world. Since the establishment of the Celts the river has been seen as important element for the city. The structure of the city began with a strategic position over the river to have an overview of the boats that where approaching the city. The city not only has formed but also grew around the river, incorporating the river as part of the city. Although, the combination of the river and the topography, with time, made a social division between both parts of the river. The heights part (Grossbasel) was mainly for the people with a better social position and the lower part (Kleinbasel) for the common people. Today this can be reflected on the fact that most of the more attractive places such as museums and commercial areas are located in Grossbasel.

With time and the interventions made to the river, the region has allowed the growth of different functions such as industry, small settlements and agriculture. In
The area different types of industry had develop and Basel is now recognized as one of the mayor cities with chemical and pharmaceutical industrial development. The harbor of Basel is the last of waterway of the Rhine to the south and one of the most important of Switzerland. At the same time, Basel is the first Swiss city in the trajectory of the Rhine and has a strong relation with its neighbor countries, France and Germany. The area is aiming to grow together instead of three different cities. Several projects are proposed and been under development to achieve an integration and better dynamics on the area.

All the improvements have made of the region of Basel a very complex spatial composition of the area and generate different needs and goals for the future. At the same time, Basel has been working on the rediscovering of the advantages of their riverscapes with the complement of a change on society in the awareness of their environment. They have restored the river edge from Kleinbasel and during summer people have the opportunity to enjoy time swimming in the Rhine. This possibility have given the opening to other ideas of recreation in the city and provided new scenarios. New spaces and activities can strengthen the identity and the increasing of the sense of community.

Strategic position for the city, since the establishment of the Celts (800 B.C.). The position have the citizens the possibility of having an overlook of the river for protection.

The expansion of the city of Basel surrounding the river from the beginning of establishment.

A division between the two part of the river reflected not only in the spatial distribution but also on social terms.
PROBLEM STATEMENT AND RESEARCH QUESTION
With the establishment and growth of the cities, humans search for a better way of developing their environment. On the 19th century with Johann Gottfried Tulla the borders and the river suffered their ultimate change. The engineering made was extreme and it accomplished a main goal: prevent flooding and transformed the river into a waterway. These interventions brought many positive consequences for the built environment but with a high price; floods were reduced and almost eliminated and the river became one of the most important elements on the development of the borders countries. But is important to emphasize that at that time we did not knew the future consequences of all the different interventions.

With all the transformations made, the natural river system was broken causing devastations to the ecological qualities. But this permitted new types of spatial relations along the river, which benefited the built environment. With the industrialization era, the riparian zones of the Rhine started to acquire more industrial settlements leaving the cities, specially the social consciousness of the river, absent from the experience of the river. Industries and their installations settled along the river edge for an effective distribution of goods, this reduced the accessibility from the people to the riverbanks leaving the river as an isolated space.

This imbalance between the two environments keeps on growing in such a way that the built environment is using all the resources and therefore the natural environment is diminished. Until 1950 a concerned aroused between the countries of the Rhine, with the catastrophe of Sandoz the Rhine had a new target, to be saved. This initiative has brought the opportunity to give the river a new way of life and a new look to the future. Unfortunately the river will not be and cannot be as it was a hundred years ago, so we need to comprehend that the river will face a next era.
To recover the balance of the natural and the built environment we should not dig into the past and erase all the human interventions made on the last centuries. We should think on creating a next phase based on the current situation. Then, this new phase will be defined on the understanding that is neither the natural environment nor the built environment is both and it will benefit each environment. Then our responsibility is to find a proper way to return the balance between the natural and the built environment through improved relation of the space. This should be based on a positive interpretation of the widely diverse overlapping of different functions like industry, agriculture, living and recreation.

So the question will center on: **How can we provide a spatial balance where opportunities for people and nature can develop in the Rhine, reinforcing the relation of the river with its surroundings through the river borders in the region of Basel?**

To achieve the balance of the natural and built environment on the element of the Rhine River in the region of Basel, we need to create a new condition for the natural environment. Nowadays, the Rhine River is an important element on the mind of the people, it is seen as an element that should be recover and treated in a different way. This project proposes a next phase with a better spatial relations looking for a different formation of an ecological development.
Rivers are part of freshwater ecosystems, and they are part of the lotic ecosystems. The lotic ecosystems correspond to the flowing water and not still water as the lakes. They include biotic, living, and abiotic, non-living, interactions. The biotic aspects include bacteria, vertebrates and plants; meanwhile the abiotic aspects include the water flow, light, temperature and chemistry.

The speed of the water flow varies along the river depending on the morphology and riverbanks. At the same time, the amount of water changes according to the precipitations, snowmelt and groundwater; regarding the amount of water it can alter the shape of the riverbed through erosion and sedimentations forming different habitats such as riffles and pools.

Rivers are considered as the "natural highways" (Forman, R, 1995) of all countries. The rivers not only consist on the water streams but also of the areas that enclose the watercourse. In this way the rivers work in two directions, the vertical path meaning the course of the river from the source to the estuary and the horizontal path referring to the riparian zones and connections to the matrix or settlements.

When we talk about the vertical path, the river has different phases or orders. The first-order is the headwater composed by small streams without tributaries, when two first-order streams join they create a second order stream. When the second-order streams come together the third-order appears and depending of the river it can come until a twelve-order stream like the Amazon River. The 1st and 2nd order are characterized by having shallow water with a rocky bed, this limits the quantity of aquatic plants and number of animals but they can have an estimable benthic community and small predators. From the 3rd and 5th orders streams are characterized by having a greater diversity of habitants and hence of plants and animals, they have more rooted and floating aquatic plants and spaces for animals to have their niches. These orders have more space for water, compared with the 1st and 2nd order streams, this give the possibilities for the watercourse to expand in different directions over a floodplain. Although the river is divided in orders it works as one element that has different structures during its trajectory.

Along every river changes are present in both directions, these changes help make the river system more heterogenic and dynamic providing space for different water processes that are interrelated with other elements of the environment. Some of the most important processes that we can find are the hydrological flows, the particle flows, animal activities and human activities, they all influence each other to get an active equilibrium of the river system.
The borders of the river are in constant change depending on the morphology and type of stream and they are the most dynamic places of the landscape. They used to be the zones where the animals and vegetation attain their greatest perfection. For example, they are the area of many types of habitats for different species; they provide shadow, food for the aquatic species and at the same time balance the temperature of the water. They also help control the runoff water by absorbing, holding and slowly disperse the water to the stream. (Forman, 1995)

The area varies depending on the morphology of the river, it can be just a stripe of vegetation with the riverbanks or it can include a floodplain area and sometimes it can be extended until the begging of the hillslope. They have a vital importance on the processes and dynamics of the river and all the species related with this ecosystem.
In the area of Basel, the river corresponds to the sections of the Upper Rhine and the High Rhine. The Upper Rhine used to have space to flood having a variety of habitats that help increased the ecological qualities. Usually the floodplains have a high water table related to the soil that can develop a variety of wetlands, marsh, shrub swamp, forested swamp etc. All these habitats are temporary; they depend on the inundation of the river and the soil drainage, which is commonly poor. The surface is occasionally covered by a layer of sediments, which makes it rich in nutrients. Nowadays the surface of the basin of the Upper Rhine is used by: agriculture 50.8%, urban areas 8.9% and forest or grassland 39.6%.

On the High Rhine the river is more confined by the topography and the riparian zones are smaller characterized by the rocky soil. This type of riparian zone is more related to the hillslope, they commonly have an abundant variety of plants with a dense root system to prevent the erosion. There is a high density of animals including the ones that nest and feed in the floodplains. Nowadays the surface of the basin of the High Rhine is used by: agriculture 40.6%, urban areas 4.4% and forest or grassland 50%.
After been ignored for a long time rivers are now been reintegrated into the cityspaces. The foundation for feature regeneration of the riverspaces starts on ecological but also economic and social factors such as the establishment of new points of access to the riverbank facilitate the experience of the river. This led us to the redeveloping of urban riparian landscapes that include the watercourse and the bank areas.

When designing with water, we are designing with processes. Especially the rivers are continuously changing due to its natural processes. Rivers have physical, chemical and biological processes. They all work together and constantly are shaping the landscape by the rise and fall of water level and shifting of the water course but the processes are not constant and do not happened in a specific or exact moment and period. These make each river unique, complex and unpredictable, it becomes a challenge to design with rivers. Nevertheless a good starting point is to understand the processes of the river to create interplay between ecology, flood protection and amenity. Then the design should look for more space for plants and animal (ecology), more space for water (flooding) and more space for people (amenity). (Prominski, M. et al., 2012)

Since this project is center on a specific spatial integration the most important process to look at are the physical processes; with them the landscapes are shaped and can be used as early stage for the evolvement of the riverscapes. There are two types of processes; the first is the temporary flow fluctuations sub-divided into the vertical water level fluctuation and lateral spread of the water. The second one is morphodynamic processes that is sub-divided into sedimentation shift within the river and self-dynamic river channel development. (Prominski, M. et al., 2012)

Temporary flow fluctuations
Water fluctuations are reversible, the watercourse returns to the original state. The volume of water that passes along the river varies according precipitations and snowmelt. The discharge volume varies depending on the extend and characteristics of the catchment areas. (e.g. Highly built up areas or steep catchments produce extreme discharges.) (Prominski, M et al., 2012).

Vertical water level fluctuations
The level of a river changes constantly but only extreme high or low water levels can be noticed. Depending of the space available certain discharge amount causes the water level. Different water levels, low and high, have consequences that reflect on the ecological and human use. (e.g. low water can be problematic for shipping as well to some aquatic habitats.) (Prominski, M et al., 2012).

Lateral spread of the water
Depending on the flood protection measures of the river, natural or artificial, the area of limitation of the lateral spread will be determined. When the limit is natural the valley borders will limit the flooding and when the limit is artificial the spread limit and the flood limit will be determine by the artificial element such as walls or dikes. (Prominski, M et al., 2012).

Morphodynamic processes
The primary current carries water down the valley. The secondary current appears along the central course, two contrary rotating spiral flows are created. In the outer curves the flow is accelerated and in the inside curves the flow is slower. The flow of water creates erosion and sedimentation along the watercourse that constantly alter the river space. (Prominski, M et al., 2012).

Sedimentation shift within the river
The slower flow of the inside curve of a river produce deposit of sediment and a small slope is created. The
accelerated flow of the outer curve of the river produce erosion deepening the bed. In this way, the riverbed is constantly varying. With the process of erosion and sedimentation the river has system of self-regulating. (Prominski, M et al., 2012)

Self-dynamic river channel development

All watercourses change with the erosion and sedimentation processes. The speed of this self-dynamic river development depends on the local geology and the dynamics of the water. Depending on the types of discharges and gradients the changes of the river can be more evident than others. (e.g. Spring fed streams have a slow change compare to high discharge streams.) (Prominski, M et al., 2012)

After all the transformations made to the rivers, the undesirable consequences are present in our rivers systems. For the concerns of water resources management, ecology and quality of life a modification is necessary. Some design approaches have accomplish to create an interplay between ecology, flood protection and amenity or at least of two of the objectives. Martin Prominski and Antje Stokman based their research on some of these design approaches and created five types of process spaces that are design tools for the urban rivers and their riparian zones.
“SPACE A Embankment Walls and Promenades: the banks are very steep and there is hardly any flood area available. For this reason fluctuations in watercourse conditions are mainly vertical and morphodynamic processes are consequently excluded.

SPACE B Dikes and Flood Walls: large vertical elements limit the flood area at some distance from the normal watercourse. Both horizontal and vertical fluctuations in the watercourse conditions take place, whereby the borders of this Process Space only permit very small-scale morphodynamic processes.

SPACE C Flood Areas: comprises spaces near the watercourse that are regularly submerged under its horizontal expansion and in which spatial design has to work with these processes.

SPACE D Riverbeds and Currents: when the river is not sealed in places, reversible aggradation and erosion processes can happen along the riverbed, with consequences for the form of the riverbed and also the banks.

SPACE E Dynamic River Landscapes: is shaped by processes that are to be found in natural watercourses. By including the flood areas in the erosion and aggradation processes, the river can shift its entire course.”

(Prominski, M et al., 2012)
Society is constantly changing and with it the way we see, relate and desire our public spaces. Accessibility, function, design combine with behavior and polices are frequently changing regarding each generation of users and every change produces an effect on everyone. Public space does not have a global definition and it usually depends on the opinion, position and perceptions of each person. Simultaneously the users of the public space are not homogeneous, however they can be grouped in a rough way taking into account the context and the diverse needs.

Nevertheless, public space can be understood as the most important space for social interaction. The public space in Basel is the evidence of the life of the city, where creativity and multiculturalism present their magnificence. The public spaces provide different sceneries and give the possibility to have diverse uses and activities. It is characterized not only by the design and the policies but also for the interaction between the people. The public spaces are the places where the identity of a community is built.

One important aspect of the public spaces is related to the quality of life that they provide. People should feel safe and should be able to move through space without any inconvenience. But since people have different types of movements, speed, needs regarding age and physical conditions the public spaces requires to be flexible and facilitate space for everyone.

Diversity on our society makes a batch of demands on public spaces. Basel has a classification for users groups with some specific aims for each one:

- Elderly they must have a better accessibility to the public space; therefore they should be able to move autonomously in public areas.
- Children have a need for play, consequently they need safety spaces.
- Adolescents and adults in particular need undisturbed space for socialization.
- People with different disabilities need a free of obstacles spaces.
- People with different cultural backgrounds bring another understanding of the public space. They see them with other eyes, use them differently and have different behaviors than locals. This can contribute to insecurity then is important to provide integration.

Basel states some guidelines to achieve a proper approach of the public spaces. They suggest four aims for the public spaces:

- Public space belongs to everyone: places of integration, sense of a collective supply and public spirit.
- Public space is used in many ways: in public spaces a variety of different uses take place.
- Public space is safe: public spaces should be understandable so people can orientate in the space. If users identify themselves with the public areas there is an impact on integration.
- Public space makes the city green: green spaces in the city are becoming an important ecological contribution to a healthy urban environment. Green spaces help the welfare of people and are important for a high quality of life.
Today we see nature as the element we need to protect from further devastation. We have created untouchable areas known as wildlife but will this help us from providing a development or to increase our natural environment?

We need to change the way we see the natural environment. We now have an altered nature from the one that we used to know; this lead us to create parks or green areas that give us the illusion of nature. But this is not enough to achieve integration of the natural and built environment and at the same time the opportunity for the development of nature. Some of the solutions are giving on small or local scale, so we need to plan on a bigger scale; if we start planning a new nature in a large scale the effect could be different.

This arising nature should address some requirements, it should be placed not only in the disused sites and decayed landscapes, as Adriaan Geuze and Matthew Skjonsberg say, but also it should involve the protected areas and new areas, such as industrial areas, living and agriculture, that will change the natural structure of the built environment. It should empower the existing green and natural spaces.

After the loss of the biodiversity and ecology of the Rhine River some of the native species are adapting to the new environment. Then this arising nature will be formed a different spatial situation where this adaptation can be reinforce and become an easier process. In this way, the area of Basel can anticipate some local biotopes, water management and an ecological system. This arising nature will be design and sometimes can evolve in a natural way but some others will be need some human control on it’s process of evolution depending on the context and the human activities that are introduced.

We need to set in the natural environment in our context and make it part of our daily dynamics. This arising nature need to contribute to the human welfare, it can provide health and wealth. We need a change the human behavior against the concept of nature and make us understand that it not only brings personal benefits but also economical benefits. People can feel more represented in space and thus strengthen the sense identity. Then we seek for a new type of river. A river that can develop its natural process but at the same time integrates with the human activities around it.
Landscape ecology is divided in three characteristics: structure, function and change. Structure is the spatial arrangement of the landscape elements. Functioning is the movement and flows from the animals, plants, water, wind, material and energy through the structure. And change refers to the variations of the structure and functioning over time. Spatial patterns strongly determined functioning and change.

The structural pattern of a landscape is founded by three elements that are patches, corridors and matrix. Depending on the combinations of these three elements we can achieve different types of land mosaics or landscapes. Spatial patterns strongly determined functioning and change. Wenche E. Dramstad exposes some landscape ecological principles divided into four categories: patches, edges, corridors and mosaics.

There are four types of patches: remnants, (e.g. remaining areas from an earlier extensive type.) introduced, (e.g. small pasture area in a forest) disturbance (e.g. an area devastated from a windstorm) and environmental resources (e.g. oases in the middle of a desert.) Patches can be large or small, numerous or scarce and depending on their location they could be beneficial or deleterious to the optimal functioning of a landscape.

**ECOLOGY**
Edges are the outside of the patches where the environment is different from the interior of the patch. The structure, width and species abundance and conditions are diverse between the edge and the inner part. Depending on the form of the edge the flow of water, species and energy differs. Landscape architects to achieve an ecological objective can manipulate the shapes of patches defined by the edges in their designs.

With human interventions loss and isolation of habitats is an unstoppable process. Some processes cause these conditions such as fragmentations, dissection, perforation, shrinkage and attrition. To restore the landscape connectivity and incorporating the higher quality link between habitat patches there is an emphasis on corridors and stepping-stones connections. River systems are corridors of remarkable importance in the landscape.

Mosaics are the overall integrity of the structural and functional elements, and then are understood by patterns and scale. Since patterns are connected and form networks they can emphasize the functioning of the landscape. When the patterns are not connected there is a fragmentation, as mention above fragmentation is related with loss and isolations of habitats but depending of the scale different strategies can be used to manage with this situation.
The built environment is becoming one of the main causes of climate change not only for the changes on the natural environment but also for the supplies of non-renewable (natural gas, petroleum) energies that is based on. However, introducing renewable energy and other strategies such as recovering nutrients instead of flushing them away or the way we placed the building in the space can help us to take advantage of the sun and terrestrial radiation, wind and temperature in our contexts and start shaping a sustainable environment. Clever designs and planning decisions could start shifting our setting and help us to manage more carefully our resources, improve and reduce environmental damage. In this way, we can create a sustainable progress involving the natural and the built environment, helping each other and generating a life dynamic cycle. We need to understand that “The decisions we make every day – as the creators of the built environment – not only determined the places we live in today but also have an influence on our environment forever.” (Luebkeman, C. in Hegger, M, 2008)

Regrettably, our society is mostly dependent on non-renewable resource and since our population is growing, is demanding even more consumption of fertile land, and natural resources. These can become a dilemma of unfortunate proportions as the non-renewable resources are gradually becoming scarce. We need to emphasize and make grow the global awareness, now is the time for action. How our future environment will look like and will be experience by our future generations depend in many ways on the decision that we implement today.

We need to reduce the environmental damages that are strengthening the climate change. Introducing renewable resources and taking advantage can be the starting point but this needs to be planned and done as strategies that incorporate or create systems and structures. If we keep on thinking in small scales (e.g. buildings), we are optimizing isolated aspects rather than molding a concept of sustainability environment. Although, these punctual interventions can become the starting point for the creation of a structure or system that will help as shape a more sustainable environment. Then we need to adjust and improve the way the urban areas functions.

Each urban area was different location hence they have different site characteristics. But this doesn’t mean that they don’t have some basic elements that can establish similar fundaments to work with. In general all the urban spaces (urban spaces refers to the spaces created by humans = built environment) function due to the interaction of the building, the open spaces and the networking with the surroundings. The functioning of the urban spaces have consequences on the temperature, air and water and consequently on the development of the cities, economical and social aspects and the ecology. With the modifications and intervention of the environment, the urban settings have created some changes, for example in the case of the cities; they have created an urban climate. “The high roughness of the built environment results in lower wind speeds in the atmosphere over towns and cities; the various types of usage and the different surfaces increase the quantity of dust, which bonds more and more water vapor.” (Hegger, M, 2008)

Air pollution / Fresh (Cold) air

In the case of air, we look into two things: pollution and cold air. Referring to pollution it consists of various substances in the air. These substances (particulate matter, nitrogen oxides, etc.) are cause by human activities even by local sources (transportation) and external sources (industry). Pollution in the air creates health problems, damage to the environment and damage to some construction materials. The quality of the air is decreasing, and not all the particulate matter, depending on the size and amount, can be absorb by the used of trees. The trees can help to remove the pollution and store CO2 of the air.
Sun radiation

However, in a very small scale. Using the green structure and open spaces facilitate mixing the polluted air with the fresh air having a major effect on the quality of the air. Nevertheless, the placement, type and size of vegetation used, if is not the appropriate, can create a negative effect on the air deteriorating the quality if the air.

Surrounding areas of the cities provide a cold wind by rivers or streams courses, low or flat ground, traffic routes or open spaces. Then, buildings, structures and the open spaces define the system of the urban ventilation. To reduce this, using surfaces with different degrees of absorption can create thermal air movements and provide better ventilation.

At the same time, large parks and gardens within the urban fabric have a positive ventilating effect, which can be expand by a network if linked to other natural and open spaces. Although, this air from the surrounding countryside or parks contains a higher proportion of pollen and when is combine with particles emitted from vehicle exhausts it becomes into allergens.

Water

Water cycle pass from evaporation (lakes, river and oceans) and transpiration (plants) to condensation, then to precipitation, snow fall or hail, run-off (surfaces) or filtration through the soil and reaches the lakes, river and oceans. In the cities the water cycle is been blocked, the water can’t be filtrated since the surfaces are seal and the pipes are taking away the evaporation of the water. To return the proper function of the cycle some measures can be implemented related to water retention, water filtration and evaporation.

Since precipitation is almost immediately discharge by pipes, the soils do not absorb water making the groundwater table become lower. The high volume of water discharge sometimes cannot be all treated ending in a discharge of polluted water into rivers and
Type of trees

Coniferos

Desiduous trees

With a dense canopy

With a light canopy

Temperature / Heat

Cities have a higher temperature compared to rural areas due to the continuing density of the cities, the absorption of solar radiation on the surfaces of the buildings and floors but also for the drainage by pipes of the rainwater instead of evaporating. “Recent studies show that in the Haaglanden and Rotterdam regions the difference in surface temperatures between rural areas and highly urbanised areas can be as much as 10°C on hot days.” (Duyzer et al., 2011 in http://www.urbangreenbluegrids.com)

Urban planning that takes into account solutions that incorporate more use of vegetation, green roofs, impermeable surfaces and the use of materials with high reflection factor in buildings and surfaces, can lower temperatures in the cities. Creating connections between green areas within the cities and the rural areas, generate airflows that help for the urban ventilation. At the same time, the implementation of trees makes possible spaces with shade, keeping the surface and the air temperature down.

With the solar radiation normally some of the heat is absorb and reflected by the ground, trees, and buildings. In the urban settings, the amount of aborption and refection depend on the materials but usually the urban surfaces tend to absorb more than reflect, resulting in a higher air temperature because of the retention of heat. Dark surfaces tend to absorb more quantity of solar radiation compare to light color surfaces, for example asphalt absorbs more than concrete that’s why asphalts gets more warmer with sun exposure. “As a rule, urban environments absorb twice as much heat as rural areas.” (EPA, UHI Basics, 2008, in http://www.urbangreenbluegrids.com)

Positioning and geometry of buildings also affect on the raising of the temperature of the cities. Close high rises create shade during the day but during the night the area cannot manage to cold down the temperature of the air. Together with the position of the building and the shape, they can interfere with the urban ventilation lowering the wind or creating obstacles.

Vegetation has a cooling effect on the climate of the cities. They provide shade so less sunlight reach the ground and the water evaporation from their leaves help to absorb the heat. Other green areas as green roofs, green facades and strategically positioned trees can also reduce the amount of energy used in buildings. Although, the preservation and the expansion of the green areas at ground level can not only decrease the temperature but also provide better spaces within the cities for people and nature. If all the green spaces could create a proper network it could present a major impact on ecological development, the cities and in the quality of life.

Stream. With the sealed ground by the asphalt and other materials, water doesn’t infiltrates into the soil; instead it moves directly to be discharged or in periods of heavy precipitations can cause some flooding in the cities. Surfaces in the urban areas should be permeable to water but we need to make sure that they don’t pollute the groundwater.

Then combining systems for retention, cleaning and infiltration can help provide a short-term storage and a constant filtration of water. For the infiltration a careful consideration should take place on the type of soil to provide the accurate and desirable process. With the proper water retention, water can improve the microclimate, prevent soil deterioration, decrease the amount of water discharge, prevent temperature peaks and decrease the amount if dust in the atmosphere.

Having water in the surface will allow the evaporation; this can reduce the amount of wastewater and at the same time lower the temperature. If incorporated in open spaces and public spaces it can improve the general quality of life locally.
AGRICULTURE

The agriculture areas can provide connections and expansion of the rural green structure. These areas can function as green corridors without leaving aside the production or economical benefit of the agriculture. Looking to the development of both environments two possible changes in the agricultural area can be made. Introducing and changing the non-irrigated arable land into agroforestry and biomass crops will provide a better interaction and merge between ecology and agriculture. At the same time, introducing space for recreation such as bicycle paths and observation points on the river banks will enhance the connection with the cities and will allow the experience of the rural landscape. When thinking of the new types of agriculture, it should be taken into account to provide to most accurate transition or inclusion of habitats that will allow the expansion or the green corridors.

AGROFORESTRY POLycULTURE

Agroforestry is the combination of agricultural and forest to generate more diverse, productive, profitable, healthy, and sustainable land-use systems. Annual crops are interplant with perennial trees or shrubs, the system reduce the nitrate, helps to protect the soil from erosion and enhance the ecological biodiversity. The trees help to offer shade to grazing animals, protect the crops from strong winds and provide resting places for insects and birds. The use of species depend on the farmers but some of the tree species that have been used are: poplar, holm, oak, stone pine, walnut, cherry, willow.

BIOMASS

Biomass is biological material resulting from living, or recently living organisms. Biomass is an energy source that can be use either directly as combustion to produce heat or, after converting, in vary forms of biofuel.

The carbon used to create biomass is absorbed from the atmosphere as carbon dioxide (CO2) by the plant photosynthesis, consuming energy from the sun. The difference between biomass and fossil fuels is of time scale. Biomass takes carbon out of the atmosphere while it is growing, and returns it as it is burned. It is harvested as part of a constantly or annual crops that can be either during woodland, arboriculture management or as part of a continuous programme of replanting, that with the new growth the CO2 from the atmosphere will be taken out at the same time as it is released by combustion of the previous harvest. This provides a closed carbon cycle with no increase of the amount of Co2 in atmospheric levels.

There are five basic categories of material:
- Wood, from forestry, arboriculture activities or from wood processing
- Energy crops: crops grown for energy applications
- Agricultural residues: residues from agriculture harvesting or processing
- Food waste
- Industrial waste and co-products from manufacturing and industrial processes

Some of the species used for biomass in woody crops are: coconuts, gliricidia, oil palm, pine, and poplar. Some of the species used for biomass in food crops are: agave, alfalfa, oats, maize, wheat, sugar beet, sugar cane, canola, rapeseed, sun flower.
ANALYSIS
ANALYSIS

SOIL

Knowing the types of soil in the area of Basel help us have a grip on the types of landscapes that develop in the region.

At the same time, by the types of soil we can understand the different habitats and species that can be present in the area as well as the functions that humans established.

This can also help to determine which areas can be possible for a future development even for activities for humans or for fauna and flora.
BASEL REGION – Soil and landscape types

UMBRISOL
Woodland, cool and humid climates

PODZOLS
Acid soil, accumulation of organic matter, conifer trees.

LUVISOL
Clay accumulation, high base saturation.

FLUVISOL
Periodically flooded, layering of sediments.

CALCISOL
Accumulation of calcium carbonates, dry areas.

CAMBRISOL
Young soil, agriculture.
ANALYSIS

RIVER COURSE THROUGH TIME

Learning of the changes of the course of the river give us clues and tools of how the landscape operates in terms of water.

We can understand strategic positions for settle, good areas for agriculture, the risk areas for inundations and areas for ecological development.

Obtaining this information also can point out specific facts to address even for protection or for better opportunities equally for nature and for people.

In this case, to understanding the water through time two types of drawings where made. The first was plan where the course of the water is the protagonist and the second where a series of rough sections to help us comprehend how the river has changed and hence the relation with surroundings.
BASEL REGION - Changes of the Rhine through time

Years of the river
- 1856
- 1909
- 1958
- 2000
- 2015

UPPER RHINE
- Braided river / flood areas

BASEL - CITY
- Confined river by city edges since the establishment of the Celts

HIGH RHINE
- Confined river by the morphology of the terrain
BASEL REGION - UPPER RHINE Braided river

- No water processes
- No water free flow
- Less habitats
- Agriculture
BASEL REGION - City
BASEL REGION - HIGH RHINE Confined by morphology

- New border / Industry
- Less habitats
- Agriculture
ANALYSIS

LAND USE

GREEN AREAS
Learning what types of green areas exist in the area, give us the possibility to recognize the types of fauna and flora present in the environment. At the same time, understanding the spatial situation of these green areas lead us to make some design decisions, in this project especially, for the evolvement of the ecology. This information also provides opportunities for the design to have more specific goals and to make the choices of the correct or more faceable type of flora. The project can combine spatial projections for specific species that can allow space for other types of species and also spaces for people.

INDUSTRY
Understanding the kind of industry and the relation with the river give us the knowledge of the spatial composition but also set some starting points for the design. Mainly it can indicate which can be more involve still if it is just a small intervention.

AGRICULTURE
Finding out how the agriculture functions in relation with the river sets an initial approach to decide if the relation is accurate, should be improve or should change.
LAND USE - Nature / Broad leave forest

- Populus nigra, Willow, Alder, Elm, Ash, Oak, Populus Alba, Hackberry, Acer, European crab apple, European spindle, Honeysuckles, Hop
- Fox, European beaver, European badger, Roe deer, Boar
- Coleoptera
- Woodpeckers
  - Eurasian nuthatch
  - Eurasian blackcap
  - Common chaffinch
- Tufted duck
  - Gadwall
  - Canard souchet
  - Common goldeneye
  - Common merganser
- European chub, Eel, Perch, Pike, Barbel, Atlantic salmon, Twait shad
LAND USE - Nature / Inland marsh

- Iris Sibirica
- Dianthus superbus
- Leucanthemum vulgar
- Populus nigra
- Populus italica
- Dormouse, Harvest mouse, European badger, Roe deer, Boar, Bats
- Grass snake
- Wall lizard
- Sand lizard
- Natterjack toad, Yellow-bellied toad, Northern crested newt, European tree frog, Pool frog
- Kingfishers, Black kite, Grey-headed woodpecker, Middle spotted woodpecker, Little bittern
- Odonata
- European chub, Eel, Perch, Pike, Barbel, Atlantic salmon

- Broad leave forest
- Moors and Heathlands
- Inland Marshes
- Mixed forest
- Road leave forest
LAND USE – Nature / Mixed forest

- Elm, Oak, Acer, Beeches, Birches, Pines, Firs, Spruces
- Fox
- European badger
- Roe deer
- Boar
- Dormouse
- Bats
- Woodpeckers
- Eurasian nuthatch
- Eurasian blackcap
- Common chaffinch
- European green lizard
No connection with river:
Blocked accessibility to water. The border remains natural on some cases.
Efficiency to load and ship different types of merchandise. The borders of the river were changed into concrete walls.
Efficiency to load and ship different types of merchandise. Constantly movement in the water by the ships. The borders of the river turned into steel walls.
The area related to the Upper Rhine, where the river used to be braided, contains a large amount of water in the soil (Fluvisol, Cambrisol), for this reason most of the agriculture is non-irrigated. The agriculture helped break the ecological structure specially for the quantity of space that has taken over.
Nowadays we have a fragmented nature, then we need to create connections between the existing patches and create new connections that will lead to the development of new patches. The important concept is to link and create a network. This network should incorporate disused sites, decayed landscapes, protected areas and urban areas as industry, living and agriculture.

For a sustainable city approach one of the most important components is a high quality public space within the towns and cities that provides the accessibility to well manage open spaces network. Nigel Dunnett defined the factors of the network shown in the diagram below. As we see the open spaces are compose of grey and green spaces, then we can take advantage of the green spaces to reinforce and create a linkage that will benefit the built environment and the natural environment. These green spaces connect and allow the flow of the species and at the same time can provide a better quality of space. This quality will be improve by the retention of the rainwater, reducing the particulate matter in the air and decreasing the temperature by reducing, absorbing the solar radiation combine with the evo-transpirations of the plants.

The green and open space network of the cities, at the same time needs to connect with the green network of the rural areas. Therefore all the networks can work together and provide a complete system.

The project is focus on the Rhine River and it’s new riparian zone, two types of connections are proposed. The first one is through the industry and settlements and the second one is through the agriculture. In this way we will have two networks that will be link to river and will provide opportunities to evolve for both environments.

Diagram of components of opens spaces network design by Nigel Dunnett.
With the new connections a new green structure will start to take place. These connections between the Rhine River and the green spaces will be made using the agriculture and industrial areas. Then a new riparian zone will start to develop and will benefit both environments.

The new structure will be the starting point to set a system of local biotopes, water management that will allow the development of the ecology and therefore provide a better quality of open and public space. To start changing the image and the dynamics of the river, new spaces will be introduce for a better involvement between people and nature on the river edges.

The river edges and riparian zone need to be redefined and should provide the **ECOSYSTEM RESTORATION AND ACCESSIBILITY TO THE RIVER**. “Providing habitats for wildlife, aiding biodiversity, helping to stabilize urban temperatures and humidity, absorb pollutants in the air and ground water, provide opportunities for the recycling of organic matter, slow storm water and reduce the drainage infrastructure” (Urban green spaces taskforce, 2002 in Roe, M 2007) will provide a more effective environment, where the natural environment and the built environment work hand by hand for the benefit of both.

Connections: conceiving the country side, the settlements, industrial areas and the river as a functional unity. Strengthening existing ecological potentials.

Agriculture:
- Few spatial obstacles

Industry and settlements:
- Multiple spatial obstacles such as traffic infrastructure.
The evolution of the arising nature aims to provide a better environment for humans, fauna and flora. Shaping effective and sustainable environments based on cycle processes with the use of elements of both environments can be the starting point of the integration and developing of both environments. Relaying on the qualities of each environment and using them is the key connection for the evolution and expansion of the opportunities for ecology and people.

Current river edges situation:

1. Artificial: Movement along the edge. No relation with surroundings, fragmentation of the riparian zone.

Future river edges:

1. Alternated: Natural and artificial dynamics can take place but due to the processes and functions is not easy to develop on the same space. Although, they can create a cycle system where they can benefit from each other. Involving the processes and making them co-dependent is a way of evolvement.

2. Integrated: Natural and artificial dynamics can take place in the same space. Both dynamics dependent of each other and function mutually as a unity.
1. CONNECTION – RIPARIAN ZONE SETTINGS

Within the new uses found in the riparian zone create an emerging green space system.

1. Conceiving the countryside, industrial areas and the river as a functional unity.
2. Strengthening existing ecological potentials.
3. Developing new scenes:
   - Including recreational spaces throughout the river.
   - Including the built elements to provide a green and built arterial connection with the river.

To accomplish this objective

1. Typologies for industrial buildings
2. Typologies for residential buildings
3. Green corridor through agriculture land with few spatial obstacles
4. Green corridors-streets between settlements with multiple spatial obstacles:
   - Riverbank streets
   - Perpendicular to the river
5. Green corridors-streets between industrial areas with multiple spatial obstacles:
   - Riverbank streets
   - Perpendicular to the river

2. ACCESSIBILITY TO THE RIVER

1. Reshaping the river corridor to create open spaces with public amenities
   - Increase visual and pedestrian accesses to the river
   - Improve public awareness of the river
   - Increase recreation related with the river

Some of the solutions to provide more space for people along the river are:

Promenades, observation points, platforms
Buildings settlements integrated
The integration in the buildings is made in a relation of layers. This can be applied when the available space is not enough or to existing buildings. The buildings can play a new roll on the new image of the cities to provide a better quality of life based on the spatial experience. At the same time, the buildings should integrate or provide space for better ventilation and heat regulation using even water or vegetation.

Buildings industry integrated - alternated
For the industry the integration with the buildings depend on the type of industrial activity. In case, for example of health and chemical research, some of the typologies establish for the building in the settlements can be follow (Roof, facades, Courtyard). However, other activities need special structures and distributions that will need an extensive development.

In this case, the building is going to be consider as the group of building of one parcel. For the integration then the purpose is based on possibilities inside the parcel, between parcel and the boundary of the parcel. In a way the integration can be seen as a relation of alternation since the notion of layers is not explicitly acquire.

Nevertheless, using the complete parcel can provide new spaces to create a system of self-restoration even helping in a small scale with the air pollution, rainwater retention, water treatment, and small habitats for resting or transition At the same time, these new spaces can involve areas for the personnel, provide a better working space or develop a better public space incorporating the river.

Streets settlements - Riverbanks/parallel to river:
Riverbank streets are the ones that have a direct physical relation with the river. The streets along the river can provide a better interaction between the city and the river. Nowadays these streets, especially in the cities have become main connections for the transit of cars. These situations create a visual relation but could enrich the experience of the river and the water. Thereby, introducing more space for pedestrian with facilities for recreation combine with habitats development can make an improved approach for a better space and hence quality of life. These streets can expand the native plants to provide a functional wildlife habitat, enhance the local character and strengthen the river experience and vistas.

Streets industry - Riverbanks / Parallel to river:
The riverbanks and parallel streets of the river in the industrial areas function in favor of the development of these zones. This implies that the accessibility for people is limited because there are no spaces for them. These streets can connect with left over spaces that can provide a visual relation and increase the experience of the river and the water. Thereby, introducing space for people for passive recreation combine with habitats development can make an improved approach for a better space and therefore quality of life. These spaces can expand the native plants to provide a functional wildlife habitat, enhance the local character and strengthen the river experience and vistas.

Perpendicular to river - Settlements:
The streets perpendicular to river can start connecting the city and the river. At the same time they can provide connection for bike and pedestrian where rainwater management, native habitat (where it can be implemented) can be incorporated. Some areas can use bulb-outs, infiltration, bio-filtration planting strips and continuous shade along the street. These streets should connect major attractions of the cities highlighting the awareness of the river. They can be characterized by vegetation and design of the public space where public transport, bikes and pedestrian have a space.

Perpendicular to river - Industry
Depending of the location of the industrial areas more the quantity of space for pedestrian will differ, the streets perpendicular to the river should provide a safe industrial use and recreational access to the river. They can highlight the access to the river by the use of native vegetation and simultaneously the safe access through industrial zones can be reinforced by the use of trees. Since the main propose is for people to reach the river and not to access the industrial zones as such, these streets should provide a clear path for pedestrian and bikes even in the sides or in the middle of the streets.

Agriculture
The rural areas can be alternated or integrated by the creation of corridors for species, wind and water flow. These areas can also allow the expansion of some habitats and can be integrated into a new green system. For the connections is important to understand the space available, then the corridors can be for transition such as stepping stones or continuous habitats. These connections will enrich the movement of the species and the diversity, especially if they connect different types of habitats.

For a better functioning of the integration the use of polyculture agriculture can achieve a better approach. In this way the heterogeneity and the use of more native or naturalized species can work together letting the diversity to take place. Diversity in fauna and flora offer more advantages for the environment and enrich the rural landscape.

Agriculture streets crossing
Since several streets divide the agriculture fields, connections between the fields needs to be address. Fortunately the traffic in the rural areas tends to be less crowded and demanding than the cities, in this way small intervention even by surface, underground or over the fields can be made.
BUILDINGS + VEGETATION

With the addition of vegetation the temperature of the buildings can reduce. The rainwater can be retain and storage or even reused for irrigation of plant or in the toilets.

POSITION - VENTILATION

Depending on the position of the buildings, the flow of the cold and fresh wind can be directed, blocked or improve.
Industry is seen as a system. The aim is to create a cycle system to even reuse the water and the air or to clean and cool down the water before discharging it into the river.

**SIMPLIFY WATER PLOT**

Creating, adding or incorporating surrounding spaces for reusing, cleaning or providing habitats.

**WATER - WR, CW, RW**

**HABITAT - WT, RW, CW**

**HABITAT - AP**

**LEVELS - TH, AP, PA**

**INDUSTRY**

Introducing more space for pedestrian with facilities for recreation combine with habitats development can enhance the local character and strengthen the river experience.

**STREETS RIVERBANKS**

**SETTLEMENTS**

Introducing more space for pedestrian with facilities for recreation combine with habitats development can enhance the local character and strengthen the river experience.

**STREETS PERPENDICULAR TO RIVER**

**SETTLEMENTS**

Connect and create a green structure, incorporating the river with the inner green spaces in the city. They can provide connection for bike and pedestrian where rainwater management, native habitat...
Industry is seen as a system. The aim is to create a cycle system to even reuse the water and the air or to clean and cool down the water before discharging it of the river.

In agriculture areas, depending on the type of production the hole area, the edges of the area or a small line can be used for the green network. A buffer area will improve the groundwater quality before reaching the river.

**STREETS + VEGETATION + VENTILATION**

**AGRICULTURE**

**ABBRVIATIONS**

- PA: People access
- RW: Reuse water
- S: Shadow
- SH: Small habitats
- SS: Stepping stones
- TH: Transition/temporary habitats
- V: +/- ventilation
- V: Ventilation
- VB: Ventilation buildings
- WT: Water treatment
- WR: Water retention

- AP: Air purification
- c: +/- green connection
- C: Green connector
- CW: Cooling water
- LH: Less heat
- LP: Linear park
- LV: Low ventilation
- OP: Observation point
NEW RIPARIAN ZONE - HABITATS GREEN AREAS

WETLAND
Wetlands are the places where the land is covered by water; it could be either salt, fresh or somewhere in between. They help with the water purification, flood control, carbon sink and shoreline stability. They support a wide range of fauna and flora which makes them the most biologically diverse ecosystems. Constructed wetlands can be used to treat municipal, industrial wastewater as well as stormwater runoff.

DECIDUOUS FOREST
Provide and support the habitat for a diversity of species including plants, animals, fungi and bacteria. They protect the watersheds, supply oxygen. And play an important role in the mitigation of climate change for the absorption of the carbon dioxide.

MEADOW
The primarily vegetation is grass and other non-woody plants. They are open, sunny areas that attract and support flora and fauna that cannot thrive in other conditions. Meadows may be naturally or artificially created from cleared shrub or woodland. They often host a multitude of wildlife, providing areas for courtship, nesting, gathering food or sheltering. They support diversity of wildflowers, that attract insects like bees, pollination, and hence the entire ecosystem.
Agroforestry
Agriculture + Forest in the same land. Annual crops with perennial species: trees, shrubs. Protect soil, storage CO₂ in soil, reduce nitrate. Enhance biological diversity.

Biomass crops
Absorption of carbon dioxide in the air and water. Versatile implementation or creation of different products as ethanol and other fuels. Protection of the soil. Help increase wildlife biodiversity.
Chemical and Pharmaceutical/Logistic and transportation
Capturing carbon dioxide
- Can be used for horticulture
- Reuse in chemical industries in polymers

Water retention / Water treatment
- Wastewater can be treated in surface systems, lowering the temperature and being reused, even in the toilets or in the industrial process
- After treatment water can discharge in case of non-reuse
- If the water treatment method is based on natural processes, they can work as an ecological corridor or steppingstones.

Mixed Industry
- Wastewater can be treated in subsurface systems, lowering the temperature and being reused, even in the toilets or in the industrial process
- After treatment water can discharge in case of non-reuse
- If the water treatment method is based on natural processes, they can work as an ecological corridor or steppingstones.
- The surface space can be complemented with recreational areas for private or public use.
Buildings
- Position and relation with open space can provide a better urban ventilation.
- Incorporating vegetation in the buildings can reduce almost 5⁰ of temperature.
- With water retention on the roof the runoff water volume decreases.
- Changing material to lower the heat.

Reuse of waste
- Return nutrients to the natural cycle by using them in agriculture. A precondition for doing so is the separate recovery for the urine, black water and grey water. This is achieved by employing urine separation. Then the N, P, K can be extracted and be reused as fertilizers.
Retention hollows and vegetated swales could be integrated into the open spaces. They should guarantee the retention during intensive rainfall.

The water can be treated and reused for public purposes or discharged into the river. This new urban elements can characterize the space and enrich the river experience.

Creating connections between green areas within the cities generate airflows that help for the urban ventilation. The implementation of trees makes possible spaces with shade, keeping the surface and the air temperature down.

Green areas provide better spaces for people and nature. If all the green spaces could create a proper network it could present a major impact on ecological development, the cities and in the quality of life.
Four zones each one characterized by different spatial dynamics. The first zone is related with water, in the past the river in this area used to be braided and now the river is divided into a channelized branch and a natural branch. The soil is cambrisol and fluvisol, good for agriculture and flooded areas. With the project this area can be the opportunity of approaching to the reinforcement of the ecological network allowing the accessibility of humans in some spaces and creating a merge between agriculture and ecology.

The second zone is determined by the changes that France, Germany and Switzerland are doing as a region. The project follows the modifications in the harbor with the connection to the area in front and the development of a new meadow park. The project introduce to this proposal the river edges combine by recreation and nature.

The third zone corresponds to the city of Basel. One edge of the city has already been developed for a better connection between the river and the people. But there are some remaining parts of the edges that need improvement not only for people but also for a healthier relation with ecology. At the same time, these interventions will be the starting point for the further development of a sustainable network that involves the natural and the built environment.

Two big patches of forest characterize the fourth zone. They both lack of connection with the river for obstacles as roads, railways, industry and houses. At the same time both are becoming isolated patches surrounded by humans development. The edges of the river are contrasted, one side is natural and the other is built for industrial purposes. Then both elements should try to remain as much as possible as their current situation to maintain the balance but at the same time without destroying each other.
ZONE 1
OVERVIEW DIVISION RHINE
ALSACE RESERVE
INDUSTRY OVER RHINE
LEFT OVER SPACE
NATURAL BRANCH RHINE
Agriculture connection
Wetland park
Modification of the river edge
Green connection
Expansion inland marsh
Improve edge: more accessible to people
Agriculture connection
Boat connection

River edges
Ecological aim
Large patch + finger
New dynamics in the border and connections
Alternated
Agriculture
Typologies
PATCH
New dynamics in the border and connections
River edges
Ecological aim
Linear edge + steppingstones
Integrated
Industry
Typologies
Strategies
Zone 2
WATER
MEDIUM
TROUGH BUILDING

Boat connection
Modification of the river edge
Park + new edge
Meadow park
Housing
Recreational water
Pedestrian axis
Connect path
Improve edge

River edges
Ecological aim
Steppingstones
New dynamics in the border and connections
Integrated
Settlements

Typologies
LINE
LEVELS
STRIPE
River edges

Ecological aim

Linear edge + steppingstones

New dynamics in the border and connections

Alternated

Industry

Typologies

LINE

PATCH
ZONE 1 – NATURE TAKING OVER

The river split in two, one of the branches is still natural but a dam restricts the amount of water of the stream. This makes difficult to have some water processes and also decreases the possibilities of heterogeneity in the habitats. The natural branch of the river is isolated from the natural preserve and protected areas by the channelization made for electric power, breaking the continuity of the ecological structure.

The aim is to create a connection of these elements, the artificial borders will be demolished in two points to provide a perpendicular connection of the river with the surroundings. These new water will allow a natural evolution over time and can be access by humans for recreational purposes. River walls are modified to provide green spaces for wildlife habitats, water quality treatment and public access and enjoyment. Modifications involve reconstructing the banks of the river to provide a pool and riffle system for Atlantic salmon and other fish, and to reestablish a riparian corridor along the river. This will involve restoring riparian vegetation to support habitat for different type of species as birds, mammals, etc.

With the opening of the borders a small island is created. Currently the land is used for agriculture but since this zone will be taken by nature, the use of land will change by phases to a mixed forest. One spot will be left for agriculture use and this will be the remaining trace of the incredible human intervention of the Rhine. At the same time, this spot will be the only entrance for the island that will be provide passive recreation. The spot of agriculture will change from non-irrigated arable land to agroforestry. This type of agriculture combines at least two different species to create agriculture + forest system. The forest can become stepping-stones, continuous connection or fingers for ecological expansion.

Meanwhile the borders of the perpendicular water (in relation to the river) will developed in a natural way, the border of the river will allow the horizontal processes but are control in a certain distance to maintain the power station working. These changes will give more space to the water and will be retention of water, then the speed of the stream can slow down and the water level can decrease. Then the border will follow an alternation between artificial and natural. The areas for recreation will be located on higher and transitional places of the island. In this way people can enjoy of site during all the seasons.
PHASE 1
Opening of the embankments, creating ecological connection

PHASE 2
Natural development, path following former agriculture roads

PHASE 3
Agroforestry, entrance to the recreational island

Control development

Natural development, wetland habitat

Recreational areas, placed in high places for flood protection

Passive recreational areas

Inland water bodies closer to camping areas

Entrance to the island, modification of the border. Introduction of an observation point

Reduce of agricultural area, introducing agroforestry in the unique spot of agriculture

Agroforestry for expansion of the ecological patch

Expansion of the broadleaf forest

Biomass crops involving production with soil protection
Agroforestry made by annual crops combine with oaks, at the same time they function as stepping stone for the species to reach the river.
The river will have a free flow. In high level seasons can flood and expand enriching the habitats and the experience for people. Beaver can build their dams and help with the water processes and regulation. Atlantica salmons can breed near the beaver dams and have resting spaces before the breeding.
Deciduous forest

- Phelka interkata
- Alnus glutinosa
- Salix alba
- Quercus robur
- Fraxinus excelsior
- Ulmus minor
- Eurasian blackcap

SECTION NATURAL DEVELOPMENT

Wetland

- Atlantic salmon
- Tufted duck
- Thylæa corvida
- European tree frog
- Common merganser
- Aesculus hippocastanum
- Phalaris arundinacea
- Tilia cordata
- Linum usitatissimum

- Eurasian beaver
- Kingsfishers
- Salix alba
- Phyllostachys nigra
- Thylæa latifolia

SPAWNING

- Eurasian nuthatch
- Eurasian blackcap
- Aesculus hippocastanum
- Tufted duck
- Eurasian beaver
- Eurasian nuthatch

JUVENILE
This area is the merge point of three countries Switzerland, France and Germany and together they have established a future development call 3land. This plan focuses on the re-organization of the industry located in the harbor and on the other side of the river. The harbor will become a residential island and will connect to the other side of the river where more residential areas are proposed. At the same time, a new Meadow park will be developed in the border between Germany and Switzerland for further ecological purposes.

The goal for this zone, following the two plans of the countries is to incorporate space for recreation and to enhance the connection of the river. For this, the project states a new active recreational area on the border and in the river for all the citizens of the three countries. The borders will allow both natural processes and human activities, and then they will be considered as an integrated border.

To provide the integration on the borders, the design is based on the selected spatial expansion edge where the water can access small areas and generate ecological niches or small habitats can develop. At the same time, the border will give space for activities such as swimming, canoeing, jet ski, sky coaster and roller-coaster.

The design follows the essence of the area, industry. In this way, the materials and scale will represent the former industrial area and spirit of the place. At the same time, soft surfaces and water bodies in the streets are proposed to deal with the retentions and surface absorption of the water. Main air flows; with water or few deciduous trees provide better urban ventilation for the area.

In the edge, between the river and the land, some local wetlands can develop for resting fishes and water treatment. These local biotopes are connecting by stripes or linear parks to the exiting green area located after the housing area. For the new residential island allowing green courtyards in the buildings and proper open spaces in the middle can deal with the ventilation of the area.
New residential areas

Water retention, expansion river

Local biotopes

Active recreation expansion over the river

New industrial area, can developed with cycle processes

Water retention
Soft surfaces for infiltration and human use
Open spaces to allow wind flow and experience of the river
Combination of hard and soft surfaces for filtration
Water selected expansion with the development of local biotopes
Recreational expansion over the river. Skycoaster, jetski, canoeing
Open flow for water and wind
Incorporating vegetation in the buildings to reduce the heat
VIEW ZONE 2

NEW GREEN BUILDINGS
WATER RETENTION
RECREATIONAL BEACH
RIVER SQUARE
SMALL WETLANDS
GREEN SURFACES
RECREATION
CONNECTION BRIDGE
TERRACES RIVERFRONT
NEW GREEN BUILDINGS
Basel is looking for a better relation with the river, they improve one of the left border of the river and created more space for people and water. But there are some areas that could be improve and bring new dynamics for the border of the city.

The traditional bricks used by the Celts characterize the right border of the river, the big and protected walls can only be seen from the other side of the river and at the same time make inaccessible the water. Considering this, an improvement for the right edge will be design creating a continuous path that gives to the citizens and tourist access to the river and to the built history of the city. In some parts of this reformed edge, where the space is adequate the border will extend to provide resting spaces for the fishes and people. To create the continuity is necessary to go over the water (Space A) like an endless balcony. This improvement is considered as an integrated border where humans and ecology have a space.

On the other hand, Basel is looking for more space for pedestrian in the hard and rocky city center. The city plans to create a pedestrian axis that connects the two train stations crossing the city center and the river by the oldest bridge. Taking advantage of this opportunity, introducing a water element in this axis will emphasize the awareness of the old streams, nowadays buried under the streets, and of the presence of the river.

All the interventions have the purpose of inserting small points of each environment into the other creating a connection and a unity.
Incorporating vegetation even to the buildings or the street to create connections.

Improving the border by extending the pedestrian space and adding resting biotopes for species.

Green connections using the buildings.

Continuing the path to creating opens spaces over the river.

Water retention along the street and over the bridge.

Tolerating...
SECTION TOLERATING

- Populus nigra
- Populus canadensis
- Celtis occidentalis
- Tilia cordata
- Alnus glutinosa
- Thylia latifolia
- Atlantic salmon
- European tree frog

SECTION BALCONIES

- Aesculus hippocastanum
- Ulmus minor
- Euonymus europaeus
- Fagus sylvatica
- Ptelea trifoliata
- Alnus glutinosa
- Eurasian blackcap
- Eurasian nuthatch

Populus nigra
Populus canadensis
Celtis occidentalis
Tilia cordata
Alnus glutinosa
Thylia latifolia
Atlantic salmon
European tree frog
Aesculus hippocastanum
Ulmus minor
Euonymus europaeus
Fagus sylvatica
Ptelea trifoliata
Alnus glutinosa
Eurasian blackcap
Eurasian nuthatch
- Green Terraces
- Small Habitats
- Resting Places for Species
- Can Be Flooded in High Water Level
In the south part of the area of Basel the left edge of the Rhine preserves the natural composition meanwhile the right side had been altered for industrial aims. This parallel situation makes a contrast but allows the development of both environments. The zone has two big patches of forest located on both sides of the river with not so strong connections to the river but contributing to a balance between both environments.

There are two specific interventions that will help the zone to reach a better integration in the perpendicular axis of the river, the first one is to open small parts of the artificial edge to give the opportunity for amphibious species to reach the patch of the broad leave forest and the second intervention pursues the accessibility of people to the river.
Green connection steppingstones

Green connection, breaking the edge to allow the passage of amphibious

Accessibility to edge by hidden pedestrian paths

Logistics and transportation industry - space for water retention
AMPHIBIOUS PASSAGE

HIDDEN PASSAGES FOR PEOPLE

VIEW ZONE 4
The graduation project Flowscapes explores infrastructure as a type of landscape and landscape as a type of infrastructure. “The hybridization of the two concepts seeks to redefine infrastructure beyond its strictly utilitarian definition, while allowing landscape design to gain operative force in territorial transformation processes. Through focusing on landscape architectonic design of transportation-, green- and water infrastructures the studio aims to develop innovative spatial armatures that guide urban and rural development and represent their civic and cultural significance.” (Steffen Nijhuis, S. Jauslin, D. 2014). The studio postulates a framework thru the themes of flow, movement related with ecological, social and spatial evidences.

The project shows an awareness and interest on the theme of the water infrastructure, especially in the changes of the relation between the rivers and the surroundings. The studio is spatially framed on the basin area of the Rhine-Danube Rivers, which give us different situations and opportunities to work and research. Concentrating on the Rhine River, the project is motivated by the impressive transformations that the river has had through the years. The aim of the project expands around the integration of the river borders with the new built riparian zone in the area of Basel, one of the places that manage to clearly illustrate the spatial complexity created as a result of the human interventions. The project uses water and ecological processes as approach in order to increase their development but at the same time to provide new spatial opportunities for humans.

The method of the studio Flowscapes focus on the exploration of different layers of understanding the landscape architectonic design. The studio exposes for main approaches: landscape as spatio-visual structure; landscape as palimpsest; landscape as scale-continuum; landscape as ecologic, economic and social process. Depending on the choice of project the students will develop their own methodological approach related to the focus of each project.

The individual method used in the project was landscape as a process, although the four approaches tend to overlap during the process of the project since the project looks for the integration and development opportunities for ecology and people. When designing with nature we need to take into account the different processes that carry the natural elements, they made and spatio-visual structure that changes through time and create different scenarios. At the same time understanding the all the evidences that helped shaped the landscape need to be address or understand to reinforce the identity and interaction with the people.

Together with the research based (precedents studies, theory) and design based (context analysis, related projects) approaches the understanding of the landscape becomes more clear. These two approaches work hand by hand and are present throughout the complete project. In this case, they helped to provide a response to each other and where used parallel from the begging to the end. Both processes were needed to achieve and specific goal, strategies and design.
needed for development of the ecology and the types of activities and spaces for the interaction with people. Studying each zone and learning the future vision of the area, facilitated to define the main propose of the design plan, always following the main achievement of creating a space where ecology and people can evolve. The design is made by different scales from strategies to detail where the integration is seen in diverse ways.

In long term, the project aims for the expansion of the ecological structure and a leading interaction with people. Nowadays the demand for more natural and green areas for people has increased, is becoming a common need and we need to provide permanent solutions. A large number of countries are starting to confront this situation and are acting with successful outcomes. With this new wave of thinking the project explores to provide more effective and positives solutions for our future environment.

Looking back, the definition of the framework was decisive for the design approach. It narrowed the research and make it easier to continued with the project. The design went through different phases and every time needed for extra approaches that enriched the progress. Viewing related projects also enhance the design and gave better approaches to the solutions. Nevertheless, the scale of the project made it slightly complex regarding the amount of different situations that take place in the area.

THE RELATIONSHIP BETWEEN THE PROJECT AND WIDER CONTEXT

The entire research design transforms the riverscape in the area of Basel; it provides new relation as a starting point or proposal for new dynamics of our environment. The project pursues a reinterpretation of the landscape on the area of Basel based on both ecological and human needs. Based on the current structures of the place, the project sets some strategies to allow the evolution of the ecology in relation with the built environment. This was mainly been achieved exploring the relation between nature and recreation, a fundamental point since nature is or have become the paradise where we find tranquility and peace within ourselves. With this starting point design can set some guidelines for a future where the two environments can evolve and complement each other and not destroyed each other.

The project provides a new spatial identity with a new river landscape that gives the opportunity of the accessibility not only to the water but also to different scenarios such as industrial and agricultural landscapes. People are able to get out of the city and experience their surroundings that also allow some ecological advantages. At the same time, the adaptation of the species can be easier and the evolution could be faster and simple.

It is important to highlight that we need to work hand by hand with the entities of the government to adjust the human behavior against the concept of nature and make us understand that it not only brings personal benefits but also economical benefits.
REFERENCES


MAMMALS

Eurasian beaver

Boar

Roe deer

Fox

European badger

REPTILE

Grass snake

European green lizard

BIRDS

Common merganser

Eurasian blackcap

Eurasian nuthatch

Kingsfishers

Tufted duck

FISH

Atlantic salmon

AMPHIBIA

European tree frog

INSECT

Coleoptera
HABITATS

Mammals

Roe Deer
Roe deer is a mammal species that can be active during the 24-hour of the day, but the principal times of activity occur at dawn and dusk. They are either solitary or live in small mixed groups, and in winter large groups may form to feed together.

They are herbivorous and have a wide diet, which varies depending on the time of year. It includes almost all type of ground vegetation as grass, leaves of deciduous shrubs and trees, cereals, weeds, acorns, fungi, conifers and ferns.

The roe deer habitat occurs in open, deciduous, mixed or coniferous woodlands. Roe deer also inhabit moorland, and suburbs with large gardens. Even though they live in the woods, they go often into grasslands and can be easily found moving along the edges of the woods.

Eurasian Beaver
Eurasian Beavers are mammals with a semi-aquatic life. They are known for the construction of Dams. Since they are nocturnal animals all the construction activities take place during the night. The Eurasian beaver builds a dam to create an area of still, deep water, relatively safe from terrestrial predators, where a ‘lodge’ can be constructed. The dam not only provides an area where building materials and food supplies can be stored and be kept from washing away but also help to increase the aquatic vegetation and habitats for invertebrates that are part of the food supplies of some fishes, amphibians and birds.

The Eurasian Beavers are herbivorous, during winter the diet is mainly based on woody vegetation. They feed from willows, alder, birch, ash, oak and aspen with a diameter no higher than 10 cm. When is possible they prefer to feed from herbaceous vegetation.

The Eurasian Beavers habitats are streams, rivers, lakes and swamps. It generally favors freshwater habitats that are surrounded by woodland, but may sometimes use a river or stream flowing through agricultural land or even urban areas. During winter the size of the area reduces to an area that can be patrolled during one day and in warmer season the territory can extend up to 1 – 2 kilometers along the shoreline.

Reptiles

Grass Snake
The grass snake derives its body warmth from the environment, it has to bask in the sun after emerging in the morning so it can reach high enough body temperatures to be able to fonction efficiently and digest its prey. During winter, since the temperatures are too low, the grass snake will find frost-free places such as deep leaf litter or rock piles in which to hibernate between.

They are an active predator of frogs, toads and newts, although fish, small mammals and young birds may also be part of their diet. The preys are grabbed and then swallowed alive. This species is a good swimmer, and is able to stay submerged for over half an hour. Badgers, foxes, domestic cats, hedgehogs and a number of birds predate upon the grass snake.

The grass snake is an aquatic species that is usually closely to water. It is found in habitats including ponds, lakes, streams, marshes and ditches, which provide access to sunshine for basking and plenty of shelter. They can also be found in open woodland, rough grassland, wet heathlands, gardens, parks and hedgerows.

European Green lizard
The European green lizard lives on the ground and in low, dense vegetation, they like to lie in the sun, early and late in the day. It feeds mainly on arthropods and other small invertebrates but it also sometimes takes fruit and birds eggs.

Their habitat is characterized by dense bushy vegetation, open woodland, grasslands and along hedgerows surrounding cultivated land. In the northern part of its range it may be found on bushy heathland and in the southern part it prefers damp locations.

Amphibious

European Tree Frog
European tree frogs diet is based on small arthropods, such as spiders, flies, beetles, butterflies, and smooth caterpillars. They hibernate in walls, cellars, under rocks, under clumps of vegetation, or buried in leaf piles.

European tree frogs can be found in marshlands, damp meadows, reed beds, parks, gardens, vineyards, orchards, stream banks, lakeshores, and humid or dry forests. They tend to avoid dark or thick forests.

Northern Crested Newt
Northern Crested Newt is primarily active at night, spending the day at the bottom of ponds or hidden in vegetation. Their diet is based on a variety of aquatic invertebrates, but occasionally attack large prey as large dragonflies.

They are found in a wide range of habitats, including farmland, woods, grasslands, dunes, quarries, industrial and brown-field sites. The availability of refuges where they can hide is very important and can determine whether the species can occupy a site or not.

Birds
Tufted Duck
Tufted Duck belong to the group known as diving ducks, and feed mainly on water animals. Their diet includes crustaceans, small molluscs such as snails, and insect larvae.

They are mainly found on water bodies that provide islands where they can nest. The habitats are large lakes, flooded gravel pits and even city park lakes.

Common Merganser
The Common Merganser is a diving ducks and their diet is mainly based on small fish. Sometimes they also feed from insects, molluscs, crustaceans, worms, amphibians, and even small mammals and birds. They usually feed in group and during the day.

During the breeding the Common Merganser in found along the rivers or lakes that have a forest edge. During winter they can be found in large, unfrozen lakes, rivers, lagoons and reservoirs.

Eurasian Nuthatch
The Eurasian Nuthatch diet is based on insects, particularly caterpillar and beetles. During autumn and winter, the diet is supplemented with some nuts and seeds, especially hazel nuts and beech mast. When they are young, they are fed mainly on the insects and seeds that their parents bring for them. Most of the food is found mainly on tree trunks and large branches and from the ground, especially outside the breeding season. They store food during autumn for the winter.

In Europe, the Eurasian Nuthatch is found in broad leave or mixed forest, particularly when including oak. Parks, old orchards and other wooded habitats may be occupied as long as they have at least a 1 ha of suitable trees. The Eurasian nuthatch is a lowland bird but can reach the tree line in Switzerland.

Eurasian blackcap
The diet of the blackcap varies seasonally, during the breeding season (mid-April to August) is mainly insects and during the rest of the year is based on fruit. Eurasian Blackcaps eat insects and other invertebrates, including mayflies, dragonflies, grasshoppers, moths, beetles, spiders, woodlice, snails and earthworms. Prey may be taken from leaves or twigs, or is sometimes caught in the air. Different fruits and berries are also eaten.

During the breeding season, they are found in a variety of woodland and forest habitats. It also occurs in orchards and fruit-tree plantations, as well as parks and gardens with plenty of trees and shrubs. The nest is usually built in a shrub, bush or small tree, or in dense vegetation. During winter, they are found in areas rich in berries and other fruits, including olive groves, gardens and palm plantations.

Kingfishers
The Kingfisher nest consists of a tunnel in a riverbank or amongst the roots of a tree; both sexes help to excavate the tunnel, which terminates in a rounded chamber. The diet is based on fish and invertebrates. When they are young their parents feed them.

Their habitat can be all types of fresh water, including ponds, canals, rivers and streams. The Kingfisher may also exploit salt waters on the coast and marshes.

Fish
Atlantic Salmon
Atlantic Salmon has a complex life cycle and high requires habitat. They require four types of habitat during all their life cycle:
1. Spawning and early development
2. Juvenile rising
3. Adult migration
4. Pre-spawning adults

1. Spawning and early development
In riffles or borders of a pool they excavated a hole to create the nest. They need non-compacted, stable and permeable gravel. When the eggs become alevins they stay in the nest for several weeks. For the survival of the eggs and alevins, they need well-oxygenated water and the adequate flow of cool water. Usually the Atlantic Salmon spawn the eggs in the tributaries of the rivers.

2. Juvenile rising
They prefer riffle habitat but as they grow they move to deeper water. They can also occupy lakes or ponds so a connection between habitats is required. They need cool, clean, well-oxygenated water adequate food and shade protection from predators.

3. Adult migration
Juvenile Salmon migrates to the sea. They need free access to the sea, delay on the emigration can result in disease or predation and can affect the adaptation to seawater. Water flow and temperature play an important factor in this stage of the Atlantic Salmon life.

4. Pre-spawning adults
When the Atlantic Salmon is ready to spawn they come back to the spawning habitat. They arrive in advance so they need resting areas that provide shade and protection meanwhile they wait to spawn. For this they need deep pools with cool, clean, well-oxygenated water.
### Plants

<table>
<thead>
<tr>
<th>LATIN NAME</th>
<th>ENGLISH NAME</th>
<th>HEIGHT</th>
<th>USES</th>
<th>SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies Nordmanniana</td>
<td>Caucasian Fir</td>
<td>60 mts</td>
<td>Coniferous</td>
<td></td>
</tr>
<tr>
<td>Acer Campestre</td>
<td>Field Maple</td>
<td>12 mts</td>
<td>Hedge, Industrial areas, parks, streets,</td>
<td>Clay and sand</td>
</tr>
<tr>
<td>Acer Platanoides</td>
<td>Norway Maple</td>
<td>20-30 mts</td>
<td>No good with hard surfaces, parks</td>
<td></td>
</tr>
<tr>
<td>Acer Pseudoplatanus</td>
<td>Sycamore</td>
<td>40 mts</td>
<td>Industrial areas, no water for long time, parks, streets</td>
<td>All, better in sand</td>
</tr>
<tr>
<td>Aesculus Hippocastanum</td>
<td>Common Horse Chestnut</td>
<td>30 mts</td>
<td>No good for streets too many fruits</td>
<td></td>
</tr>
<tr>
<td>Alnus Glutinosa</td>
<td>Common Alder</td>
<td>10-20 mts</td>
<td>Industrial areas, coast areas, no hard surfaces</td>
<td>Clay, sand, peat, tree helps the soil</td>
</tr>
<tr>
<td>Betula pendula</td>
<td>European Birch</td>
<td>15-20 mts(30)</td>
<td>Poor tolerance to hard surfaces, parks</td>
<td>Clay, sand, peat, tree helps the soil</td>
</tr>
<tr>
<td>Celtis Occidentalis</td>
<td>Nettle Tree</td>
<td>8-15 mts (30)</td>
<td>Streets, industrial areas</td>
<td>Clay, sand, peat, good with dry places</td>
</tr>
<tr>
<td>Euonymus europaeus</td>
<td>European Spindle</td>
<td>3-6 mts</td>
<td>Parks, small gardens, coast</td>
<td>All, resist temporary floods, tree helps the soil</td>
</tr>
<tr>
<td>Fagus sylvatica</td>
<td>European Beech</td>
<td>20-25 mts</td>
<td>Park, solitary, hedges, woodlands, no hard surfaces</td>
<td>Sand, peat</td>
</tr>
<tr>
<td>Fraxinus Excelsior</td>
<td>European Ash</td>
<td>25-30 mts (40)</td>
<td>Wind breaks, wide green edges, industrial areas, no hard surfaces</td>
<td>Clay, calcareous, tree helps the soil</td>
</tr>
<tr>
<td>Malus Sylvestris</td>
<td>European wild apple</td>
<td>7-9 mts</td>
<td>Industrial areas, no hard surfaces</td>
<td>Clay, calcareous, sand</td>
</tr>
<tr>
<td>Populus Alba</td>
<td>White Poplar</td>
<td>15-20 mts</td>
<td>Streets, coastal areas, no hard surfaces</td>
<td>Clay, sand, good with dry places</td>
</tr>
<tr>
<td>Populus Canadensis</td>
<td>Hybrid black poplar</td>
<td>25-30 mts</td>
<td>Good for streets and avenues</td>
<td>Clay, sand, tree helps to soil</td>
</tr>
<tr>
<td>Populus Negra</td>
<td>Black poplar</td>
<td>30 mts</td>
<td>Shade tree for streets, industrial areas</td>
<td>Clay, calcareous, sand, tree helps the soil (close to rivers)</td>
</tr>
<tr>
<td>Ptelea trifoliata</td>
<td>Hop Tree</td>
<td>5-6 mts (9)</td>
<td>Parks, small gardens</td>
<td>Sand and calcareous</td>
</tr>
<tr>
<td>Quercus Robur</td>
<td>Common Oak</td>
<td>25-30 mts (40)</td>
<td>Woodlands, parks, streets, industrial areas, tolerates moist soil</td>
<td>Sand and calcareous, tree helps to soil</td>
</tr>
<tr>
<td>Robinia pseudoacacia</td>
<td>Black Locust</td>
<td>20-25 mts</td>
<td>Grows well with light, forms many underground runners, industrial areas, parks</td>
<td>Calcareous, sand, clay</td>
</tr>
<tr>
<td>Salix Alba</td>
<td>Willow</td>
<td>20-25 mts (30)</td>
<td>Temporary submerison, good also in dryer places</td>
<td>Clay, calcareous, sand, tree helps to soil</td>
</tr>
<tr>
<td>Spruces</td>
<td>Spruces</td>
<td>60 mts</td>
<td>Coniferous, no or dry sunny places</td>
<td></td>
</tr>
<tr>
<td>Tilia Cordata</td>
<td>European Linden</td>
<td>20-25 mts (30)</td>
<td>Streets, coastal areas, no hard surfaces</td>
<td>All</td>
</tr>
<tr>
<td>Ulmus Minor</td>
<td>Elm</td>
<td>20-30 mts (40)</td>
<td>Lying forest along rivers, tolerates summer floods, associated with ask and ash, parks, industrial areas, coastal areas</td>
<td>Clay, calcareous, sand, tree helps to soil</td>
</tr>
</tbody>
</table>

### Flowers

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Agrostis zizanioide</td>
<td>Common bent</td>
<td>10-70cm</td>
<td>perennial, moist grassland and open meadows</td>
<td></td>
</tr>
<tr>
<td>Linum usitatissimum</td>
<td>Flax</td>
<td>0-1m</td>
<td>Food (linseed), textiles,</td>
<td></td>
</tr>
<tr>
<td>Phalaris arundinacea</td>
<td>0-2m</td>
<td>Perennial, water purification, good for poor soils and industrial contaminated. can become bricks after biomass process. invasive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typha latifolia</td>
<td>1.5-3 m</td>
<td>Perennial, wetland specie</td>
<td>moist, clay</td>
<td></td>
</tr>
<tr>
<td>Dianthus superbus</td>
<td>Large pink</td>
<td>0-80cm</td>
<td>Perennial, good with sun in hot climates better with some shade, can be eaten</td>
<td></td>
</tr>
<tr>
<td>Iris Sibirica</td>
<td>0-1,2m</td>
<td>wetlands, damp woodlands, wet meadows, grasslands or pasture</td>
<td>moist soils</td>
<td></td>
</tr>
<tr>
<td>Leucanthemum vulgare</td>
<td>Oxeye daisy</td>
<td>0-30cm</td>
<td>Grassland perennial wildflower, meadows, fields, open canopy forests</td>
<td></td>
</tr>
<tr>
<td>Beta vulgaris</td>
<td>Sugar beet</td>
<td>30-50cm</td>
<td>Biofuel - biobutanol</td>
<td></td>
</tr>
<tr>
<td>Brassica napus</td>
<td>Rapeseed</td>
<td>0-1,5m</td>
<td>Annual plant, Biodiesel, food</td>
<td></td>
</tr>
<tr>
<td>Miscanthus</td>
<td>Elephant grass</td>
<td>over 3,5m</td>
<td>Biofuels - Ethanol. It can be burn to produce heat ans steam for power turbines.</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>Corn</td>
<td>2.5-12m</td>
<td>Biofuel - Ethanol production</td>
<td></td>
</tr>
</tbody>
</table>

### Biomass

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