Implementing Metropolitan Agriculture

Graduation Report

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Implementing Metropolitan Agriculture

| In the metropolitan region of Bucharest, Romania |

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Foreword

This thesis is the final step in finishing my masters in Landscape Architecture at the TU Delft. I would like to thank a number of people who have supported me through the process and who have helped me to deliver the thesis in front of you.

First and most of all I would like to thank my parents, who have always supported me in every possible way and who were there whenever I needed them. A special thanks goes to my mum, who went with me on my study trip to Bucharest and who brought me into contact with Ms. Pamfil. Special thanks also goes to her for showing us Lacul Vacaresti, for the good conversations about Romania and for letting us taste the typical Romanian zacuscă.

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Thank you all.

It's all about

finding

the right balance

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Introduction

Currently we see huge changes in land use patterns happening worldwide. Cities are suppressing the productive hinterland, which is suppressing what is left of our natural world. The reason behind this process is scarcity of food and raw materials. With a growing world population we need to think of solutions to this worldwide problem of suppression.

Metropolitan Agriculture is a relatively new concept that aims to capture the aspects of a new relationship between the city and the agricultural landscape. It proposes an answer to the pending needs to stop suppression and safeguard our worldwide food supply. The concept is broad in its theoretical description, but the implementation of the concept is not yet very clear. My question is how this abstract concept can be used for design, how the concept can literally 'land'. With this graduation project I want to capture the principles and guidelines of Metropolitan Agriculture and implement these in my graduation design project for Bucharest, Romania.

This thesis report exists of three parts:

Part I: Context
In this part I will go into the concept of Metropolitan Agriculture, placing it in the context of the urban agriculture field. I will discuss the design methodology to implement Metropolitan Agriculture into design and I will go into the ecologic aspects of the concept.

Part II: Analysis
In this part of my thesis I will go into the specifications of the site, working through the scales, starting at the level of the super region of Romania and zooming in to the metropolis of Bucharest.

Part III: Metropolitan Agricultural Structure
In the last part of this thesis I will discuss the design strategy to create a metropolitan agricultural structure and the spatial interventions that are made.

PART I

CONTEXT

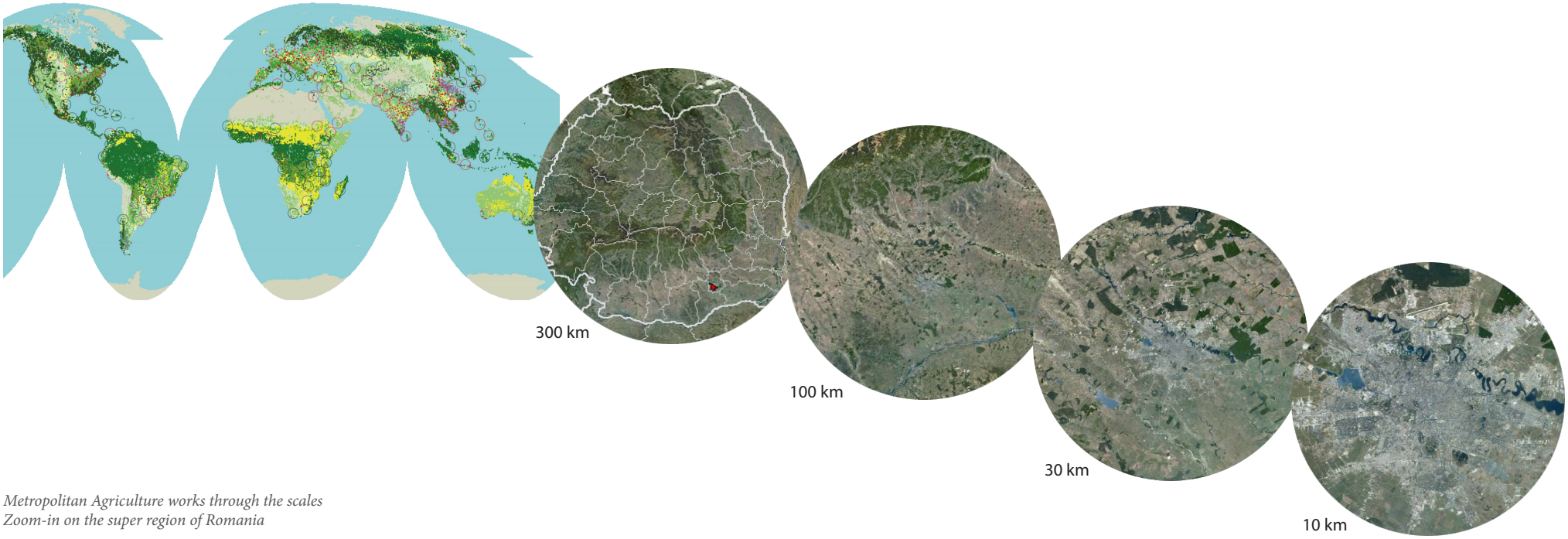
1. Metropolitan Agriculture

Concepts for understanding Metropolitan Agriculture

The concept 'Metropolitan Agriculture' is a combination of two land use types that seem to be the opposite of each other. According to the Merriam-Webster dictionary, 'Metropolis' is defined as "*The chief or capital city of a country, state, or region*", 'Metropolitan' is *"of, relating to, or characteristic of a metropolis and sometimes including its suburbs"*. 'Agriculture' is defined as *"the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products"*.

The concept 'Metropolitan Agriculture', TransForum (2011), indicates the complex relationship between the city and agriculture through the different scales. It states that new relationships should be invented where the best of both the city and agriculture are combined in order to stop suppression of the agricultural and the natural landscape and to contribute to a more sustainable food system.

Metropolitan Agriculture can be used as an analysis-framework to link the different scale levels on which the urban tissue and the agricultural land are related to each other. Each level offers a different perspective and also a different method of analysis, which can result in different types of strategies or designs on the different scale levels. Even though the strategies and designs can differ through the scales, they should work together as a coherent system. The highest scale level that is worked with in the Metropolitan Agriculture report is the 'super region', which is a circle with a radius of 300 km. There are 180 super regions defined worldwide where Metropolitan Agriculture can be practised. This scale was chosen as the 'highest' scale because it offers a full palette of the diversity in agriculture types and the metropolis. Within the super region the distribution flows between city and hinterland can be considered efficient. From the super region, the scales zoom in with a factor 3, based on the Composition Analysis Theory of professor T.M. de

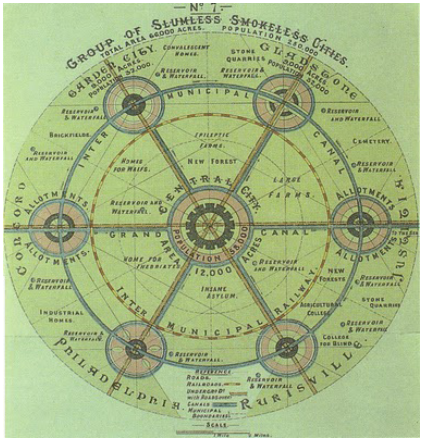


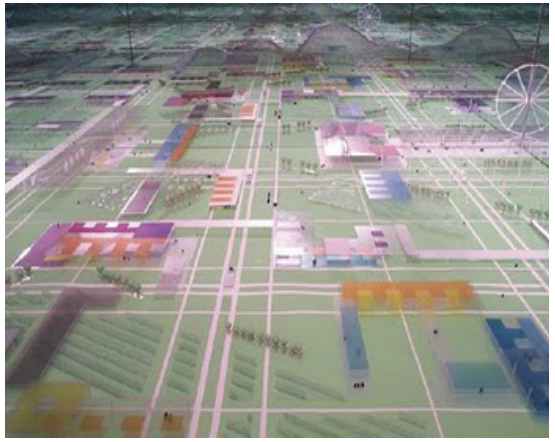
Metropolitan Agriculture works through the scales
Zoom-in on the super region of Romania

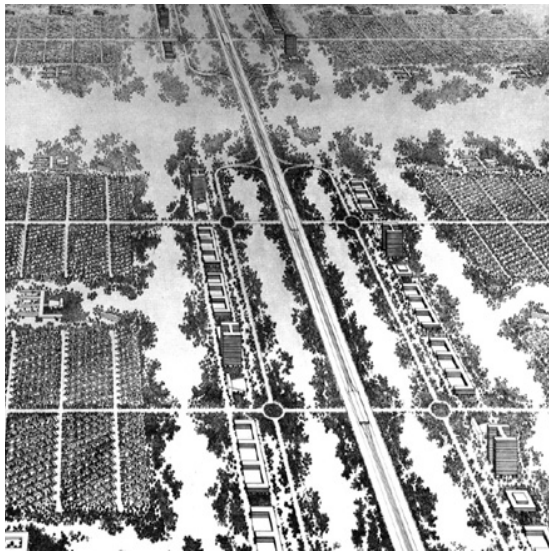
Jong from the TU Delft. Each scale level can be compared to its higher and lower scale to test if they are in line with each other, creating a coherent system through the scales.

In the report, there are three strategies defined to give the existing agricultural landscape new perspectives within the metropolitan area: sustainable improvement, sustainable valorisation and sustainable renewal. These are placed within the context of the People-Planet-Profit model. Sustainable improvement focuses on the intensification of food production (profit goals) and on the cooperation and clustering of agriculture with other sectors (planet goals). Sustainable valorisation focuses on broadening the agricultural scope related to existing markets and economic needs from the city (profit). Sustainable renewal focuses on broadening the agricultural scope related to the social and cultural needs of the city (people). By using one or more of these strategies there can exist new relationships between the metropolis and agriculture that can create more values for both and eventually a more sustainable kind of agriculture.

Three underlying characteristics for metropolitan agriculture projects are: creating 'spatial-functional entities with boundaries determined by system integration at the production level thereby defining what constitutes a metropolitan area', using 'sustainable principles, limitation of agriculture's ecological footprint by using only the resources, conditions and infrastructure that are available in the same area of demand' and using a 'multifunctional approach by covering society's material and immaterial demands' (Warscher, 2009). The question is how these abstract and conceptual ideas can become reality in a project, how the metropolitan agriculture guidelines and analysis can literally 'land' and become translated into a spatial design. To use the concept as a design tool, the general principals and ideas can be translated into generic spatial models, arrangements and patterns that can function as a toolbox for design. This toolbox can help to make the guidelines and principals become feasible. When implementing these generic design solutions, they should be adapted to the particularities of each place to be fully and optimally integrated in the local systems.







top left: "Garden Cities of Tomorrow", Ebenezer Howard, 1902.
(source: http://www.interculturalurbanism.com)
top right: "Masterplan Strijp Philips, Eindhoven," model view, 1999–2000.
(source: Andrea Branzi, et. al)
left down: A square-mile section of Broadacre City, Frank Lloyd Wright, 1934.
(source: places.designobserver.com)
right down: "Bird's-eye view of commercial area and settlement unit," 1944.
(source: Hilberseimer, The New City)

Application of the concept: Urban Agriculture models

In the past century there have been introduced several generic urban agriculture models that take a new look at the relationship between the city and the rural hinterland. Within these models we can distinguish a difference between concentrated and dispersed models. Ebenezer Howard's 'Garden city' (1898), where cities had the perfect size in relation to the surrounding (agricultural) landscape and in relation to each other is an example of a concentrated model. Cities were interconnected through blue and grey infrastructural routes of canals, roads and railways. A dispersed type of model we find in Frank Lloyd Wright's 'Broadacre City' (1934), which is based on the idea that each inhabitant of America should have the right to his or her own acre of land. The regional infrastructure forms a basis for an American pattern of urban development, which is an organic model for the dispersed North American settlement across an essentially boundless plain of cultivated landscape (Waldheim, 2010) Also in 'The New City' of Hilberseimer (1944) and in Andrea Branzi's 'Agronica' (1999) we see de-concentration of living space in relation to the rural areas.
In Hilberseimer's 'The New City' there are three structuring elements that structure the plan: traffic arteries, settlement buildings and nature. These would be separated from each other without conflict and they would work in their own logic, forming the backbones for his plans. Hilberseimer also uses zoning to order his city. He makes a distinction between a zone containing functions as living, working, commerce, parking, administration buildings, a zone with recreation and industry and a natural zone. These zones are carefully composed and mixed in Hilberseimer's plans, always adjusted to the specific sites and circumstances.
Branzi explores the potential relationships between agricultural and energy production and the culture of consumption they produce. He shows in what way the agricultural production shapes the urban form (Waldheim, 2010) and designs a 'weak urbanization' where forms and fields are flexible, mobile and open to change.

In the last three models the concentrated city is opened up into smaller units that are closely related to, and work together with, the surrounding productive landscape.
In all four exemplary models, the city and the productive landscape have a strong relationship. This is a principal that is also propagated by Metropolitan Agriculture. Interesting is that in all of the models landscape infrastructures, such as road, rail and water, are the main structuring backbones for the plans. These infrastructures are of great importance in how the plans function. Metropolitan Agriculture intends to use the existing infrastructure available at the place of design. However, it is important that when doing this, the infrastructure will become a structuring backbone for the area, able to facilitate the right capacity of flows for the region.
In the four examples, but in 'The New City' explicitly, we see a clear distinction of zoning and functions being separated or mixed in order to profit from each other. In Metropolitan Agriculture there is a tendency to mix the right functions through improvement, valorisation and renewal, thus integrating the zones and creating several gradations between these zones.

The most important ideas derived from the urban agriculture models and the principals and guidelines of Metropolitan Agriculture are the use of different zones, the importance of landscape infrastructures as backbone for the functioning of (regional) plans and the coherent design on different scales for these plans. In the next section I will translate these ideas into generic models that can function as a toolbox for design.

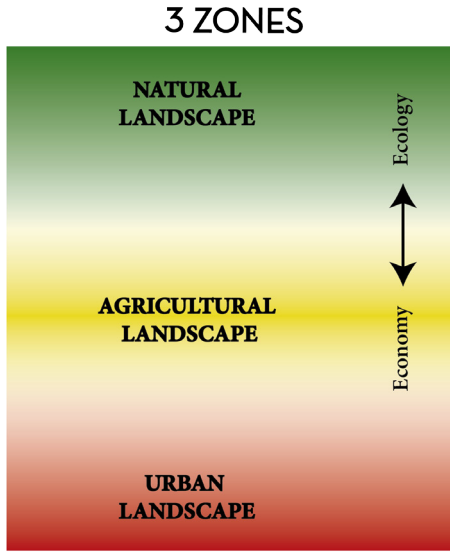
2. Design methodology

Defining generic models

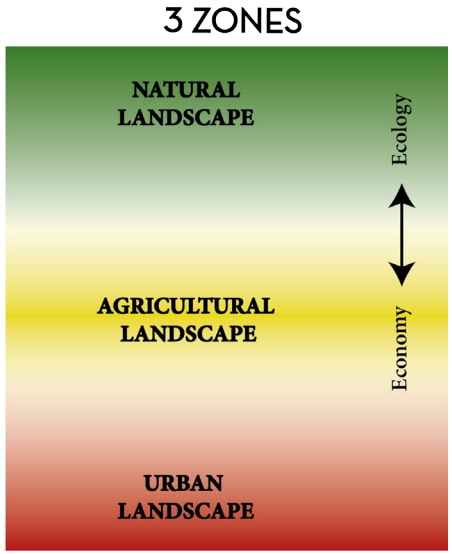
Generally we can define three types of landscape: the natural landscape, not touched by humans; the rural landscape, inhabited by humans and used for agricultural purposes; and the urban landscape, inhabited by humans and dominated by buildings for living and working space. The latter two are designed and created by humans and they are found in many gradations. Landscape infrastructures (green, blue and grey) are the connection between the different zones, being the carrier for flows of goods and species.

Urban and agricultural design motivation is often based on economic and strategic reasons. Strategic reasons have to do with the placement of settlements within the geomorphology of the landscape. The economic reasons have to do with the prosperity of a settlement. This often also depends on the placement within the landscape. Delta cities with big harbours are a good example of placements that gain economic wealth because of the strategic position within the landscape as are agricultural fields placed on fertile soil that will gain more produce and wealth than fields on less fertile soil. Also on a smaller scale design decisions can be motivated by strategic and economic reasons. Agricultural field sizes and disclosure can, for instance, depend on the newest machines that can harvest the crops growing on them.

In the past century we have seen that the economic motivation for creating agricultural landscapes has been the main design guideline, especially in the USA and Europe, and it has had many advantages. The production of food has intensified and more food could be produced on the same amount of land and therewith creating greater food security and a rise in economic value of the land. But there also have been disadvantages to this profit-oriented design motivation. Monocultures, existing as a result of profit-oriented agriculture, ruined the existing ecosystems. Land became more and more exhausted, got worn out and the production went down again. This implies that using intensive fields with monoculture crops is economically attractive on the short term, but from an ecological viewpoint this type of agriculture has a destructive impact on the soils and on biodiversity. This type of agriculture appears not to be a sustainable, while the economic motivation was too high



Natural zoning model, landscape infrastructures & flows

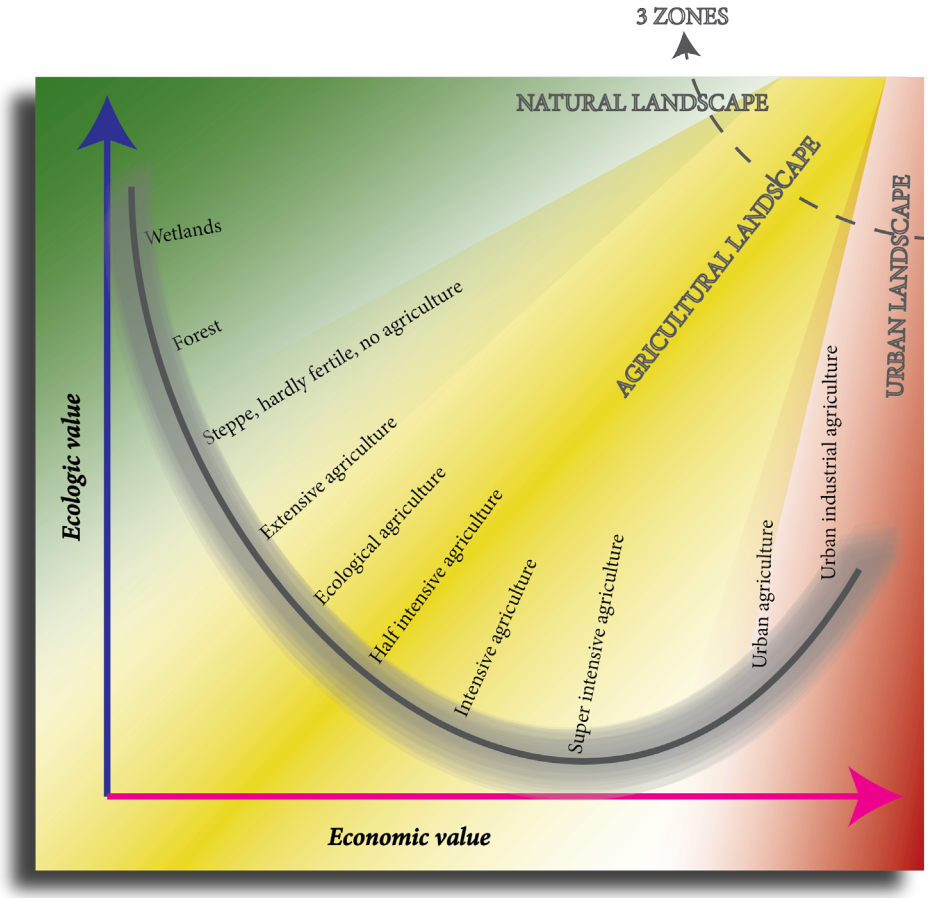


Natural zoning model, ecology vs economy

and people cared too little for the impact on ecology.

In the past few decades, people have become more and more aware of the important role that ecology plays in (agricultural) ecosystems. Finding a balance between economic values and ecologic values is of great importance to get to a sustainable agricultural system. This complex balance is illustrated in the hypothetic generic model, which places agricultural typologies within the bigger zoning of the landscapes. There are of course many gradations within the model, depending on how the agricultural types are practised. Generally, all types of agriculture can be placed on this model, where ideally the economic and ecologic values are both as high as possible.

When designing rural landscapes, a good balance between ecology and economy should be found. Within a region or super region there should be a mix of types of agriculture that all work together as one system in order to keep producing enough food on the long term, taking into account both economical and ecological values.

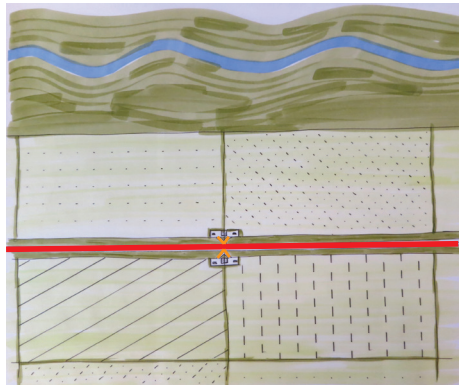


Zoning model with agriculture types defined within the balance of ecology vs economy

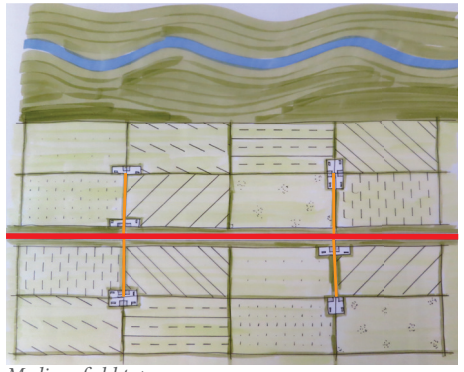
Each type of agriculture is practised in a different way and will be more intensive or extensive. Accordingly, each type asks for a different scale to work on: a subsistence farm will use a smaller plot than a corporation producing large portions of wheat. The agricultural field is the smallest scale to work with when designing a rural landscape. We will now look at how this scale functions with different field typologies.

Field Size Typologies

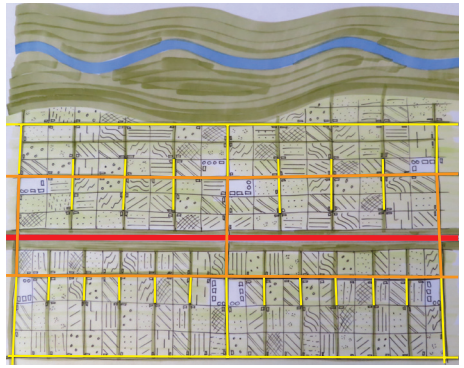
When looking at agricultural field sizes, one can make a distinction between scales. We can distinguish large fields, medium size fields and small fields. Sizes of fields often display what type of agriculture is practised on them. In-



Big field type



Medium field type



Small field type

Legenda

- agricultural fields
- river corridor
- field corridor
- collective storage
- farm and storage
- farm
- primary road
- secondary road
- tertiary road

dustrial agriculture growing a monoculture often uses large fields while the subsistence farm often has a small field or multiple small fields. Within the generic agriculture types model, implicitly we find all types of fields a, again with a lot of gradients. The aim is to reach a balance for each type of agriculture where both the economic and ecologic values are as high as possible. The different field sizes carry different qualities regarding economy, ecology, transport, spatial aspects and social aspects, which can be used for design. These qualities are displayed in the field size matrix.

	Agricultural Economy	**Ecology**	**Transport**	**Spatial Aspects**	**Social Aspects**
Big Fields	*Large scale oriented on national and continental production*	*Monoculture, large patches and robust corridors*	*Close links to main structure, relative long distance transport*	*Large open spaces, monotonous landscape*	*Large organisation; more people work for one company*
Medium Fields	*Medium scale, national and regionally oriented*	*Multicultural, medium size patches and corridors*	*Close links to regional structure, medium distance*	*Open spaces, more diversity in fields and structures*	*Small organisation; more cooperation between (private) farmers*
Small Fields	*Small scale, regional and locally oriented*	*High diversity, fine structures*	*Close links to local structure, short distance*	*High diversity in fields and structures*	*Community of private farmers; cooperation and integration of social functions*
All should be:	*Efficient*	*Sustainable*	*Efficient*	*Quality enhanced*	*Communicative and integrated in society*

Spatial qualities diagram

All the different types of fields and related agriculture should work together in a complex sustainable system. On this small scale, we already see the relationships with landscape infrastructures in how the fields are related to transport and to the river, which is accompanied by a natural zone. Also we see an idea of zoning, where the housing and agricultural areas are dispersed, aligned by a natural zone in the North. Of course this is just one of many possibilities to make a distinction between the different sizes of fields, but evident is that on this small scale, as a designer, you already work with different zones and landscape infrastructures that can be used as tools for the design.

Translation into design

We have seen that the most important ideas derived from the guidelines and principals of Metropolitan Agriculture and from Urban Agriculture models are: landscape infrastructures functioning as backbones for design plans, zoning and designing on different scales that work together. These ideas were translated into generic models, placing different types of agriculture and therewith the corresponding fields. On the scale of field sizes we already see the landscape infrastructures and zones playing an important part in a typology exercise.

The important next step is to translate these models into design. This means using them in different ways for implementing a design on a specific place. I distinguish three different ways in which the models can be used: The models can be used as a tool to analyse the site and use them for design research (Nijhuis, 2012). They can be used for monitoring during the design process: making sure that landscape infrastructure and zoning are covered and corresponding through the scales. Also they can be used as a design lens, taking a different perspective each time from where you start designing. This includes the economic versus economic perspective, but also changing perspective between the landscape infrastructures, zoning and scales.
However, at every design site the models will serve as a guideline and a toolbox that has to be customised for the specifications and particularities of the site. To accomplish this one must first make an extensive analysis of the site that is focussed on the economical, ecological and the social situation, which are the basis for an existing area. From there, the models can be used according to the needs of the specific site for further analysis, monitoring and design perspectives.

Discussion

Using the generic models as design tools for Metropolitan Agriculture designs within the super regions has to be tested. To do this, the models have

Agricultural fields of Romania

to be used in a combination with an extensive analysis of the super region on multiple scales. As defined the models can be used for analysis, monitoring and as a design lens during the design process. The design process can be considered as an iterative process in which design steps are constantly evaluated and reflected on. In those steps, these models will definitely be important, regardless the scales that are of importance at that time. When with each step the evaluation and reflection are corresponding with these models, the design can be considered as a Metropolitan Agricultural design.

Of course, these models will have to be tested in practise. As a test case I will make a design in the super region of Romania, where I will make a Metropolitan Agriculture design for the region around Bucharest specifically. During the design process I will use the models as mentioned and test the functioning of the models within the design process as a 'research by design' test case.

Conclusion

Metropolitan Agriculture is a promising concept that aims to capture the complexity of the relationship between the city and the agricultural landscape. Making new connections between both can offer a more sustainable food production system to feed the world population and stop the suppression. To translate this concept into design tools that can be implemented I used the guidelines and principals of Metropolitan Agriculture together with important ideas from Urban Agriculture models to create generic models. These models can be used to implement the ideas of Metropolitan Agriculture into design by functioning as a tool for analysis, monitoring and by functioning as a design lens. The ideas of Metropolitan Agriculture could be implemented in any super region. To make these generic models place-specific they should be combined with an extensive analysis of the place. Together with a specific analysis, the generic models can be used as design tools for a Metropolitan Agriculture design.

3. Ecological aspects of Metropolitan Agriculture

Abstract

In this chapter I will discuss the ecological aspects of Metropolitan Agriculture. These are translated into generic models that can be used for implementing Metropolitan Agriculture in design. These generic models can be seen as guidelines and can be used in combination with a site analysis for implementation. In this essay the ecological aspects and guidelines of these models are explored.

Introduction

Metropolitan Agriculture is a relatively new concept that aims to capture the aspects of a new relationship between the city and the agricultural landscape on different scales. The focus of this concept is on creating a sustainable food supply system while stopping suppression of the natural world. The ecological aspects of this concept are of great importance for the implementation in design. Capturing the ecological guidelines in generic models offers a design tool that can be used for implementing Metropolitan Agriculture, which safeguards the high ecological value needed for a sustainable system. In this article I will discuss the ecological aspects of Metropolitan Agriculture, translated into generic models and in field typologies. These models can be used in the design process as tools for analysis, monitoring and design perspectives (van Niekerk, 2013).

Metropolitan ecology

There is a complex link between the city and agricultural land from both an ecologic and economic viewpoint. In both habitats (the urban and the rural landscape) the human species plays a big role. Humans design and inhabit their surroundings; they live in both the city and the agricultural landscape. The ecological value of these habitats highly depends on how humans treat their environment.

In the city the ecological system depends on drivers, patterns, processes and effects/changes (Alberti, 2003). Until recently the ecological systems of the city and of the agricultural landscape were treated separate from each other, but the ecological system in the city doesn't exist apart from the ecological system in agriculture. Drivers from the city can result in agricultural patterns and processes taking place in agriculture can have their effects on the city. Only think about how the agricultural hinterland feeds the city. The amounts of food available to citizens are depending on the amounts produced in the agricultural regions. Thus the ecological systems of the city and agricultural landscape are intertwined. They should be considered as one 'metropolitan ecologic system'. A metropolitan ecologic system can be considered on multiple levels. On each scale there are different ecological processes and aspects to consider that should work together through the scales.

The agricultural process

As an hypothesis for my graduation project I made a zoning model of the three different landscape zones (natural, rural and urban) wherein all different types and spatial arrangements of agriculture can be placed. For each type of agriculture there exists a balance between economy and ecology. To make agriculture sustainable on the long term, there has to be found a 'good' balance. This means that next to crop yields there should be paid attention

Pre-industrial agriculture method

Industrial agriculture method

to the ecological aspects and impacts of a certain type of agriculture on the environment. Soil should be used in a way that it can be continued to use without it losing its fertility on the long run. Therewith its production can stay on a constant level, reaching a constant economical value and ecological value of the land.

To reach sustainability, one must take into consideration the different ecological factors that are generally involved in the agroecosystem:

IN: rain, sun, fossil fuels, fertilizers, chemical pesticides,
PROCESS: pest control, soil nutrients, crops that are produced,
OUT: by-products of the process, soil erosion, habitat loss and yield of the production.

The steps in this loop-process are interconnected. By changing one of the factors going in or during the process, the outcome will change. Man can hardly influence natural factors such as rain and sun that run the natural growing process. The agriculture method using only the natural process is called pre-industrial agriculture. This method is often practised in third world countries or in poor countries. The yields of the crops produced with this biological method highly depend on the natural circumstances. There are some factors that man can use to influence the output of the process. When they use a lot of fertilizers and chemical pesticides for instance, they raise their yield of the production and therewith the short term economical value of the land. But, while raising the amount of fertilizer and chemical pesticides, they create more unnatural by-products, which will eventually result in more soil erosion and habitat loss and thus a lowering of the economical value of the land in the long term. This is an example that can be considered as an industrial agroecosystem, which has proven not to be sustainable on the long run, because economy weighed more on the scales than ecology; the balance wasn't right. To find the right balance, agriculture in first world countries is generally moving to a more low-input and alternative agroecosystem where the adding of fertilizers and chemical pesticides is reduced to a minimum to keep the soil in optimal condition.

There are different methods to keep the soil in good condition. An example is by using crop rotation systems with cover crops (Mohler, 2009). These cover crops are planted for the multiple benefits they provide to the farmer and to the environment rather than making profit from them. These benefits include soil quality improvements by protecting soil from erosion, increasing soil microbial activity and cycling nutrients, decreasing excess nitrogen and adding carbon to the soil (Carlson, 2012).

Agricultural types

The agricultural process is complex. There are a lot of different types of agriculture practised within the pre-industrial, industrial and the alternative methods of agriculture. The zoning model with agricultural types is a theoretical model placing different types of agriculture within the three distinguished landscape zones. These types are broadly placed on the graph and other types can be placed on it as an addition. The general types of agriculture are placed relative to each other, but they are not fixed: according to how they are practised they can move. Depending on how a typical type of agriculture is practised on a specific place, looking at the ecological and the economical value of that place, this specific type can maybe move up or down along the line, or move into the gradients of the line. Preferably they move up on both the ecologic and the economic scale while finding a sustainable balance.

Balance through the scales

Finding a sustainable balance should be done through the scales. For each type of agriculture on a specific place, one must find a sustainable balance between ecology and economy to make the type feasible on its own. On a higher level, finding a sustainable balance means using a palette of different sustainable types and methods of agriculture that work together in a complex ecological and economical system.

However, it is important that all the scales are considered in line with each other, using sustainable principals and guidelines on each level. Ideally, the smaller systems will work within the bigger systems and all scales will work together in a Metropolitan Agricultural system. According to Warscher, "Spatial-functional entities with boundaries (are) determined by system integration" (2009). Also ecological processes can be used for defining

boundaries. This can happen at multiple levels and on each level we should use "sustainable principles, limitation of agriculture's ecological footprint by using only the resources, conditions and infrastructure that are available at the same area of demand" (Warscher, 2009) Especially when defining the 'sustainable principles' and in 'limiting agriculture's ecological footprint', agroecosystems and metropolitan ecology should be taken into the equation.

Ecological aspects and guidelines

Richard Forman shows how every landscape can be interpreted by using the landscape mosaic, which is composed of three elements: the landscape matrix, which is the large area of similar ecosystem or vegetation types, the landscape patch is a relatively homogeneous area that differs from the surrounding matrix and the landscape corridor, which is a strip of environment that differs from the matrix on either side and frequently connects two or more patches of similar habitat (Odum, 2005). Landscape mosaics can be used as tool for analysis and for design and it can be used through the scales. Scale differentiation in this process is very important, for at one scale, a landscape can appear to be homogeneous, while at a smaller scale it may appear much more differentiated.

At a specific scale, the composing elements can differ in texture between areas. Forman refers to this difference in coarseness in texture as the "grain" of an area. A fine-grained landscape is primarily composed of small patches and thin corridors, while a coarse-grained landscape has large patches and more robust corridors. Translated to the properties of the agricultural field system, a small field system can be interpreted as fine-grained landscape while the big field system can be interpreted as coarse-grained. The different grains and therewith the different patch and corridor sizes bring different qualities in terms of economy, ecology, transport, spatiality and sociality.

Agricultural fields are made by man and are therefore introduced patches. Big fields can be considered as large patches and small fields as small patches. These patches generally include several habitats. Normally, the same surface area consisting of small patches will include more habitats than the same area consisting of larger patches. Which is better? The debate is undecided, but clear is that large patches and small patches bring different ecological values. According to Forman, "an optimum landscape has large patches, supplemented with small patches scattered throughout the matrix".

Ecological effects on agricultural fields may be considered when deciding on their size. For instance how natural elements work the land and the implications of them. Wind, for instance, is a factor that may harm the vegetation. If forests or hedgerows surround a field, these may function as a windbreak. Then in the upwind edge and the downwind edge the wind speed is somewhat lower than in the middle of the field and production will be enhanced here, while at the edges in the wind direction the wind speed is higher and productivity somewhat lower. The interior-to-edge ratio and shape of the field and wind direction can be used in determining the field size. Taking wind into account, for productivity perhaps a mid-sized field is ecologically optimum. (Forman, 1995)

Using only mid-sized fields, however, may not be the optimum for biodiversity. Larger patches often have more species than smaller patches. This doesn't mean that there should be only large patches for an optimum in biodiversity, because different species live at different parts of the patches. Some species live in the edges of the patch, some in the interior and others cannot live there at all because their predators already do. These species are bound to live in smaller patches where their predators do not live. In a complex system the different types of patches and the different parts of these patches offer a home to different kinds of species. The ones living in the core of a patch are often more rare and need more stability than the ones living near the edge. The edges of a patch are more dynamic and often contain multihabitat species that move between two habitats. The edges of a patch are the place where resources come together and are exchanged between two land-uses. The type of edge and the length of the edge are of great importance for biodiversity. Often natural edges are curved and man-made edges are straight. The most common shape of an agricultural field is a straight rectangle with hard edges. More natural edges are most of the time more layered with a constructive layering of different types of vegetation. Generally the longer the edge, the more exchanges with the matrix, regardless the layering in the edge.

In agriculture, economical drivers such as how the fields can be ploughed

best with machines often decide patch or field sizes. Ecological drivers might decide how the fields are situated best according to weather conditions such as sun and wind for an optimal produce. Biodiversity in patch sizes might be important to consider when there are certain predators for a crop or certain predators for the predators of the crop that thrive in the patch size of the field. Shaping the edges in a certain way so that species favourable for the crops can live there might be a strategy to consider.

Next to patches, corridors are of great importance in the landscape. Corridors provide biodiversity protection, they enhance water resource management such as flood control and control of sedimentation, they enhance agroforestry production by acting as windbreak for crops, they control soil erosion, they can be a source for recreation, they can enhance community and cultural cohesion by acting as a boundary for a living space and they provide dispersal routes for species isolated in threatened areas. (Forman 1995). Their attributions differ with their size and building elements. When a corridor is wide, it is called a strip corridor and it may function as a patch with internal living conditions and edge conditions. It can host both interior species and edge species. A thin corridor is called a line corridor. In this type of corridor there are only edge conditions and it will be dominated by edge species. Depending on the character of the corridor it can host different species and will fulfil different functions. The functions mentioned are very important in the maintenance of the agricultural landscape and in creating a sustainable balance within the landscape.

In the agricultural matrix it is important that there is diversity through the scales, from the coarse and fine grains in the landscape patterns looking at it on a regional scale till the differentiation in field sizes when zooming in. The matrix should be balanced with a diversity of larger and smaller patches and strip corridors and line corridors that create good connections between the patches. Also on the field-scale it is good to have a variety in coarse-grained parts and small-grained parts. Still, both are needed in each landscape, it is a matter of proportion to find a balance. In the end, from an ecological viewpoint diversity seems to be the best strategy to reach a sustainable balance.

Discussion

In this chapter we have discussed the ecological aspects of the Metropolitan Agriculture models that can be used to create a sustainable balance in the agricultural landscape. To implement these models on a specific place, a thorough analysis should be made of the ecology of the place. Dealing with the ecological aspects of a specific place is important, for on each place are different ecological circumstances regarding climate, soil type, agricultural types and methods used, field sizes, etc. Based on a specific site analysis, a complete picture will exist of how these models can be best implemented and how one should deal with the ecological aspects of the place to come to the best balance between ecology and economy. When combined with an extensive analysis of the specific site these models can be used as tools to design a sustainable system.

Conclusion

It is important to realise that the ecological system of the city and the agricultural hinterland are closely connected. The general models capture the differentiation of the different types of agriculture and the balance between economy and ecology. The ecological aspects of the general models are of great importance for the functioning of the concept and for creating a sustainable system. Without paying enough attention to the ecological aspects of a system, it cannot become sustainable in the long term.

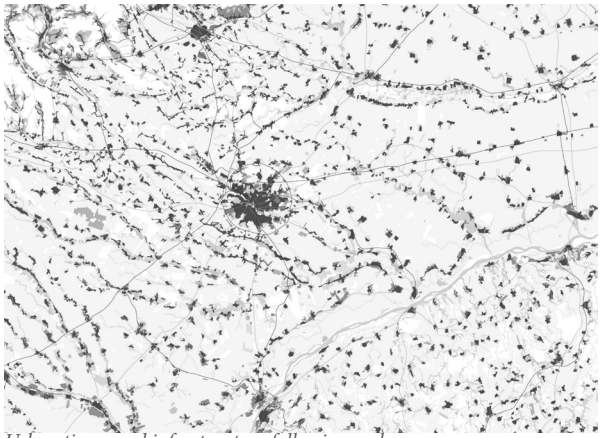
When designing a sustainable Metropolitan Agricultural system, this should function though the scales and each level should work within the whole system. The models presented are generic and whenever using these models, they should be combined with an extensive analysis of the site to come to the right implementation at that specific site. Taking the metropolitan ecology into account when designing within a Metropolitan Agricultural system brings us one step closer to create a sustainable balance.

PART II

ANALYSIS

Romania

Carpathian Mountains going through the country



Urban tissue and infrastructure following geology

4. Context Analysis

Geography of Romania

Romania covers an area of 238.391 km² and has 21.8 million inhabitants. It borders the Black Sea on the West side and the southern border is the Danube River, which connects the country with the western part of Europe. The Carpathian Mountains cover approximately 1/3 of the country and divide the country in three parts: Transylvania, the northwestern part: Walachia, the southern part, and Moldavia, the eastern part. The southern part is mainly flat and is called the Campia Română. In these mountains different rivers spring and flow through the plain towards the South and finally flow into the Danube. Urban and infrastructural patterns on the plain mainly follow these rivers. The exception to this urban pattern following the geologic layers is Bucharest, the metropolitan capital of Romania counting 2,35 million inhabitants. This city grows into different directions like an amoeba, largely ignoring the geological sub layers.

Romania has a land climate with hot summers and cold winters. However, there can be huge differences between the mountainous areas and the plains. The average temperature on the plains is 10°C and in the mountains it is 8°C.

Romanian Agriculture: weaknesses and opportunities

Romania is a highly fertile country and heavily relies on its agriculture: 42% of the Romanian land is arable (Ustinescu, 2012). The southern plain of Romania exists of different types of highly fertile soil, one of which is chermozem, the most fertile soil type. Regardless of her fertile soils, Romania is not producing what it could produce. In 2010, 32.1% of the population was preoccupied with practicing agriculture while only 8.5% of the GDP was generated by agriculture. This is around 30% of the productivity average in the EU. (Knight, 2010) This shows us a disbalance that exists due to a complex set of factors that often date back to the period following the communist era.

Fragmented parcellation and high level of subsistence farming

One of these reasons is the fragmented parcellation that existed after the reign of Ceausescu. In total Romania counts around the 4 million operating farms (Ustinescu, 2012). Roughly 65% of all farms in Romania are small-

scale farms and 35% are large-scale farms. There hardly are any in-between size farms.

The small-scale farms are mainly individual landowners or family farm businesses. They are mainly subsistence farms, producing enough food for themselves and living from the produce they make. These people reclaimed their land after communist reign. Instead of the land that they used to be their property, they all got several parcels that were divided into three different quality categories. This resulted into a fragmented parcellation where people own multiple plots that are spread around their village.
The family farms are often run in a traditional way with old-fashioned tools and measures due to a lack of money to invest in better tools. The fragmented parcellation is inefficient for working the land because of the plot size, shape and their positions. Farmers can own different parcels that are a few kilometers apart. This often results in land laying fallow when the farmer does not need all the plots for himself. The owner-structure of the parcels is not transparent. There are no good records kept on the owners of land, which makes selling or buying the land to create a bigger parcel difficult. Next to that people are, as a reaction to the communist era, very keen to their property and to their land. Swapping pieces of land seems to be out of the question due to a lack of trust that still exists. This is also seen in a land consolidation project in Jirlau, a Romanian village near Braila, where Eurodite, in cooperation with the Dutch Kadaster and some other Dutch organizations are proposing a land swap strategy. The Romanian farmers are reluctant to participate because they do not trust each other and the government. They rather rely on themselves.

Subsistence farming is a type of farming that is quite inefficient when we look at a larger scale. The production rates of these farms are low and often just efficient to provide food for a family. The un-used land of these farms is also a factor that weighs heavy in the inefficiency of the subsistence farms. The land could be used in a much more efficient way, producing more food while at the same time maintaining a high ecologic value. The stubbornness of the Romanian farmers is one of the factors why there are still so many subsistence farms in Romania.
However, there is seen a trend in a growing farmer cooperation in the coun-

Farms	1948	1990*	1998	2001**
Less than 1 hectare	36	20	45	40
1–2 hectares	27	17	24	—
More than 2 hectares	37	65	31	—
Between 1–5 hectares	—	—	—	48.5
More than 5 hectares	—	—	—	11.5
Total	100	100	100	

Source: Chirca and Tesliuc (1999). *Brooks and Meurs (1994). **Rusu (2002).

Size distribution of Romanian Landholdings in different periods (in percentages) source: Sabates-Wheeler, page 26

Typical Romanian small-scale fields

Large-scale fields

	Area (thousands hectares)				Total Production (thousand tons)			
Year	2007	2008	2009	2010	2007	2008	2009	2010
Wheat & Rye	1,987	2,123	2,164	2,166	3,065	7,212	5,236	5,809
Barley	364	394	518	518	531	1,209	1,182	1,314
Oat	209	200	203	189	252	382	296	325
Corn Maize	2,525	2,442	2,339	2,089	3,854	7,849	7,373	9,008
Rice	8	10	13	12	28	49	72	62
Sunflower	836	814	766	794	547	1,170	1,098	1,267
Oilseed Rape	365	365	420	537	362	673	570	943
Soy	133	50	49	64	136	91	84	150
Sugar Beet	29	20	21	22	749	707	817	838
Potatos	268	255	255	241	3,712	3,649	4,004	3,284

Cereals production in terms of total farmland used and total quantities, Source: DTZ

A lot of plots are for sale due to the aeging of the subsistence farmers and young people who move to the city

tryside where farmers share tools, transportation possibilities and land. This may be a step in the direction of a more efficient and sustainable type of agriculture for the small-scale farmer. When they use all their land in a co-operative configuration, these farmers can easily create a surplus of produce that they can sell in town and with which they can create extra income and wealth for their families.

Pollution, lack of investment and industrialization

During the communist era, Romania was one of the larger producers of agricultural products in Europe. They were very good at bringing the knowledge gained from research onto the field into practice. They were practicing an industrial type of agriculture with large fields. However, agricultural pollution was one of the main sources of environmental pollution in Romania. This is because of the encouragement from the regime to use chemical fertilizers, pesticides and herbicides for maximum crop output, regardless the natural environment and resources. After 1990, the National Programme for Environment Protection was established. Their job was to protect the environment and to harmonize environment regulation with the European Union, with the prospect of Romania becoming a member of the EU.

In 2005, most of the agricultural production in Romania was still intensive on the land that belonged to the state. Also on the land of legal associations and agricultural commercial companies, the land is intensively used, but the use of fertilizers and pesticides has drastically decreased compared to before 1990. Thus we see a shift from industrial agriculture towards alternative agriculture on the state-owned land.

When after the communist era the land was reallocated, the knowledge gained by the Communist regime on how to produce efficient was largely lost. Many small-scale farms with individual owners or family companies lacked money to afford the right tools, fertilizers and pesticides. As a result their farming became less intensive and is now close to ecological agriculture (Gurau, 2005, p 551), which they practice unintentionally. This type of agriculture could be typified as 'pre-industrial agriculture'.

Poor irrigation systems are also part of the reason that production stays low.

In the southern part of Romania, irrigation comes for the large part from the rivers. This part of Romania belongs to the delta system of the Danube. Next to the rivers small ditches provide irrigation. The irrigation systems are all there, but they are mostly out-dated and not maintained well after the fall of communism.

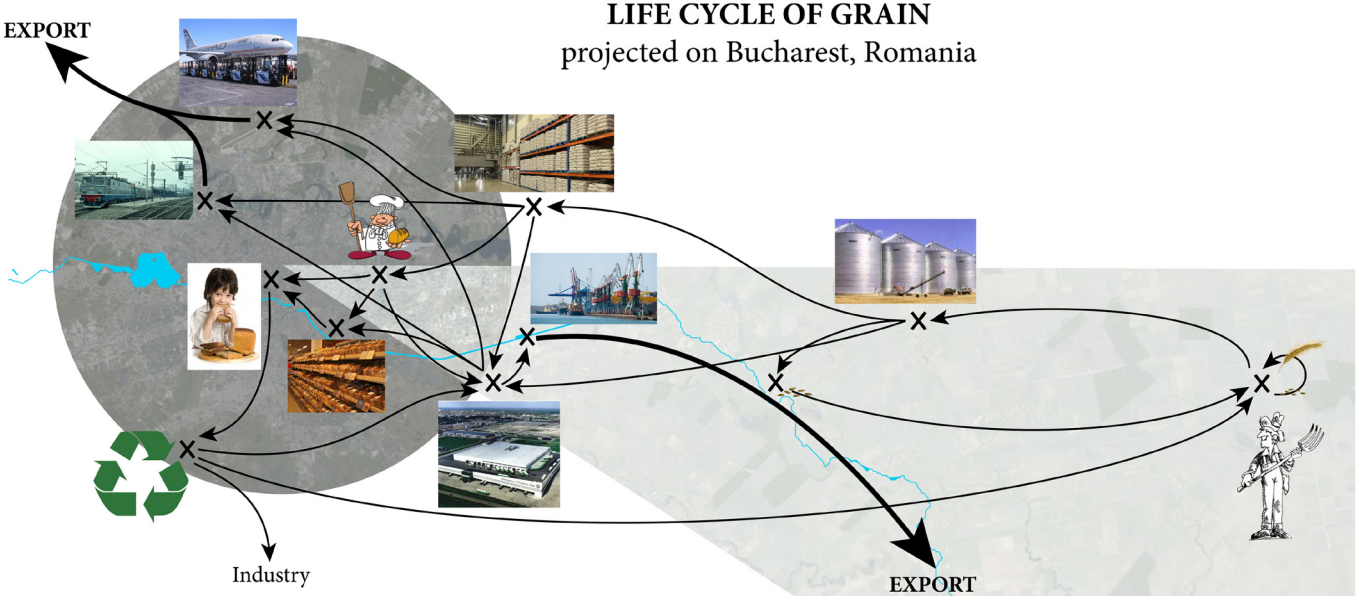
The large-scale farms are mostly corporations that often do have money to invest in tools and industrialization. The amount of these farms is growing because they buy new land from ageing people that want to sell the land, but this is a slow process.
Mainly due to these bigger farms, agricultural output is growing in Romania and the production is becoming more intensive. This growing trend is continued. In 2011, the maize output stood at 11.7 million tons, and that of wheat at 7.1 million tons, Romania being the second and fifth largest producer of maize and wheat, respectively, in Europe. Agriculture was contributing 0.7 % to Romania's economic growth rate of 2.5% in 2011 (Radio Romania International)

Unintentional organic agriculture
Since a lot of Romanian farmers who can't afford to buy pesticides and fertilizers are actually performing a kind of ecological farming, the step towards actual organic farming seems small. The organic farming market is one that is growing fast in Romania, as in the rest of Europe. The number of operators in Romania tripled in 2011, reaching 10.000 people. Most operators are the small, subsistence farmers, with plots of sizes between 3 and 20 hectares. (Radio Romania International)

The demand for organic products is growing, especially in the most developed countries, but also in Romania. The market for organic products in Romania was 80 million euros in 2011 and half of this sum was spend on Romanian products (Aldescu, T. in Radio Romania International). Exports of organic farm products from Romania were worth 200 million Euros in 2011 (compared to 100 million in 2010) and were mainly exported to European countries. ('Bio-Romania' Organic Farmers Association, Radio Romania International)


Farmers still using horse and carriage as a result of a lack of industrialisation


Farmers drive to town with their goods to sell them at random and dispersed places



The market for organic products is expected to grow in the coming years. Growing ecologically grown products for Romania and the rest of Europe can become a step forward for the small-scale Romanian farmer. Already there is seen a trend in Romania of farms adapting to the international standards required for exports (Gurau, pp 552). While certified organic products are sold against a higher price than the non-certified comparable products, the certification can bring extra money to the small-scale farmer. They can on their turn invest in more land and better equipment to work the land. When they pursue organic farming, the use of fertilizers and pesticides can stay at low and environmentally sustainable levels.
Moving into a more deliberate organic farming model, this type of agriculture would move higher on both the economic and ecologic scales of the agricultural landscape graph. People would become more conscious about the ecological implications of their farming method and use that to create more revenue from their land.

Food distribution

Storage of harvested products and distribution is a bottleneck in Romania. There is a silo scarcity in Romania that forces the farmers to sell cereals immediately after they collect their crops against reduced prices. According to DTZ, approximately 70% of the cereals are sold in this way in autumn while in winter the prices to obtain the same cereals are twice as high (Ustinescu, 2012).

Romania is working on this situation. According to the minister of Agriculture Daniel Constantin, "Romania's stocking capacity has increased considerably, and farmers do not hurry to sell the products they obtain shortly after they have harvested them" (Daniel Constantin, minister of Agriculture, Radio Romania International, 22-10-2012)

The main distribution channels for green products are supermarkets, specialized shops, and direct sales – mainly through organic 'farmers' markets. (Gurau & Ranchhod p 551) These distribution channels differ between the large-scale farmers and the small-scale farmers. The large-scale farmers mainly produce the same crop in large quantities that are processed and exported or sold in supermarkets in the city. The storage, processing and distribution of these products is mainly done around the edges of the city, where industry and infrastructure are two main elements that come together at that point and are needed for these processes.

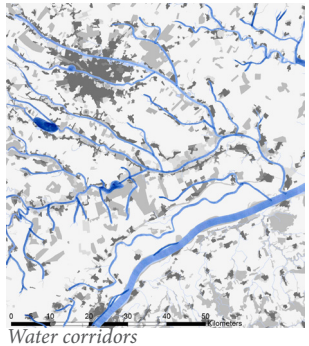
The small-scale farmers mainly produce for themselves or for their community. Up until five years ago, people from Bucharest would drive around the rural villages in the neighbourhood to collect the best products from the farmers themselves and they would put up a stand along the road. Since a decade more and more supermarkets were introduced in Bucharest and since five years they have taken over. People don't take the time to drive to the villages any more to buy products there. When farmers have a surplus they come to the city to sell their goods. Most of the small-scale producers take horse and carriage and commercialize their agricultural output on the market places organized in towns, where there is an increased demand for cheap, naturally grown products. There are a few places where farmers are allowed to sell their goods, but there is not a

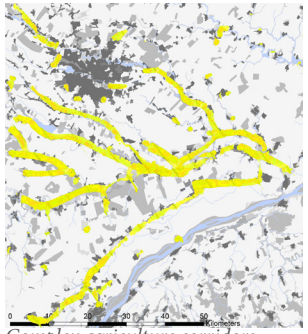
central place in the city to do this. It would make the process more efficient for the farmers if they could go to a central market place to sell their goods, instead of hopping around the city. It would be even be more efficient if all farmers could sell their produce to an intermediate party such as a stock market that would sell the products to the consumer. In that way farmers wouldn't lose a whole day standing on the market selling their produce and they would be sure of a certain income for their produce.

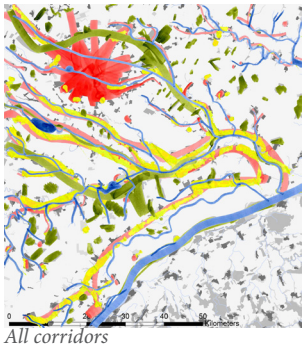
The Bucharest-Danube Canal

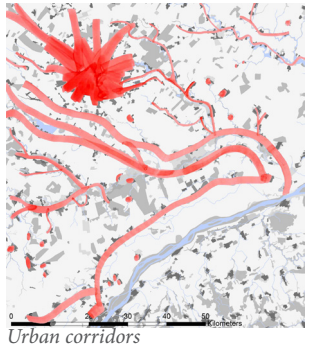
Bucharest lies in the middle of the Campia Română and is surrounded by agricultural land. The city itself is an exception to the rural pattern found on the plain. Through the city flows the Dâmbovița river that later flows into the Arges river, which flows into the Danube. These rivers were supposed to become a canalized connection between Bucharest and the Danube, the Bucharest-Danube Canal, offering Bucharest the opportunity to be connected to the Danube as an important waterway, providing interesting opportunities for import and export. Ceausescu took up this project, which was already thought of in 1880 by the engineer N. Cucu. In 1986 they started with the execution of the project, but after the Communist era, they stopped construction in 1990. Since then, the constructions were unused and subject to vandalism. However, a feasibility study of V. Dumitrescu (2012) shows that it is feasible and profitable for Bucharest to finish the project.

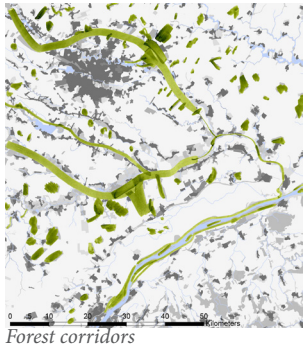
When we look at the Bucharest region through the eyelashes of Richard Forman, we can discover different corridor types in the landscape between Bucharest and the Danube: water corridors, urban corridors, complex agriculture corridors and forest corridors. When we overlap these, we find out that these corridors overlap each other around the Bucharest-Danube canal to be, forming an intensified corridor. This intensification around the canal looks a lot like the Von Thunen's Regional Land Use Model. He developed this model to describe the relationship between markets, production and the agricultural landscape. He looked at the relative costs of transporting different types of agricultural products to the city, or central market. Based on these costs he determined the agricultural land use around the city and around a navigable river. (Rodrigue, 2013) The difference between Von Thunen's model and the region around Bucharest is that this intensified corridor is around a river

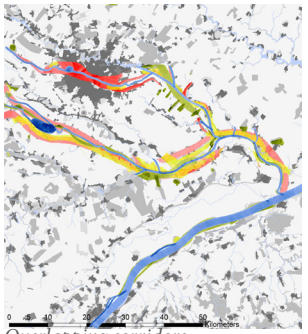

Water corridors

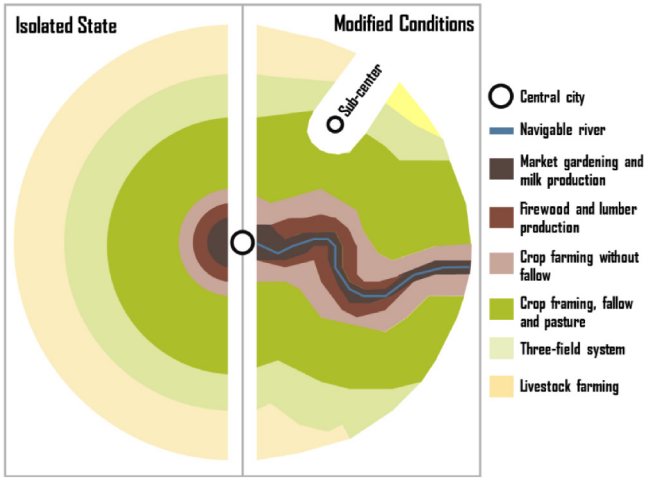

Complex agriculture corridors


All corridors

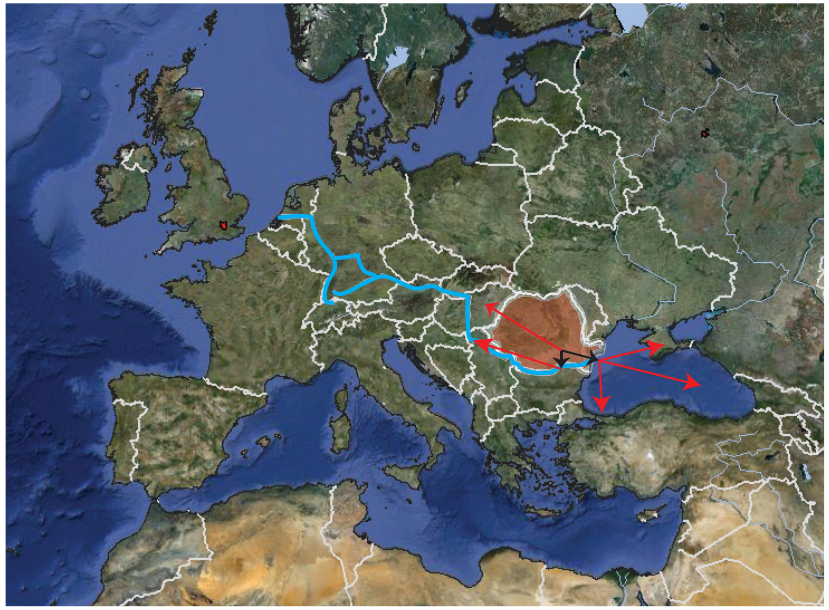

Urban corridors


Forest corridors

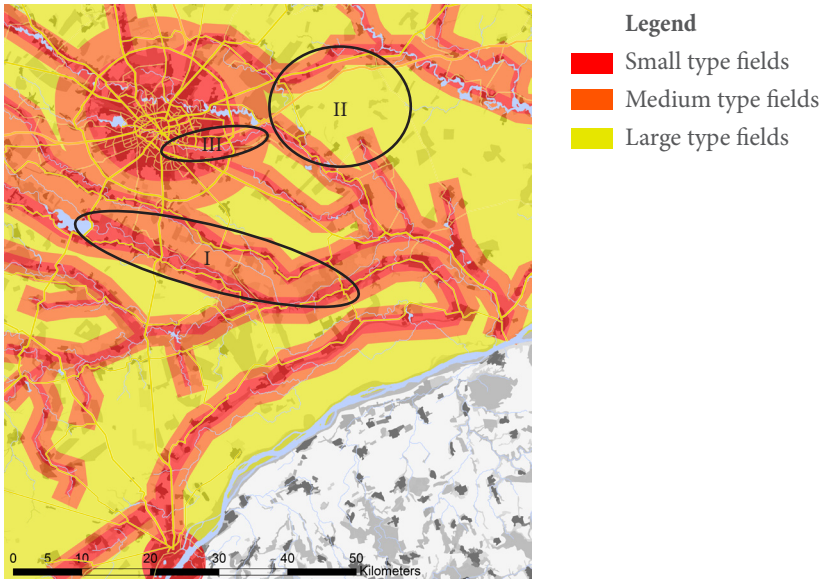

Overlapping corridors



Regional Land Use Model by Von Thunen
source: http://people.hofstra.edu/geotrans/eng/ch6en/conc6en/vonthunen.html



Romania's favourable position in Europe for import and export



Legend
Small type fields
Medium type fields
Large type fields

Field sizes in relation to the urban tissue, vision projected on the Bucharest Region

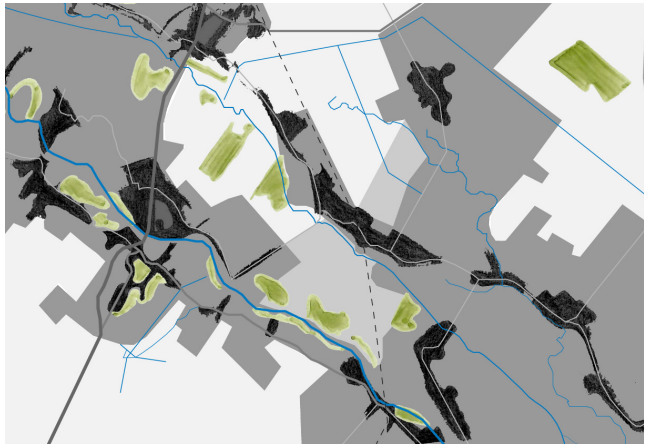
that is not navigable. However, the intentions of the canal to be finished have had their influence on the area, and still have. The area around Decembrie 1, for instance, is next to Bucharest, the fastest growing area in inhabitants settling there, exactly the spot where one of the future harbors of the canal would be positioned.

The development around the canal would be more intensified, would the canal be finished. This would offer great benefits to Bucharest. Not only would it give cheaper opportunities for import and export to Western Europe and countries around the Black Sea, the canal also offers electric power production, better flood protection, water supply, irrigation systems and drainage systems and tourism development for leisure tourism and cross-border tourism. (Dumitrescu, 2012) When the canal will be finished, this would be a great boost for the regional and national economy. The canal would become even more of a structuring landscape infrastructure than it already is and it could become a landscape backbone for the Bucharest region.

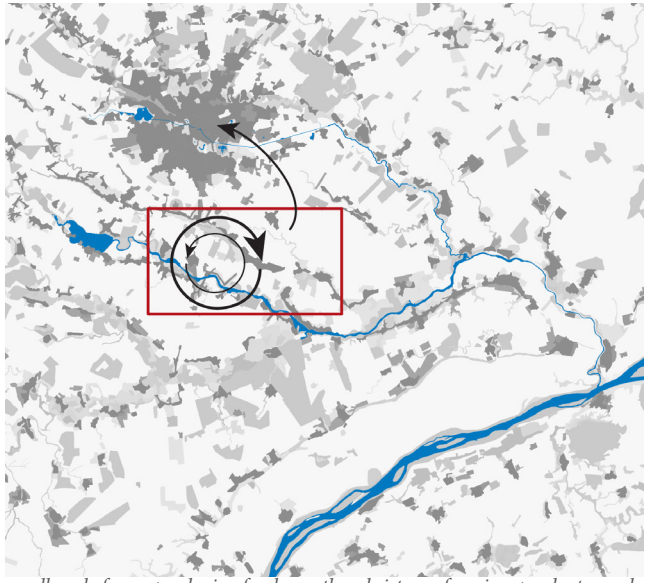
Regional typologies

Looking back at the field size typologies, we can distinguish small, medium and large types of fields. These fields can be considered as agricultural plots. When we look at the urban plots, these are much smaller in size even than the small agricultural plots. In creating a metropolitan agricultural system, it is necessary that the urban and the agricultural landscape exchange functions and are more integrated. This also means that the plot sizes correspond with the idea of an integrated landscape. In my idea, this integration leads to a gradually changing landscape rather than a sudden change. This relates back to a gradual change in plot size as well. This means that close to the urban tissue there are small agricultural fields and further away from the city are bigger fields.

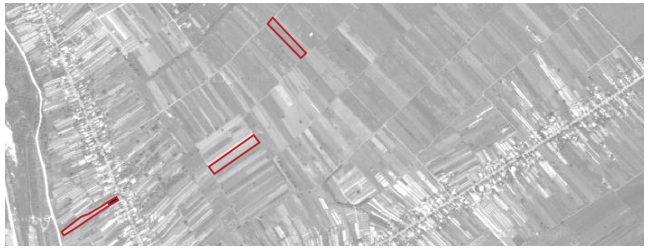
When we project this idea on the Bucharest region, there are three types of landscapes to be distinguished where urban and agriculture come together. These three locations work in different ways in terms of agricultural production and living. They are connected by the Bucharest-Danube canal, which functions as a landscape infrastructural backbone for industrial flows.



Location I: Rural lint villages

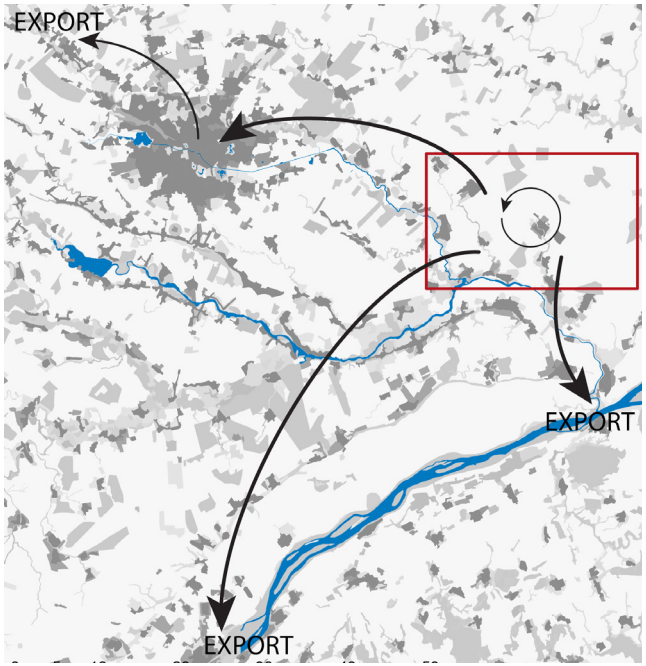


small-scale farms producing food, mostly subsistence farming, products reach Bucharest via farmers markets

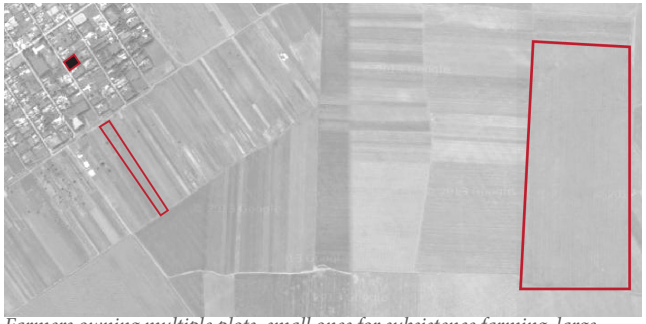


Farmers owning multiple plots

Location II: Condensed rural villages

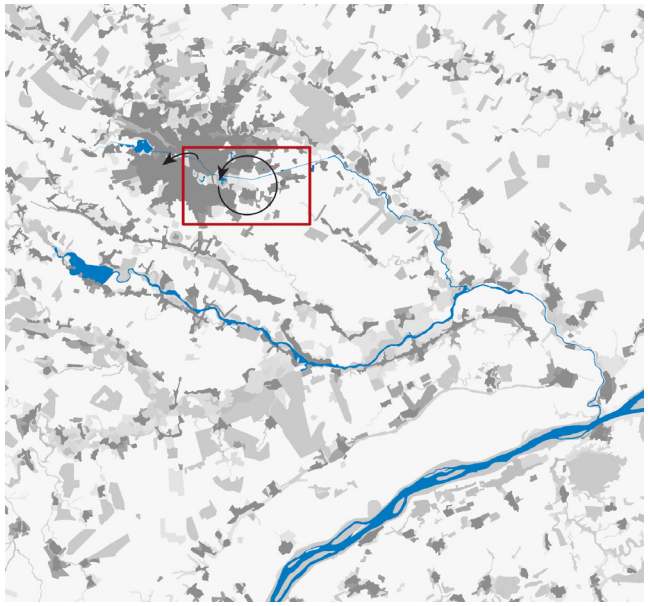


Large scale farms producing food, products reach the city after being processed or are exported, small level of subsistence farming



Farmers owning multiple plots, small ones for subsistence farming, large plots for producing crops to make a living

Location III: Metropolis meeting the agricultural hinterland



Small scale urban gardens and small plots for own produce

Citizens owning small plots next to their houses for kitchen gardens

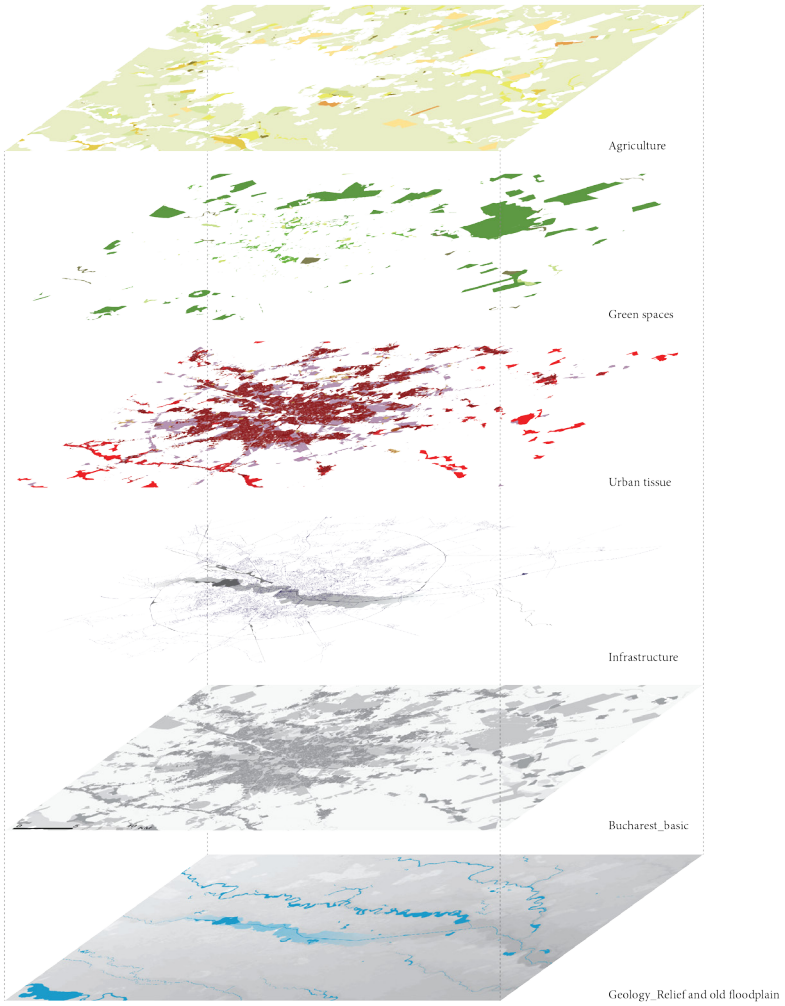
Location I consists of rural lint villages surrounded by small fields. Subsistence farmers that own multiple small plots inhabit these villages. They produce for themselves and may trade produce with neighbours. Often the plot closest to the house functions as kitchen garden with a variety of vegetables. Plots further away show less variety in produce because they are more difficult to work on. The surplus of the produce was usually sold in a stand by the road. People from Bucharest would come to these villages to buy the best products for their zacusca (a local vegetable spread, typical Romanian), but in the last 5 years the supermarkets have taken over that role from the farmers. Now the farmers go to Bucharest themselves to a marketplace or they walk on the streets with a bag of their produce to sell.

Location II consists of condensed rural villages. A strip of small fields for subsistence farming surrounds the villages and behind there are bigger fields that are used for producing crops on a large scale. These large-scale crops are sold, processed and then sold in the city or exported.

Location III is where the metropolis and the agricultural hinterland meet. In this area there are people that have small plots behind their houses that function as kitchen gardens. The produce of these plots is mainly for the owners, who will also rely on the city to gain enough food. Production inside or on the edge of the city often has too small a scale to provide in enough food to live. Food stores of any kind are a necessity for citizens to survive. In this location we also see another type of green space appearing: the urban park. This green space is not used for production, but more for leisure and recreation.

Analysis of Bucharest city

The city grows in all directions, following the radial roads that connect the city with the country and touching the ring road on some points. The main infrastructure of Bucharest exists of an inner and an outer ring, cut through by the Dâmbovița River that crosses the city. The outer ring lies around the city and connects the different radial highways going into all directions. The outer ring road with the radial roads forms a primary road structure within the region overlapping the secondary road structure that follows the river pattern of the region. The primary road system offers an efficient connection



Analysis layers of the Bucharest Region

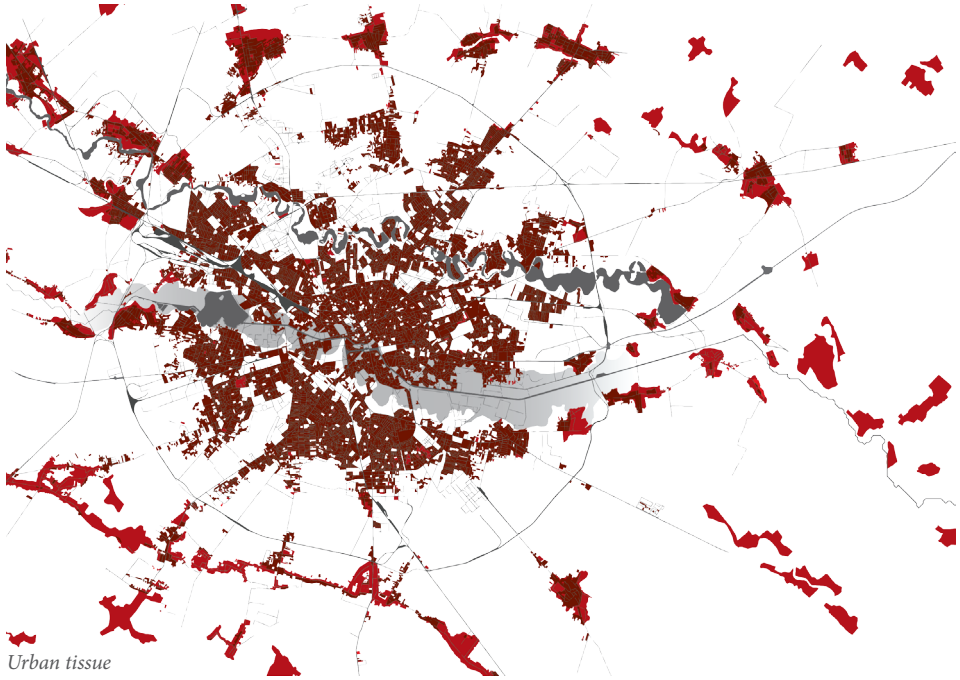
between Bucharest as the metropolis of the region and its agricultural hinterland.

The urban tissue of Bucharest grows like an amoeba into different directions, following the radial roads and sometimes touching the outer ring road. In this way the city has a lot of edges where it literally touches the agricultural hinterland. These edges form possibilities to make a connection between the city and the agricultural hinterland.

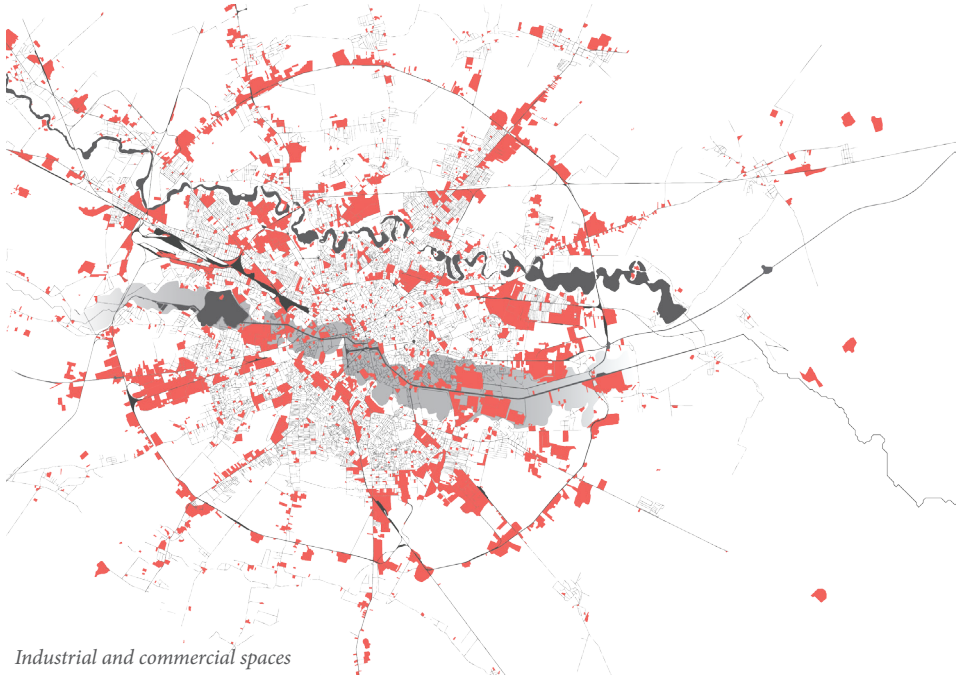
Industry in Bucharest is mainly found around the outer ring of the city, where there is a good access with road and rail transportation. Along the radial roads, some of the industry is reaching into the city. Bucharest's economy is centered around industry and services. The industry in Bucharest takes account for approximately a quarter of the countries industrial produce. Bucharest is the industrial center of the region, hosting most of the industrial branches of the country. Important for the import and export of products for Bucharest is the airport Henri Coanda in the north of the city.

The agricultural hinterland is all around Bucharest and sometimes reaches

Infrastructure



Urban tissue

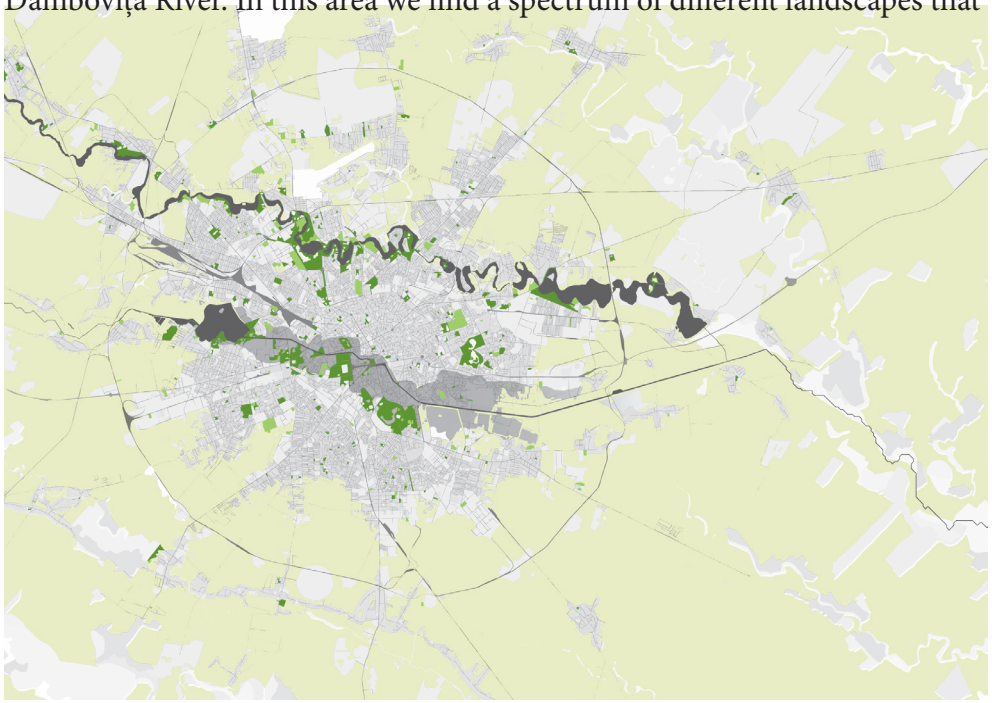


Industrial and commercial spaces

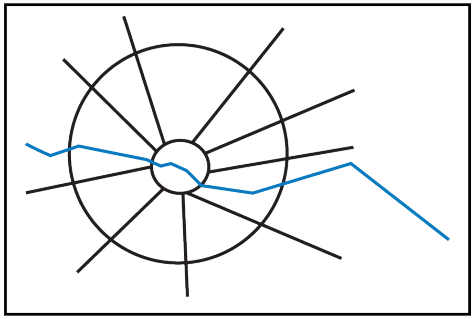
over the outer ring road in-between the radial roads. Next to the agricultural green structures there are recreational green structures found in Bucharest, mainly around the rivers Dâmbovița and Colentina. The Colentina River exists of multiple connected lakes and is slowly flowing. Around it are qualitative green spaces that are connected and used as parks. In the southern floodplain of the river Dâmbovița are also found several green spaces that are used as parks for recreation. These parks are not as well connected as the northern ones and they are found as a green dotted line through the middle of the city. These parks offer the opportunity to create a metropolitan green structure that continues through the city and that makes a connection with the agricultural hinterland at the same time where both agricultural and urban functions are found.

Site Analysis

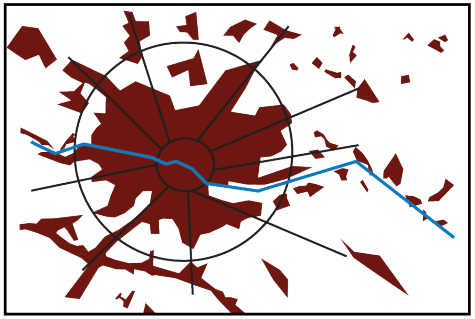
The goal of my design is to implement Metropolitan Agriculture into structure that connects the metropolitan city of Bucharest to its producing hinterland. To do this I choose my location on the East side of Bucharest, along the Dâmbovița River. In this area we find a spectrum of different landscapes that



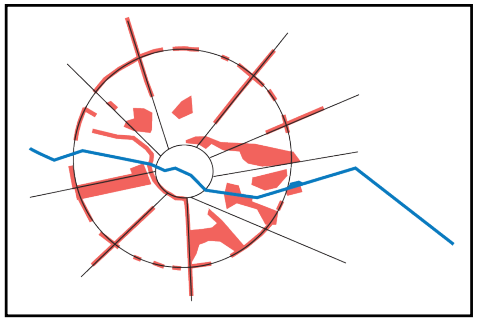
Agriculture & green structure



Infrastructural scheme



Urban scheme



Industrial scheme

Agriculture & green structure scheme

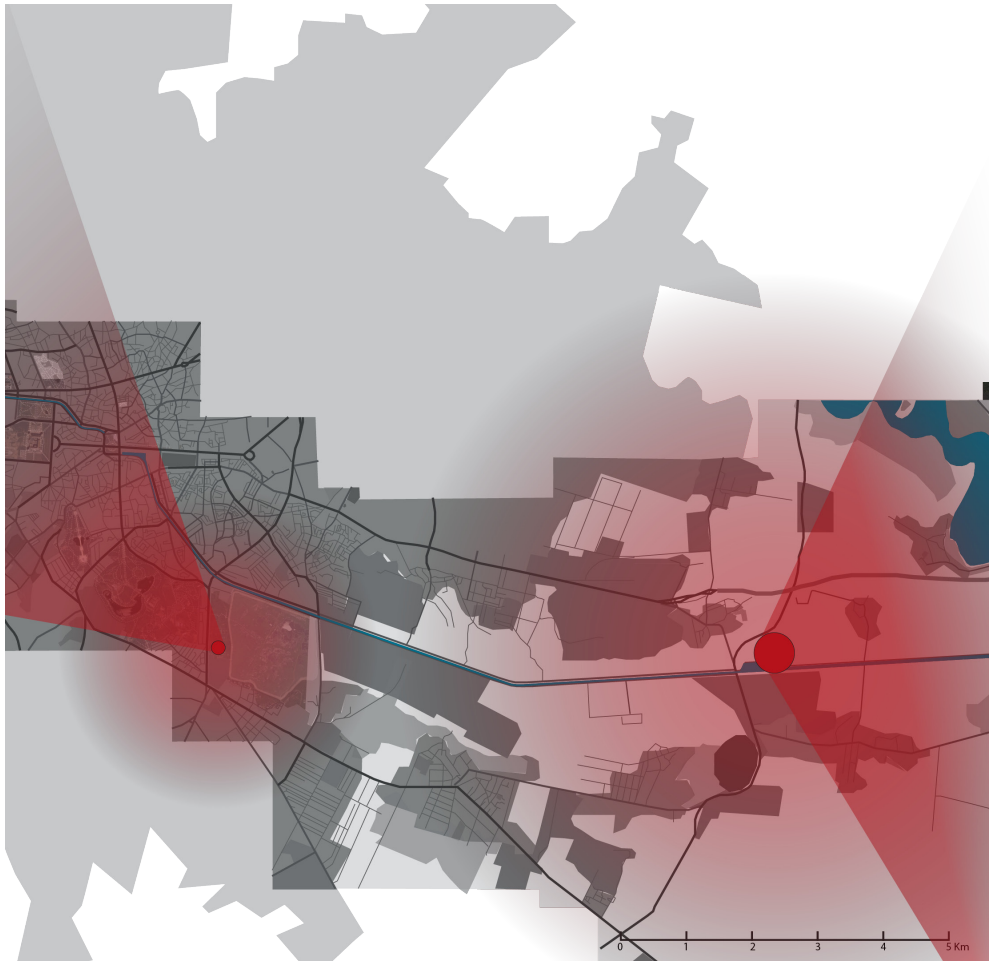
correspond with the defined landscape types. All landscape types (urban, rural and natural) are found within this location. On this site I see an opportunity to connect the different landscapes and let them work together within a metropolitan agricultural structure.

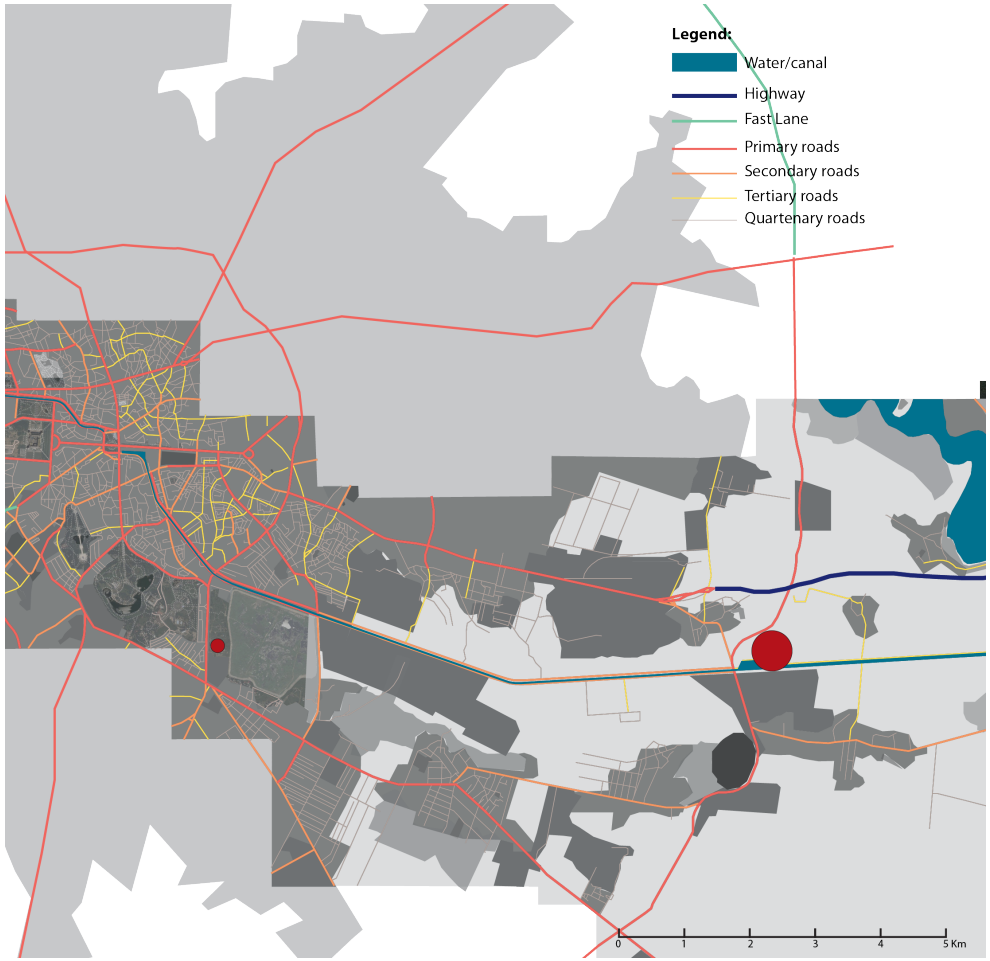
2 Catalyst locations

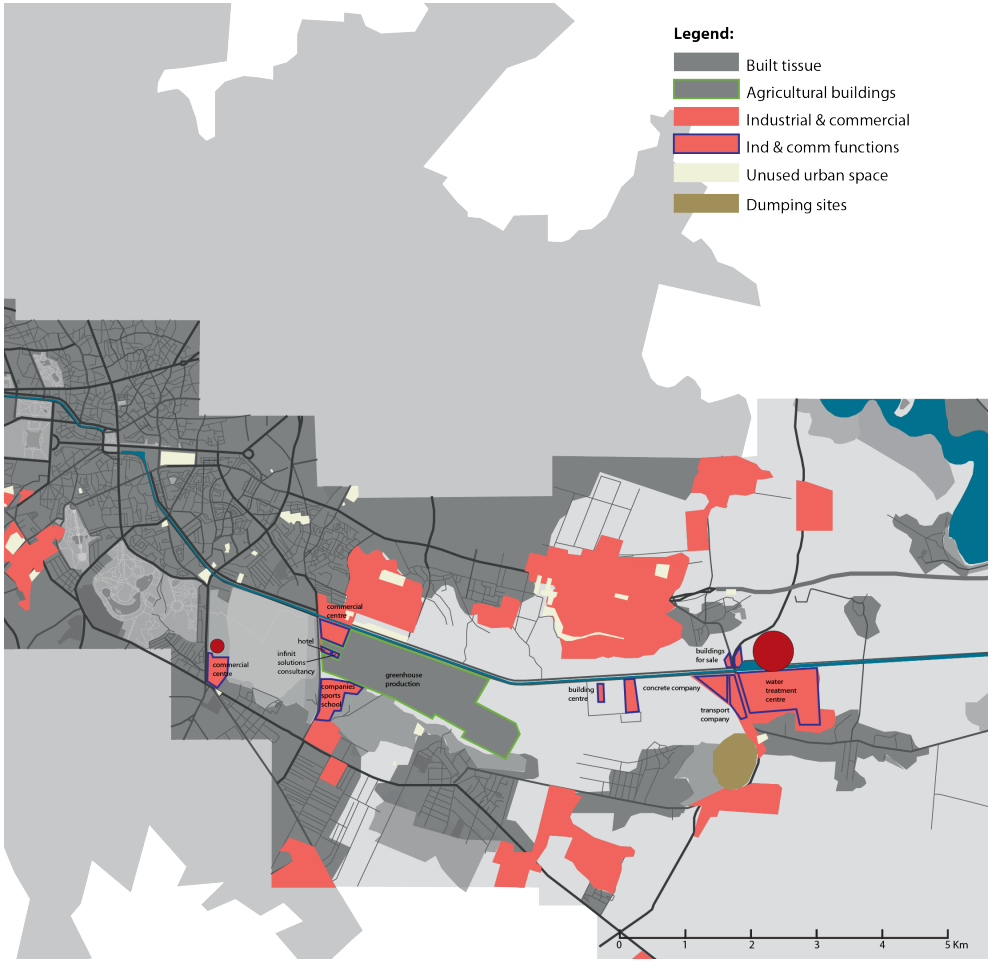
Within the new structure I distinguish two places that will have a catalyst function for economic agricultural activity of the metropolitan agricultural structure that will connect Bucharest to its hinterland through the scales. I will go into the exact functioning of these locations in part III of this thesis. However, these two catalysts locations work on different scales and also have their influence on different scales. The location closes to the centre of Bucharest, Vacaresti Market has more influences on the city and the regional scale, whilst the location situated at the outer ring road, Bucharest Food Trade Centre, will have more influence on the national and international scale. Together they cover all scales of the agricultural economy of Romania.

Good connection of the catalyst locations through the scales

The catalyst locations are well connected to the existing infrastructure on the local, regional and national levels. Vacaresti Market is connected to the inner ring of the city of Bucharest and is connected to the hinterland villages by several radial roads. The Bucharest Food Trade Centre is connected to the





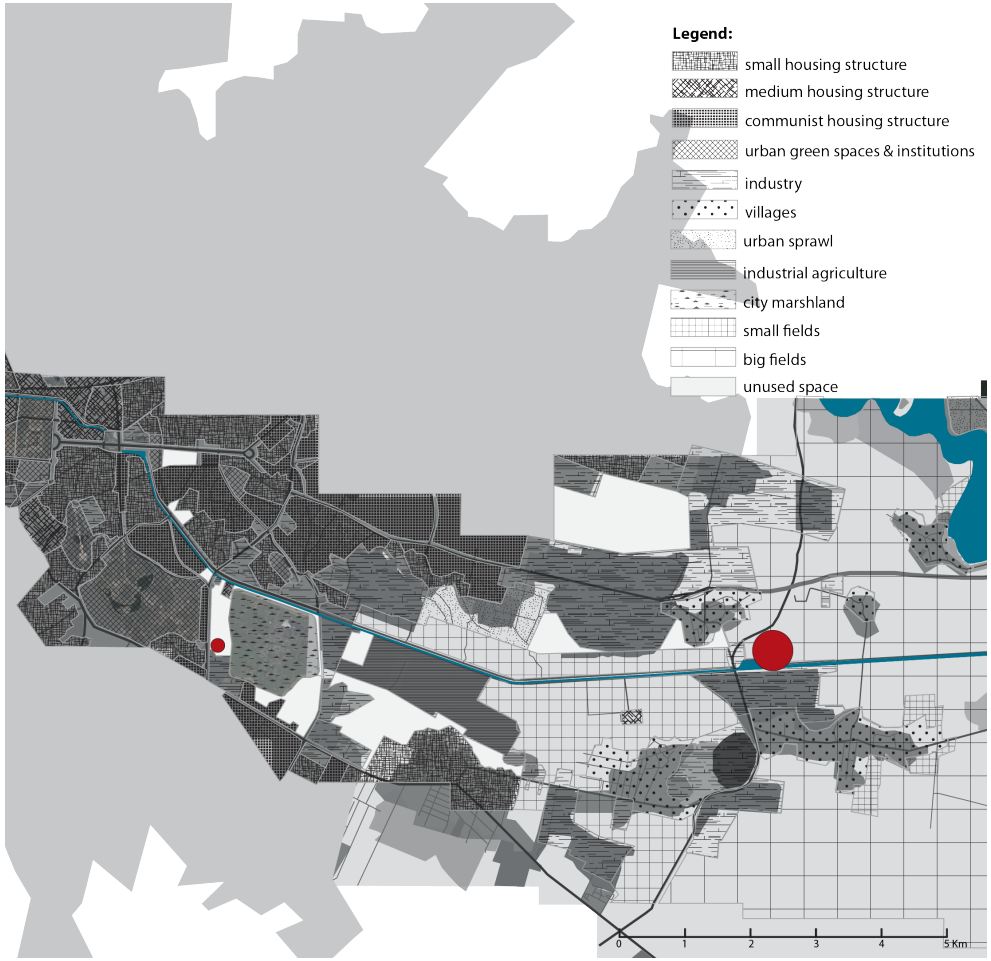


outer ring road of Bucharest, to the A2 highway, which leads to the currently most important harbour of the country at Constanta, to the national railway network and to the future Bucharest-Danube Canal.

Green structure

The continuous element in this location is the Dâmbovița River, which was canalized in the early 80's. In the old floodplain of the river we now see a high diversity in green spaces that are important in a metropolitan agricultural structure. These green spaces are of high ecologic value when considered together, because they complement each other and form a spectrum of green landscape types.

The green spaces found exist of urban green spaces, such as sports and several recreational parks, there are rural green spaces consisting of agricultural fields and allotment gardens and also we find a natural ecosystem: Lacul Vacaresti. This is a basin with concrete borders that would serve as a water basin for the city, but the basin was never filled. While lying unused in the middle of the city for twenty years, a natural ecosystem has evolved by itself within the basin. This ecosystem is of great value for 90 rare bird species that nest here. On the 5th of June 2012 the Romanian Environment Ministry stated that Lacul Vacaresti would be listed and protected (Rovana PLUMB).



Inside the city there is a well maintained park structure. The first location in this structure that is not yet developed as a park is the location of Vacaresti Market. Here lays an opportunity to extend the existing network of developed green spaces and make a link to the green spaces that are beyond.

Industry and built tissue

Around the Dâmbovița and the floodplain containing the spectrum of green spaces we see the city of Bucharest embracing these relatively open spaces and reaching the ring road surrounding the city of Bucharest. Within this urban landscape are found different functions such as housing, commercial units and industrial units. Next to Vacaresti Market is a large shopping mall that counts only a few years. This mall could be combined with Vacaresti Market. Next to the location of the Bucharest Food Trade Centre are a lot of buildings for sale, there is a water cleaning plant and also a concrete company and a transport company. All of these industries could profit from the new position of the Bucharest Food Trade Centre, the new industries arriving and from the future harbour at Glina.

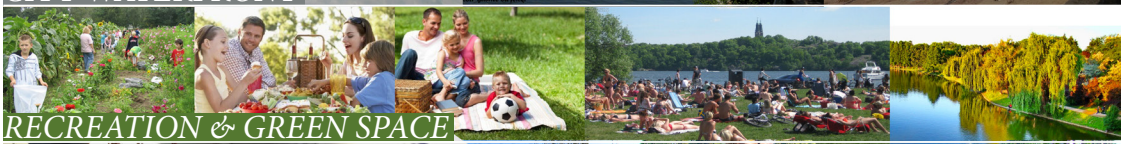
Spatial experience

The urban tissue of Bucharest city is generally quite dense. It exists of communist buildings and smaller housing from before the communist era. The dense building tissue opens in the floodplain of the Dâmbovița River, where we see the continuous green structures of parks existing and further away a selection of differentiated green spaces. The further you get from the centre into the hinterland, the more the landscape opens up and the more spacious the landscape becomes.

PART III

METROPOLITAN AGRICULTURAL STRUCTURE


BUCHAREST IMPRESSION
CITY WATERFRONT


RECREATION & GREEN SPACE


FOOD PRODUCTION & SALES

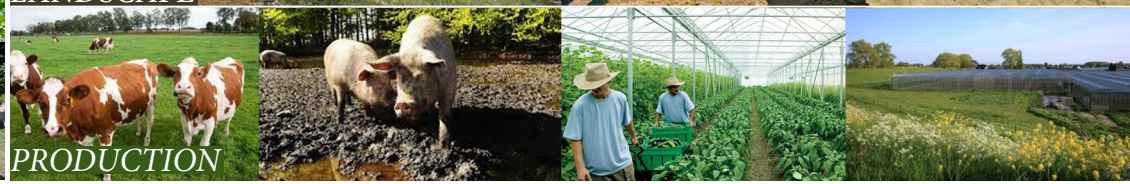

TRANSPORT & SALES


SMALL SCALE AGRICULTURE
LANDSCAPE


PRODUCTION


TRANSPORT & SALES


MEDIUM SCALE AGRICULTURE
LANDSCAPE


PRODUCTION


TRANSPORT & SALES


LARGE SCALE AGRICULTURE
LANDSCAPE


PRODUCTION

5. Design strategy

The concept of my design is to create a metropolitan agriculture structure that connects the metropolitan city of Bucharest to its producing hinterland. This metropolitan agricultural structure should facilitate the different landscape types within and connect them through the scales. The designed structure as a whole can be considered as a metropolitan agricultural design that will function on multiple levels, which creates a better connection between Bucharest and its productive hinterland.

Within this new structure I distinguish two places that will have a catalyst function for economic agricultural activity, the most important driver that will connect Bucharest through the scales. These two catalyst locations will become the main parts of the metropolitan structure that connects Bucharest to the hinterland. Within the structure there will be place for bottom-up initiatives that fit within the ideas, principles and guidelines for Metropolitan Agriculture.

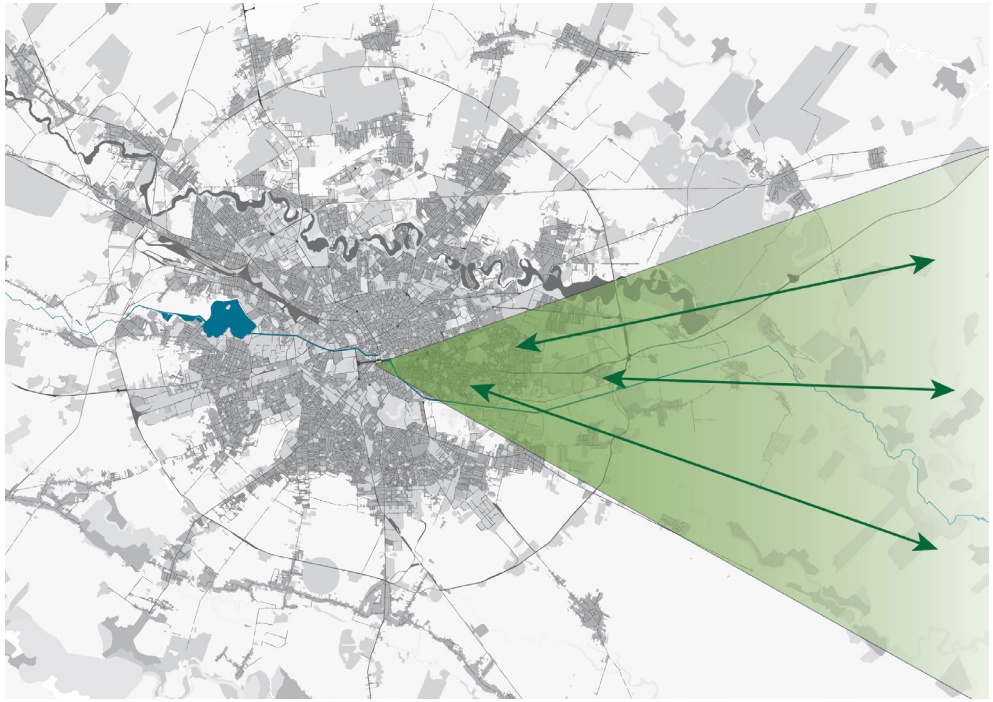
Design Steps

To create a metropolitan agriculture structure that connects Bucharest to its hinterland there are several steps to take in executing the plan:

Step1:

The first step is to develop the two catalyst locations, Bucharest Food Trade Centre and harbour at Glina and the Vacaresti Market site. These two places will be connected to the hinterland through their function in the agricultural economy.

The Bucharest Food Trade Centre will do this on a national and international level, becoming the central place for Romania where farmers can sell their produce, where raw products are processed and where food is exported and imported through one of the many infrastructure channels connected to this site. The Bucharest Food Trade Centre will start to develop as a central



Concept: connecting the city and its productive hinterland through a metropolitan agricultural structure

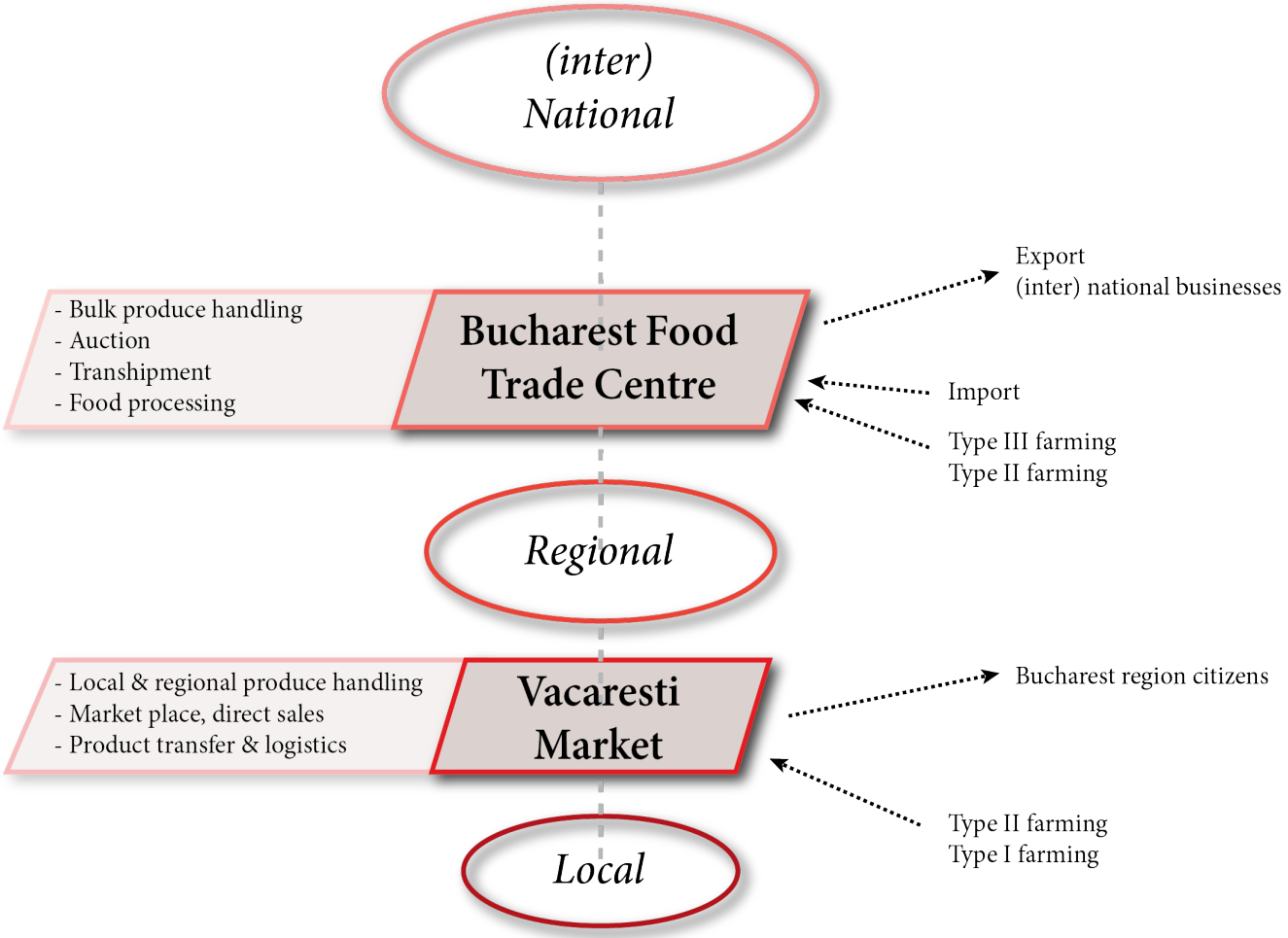
Two catalyst points well connected to infrastructural networks on different scales

trading place for Romanian agricultural goods. As soon as the trade centre has established its central function it can grow and will also attract processing industry. With the money generated by the trade centre, the harbour can start to be developed. These two can grow in parallel till they reach their optimum size for their functions.

Vacaresti Market will make this connection on a regional and local scale. Regional farmers can come there to sell their products and regional businesses and local citizens come here to buy the products. Vacaresti Market will start as a professional market where there are opportunities for farmers to set up shop themselves, or to choose for product handling by the market. When the market is there, Food Park Vacaresti can start to be developed. This new park will generate more visitors, also for the market. In a few years, when Vacaresti Market becomes more recognized as the central market for local products, it can expand in size and function, for instance adding food storage and logistics. Food Park Vacaresti can be (partly) financed with the money generated by Vacaresti Market.

Both catalyst locations will function as generators for more initiatives around agricultural activity such as gastronomy or new processing industry of food or bottom up initiatives that fit into the metropolitan agricultural framework.

Step 2:
The second step in the process towards a metropolitan agricultural structure is to develop the first part of this structure in-between the two



Two catalyst locations act as connectors on different scales

catalyst locations. The structure will facilitate different types of landscapes and will make them more accessible both for agricultural functioning of the landscape and for recreational use. Within this structure will be room for bottom-up initiatives that fit within a Metropolitan Agricultural framework and that accentuate the multifunctional use of the place.

In the mean time the network connections of the two catalyst locations grow. They facilitate more commerce and they generate bottom-up initiatives and attract extra industry around the harbour.

Step 3:
The third step is to develop the second part of the metropolitan agriculture structure, which will complete the connection between the city, the Bucharest Food Trade Centre and harbour, and the hinterland beyond the outer city ring. The metropolitan agriculture structure will function as a facilitating structure for different producing landscapes within, hosting smart initiatives that make use of the existing situation and contribute to society in a material or immaterial way.

In the mean time the network connections of the two catalyst locations are still expanding. By this time Vacaresti Market has reached its final proportions and the Agricultural Food Park is finished while the Bucharest Food Trade Centre is still expanding and the Harbour is functioning as such.

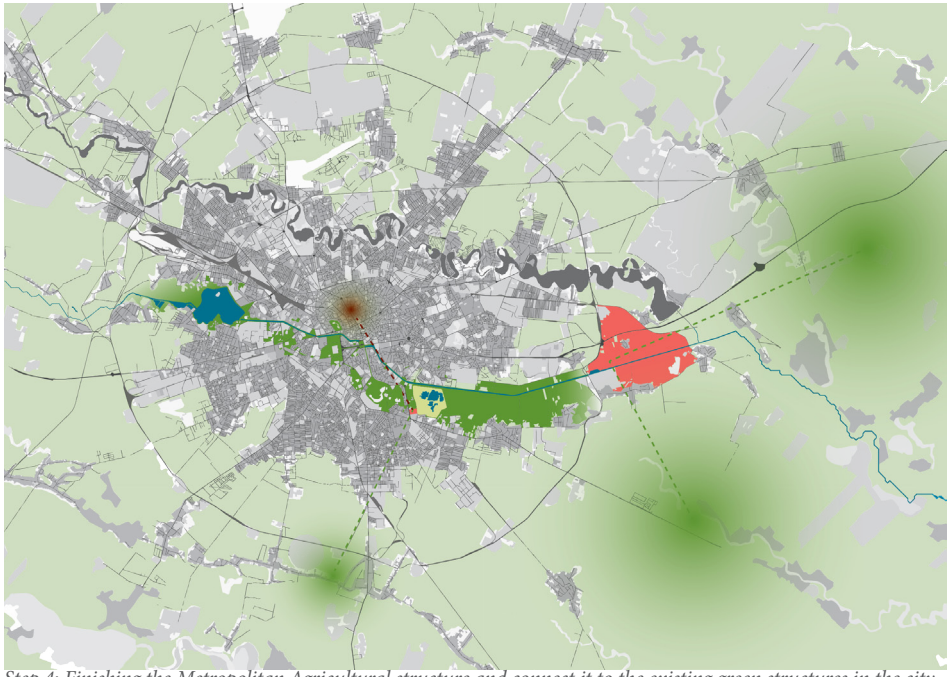
Step 4:
The final step finishes the metropolitan agricultural structure that connects Bucharest to its producing hinterland. It connects the new metropolitan structures to the existing city green structures. Adding extra green structures in the city can connect the existing parks and can also contribute to the ecologic value of the city green structures. These connections will also form a basis for a slow traffic network through the metropolitan agricultural structure to make it more accessible for recreation and display the different landscapes that the structure hosts.

Existing situation

Step 1: Developing Bucharest Food Trade Centre + Glina harbour and Vacaresti Market

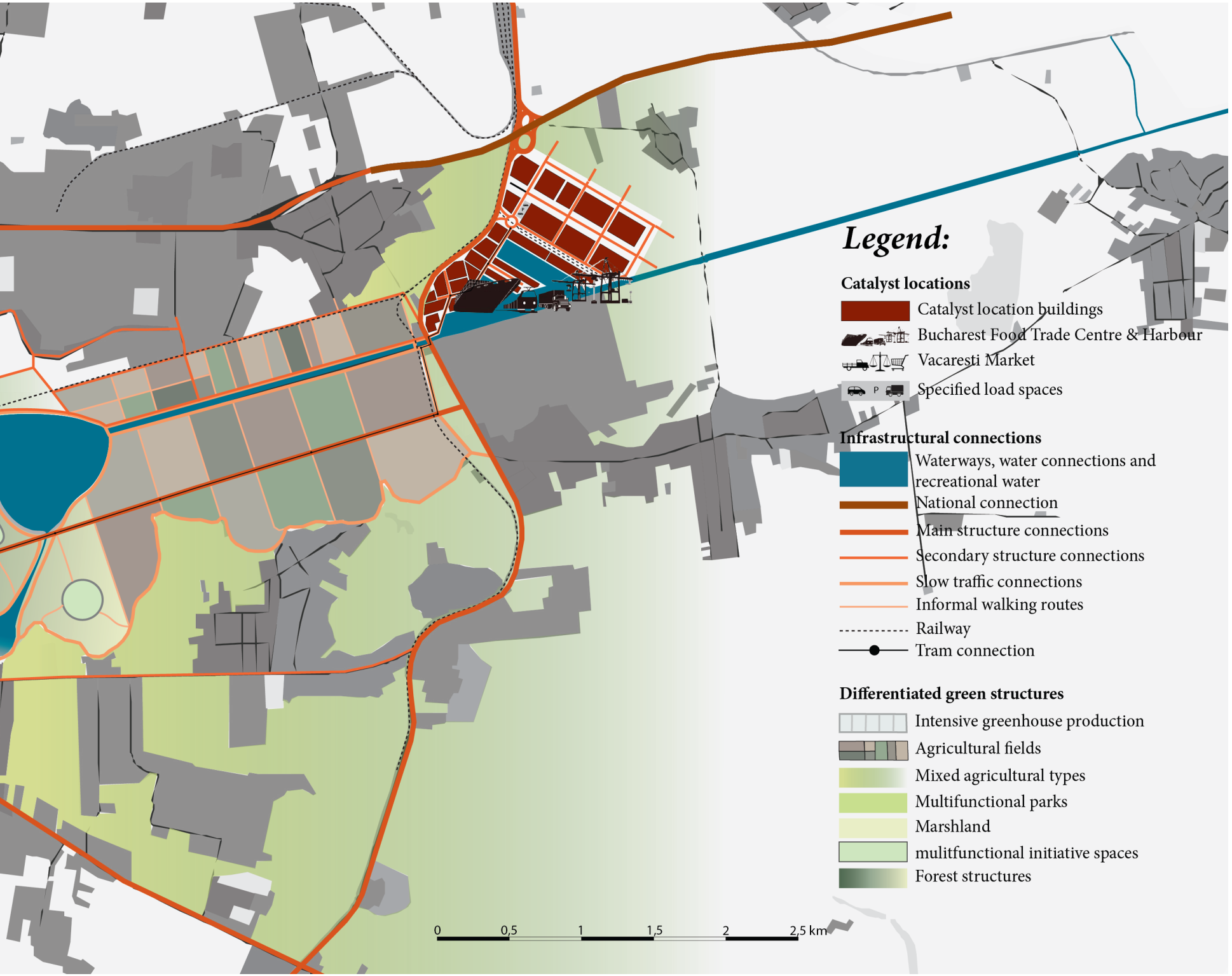
Step 2: Developing the first part of the Metropolitan Agricultural structure

Step 3: Developing the second part of the Metropolitan Agricultural structure



Step 4: Finishing the Metropolitan Agricultural structure and connect it to the existing green structures in the city

MASTERPLAN


Legend:
Catalyst locations
Catalyst location buildings
Bucharest Food Trade Centre & Harbour
Vacaresti Market
Specified load spaces
Infrastructural connections
Waterways, water connections and recreational water
National connection
Main structure connections
Secondary structure connections
Slow traffic connections
Informal walking routes
Railway
Tram connection
Differentiated green structures
Intensive greenhouse production
Agricultural fields
Mixed agricultural types
Multifunctional parks
Marshland
mulitfunctional initiative spaces
Forest structures
0
0,5
1
1,5
2
2,5 km

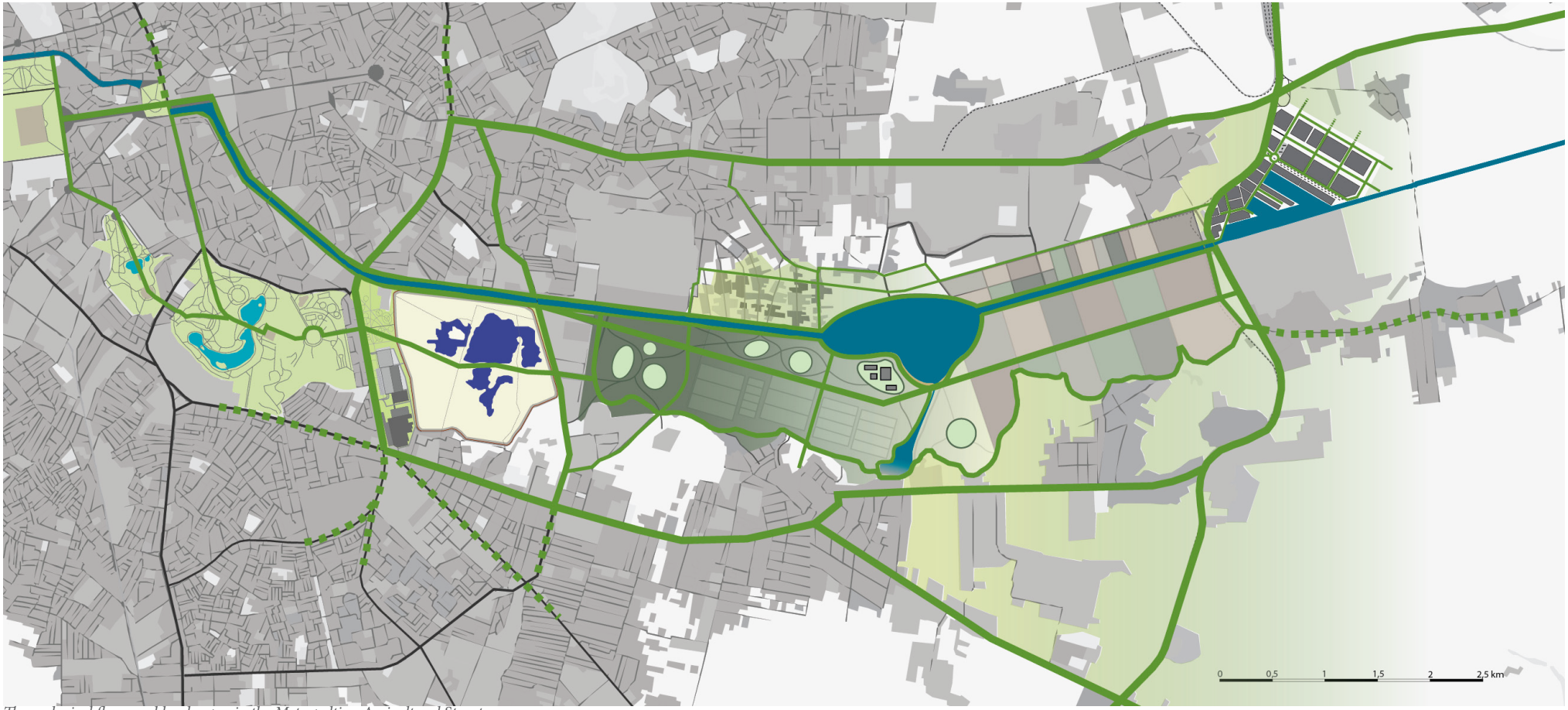
6. Spatial implications and interventions

The concept of my design is to create a metropolitan agriculture structure that connects the metropolitan city of Bucharest to its producing hinterland. Within this structure there are different layers that each make connections on different scale levels. The most important parts for this design are the structure itself and the two catalyst locations within the structure. In this chapter I will discuss the implications of these connections through the scales and the spatial interventions made to realise this Metropolitan Agricultural Structure.

The Metropolitan Agricultural Structure

Spatial implications

The metropolitan agricultural structure consists of sustainable connections that host urban, agricultural and ecological flows at the same time. The structure connects places that have an urban, agricultural and/or ecological character and it does this through the scales. The structure facilitates the right circumstances to reach a sustainable balance between the different flows. This balance can change throughout the structure, depending on the focus of the surrounding landscape, yet all flows should always be hosted.



The ecological flows and landscapes in the Metropoltian Agricultural Structure

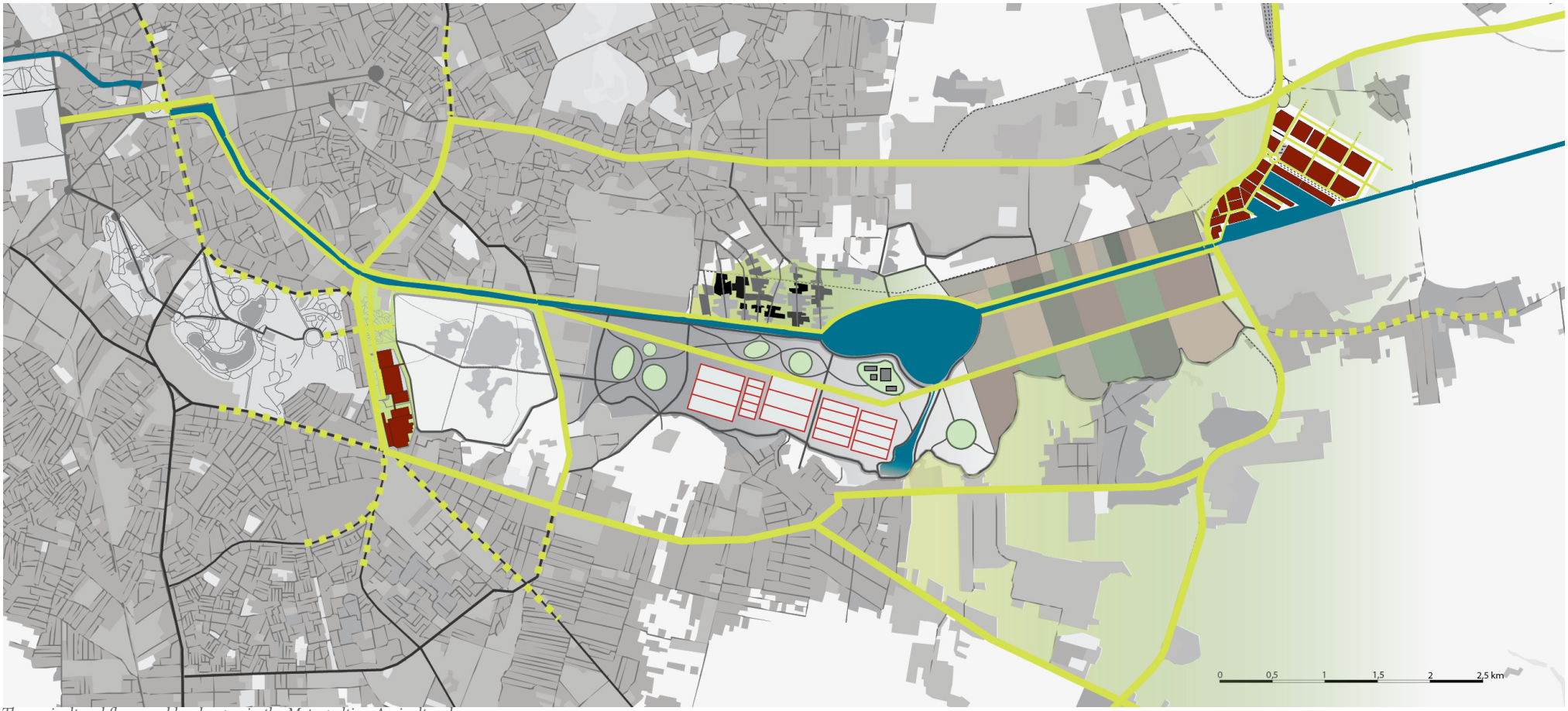
E + A + U

GUIDELINE:
within each connection of the metropolitan agricultural structure there should be facilities for ecological, agricultural and urban flows

In the four schemes we can see where these different flows are found. When we overlap them, we can see that they mainly overlap on the main connections and the slow traffic connections. These connections are the backbone of the structure and are carefully designed to meet the high standards of a metropolitan agricultural structure.

Spatial interventions

Guideline for the design a metropolitan agricultural structure is to host the three types of flows within one connection. This means that we can find routes for urban flows, routes for agricultural flows and routes for ecological flows in one section. The different routes within one connection may overlap, but they should all be facilitated.



The agricultural flows and landscapes in the Metropoltian Agricultural

The colours underneath the sections in this chapter represent the hosted routes. The emphasis of the structure changes throughout the structure. Inside the city the emphasis is more on the urban flows whereas further outside the city the emphasis will be more and more with the agricultural flows

Throughout the structure there are continuous ecological elements used such as rows of trees, bushes and grass strips. The main recognized element I used for the design of this structure is the Juglans regia, or the common walnut tree. This tree is seen everywhere in the Romanian countryside surrounding Bucharest and it is a well-recognized tree for the Romanian citizens.

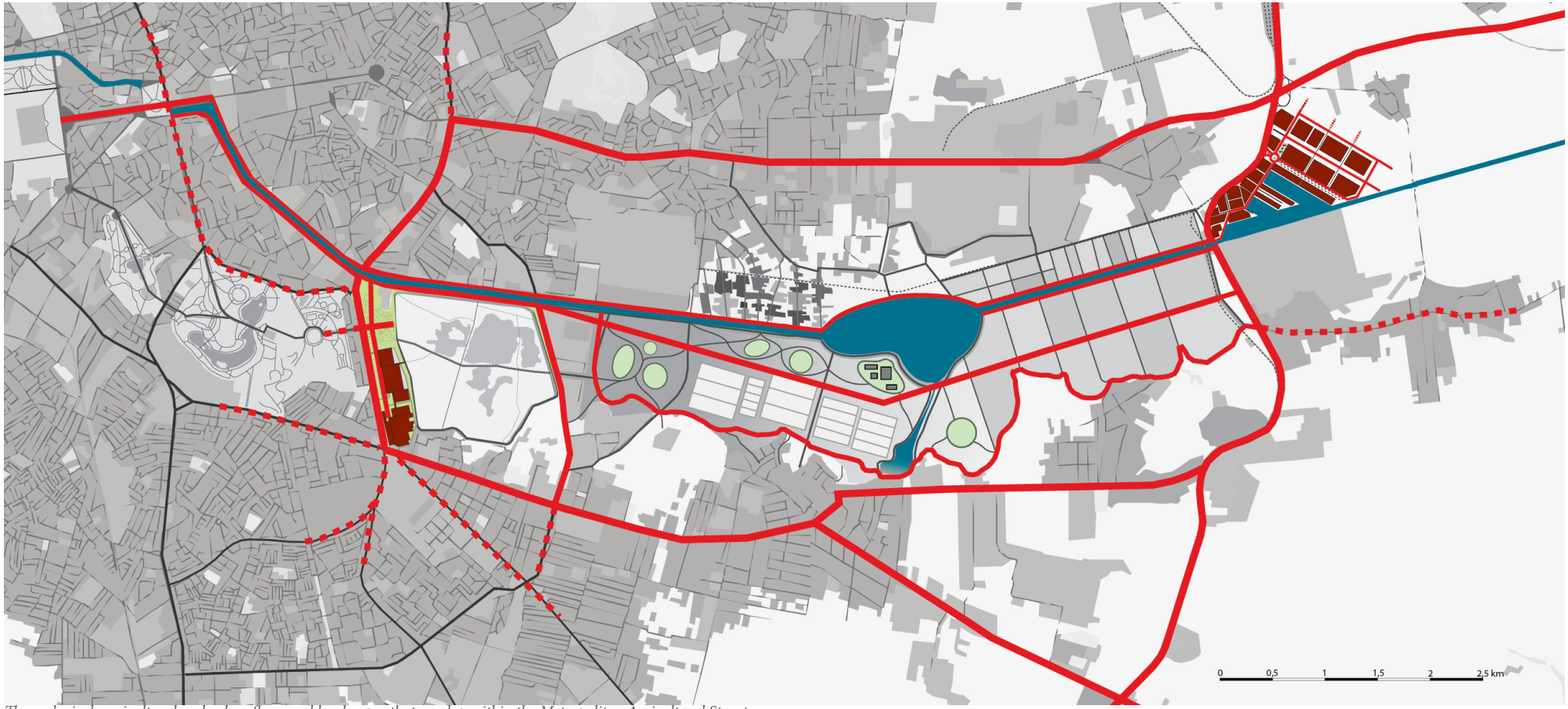
Romania is also one of the main export countries in walnuts. These trees are used along the main connections and along the slow traffic routes in the metropolitan agricultural structure. The people can collect the walnuts and they are known for their high nutritional value and their positive effects on human health. In this way these trees alone account for an ecological, agricultural and urban contribution to the metropolitan agricultural structure and they are used as the continuous icon for this structure in Bucharest.

For an optimal ecological value and purifying effect on the air, the trees must be placed in a way that ventilation can still take place. This means that the tree crowns don't merge overhead when they are mature and that they don't

The urban flows and landscapes in the Metropoltian Agricultural Structure

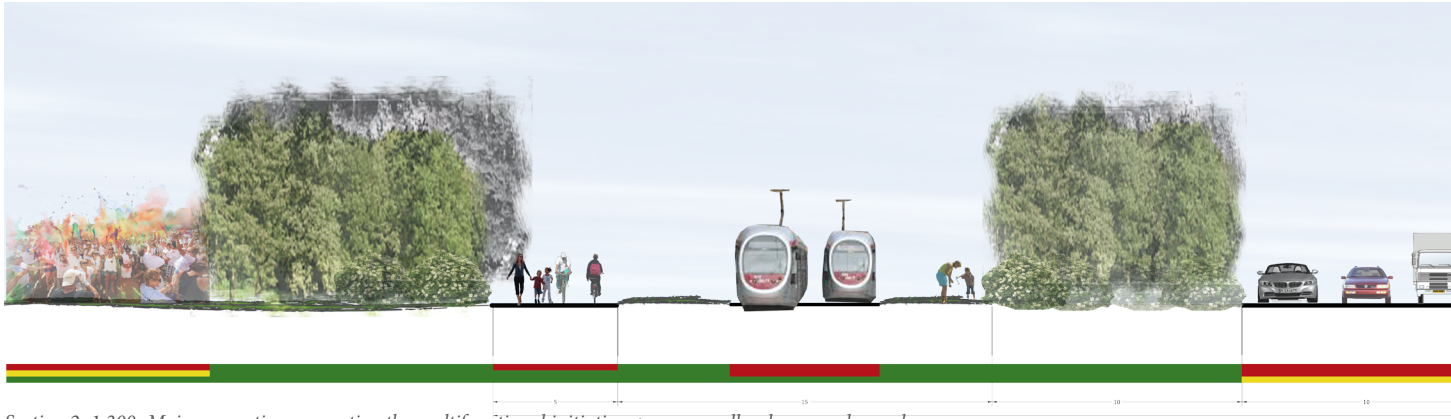
have an overhang covering the road for more than 1/3 (Pötz, 2012). For my design this means that for instance the Jusglans regia trees should be placed 15m from each other and preferably not directly at the side of the road.

The Walnut tree (Photo Credit: DK Limited/CORBIS) and its fruits



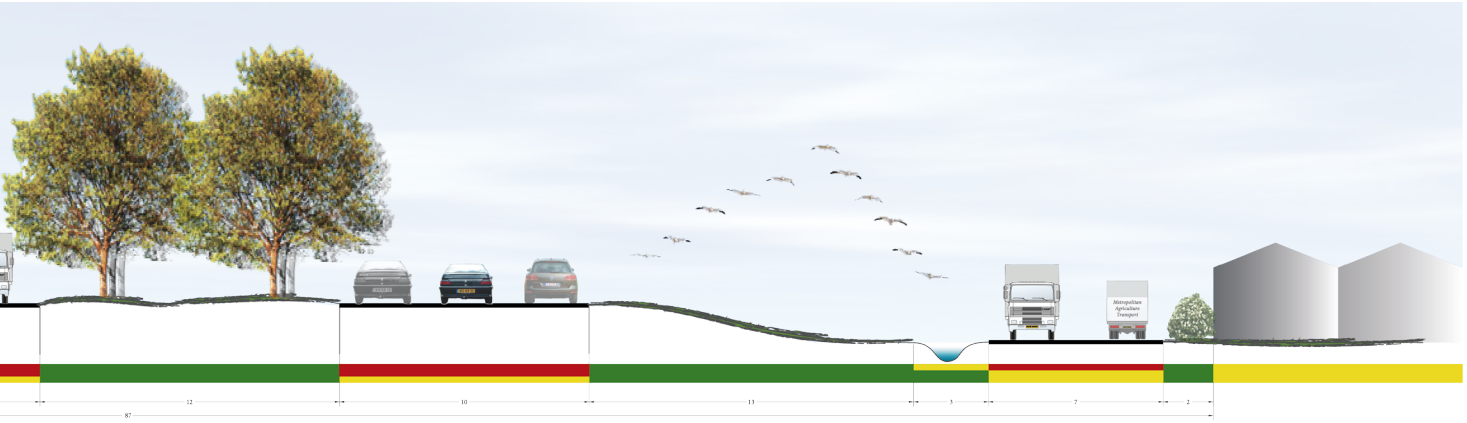
The ecological, agricultural and urban flows and landscapes that overlap within the Metropolitan Agricultural Structure

Section 1_1:300_Examplary profile of the main connections. Important is that they all accomodate urban, agricultu



Section 2_1:300_Main connection connecting the multifunctional initiative spaces, woodland area and greenhouses

ral and ecological flows in a balanced way.



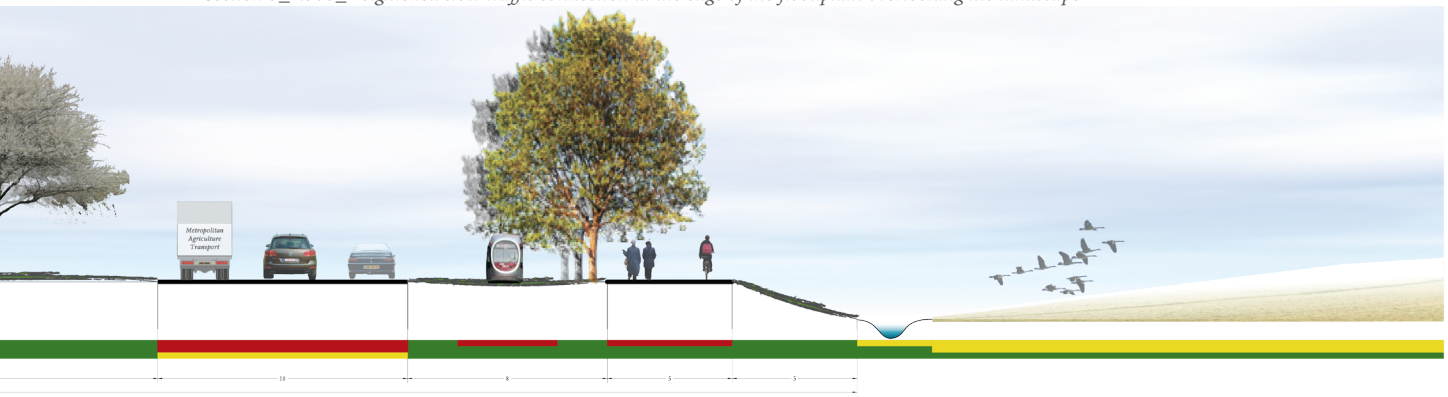
City - - - - - - - - - >

The general relationship between the urban, agricultural and ecological flows inside the city and further into the hinterland along the main connections: More urban flows in the city and more agricultural flows in the hinterland.

Section 4_1:300_Main connection through agricultural fields

Section 5_1:300_Slow traffic route along Dambovita river and agricultural connection for the fields, with in the background Glina Harbour

Section 3_1:300_Heightened slow traffic connection at the edge of the floodplain overlooking the landscape



Bucharest Food Trade Centre & Glina Harbour

Spatial implications

The location addressing the scale of the super region is the Bucharest Food Trade Centre. This location will be developed together with the new harbour of the Bucharest – Danube canal at Glina, along the city ring of Bucharest. It has excellent accessibility by road (the ring road and the A2 highway to Constanta), rail and water (the Bucharest-Danube Canal). Also the Henri Coanda airport is easy to reach by road and rail. This position makes the location attractive on different scales: on the level of the metropolitan city and region of Bucharest, as the current central place of commerce in Romania. On a national level this location is attractive as a gathering place for product export and import. Also on a continental and global level this site is attractive for easy and cheap transport options of the Romanian food, since it is linked to the Danube. Through there it is easy to provide Western European countries and the Middle East through the Black Sea.

The Bucharest Food Trade Centre will become a professional national and international trading and processing place of food products produced in Romania. It will become the gate for export and import of food products from this super region to other super regions. The Bucharest Food Trade Centre will fulfil a market position on a scale that is not yet known in Romania. Currently there is no central market for the country in food products. Existing stock markets and processing industries are decentralized. The Bucharest Food Trade Centre will provide a more efficient and easy place for all parties involved to meet and trade.

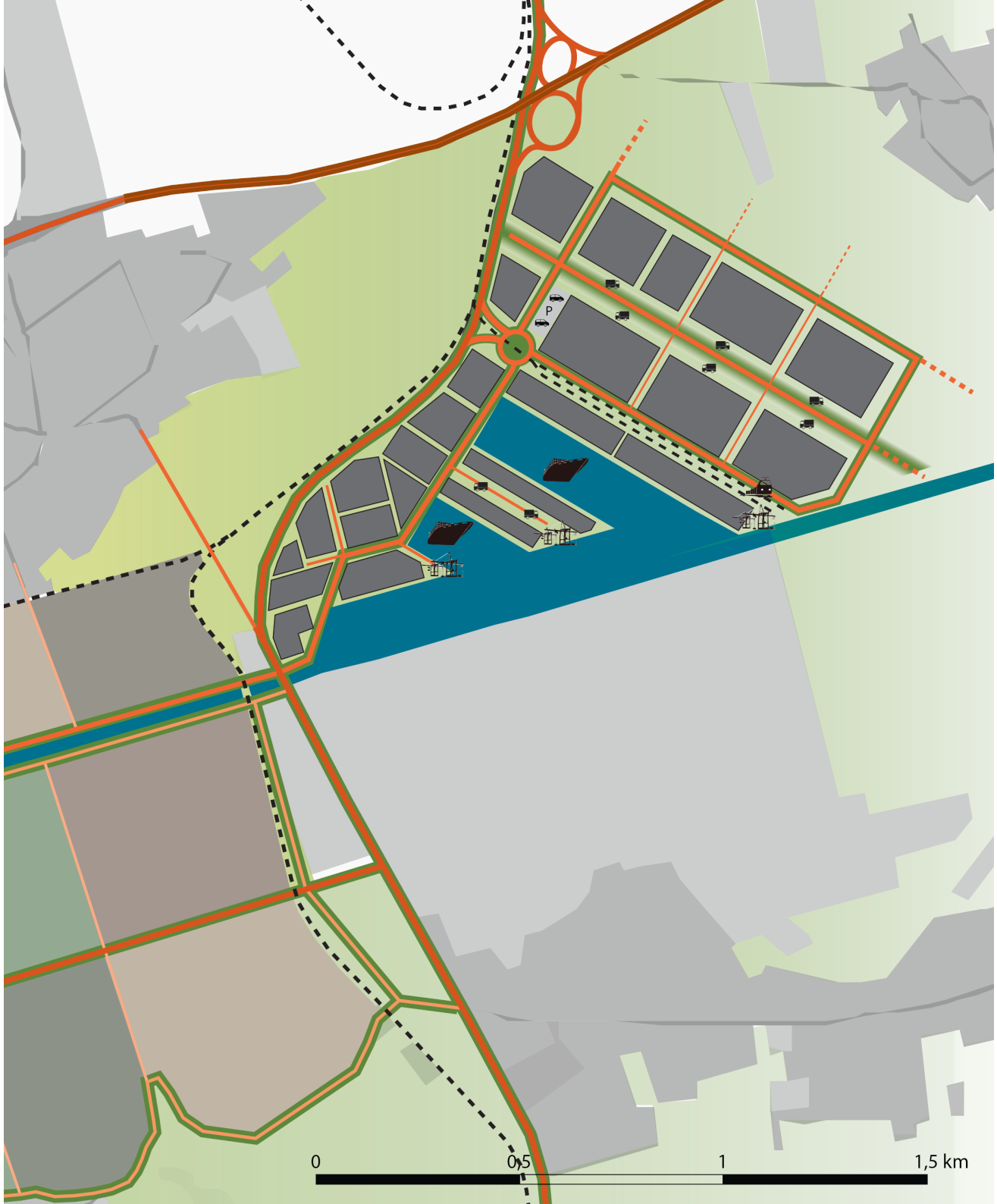
The Bucharest Food Trade Centre will also become a catalyst in attracting food-processing industries. Currently, a lot of the raw food products produced in Romania are exported, processed somewhere else, and then again imported for consumers within Romania. Here lays an opportunity to fill this gap and to start to process more of Romania's own produce.

Spatial interventions

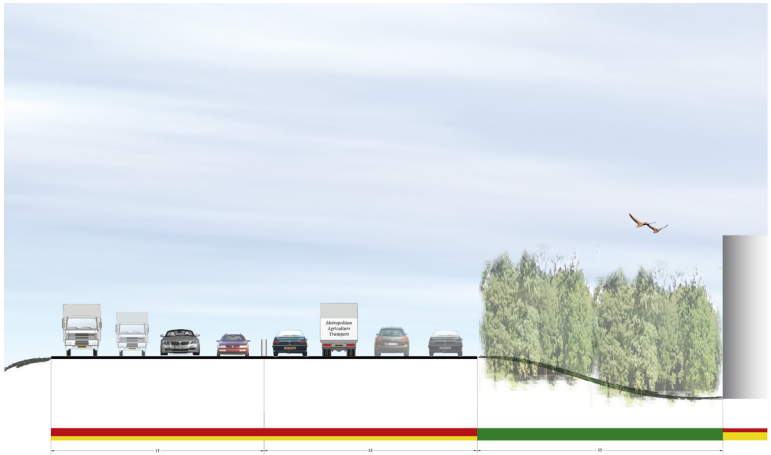
The Bucharest Food Trade Centre and Glina Harbour will develop together. On this site the complex will start with a few main buildings for the core

trade functions of the Bucharest Trade Centre (for different products such as grains, fruits & vegetables, fish & meat) and for office buildings. For the harbour the first buildings will host the primary functions of the harbour (storage and transfer) and for office buildings. In a later stage the Bucharest Food Trade Centre and Harbour will expand and host more services (this can be combined with urban services such as hotels, restaurants, tourist information centre, etc.), specialized trade buildings and storage opportunities. This location is also open to food processing industry that wants to settle on this location.

The layout of the plan for the harbour and the Bucharest Food Trade centre is designed according to a grid structure (which is common in harbours and food trade centres such as Food Centre Amsterdam and Rungis, Paris). The grid structure adapts itself to the existing geomorphology, following the existing ring road of Bucharest and fanning out into a constant grid structure further away from the city. This grid structure can be continued as the Bucharest Food Trade Centre grows. This location will start out in size comparable to the Food Centre Amsterdam. From there it will start to expand. For the future there is enough space to expand this site into the size of Rungis. This will, of course, take a lot of time, but the opportunity for spatial growth is present at this site.

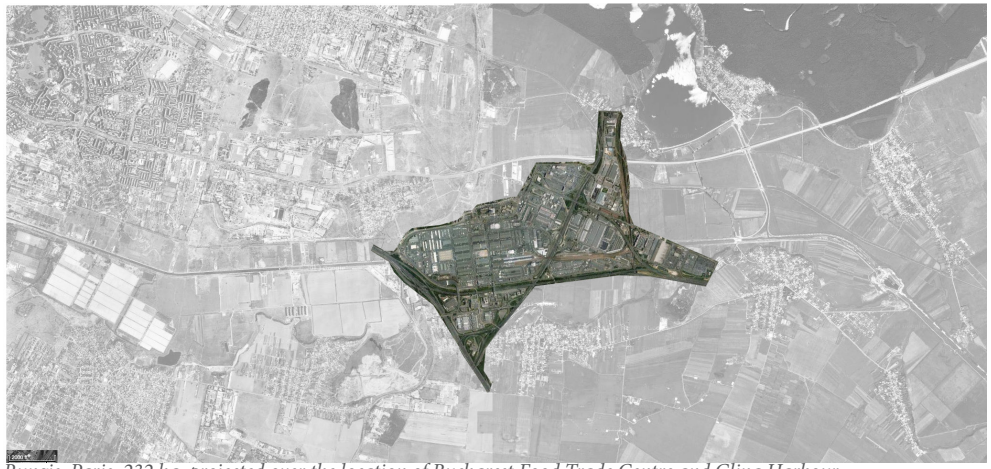


Plan of the Bucharest Food Trade Centre & Glina Harbour



Section 6_1:300_Glina Harbour, the Bucharest Food Trade Centre and the outer ring road of Bucharest

Food Centre Amsterdam, 26 ha; projected over the location of Bucharest Food Trade Centre and Glina Harbour

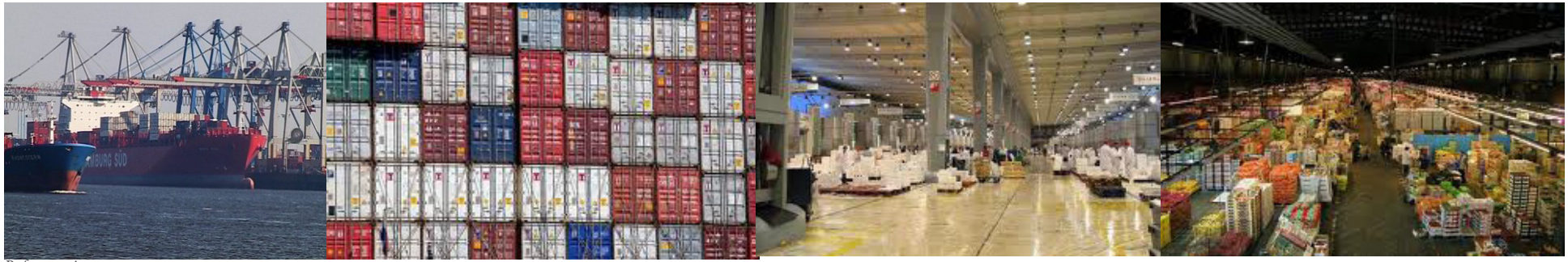


Rungis, Paris: 232 ha; projected over the location of Bucharest Food Trade Centre and Glina Harbour

Reference: World food centre on potential location in Rotterdam working together with the international harbour

Reference: the new design for Food Centre Amsterdam

Reference: Rungis, Paris. Largest wholesale food market in the world



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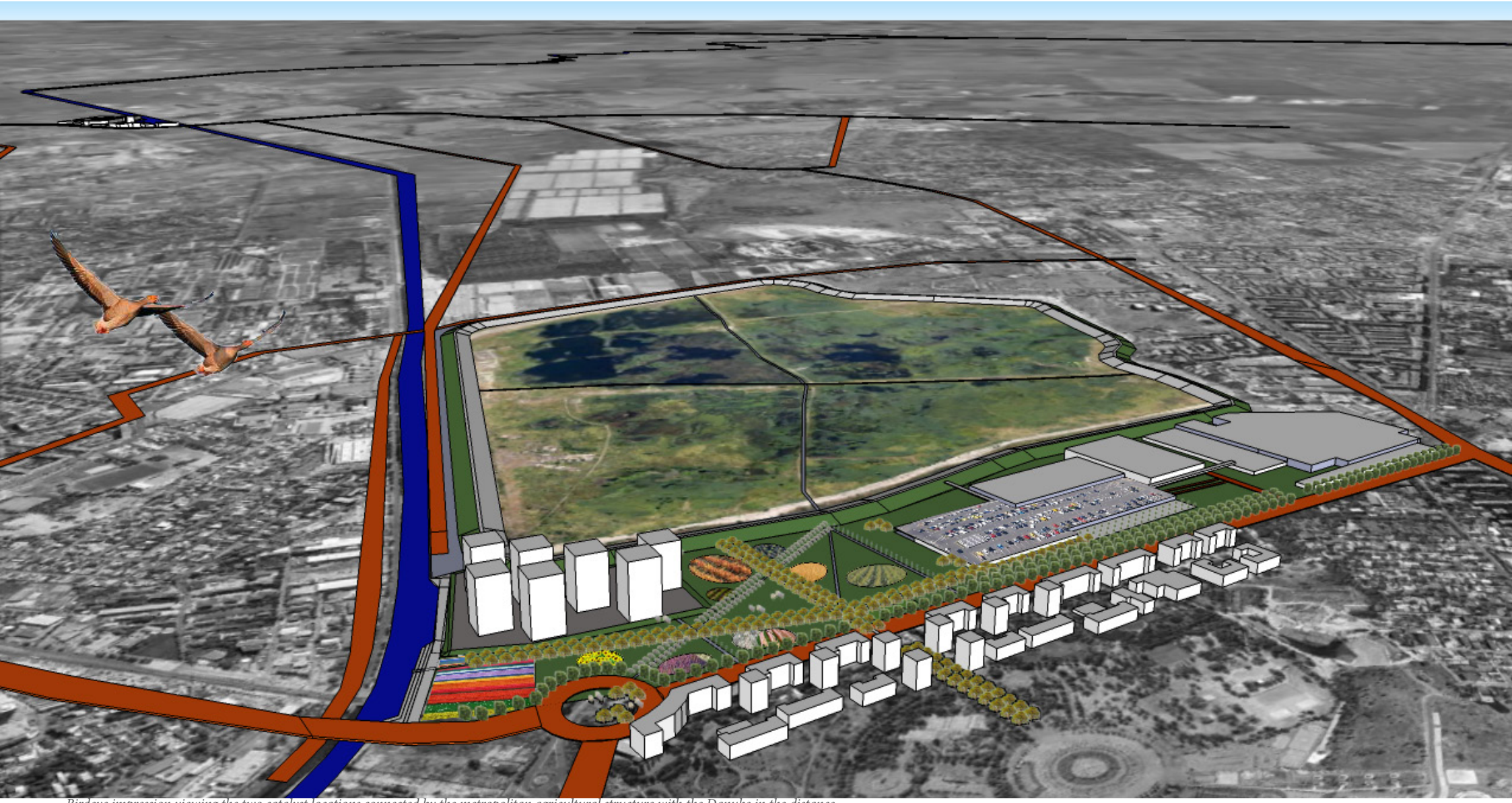


Birdeye impression viewing the two catalyst locations connected by the metropolitan agricultural structure with the Danube in the distance

Vacaresti Market Site

Spatial implications

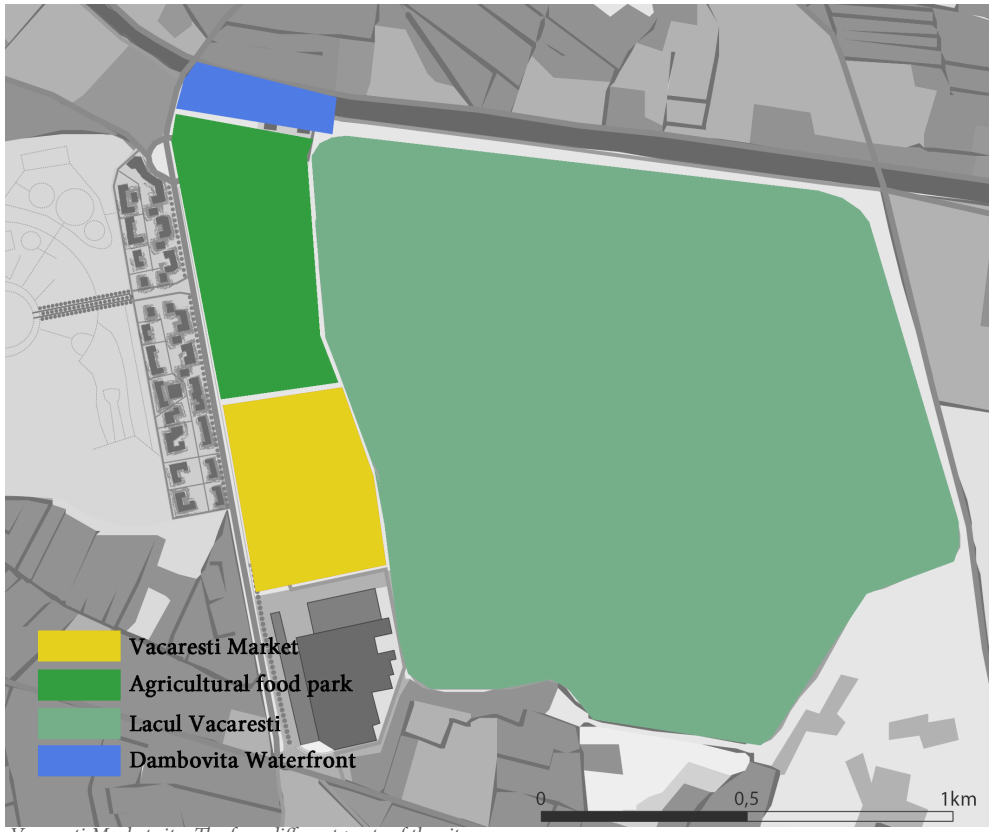
The location addressing the smaller scales is the Vacaresti Market site, which is inside Bucharest city. This location is next to Lacul Vacaresti, a big shopping mall, a neighbourhood from the Communist era and the Dâmbovița River. Also this location has a good accessibility. It borders the inner ring road of Bucharest city and several radial roads, which connect the rural villages in the region to the city. In the development plan of the municipality this site is meant as a green space for the city. It is the first location in the green structure of the city that is not yet developed, but the purpose of the municipality is to turn it into a public green space.

The Vacaresti Market site exists of four different parts: Vacaresti Market, the agricultural food park, Lacul Vacaresti and the Dambovita Waterfront. The Vacaresti Market site as a whole will contribute to the urban, the economic and ecologic value for the city and become a generator for more initiatives that can take place within the metropolitan agricultural structure.

Spatial interventions

Vacaresti Market

Vacaresti Market will become a central place where regional farmers can come to sell their produce to a central stock market and where regional gastronomy and businesses can come to buy them. It will become thé central market place for the city of Bucharest where people and professionals from



Vacaresti Market site_The four different parts of the site

Vacaresti Market site_current situation

all over town can come and buy local fresh food and typical Romanian food.

Vacaresti Market hall will start relatively small, hosting the basic market functions such as procurement and sales of products from local and regional farmers. Farmer suppliers can choose whether they sell to the central buyer or whether they want to set up shop inside the market hall (or on the market square in front of the building) themselves. In the beginning the market will function more as a traditional market, but eventually it will grow to a more professional and centralized regional food market. As the market grows, additional buildings will be built, including more functions such as services and gastronomy.

Vacaresti Market site_First market halls with market square in front of the buildings
Agricultural food park and Lacul Vacaresti's main path structure, planting scheme and connecting eco-bridges
Infrastructural connection at the waterfront goes underground to make space for watersquare and recreational harbour

Vacaresti Market site_Expansion of the market halls and functions of the market integrated with the park function
Secondary path structure for agricultural food park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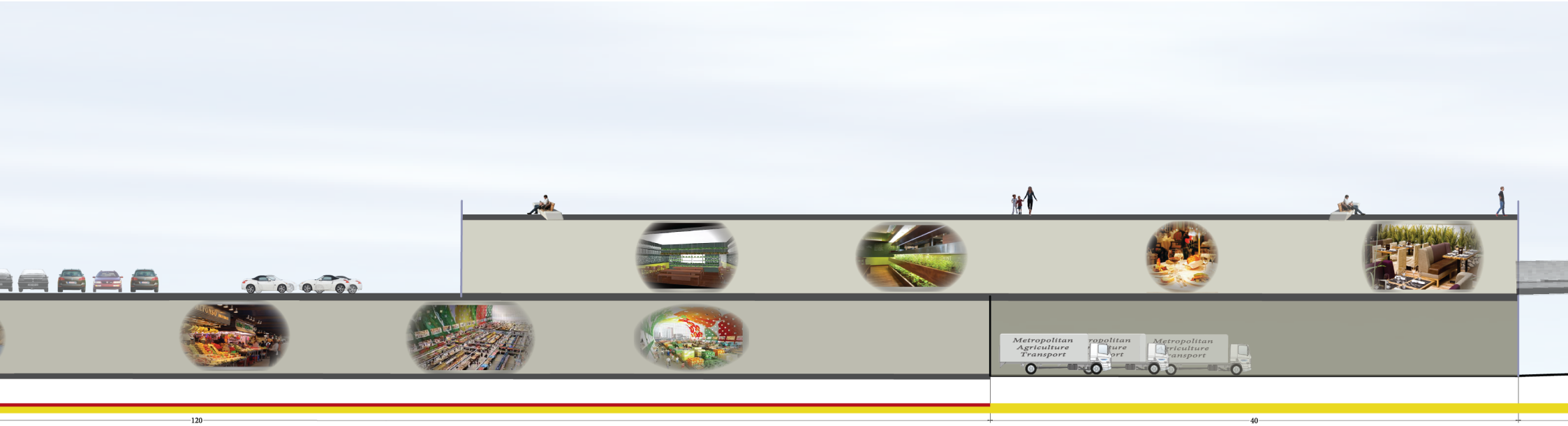
The space around the market hall will change with the hall itself during the process: At first, the market hall will be connected to the existing shopping centre to attract extra people from the city that do their shopping there. The market square in front of the building with a traditional food market will display the function of the building and will also attract people from the road passing by. The basic layout of the urban agricultural food park will attract new recreational visitors, who will be attracted to the market through the connecting path structure and layout of the park.
As Vacaresti Market becomes more known, it can grow and become more professional. Farmer suppliers will choose more often to sell their products to the central buyer, as this takes a lot of effort and time from their hands, which they can better use on their fields. As the traditional market shrinks, the market square will get a new displaying function, hosting the newly attracted gastronomy terraces and functioning as an urban square. At the same time the buildings of the market will expand, hosting extra services, specialized shops and a hotel, which will be situated in the higher tower of the complex.

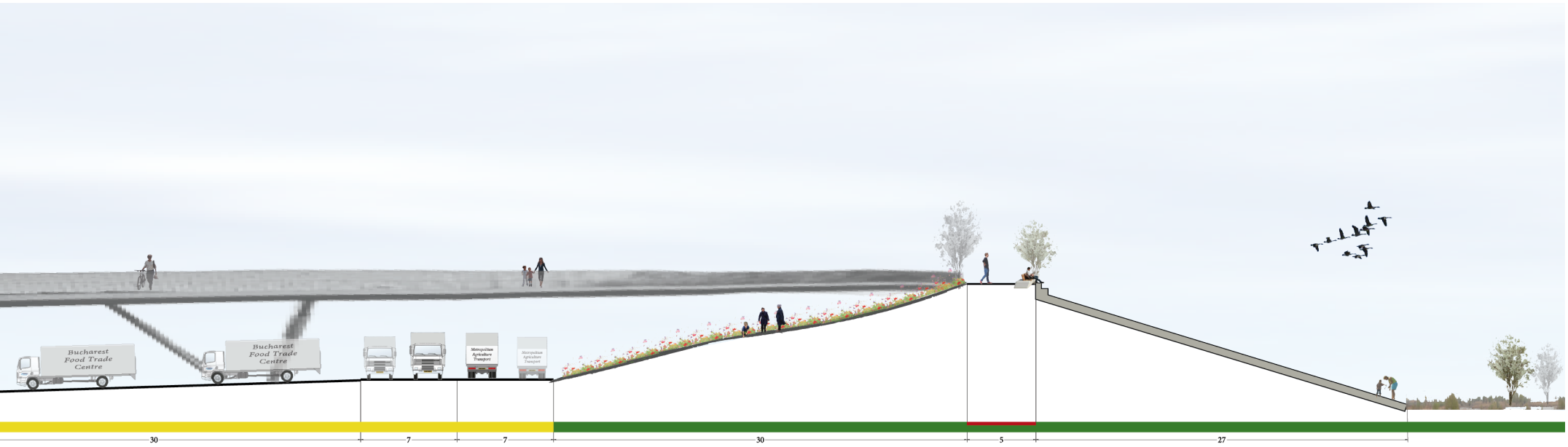
The buildings of Vacaresti Market will make a direct connection to Lacul Vacaresti through a bridge, which connects the parking deck to the main slow traffic route around Lacul Vacaresti. This will make the access to Lacul Vacaresti easier, coming from the city by car. On the other hand it makes the access to the market easier for people recreating in the agricultural food park or in Lacul Vacaresti.

Birdseye impression of Vacaresti Market Site

Section Vacaresti Market_1:400_The Calea Vacaresti, The market square, Vacaresti Market with impressions of the inside, the connecting bridge to Lacul v



acaresti and the restored marshland_section in two parts



The agricultural food park

The agricultural food park will function as a new link in the existing green structure. This will become a place where people can see the agricultural products grow, which they can buy at Vacaresti Market. In that way, the park also has educational value to the visitors. A restaurant that is situated in the halls of Vacaresti Market, overlooking the park, will use these products for their dishes. The agricultural food park will function as an educational park, and offer room for leisure and recreation. As a green element within the metropolitan agricultural structure it will also function as a connection between the existing green structure and the Dâmbovița River and is a stepping stone from the existing green structure to Lacul Vacaresti.

The agricultural food park functions as a stepping stone between the existing green structure, Lacul Vacaresti, the Dâmbovița river and the buildings of Vacaresti Market. The basic path structure is based on this connecting function (it facilitates direct connections) and on the 'shortcut' function that it, together with Lacul Vacaresti, has for locals to get from one part of the city to another. These main paths will provide an easy connection to the existing urban parks and the woodland part of the structure through eco-bridges over the main infrastructural connections. The secondary path structure in the park is based on the design language found in the existing neighbouring parks in Bucharest. These curved routes display a variety in agricultural crops that can change through the seasons and the years, according to their nature. People can follow them to discover and enjoy the different crops and to recreate within the park. Generally the crop types are divided into three agricultural divisions abundantly found in Romania: fruit, vegetables and flowers. Inside the park are also flower fields that can be used for flower picking and for recreation.

The planting scheme of the park follows the agricultural food park concept: all trees are fruit trees and nut trees that are common in Romania. Walnut trees line the main path structure that is a link in the general connection of the metropolitan agricultural structure. Chestnut trees line the edge of the park. Different types of plum trees line the 'shortcut' paths. Within the park are also found clumps of these trees in the middle of the fields.

The trees, shrubs and crops used in the park are all species that are common in Romania or commonly used in Romania (for instance the tulips are sold on each corner of the streets of Bucharest). The tree structures that are accompanying the main path structures are (from left to right) the Juglans Regia (walnut), the Prunus domestica subsp. syriaca (Mirabelle plum) and the Aesculus Hippocastanum (Horse Chessnut).

The basic tree types used in the park

The park is divided in three different sections that all have their own theme: flowers, fruits and vegetables. The crops within these sections may change through the seasons or the years and they are all edible.

The flower part lining the water contains flowers such as (from left to right) tulips, sunflowers and lavender.

Examplary flowers used for the flower fields in the park

The fruit section in the middel exists of two different plum orchards, an apple orchard with different types of apple trees and a fig orchard. This part of the park will change the least through the years in types, but as the orchards age they will produce more fruits.

The fruit types used for the orchards in the park

The vegetable section contains common crops grown a lot by Romanian subsistence farmers such as onions, cabbage and spinach. Then there are also the common crops for large scale farmers such as wheat and corn. In this section there is also an olive orchard (this is also a common tree species in Romania)

Examplary vegetables related to the subsistence farmers

Examplary crops related to the large scale farmers

the olivea is also a common tree for Romania

Current situation

Impression of the view from the edge of Lacul Vacaresti onto the ecologic reserve and the agricultural food park

Impression from the diagonal prune path in the agricultural food park

Lacul Vacaresti

Lacul Vacaresti is bordering the agricultural food park. This artificial lake was supposed to become a basin for drinking water for the city, but it was never finished planned. A concrete border was built and surrounded this area in the late 1980's. The existing water in the lake springs from natural resources, but this represents only 10% of the planned amount of water. In this lake, lying fallow for almost 25 years, a marshland area has existed that is host to a series of rare, endangered and vulnerable bird species. During breeding season the lake is a host to many European bird species that nest here. On the 5th of June 2012, the Romanian environment ministry (Rovana PLUMB) stated that Lacul Vacaresti would be listed and protected because over 90 rare species of birds nest here. (bucuresti.wikia.com).

In the metropolitan agricultural structure, Lacul Vacaresti will be renovated and cleared from the waste found inside. It will be dedicated to its ecological function, human beings are to be considered as guests inside this area. The main slow route will follow the high edges of the lake. It will offer a great view on the city and on the marshland from a higher level, showing the clear contradiction that is found in this place between the dense urban tissue and the open ecologic marshland. The most used shortcuts through the lake will be made accessible by a wooden footbridge that is higher than the water during wet seasons. In that way it also stays accessible in winter when the water level rises. This area will become supervised and protected against pollution (as the urban parks are already).

Impressions of the qualities of Lacul Vacaresti as ecologic park

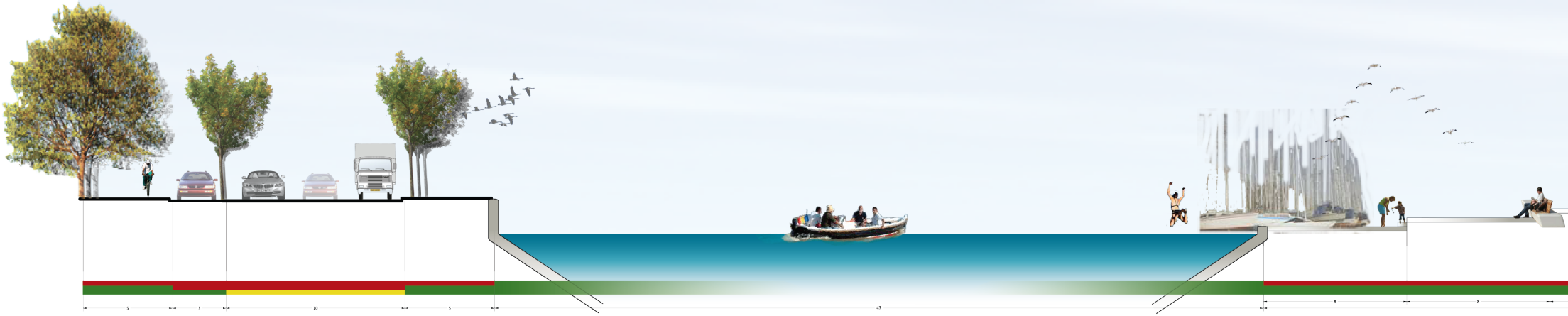
References for wooden footbridges through Lacul Vacaresti

Dâmbovița Waterfront

The last intervention of Vacaresti Market site is the waterfront at Dâmbovița river. At this site, the water will be made more accessible by a stepped water square. People can step by step get closer to the water and can even jump in if they prefer. There is also a small harbour created for recreational boats that can make use of the Dâmbovița River. This site will become directly connected to Vacaresti Market with a straight path through the agricultural food park for an optimal connection between Vacaresti Market and the waterfront of the Dâmbovița.

Reference: Sea organ in Zadar, Croatia

Reference: design for waterfront of Georgetown Park, Washington, USA



Section 7_1:300_Main connection along Dambovita river, water square and recreational harbour and beginning agricultural food park with walnut tree lane_Materialization below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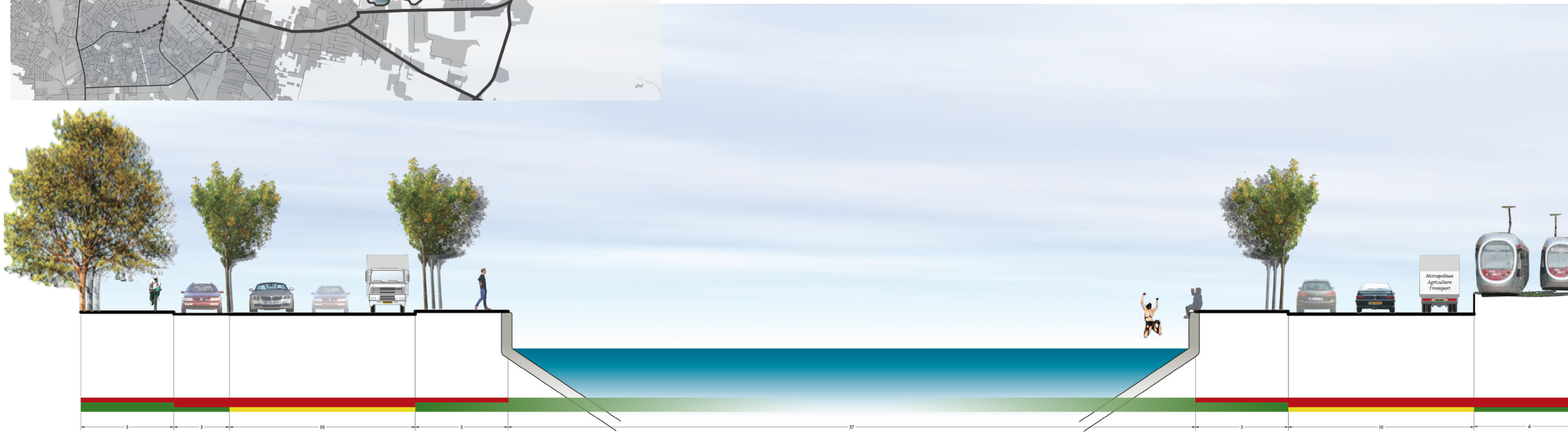


Section 8_1:300_Main connection along Dambovita and slow traffic route at the edge of Lacul Vacaresti overlooking the lake and the city

reference image for the tulip fields within the agricultural park
(design for Park 21 by Vista Landscape Architects (www.vista.nl))

reference image for the agricultural fields within the structure
(design for Park 21 by Vista Landscape Architects (www.vista.nl))

reference image for the versatility of the structure
(design for Park 21 by Vista Landscape Architects (www.vista.nl))

Spaces and connections within the Metropolitan Agricultural structure

Infrastructural Connections

Infrastructural connections are important connections to host the different types of flows. The metropolitan agriculture structure is based on and will be connected to the existing infrastructure. This infrastructure will be improved according to the guidelines for the Metropolitan Agriculture Structure.

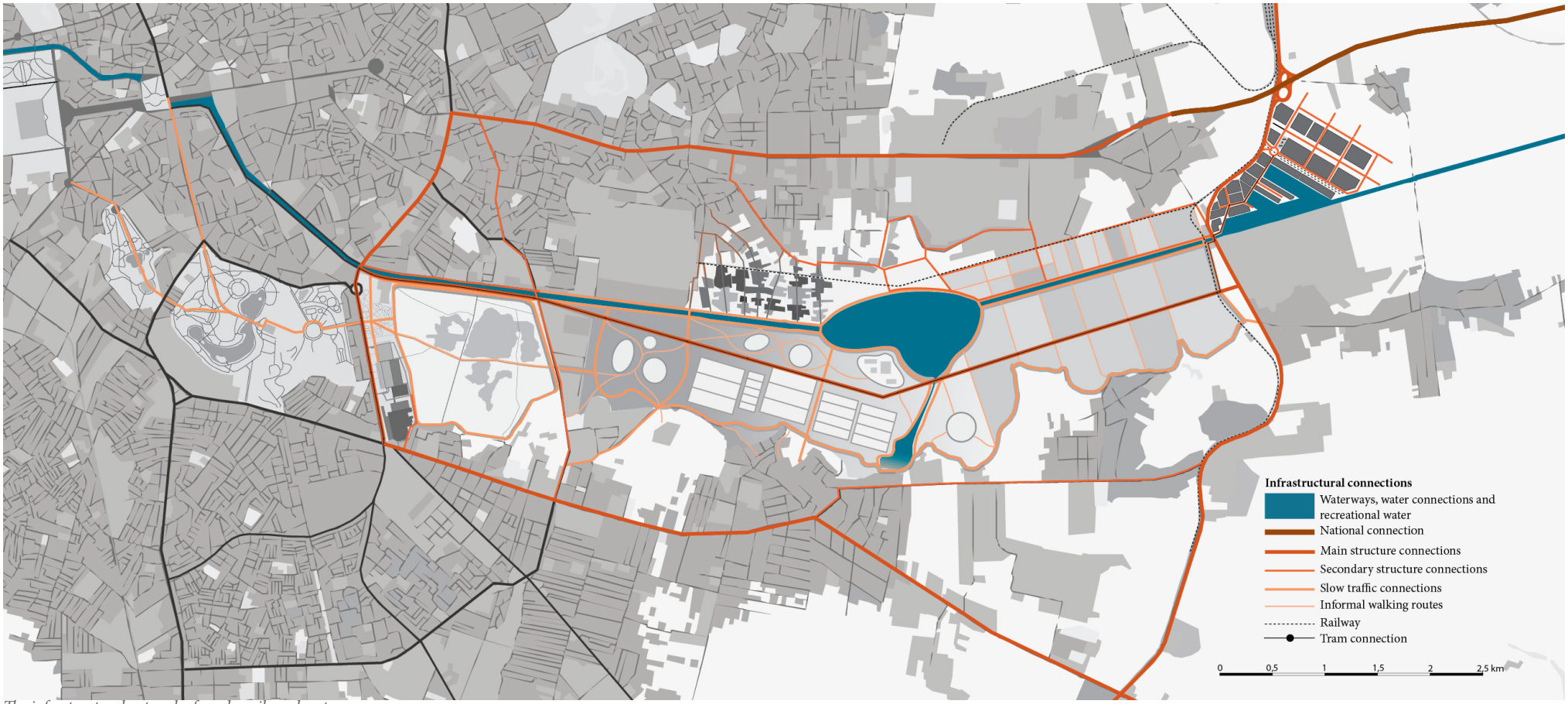
Main structure connections

The outer two main connections are part of the radial road system of Bucharest. These will be improved for the metropolitan agricultural structure. The new main connection in the middle of the structure follows the structure of the radial roads and at the same time the old parcellation structure of the site.

These main connections will function as main transportation arteries for the different types of flows in the metropolitan agricultural structure. They connect the two catalyst locations, the most important producing places within the metropolitan agricultural structure and the multifunctional initiative spaces within.

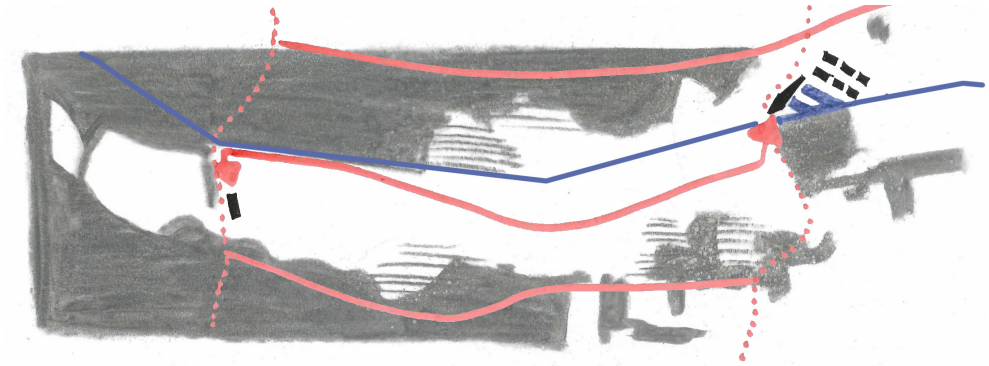
Slow traffic connections

There are slow traffic routes within the metropolitan agriculture structure that will function as recreational routes. The slow traffic routes are connected

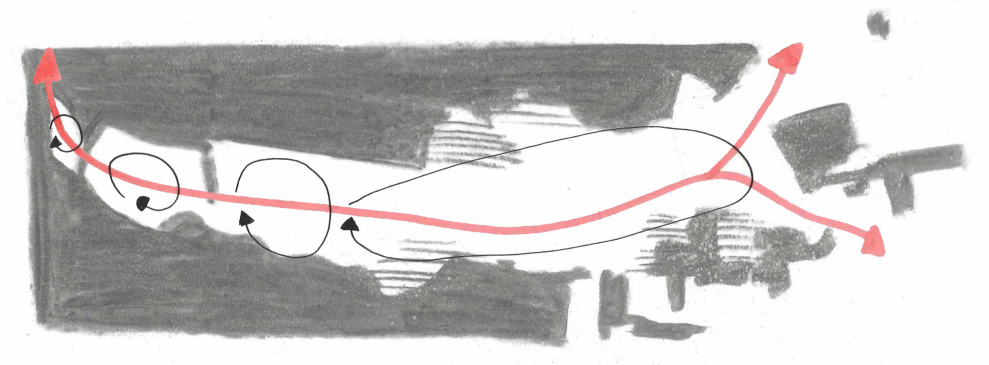


The infrastructural network of roads, rails and waterways

to the already existing slow traffic routes in the existing park structure, therewith connecting the metropolitan agricultural structure to the inner city of Bucharest at a slow traffic level. Coming from the existing parks this route will take you through the agricultural food park. From there you can choose to go to Vacaresti Market, to the Dâmbovița River or climb the edge of Lacul Vacaresti. This route will lead you over the edges or through the swamps of Lacul Vacaresti. Further along the route will lead you along and through a selection of different producing landscapes. The southern route follows the old floodplain of the Dâmbovița River. This route lays higher than the rest of the structure and offers a great overview on the different types of landscape it encounters. The northern route will take you along the Dâmbovița River to the multifunctional initiative places within the structure.



Scheme of the functioning of the main transport arteries and the Dambovita river waterway in the structure



Scheme of the functioning of the slow routes within the structure

Railway connections and public transport

The Bucharest Food Trade Centre and Glina Harbour will get their own railway connection for optimal connection for bulk product transport. These new railway lines connect to the existing railway infrastructure that follows the ring road of Bucharest.

The public transport network will be extended with an extra fast tram connection that follows the main connection of the metropolitan agricultural structure. It offers a good connection between the inner city, Vacaresti Market site and the Bucharest Food Trade Centre.

Waterways, water connections and recreational water

The Bucharest Danube Canal is an important water connection that connects Bucharest to the Danube. Therewith it offers huge possibilities for import and export of products for Romania as well as it offers opportunities for the agrotourism business. The navigable part of the canal ends in the harbour at Glina. Inside the city this water connection continues as a smaller canal. The edges of the canal will become more differentiated. Inside the city the canal will be made more accessible through steps and a small harbour for recreational boats next to the agricultural food park. Further towards the harbour, some of the edges of the canal will be opened and be made more natural to enhance the ecological value of the canal. The sluices inside the canal will be modified to let recreational and small tourist boats pass through.

An extra lake is added to the canal to function as a water buffer and supplier for the surrounding agricultural practises (the greenhouses and the fields) and to function as a recreational water body for the city. The shores of this lake follow the gradations of the old floodplain, which makes it easy to create. Near the initiative spaces will be a small beach and a harbour for recreational boats. Further along, the lake will have more natural edges. It floods into an already existing marshland lake that will be dry with low water levels and filled with high water levels. When the Dâmbovița River is cleared from pollution (a project that the government is currently working on (PMB Romania)) the water could also be used as a source for drinking water that can be purified in collaboration with the water purifying plant in Glina.

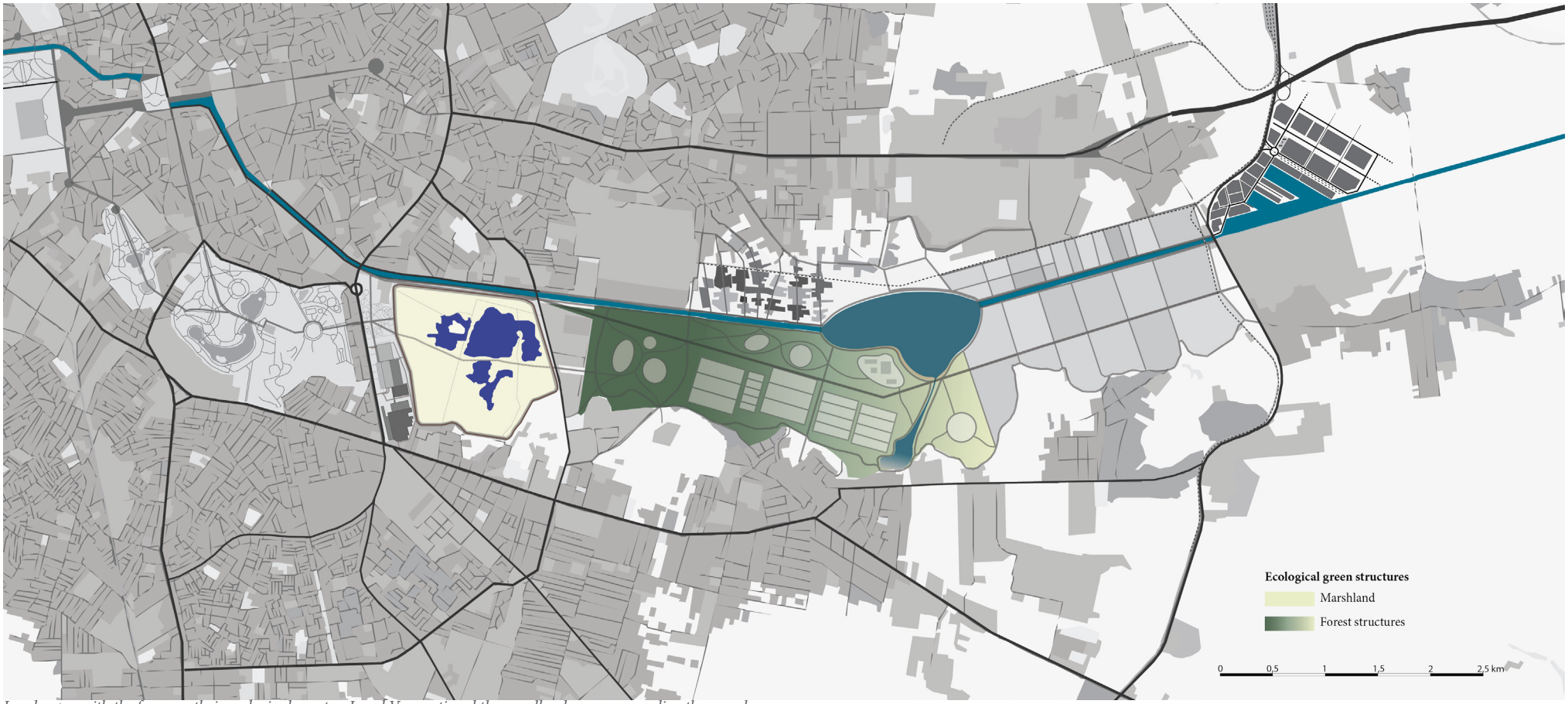
Differentiated green structures

Within the metropolitan agriculture structure are found different types of agricultural (producing) and non-agricultural green landscape types that are connected. These are made more accessible by the metropolitan agricultural structure for urban, agricultural and ecological flows. These different types of green landscapes become part of a bigger and sustainable structure and become connected through the scales.

Ecological landscapes

Within the metropolitan agricultural structure all landscapes have an ecologic value. Within the structure the aim is to make the ecologic value as high as possible. However, there is one part of the structure mainly dedicated to maintain the high ecologic value of the place: Lacul Vacaresti. This site will be developed as part of the Vacaresti Market site and its ecological value will become improved.

The area surrounding the greenhouses and the initiative spaces will have a woodland character. They will have a recreational function for the citizens and will become an ecological stepping-stone within the structure. The woodlands refer to the original landscape of this area, the Campia Română. They will make the area more attractive and are also used in defining clear initiative spaces in this part of the structure. The trees are densely placed on the west part, closest to the city and will become more and more open



Landscapes with the focus on their ecologic character: Lacul Vacaresti and the woodland area surrounding the greenhouses

towards the eastern parts, where the agricultural fields are found. In this way the forest contributes to the spatial experience that exists when moving from inside the city into the open fields.

The newly created marshland at the end of the lake and the edge of the greenhouses will also have a high ecologic value. Generally there is a high biodiversity in wetland areas. This area can also contribute to the water purification before the water is used for the greenhouses and the agricultural fields.

Agricultural landscapes

There will be a selection of agricultural landscapes that become connected through the Metropolitan Agricultural Structure: Landscapes inside the city and landscapes that are far outside the city. The character of these different agricultural places can be very different, but the food producing function is something they all have in common.

The Agricultural Food Park next to Vacaresti Market will have an agricultural value and also an urban value. The food that is produced in the park is displayed to the visitors like in a botanical garden. This park therewith contributes to the awareness of people on the food chain and on agricultural production. Combining this function with the recreational functions of a park will make the site more attractive. The products that are produced here will be sold in a shop and a restaurant inside Vacaresti Market, overlooking

Landscapes with the focus on its agricultural value: the agricultural food park, greenhouses, differentiated agricultural fields inside the ring and beyond and the home gardens and allotment gardens in the urban sprawl areas

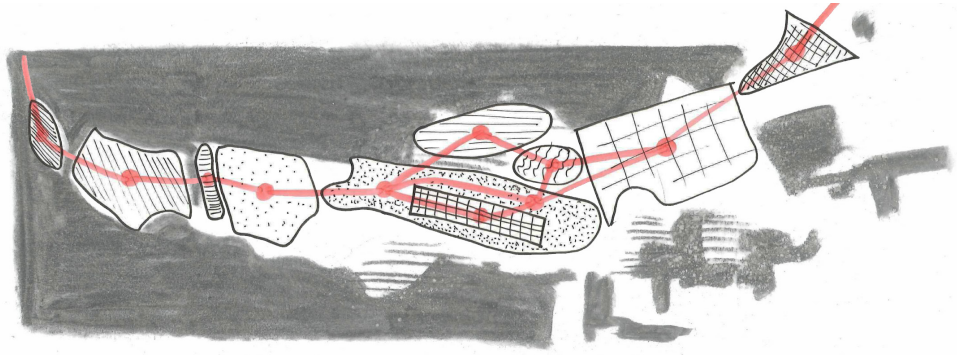
the park with its terrace.

The existing greenhouses are kept and improved, mainly functioning for agricultural purposes. These greenhouses have an intensive production and can deliver their produce directly to the Bucharest Food Trade Centre. Parts of these greenhouses can be opened up to the public in occasion to create more urban awareness or to attract people from Bucharest to work there.

The agricultural fields inside the city ring are initially kept and they are made more accessible by the new main connection laid out in-between them. The fields produce rather large quantities of different crops. Depending on their produce, they can deliver their products directly to the Bucharest Food Trade Centre or to Vacaresti Market. Vacaresti Market mainly handles the local and typical Romanian produce. The produce can also be divided between Vacaresti Market and the Bucharest Food Trade Centre depending on the quantities produced.

Outside the city ring the scale of the agricultural fields increases and therewith the production scale. Produce from these larger fields will mainly be delivered to the Bucharest Food Trade Centre.

Within the metropolitan agricultural structure are mixed agricultural types that exist mainly of allotment gardens and regular gardens. These are found inside the outer city ring next to or between the housing, where people produce some extra food for the household. This produce is mainly for own consumption. These structures contribute with their high biodiversity to



Scheme of how the differentiated green landscapes are connected within the structure

the ecological value of the metropolitan agriculture structure. Especially the small scale agricultural activities contribute to the biodiversity of the city (Pötz, 2012). These green structures, combined with agricultural activity, offer the opportunity to reorganize material flows from the city that can be reused (such as organic household waste for compost) or used to create energy for the city or for the greenhouses (with the production and fermentation of biomass and by processing organic waste from the city).

Urban (green) landscapes

The urban tissue of Bucharest city is generally quite dense. It exists for a large part of high communist buildings (Plattenbau) along the important routes in the city. Behind these buildings there are densely built neighbourhoods with lower buildings. This structure is a result of the rigorous urban change during the Communist era. The city is generally experienced as quite 'dirty' (interview with Laurentiu Picior). The urban parks are beloved places where citizens love to recreate, sport and escape from the city.

There is already a collection of urban parks existing in the former floodplain of the Dâmbovița river. These parks are high quality places for citizens for recreation and sports. These parks will become part of the metropolitan agricultural structure. They form an important connection to the inner city of Bucharest via the slow routes leading through these parks. Ecologically they also are of importance for the improvement of the urban climate, to relieve the heat stress and to take away smog. These parks, that are already multifunctional will become even more so when small elements inside them are added for agricultural value (adding fruit and nut trees and bushes) to integrate them even more into the metropolitan agricultural structure.

Within the metropolitan agricultural structure will be created multifunctional initiative spaces. These spaces are open for bottom-up initiatives that can fit within the metropolitan agricultural framework. This can be anything from opening a restaurant to organising a food festival, from starting a city farm to organising horseback rides through the metropolitan agricultural structure. From a music festival to organising a colour run. These ideas can both be temporarily initiatives and long-term initiatives. When there is no activity on these spaces, they will have a high ecological function, when they

are used, their main function will shift to the urban.

Urban connections

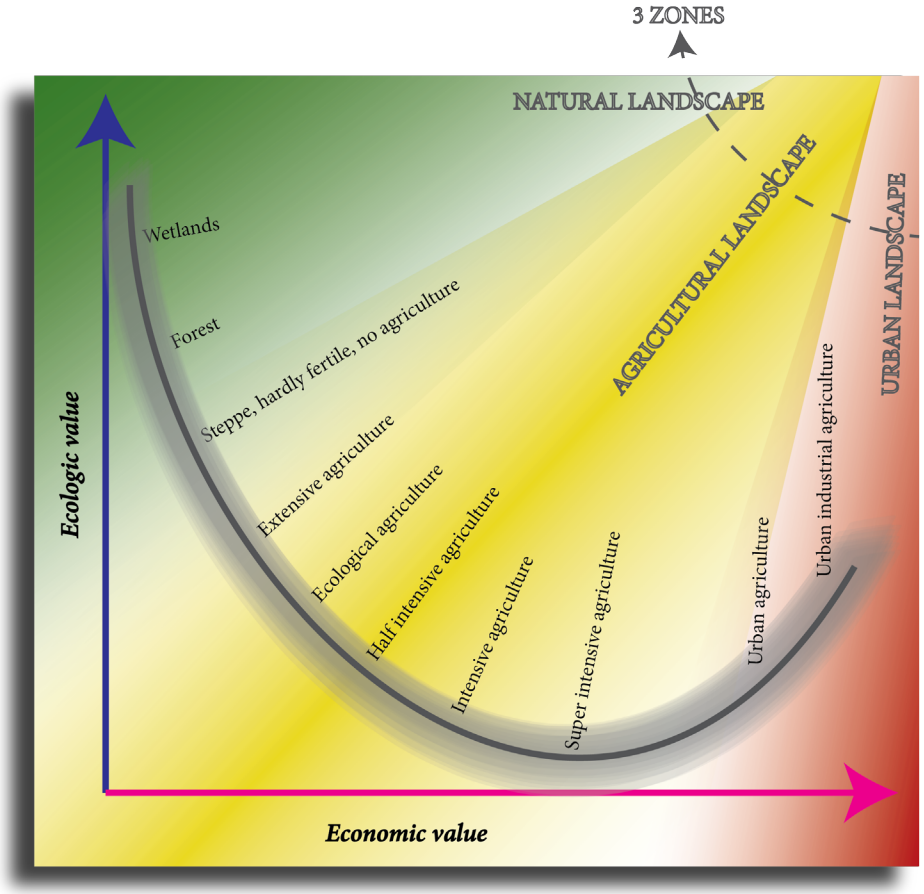
The metropolitan agriculture structure is literally embraced by the city of Bucharest. At the edges of the urban tissue there is a lot of urban sprawl spreading out into the fields. To integrate the urban tissue into the metropolitan agricultural structure this tendency of urban sprawl will be exploited and encouraged. In the urban sprawl areas the sandy roads that existed by informal use will become paved. This new infrastructure will become a formal guideline for the appearance of informal housing. The municipality can determine the areas where this happens. The urban sprawl will stop at the places where other parts of the metropolitan agricultural structure are in use. The housing existing in these urban sprawl areas is generally quite broad in setup, much more than the dense urban tissue, and often contains small (kitchen) gardens. This type of housing is an ideal intermediate between the concrete building blocks further inside the city and the metropolitan agricultural structure. This is a process that can continue throughout the realisation of the metropolitan agricultural structure. It can start from the beginning, since the paving of roads is a minor investment that can be earned by the selling of the land at the edges of the metropolitan agricultural structure.

Landscapes with their focus on the urban function: multifunctional urban parks, multifunctional initiative spaces and the urban sprawl connections to the metropolitan agricultural structure

Summary:

Different types of landscapes

Different sizes of parcels



Different types of agriculture in relation to the economy/ecology balance and the landscape types

Discussion

In this thesis I have translated the concept of Metropolitan Agriculture into a spatial design. My design methodology started with composing generic models derived from the concept that consider the balance between different landscape types (ecologic, agricultural and urban), the balance between economy and ecology, the balance between parcel sizes and the types of agriculture that are practised as a result of these. My hypothesis was that these models would function as tools and guideline during the design process. As design tools, the models could work in three ways: They could be used as a tool to analyse the site and use them for design research (Nijhuis, 2012). They could be used for monitoring during the design process: making sure that landscape infrastructure and zoning are covered and corresponding through the scales and they could be used as a design lens during the process. To test this hypothesis through research by design (Nijhuis, 2012), I used the generic models to make an analysis of the Bucharest region and to design a metropolitan agriculture structure for the Eastern part of Bucharest.

The aim of the metropolitan agriculture structure is to create a more balanced and sustainable connection between the ecological, the agricultural and the urban landscapes and flows. The design of a structure for the Eastern part of Bucharest is an example of how implementing the concept of Metropolitan Agriculture can work. However, this concept works through the scales and can also become implemented through the scales.

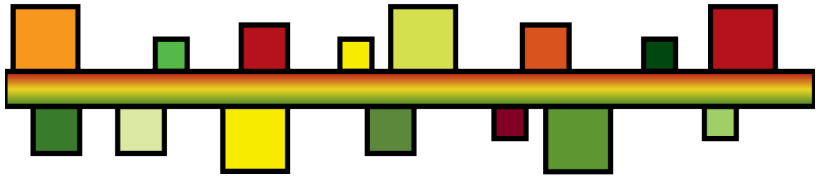
Starting with Bucharest, the site where the metropolitan agricultural structure was implemented contained important ingredients for such a structure: the presence of the three landscape zones within a relatively small distance from each other in combination with the favourable position of existing infrastructural connections and strategic places for the catalyst locations. This combination made this particular site ideal as a starting point to implement a metropolitan agricultural structure to connect Bucharest to its hinterland. When implemented, the structure connects the fragmented and differentiated landscapes that already exist and combines them into one metropolitan agricultural system.

However, to create an even more sustainable structure that safeguards the balanced connection between Bucharest and its hinterland into all directions, the structure can be expanded and built around and through the whole city. When adding these extra structural parts, they should work together with the initial structure and form a coherent system. This means that for instance the two catalyst locations shouldn't be reproduced because these function on the scale of the city, region and super region already. What should be made are the key elements of the metropolitan agriculture structure that connect the new urban, agricultural and ecological sites to the existing structure, always using a specific site analysis through the scales. This will create a coherent metropolitan agricultural structure around the whole city of Bucharest, connecting it to the hinterland through the scales.

The result of implementing a metropolitan agricultural structure is that the barriers between the differentiated landscapes become smaller. They can function together as a system, but at the same time they can keep their complementary functions and their own identity. Within the system is space for the existing differentiated types of landscapes on all scales, but there is also space for new initiatives that may combine the different landscape types and functions. This makes the system as a whole more sustainable and capable to cope with future changes.

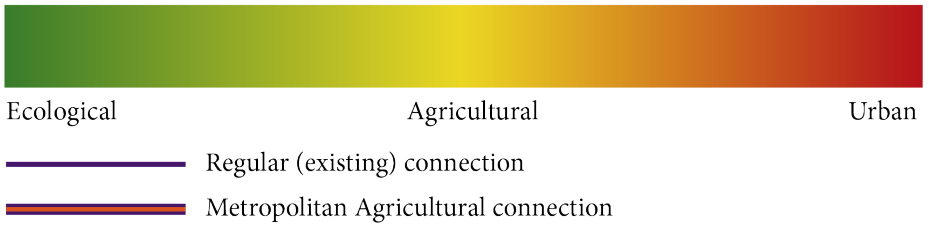
The metropolitan agricultural models can also be used for creating metropolitan agricultural structures in other super regions. The models should always be used in combination with an extensive site analysis through the scales. Only then they can function as a structural host that balances the differentiated flows and that creates a subtle balance for each specific site. The spatial implications of the concept will also turn out to be different and place specific in each design. However, the guidelines for the structure stay the same and will guard the quality of the structure wherever it is implemented.

Metropolitan Agriculture makes a new connection between urban, rural and natural landscapes. It strives for a balance between ecology and economy and uses different strategies to reach a sustainable structure for the landscape. When the concept is used in more super regions and when different metropolitan agricultural structures are implemented this could be a start of a sustainable agricultural structure on a world scale that safeguards our food supply in the future. To eventually reach this we must start on a small scale and work up through the scales.

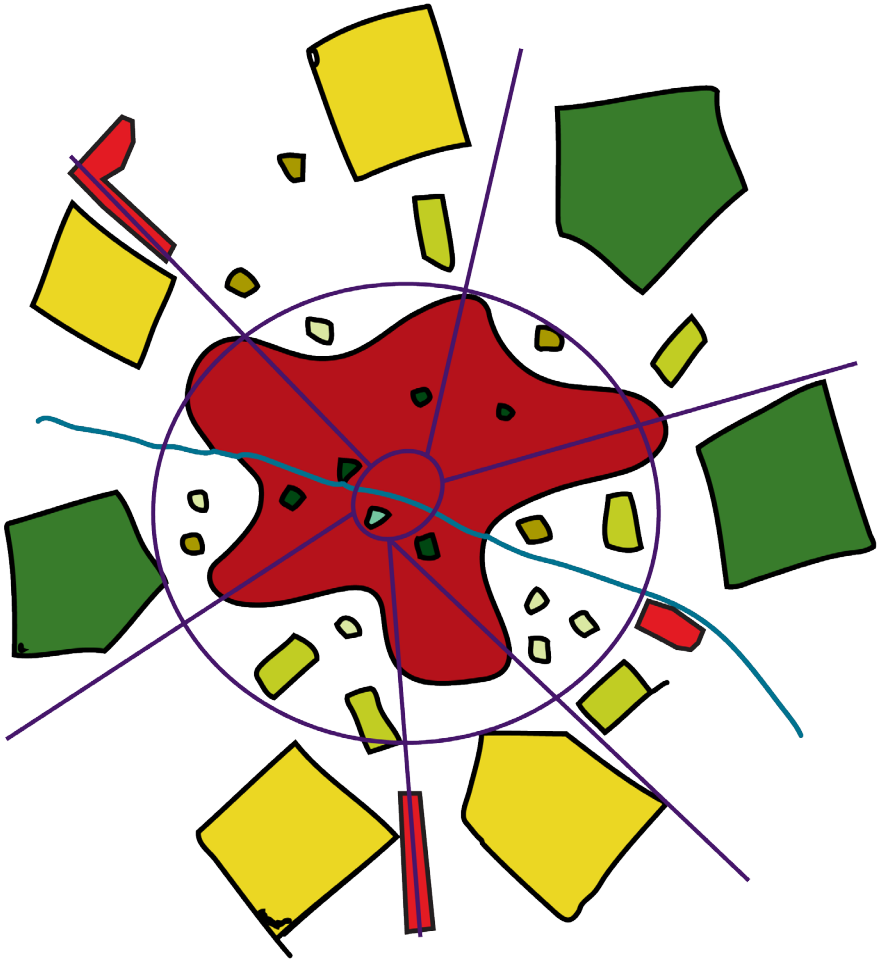


Abstract scheme of a Metropolitan Agricultural structure connecting the different landcape types and sizes, forming a sustainable system

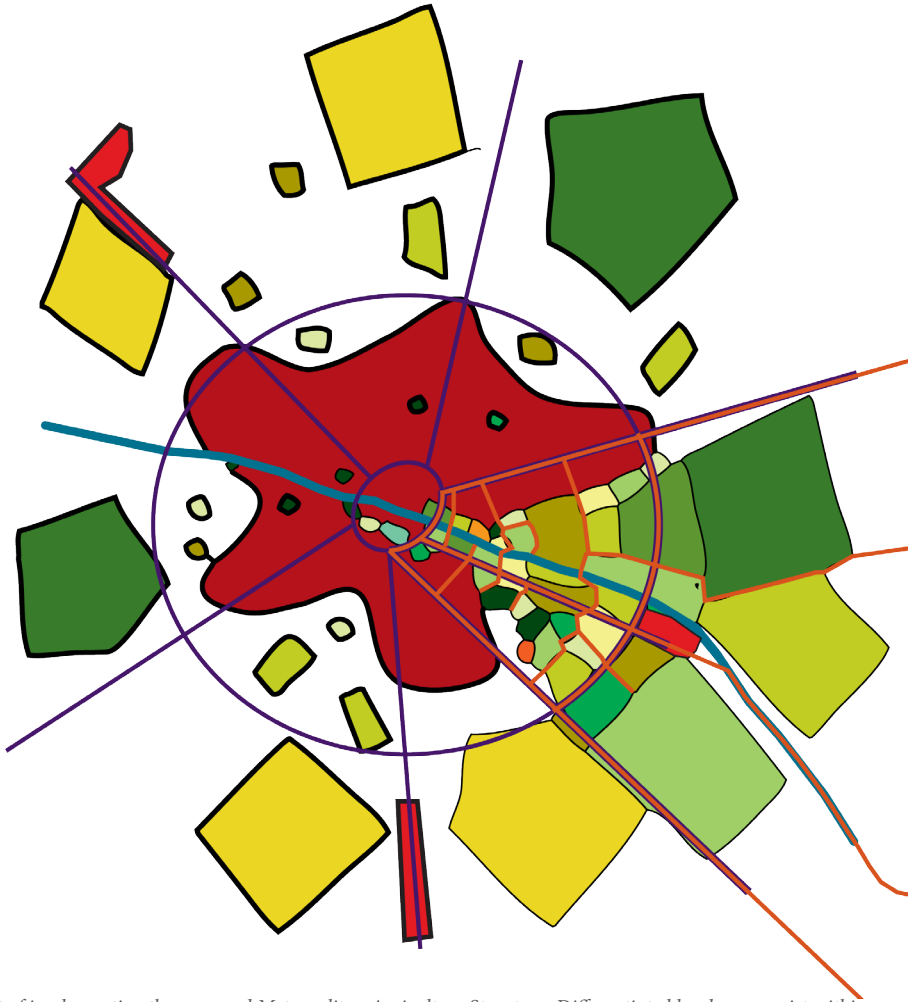
Legenda:



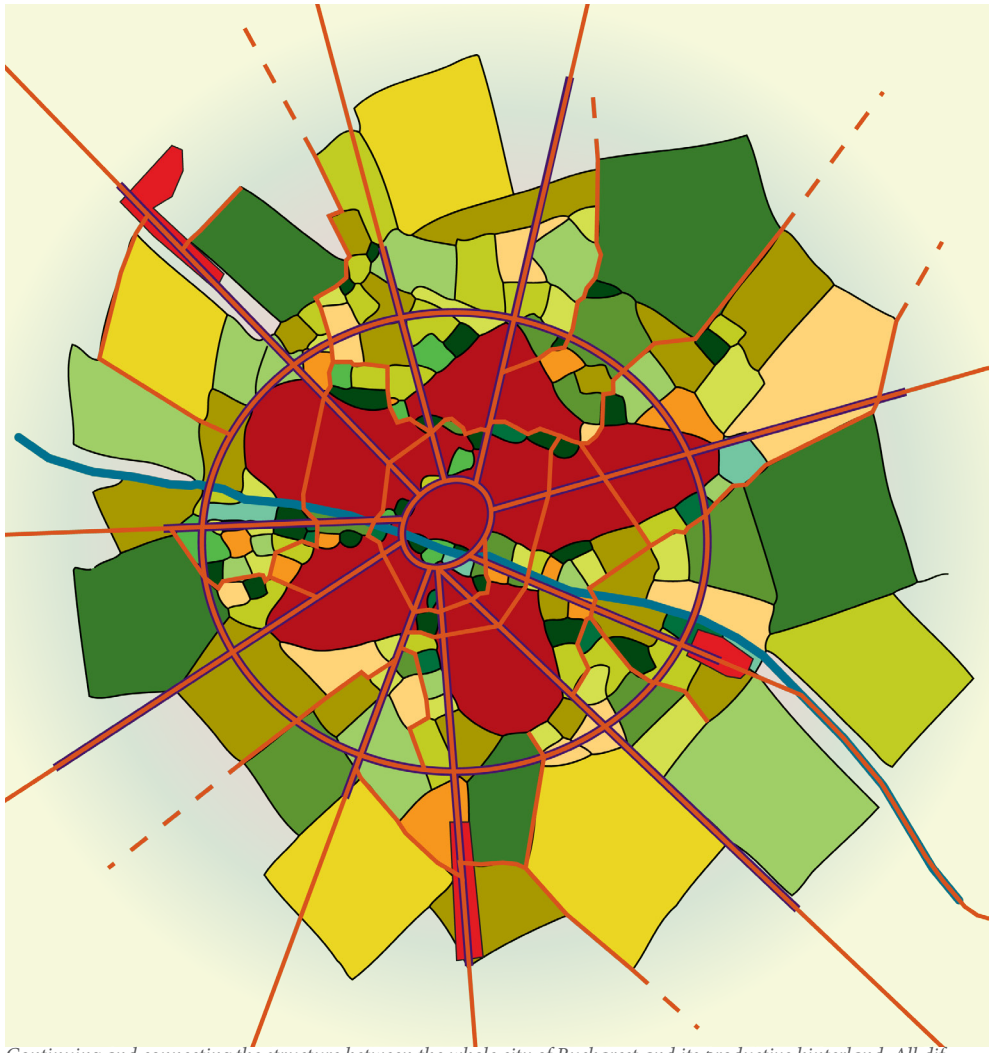
Legenda for the generic model and the schemes on the next pages



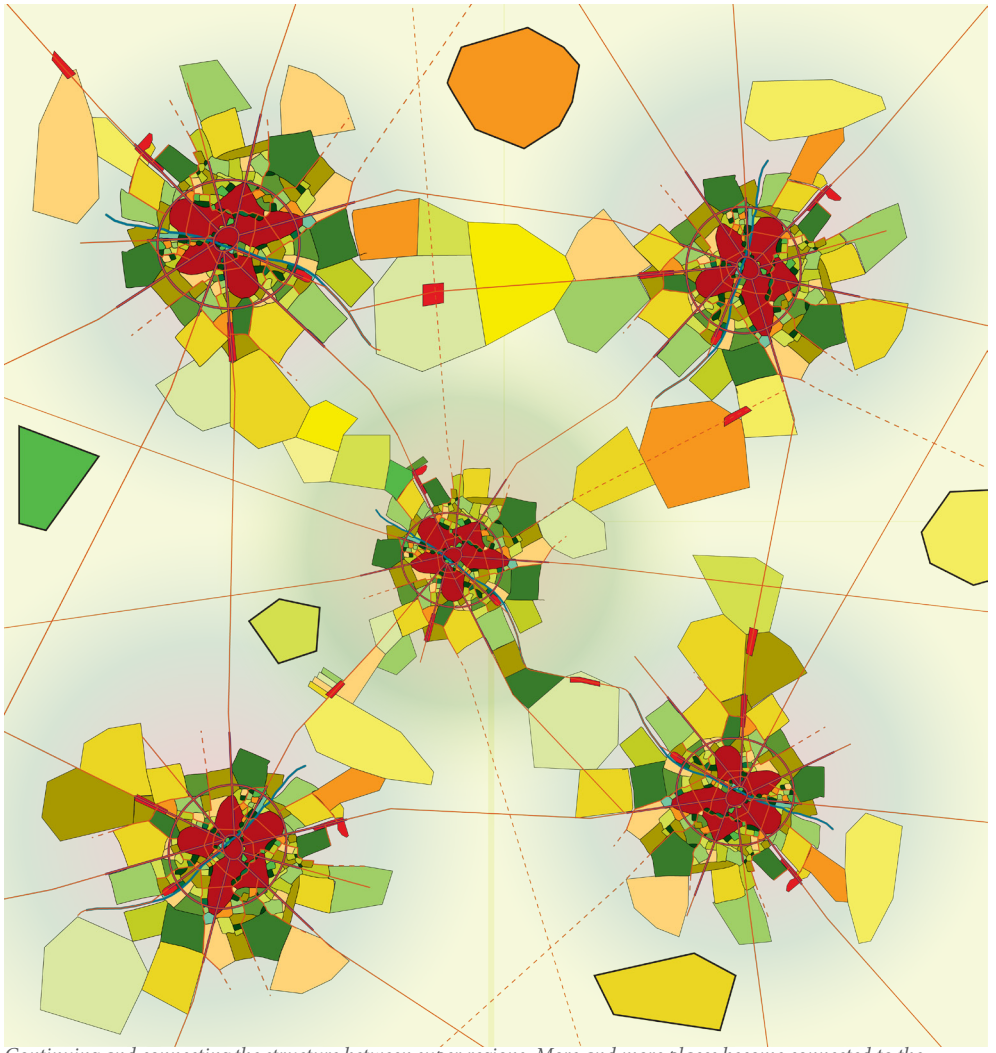
Current situation in Bucharest: Differentiated urban, agricultural and ecological landscapes with no connection



The effect of implementing the proposed Metropolitan Agriculture Structure: Differentiated landscapes exist within a structure and work together as a system. Barriers become smaller and landscapes become interconnected.



Continuing and connecting the structure between the whole city of Bucharest and its productive hinterland: All differentiated landscapes become connected and work together as a sustainable system.



Continuing and connecting the structure between super regions: More and more places become connected to the metropolitan agricultural system. The network grows from bottom-up (starting at specific places at the same time) and expands into a sustainable structure that spreads out around the world.

Conclusion

This graduation project explores the spatial opportunities of the concept of Metropolitan Agriculture. My question was how to translate this abstract concept into a spatial design to implement it and to let this concept literally land. To test my hypothesis, I made a design for the metropolitan region of Bucharest, Romania.

In the first part of this thesis I explored the promising concept of Metropolitan Agriculture and I translated this concept into generic models. To do this I used the guidelines and principals of Metropolitan Agriculture together with important ideas from existing Urban Agriculture models. My hypothesis was that these models could be used as design tools to translate the ideas of Metropolitan Agriculture into design by using them as tools for analysis, monitoring and as a design lens. These models could be used for any of the 180 super regions that are defined as potential region to implement Metropolitan Agriculture.

In the second part of the thesis I have made an analysis of super region Romania through the scales. During this analysis I could already use the defined models as analysis tools. They helped me find and focus on the differentiated and complementary landscapes that exist around the Bucharest Danube Canal and in the region around Bucharest. Exactly this differentiation in landscape types offered the perfect conditions as a starting position to implement a metropolitan agricultural structure in the region of Bucharest. The defined generic models can thus be used as analysis tools in determining a starting position for implementing Metropolitan Agriculture in super regions.

In the third part of this thesis, the research by design process for implementing metropolitan agriculture, I used the models as a monitoring tool and as a design lens. As a monitoring tool they helped to keep an overview on the project and helped to constantly keep in mind the different scales I was working with. It safeguarded the conceptual ideas of metropolitan agriculture through the scales and also the interrelation of scales in the design. The design lens function helped me to switch between scales and between visions of the future users of the metropolitan agriculture design.
The models function as monitoring tool and design lens during the process of translating the concept of Metropolitan Agriculture into a spatial design. They can also be used as such in the same process for other super regions.

The result of this process is a metropolitan agricultural structure that sustainably connects the city of Bucharest to its producing hinterland through the scales. The structure itself hosts ecological, agricultural and urban flows. The structure facilitates functional connections between the complementary landscape types it connects to. It creates opportunities for new functional integration between different landscape types to get the best out of each landscape and to create a sustainable balance within a differentiated landscape. This structure is therewith an asset to the ecological system, the agricultural system and the urban system of the Bucharest region at the same time. It could become so for another super region.

The structure in in the Bucharest region creates and hosts opportunities for new ideas and for change of the existing landscapes over time. This gives an extra spatial quality to the system, especially in the urban areas where there a lot of people with many ideas, where this concept can work for temporary use projects. The same space will have a multifunctional character. Its main value function (for urban, agriculture or ecology) can change with the different functions. At the same time it is linked to the metropolitan agricultural structure that hosts all flows for a balanced continuity.
The flexibility of the system of differentiated and multifunctional landscapes combined with the steady facilitation of the differentiated flows within the structure makes the metropolitan agricultural structure sustainable. It makes it sustainable over time, as landscapes may change, but also sustainable as a structure that can be implemented in another super region. The structure will always host the continuous flows, while the landscapes in-between can differ. The materialisation of the structure can change between super regions, but the function will stay the same and will ensure a sustainable balance between the flows and between the different landscapes.

My conclusion is that the defined generic models worked as design tools that helped to turn the concept of Metropolitan Agriculture into a spatial design.

The models capture the generic concepts and ideas of Metropolitan Agriculture. Together with an extensive analysis of the specific place, they can form a basis for the spatial translation of the concept in the defined super regions. The models can best be used for both the analysis and for the design to keep the spatial translation of the concept coherent.

For the region of Bucharest, the use of these models as design tools led to direct and specific guidelines for a metropolitan agricultural structure. Derived directly from the concept of Metropolitan Agriculture, these specific guidelines for the structure offer a more spatial approach to the concept. They can also be used for every other metropolitan agricultural structure, which will adapt itself to the specific spatial circumstances of the site.

Using the generic models as tools for analysis, monitoring and design to create a metropolitan agricultural structure makes the concept of Metropolitan Agriculture itself sustainable in the long run. The structure embodies the concept and can bring the conceptual ideas into practise. The generic models and guidelines in combination with an extensive analysis is a strong combination that will guarantee a sustainable balance between the differentiated flows. At the same time it safeguards the existing spatial qualities of the landscapes it encounters and it offers opportunities to create new spatial qualities. The spatial translation of Metropolitan Agriculture is a step in the right direction to reach ultimate goals the concept strives for.

The spatial translation of Metropolitan Agriculture for the Bucharest region is only a beginning. Ideally the metropolitan agriculture structure would spread around the world and become a guiding principle for the spatial planning and design within all super regions. In that case it has a lot of potential to reach the ultimate and long-term goals of stopping suppression and creating a sustainable food supply for the world. This ultimate goal is still far away, but every little step towards that goal can help.

This thesis is one step.

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