Sustainable Cities

Master Thesis

Re-balancing nature and culture in Copenhagen

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CONTENTS

1 - INTRODUCTION

1.1 NATURE IN CITIES

Humans in urban areas seem to be going through a sort of an identity crisis, as many of us enjoy the comfort and leisure of urban life while, and at the same time, long for an escape to a simpler and more 'natural' lifestyle. With over 55% of human population living in cities and an expected increase to 68% by 2050 (United Nations, 2018), we are increasingly subjected to environments that greatly differ from the ones for which our biology has evolved. Although we move to cities seeking unique opportunities, we often pay a price in degrading health because of the lack of recreation, stress, and pollution (Miyawaki, 2008). The hectic traffic and the ruckus of the city seems to also affect our ability to focus in a way that it constantly draws our direct attention and leaves little time for restoration of attention ability (Berman, Jonides, & Kaplan, 2008), and this effect seems to reverse with the increase of nature contact. Studies have shown that children, after being exposed to activities in green outdoors, show less ADHD related symptoms (Kuo & Taylor, 2004); we have also confirmed the direct link between exercise in nature and beneficial effects for mood, self-esteem (Barton & Pretty, 2010), and even the sole exposure to the color green can reduce mood disturbance and exertion during exercise (Akers, et al., 2012). More specifically, the benefits of nature for mental health and social cohesion seems to be directly corelated with increased biodiversity (Cox, et al., 2017).

Furthermore, since urban sprawl entails a significant modification of the landscape, it creates a vulnerability to climate extremes, often through flooding, the urban heat island effect, and landslides (European Comission, 2018). Urban areas are also localities of drastically reduced biodiversity and deteriorated ecosystems (Miyawaki, 2008). In Europe, there is a large focus on reversing this trend through ecosystem restoration and nature-based solutions (Naumann & Davis, 2020). These efforts often mean creating completely novel landscapes and ecosystems. However, we need to be aware of the thresholds of change the crossing of which can make a return to historical states difficult (Hobbs, Higgs, & Harris, 2009). Even though restoration costs of urban areas are usually higher because of poor ecosystem conditions of degraded land, they are also the most cost-effective if we consider people as the beneficiaries (Vallecillo, et al., 2016). More importantly, costs depend heavily on the type of management used - passive management has much lower maintenance costs than other options, as it favors succession of ecological processes over keeping a static pattern of species (Navarro & Pereira, 2012). There has even shown societal interest for reduced managing regimes of wilderness (Müller, Bøcher, Fischer, & Svenning, 2018). Self-managing natural landscapes are often strictly tied with native species and ecosystems (Miyawaki, Restoration of urban green environments based on the theory of vegetation ecology, 1998), and many planting goals of today include incentives to plant native as a way to drastically increase biodiversity, reduce vulnerability to pests, maximize ecosystem services, maintain ecological integrity (Butler, Butler, & Orians, 2012), prevent disasters and preserve the environment (Miyawaki, Restoration of urban green environments based on the theory of vegetation ecology, 1998).

However, experience has shown that introducing self-managing ecosystems of high biodiversity in urban environments is difficult, as the harshness of the city makes it hard for many native tree species to survive (Sjöman, Morgenroth, Sjöman, Sæbød, & Kowarike, 2016). For example, when planting trees on the sidewalk, planners will choose tree species that are known to be highly resistant to irregular irrigation, low quality soil, spells of frost and air pollution (Sæbø, Benedikz, & Randrup, 2003). In some cases, certain authors (Sjöman, Morgenroth, Sjöman, Sæbød, & Kowarike, 2016) claim that a total exclusion of non-native species might damage biodiversity. This is apparent in regions with a natural low biodiversity of plants and, due to the limited choice of native species, the ecosystem-service and biodiversity expectations can hardly be fulfilled using only native species. Observed generally, native species are often less resistant to stressors of the urban environment than exotic tree species and, considering that the global biodiversity increases towards the equator and

decreases toward the poles (Allen, Brown, & Gillooly, 2002), regions such as Scandinavia have a limited array of resistant native plants to choose for the urban environment. However, the problem of loss of biodiversity and natural integrity due to human activity still prevails and is especially important in the northern hemisphere due to the scarcity and value of biodiversity in this area. Regardless of the mentioned difficulties, if regions such as Scandinavia wish to preserve biodiversity, improve the quality of life of the citizens and establish ecological resilience, they still must find a way to plant native and learn how to create environments that invite the complexity of biodiversity to cities.

It becomes apparent that the choice of tree species is not the only important thing, but also the way of the implementation of nature in cities. To understand this problem, we must take a step back and look at trees more broadly, from an ecological perspective, rather from the perspective of an individual. We must understand the interconnectivity of actants that give life to biodiversity in abundant ecosystem. Instead of merely settling for planting exotic trees in Scandinavia due to the mentioned barriers, we should think of new ways of enabling native trees to thrive in the urban environment.

In order to explore this, in section 1.2 - Urban forestry and balance of nature and culture, we first look into the main differences of handling urban nature by landscape architects and urban foresters, which approach is more beneficial for restoring balance of nature and culture in cities and how ecological studies support this approach.

Secondly, in section 1.3 - Ecological succession and new methods of afforestation, we talk about forests as non-static systems that are always prone to change, and how can this knowledge help introduce native species in cities. Furthermore, a practical way to implement this knowledge is presented through the Miyawaki method of afforestation.

To narrow down the problem area, in section 1.4 - Cases of Denmark and Copenhagen, we introduce the current practice of tree planting in Copenhagen. As concluded, there is a difference in planting approaches whether we talk about park trees or street trees. Since native communities are not prioritized for the street of Copenhagen, the focus of this research is to notice morphological patterns of areas in the streets where Miyawaki forests of native communities could be easily established, so to restore balance in the city.

1.2 URBAN FORESTRY AND THE BALANCE OF NATURE AND CULTURE

Nature is an imperialist force, and it has been on a siege to take over the creation of culture from the beginning of culture's emergence. We have been welcoming this force in cities up to an acceptable degree and have been introducing bits and pieces of nature in the forms of parks, gardens, lawns, bioswales, and many other models of 'green space'. Hence, different disciplines formed for managing nature, such as urban forestry and landscape architecture. Although many different actors are responsible for planting trees in cities, species selection criteria and knowledge levels of landscape architects are not researched much by ecology studies, while urban foresters stress the importance of the result of their studies for landscape architects (Conway & Vecht, 2015). Despite both disciplines dealing with trees in cities, we can notice a type of conflict between the two, which exists because of the core differences in their approach to and view of urban nature.

If we think of landscapes as expressions of the dynamic interaction between natural and cultural forces (Antrop, 2005), the urban forestry and landscape architecture differ in the attention given to one or the other force. The goal of landscape architecture is to create the most pleasant environment with careful managing of nature and culture. It is focused on the designing urban outdoors, and this often entails creating aesthetically pleasant and livable space for citizens. This type of approach seems to be favored in cities, as there is a preference towards designing "lavishly planted" urban parks while there is less attention to functional utility (Wu, 2008). Urban forestry, on the other hand, attends more the biological aspect; urban foresters should know more about forest ecosystems and the services they

provide. Habitat creation, water management, carbon cycling, soil stabilization, beauty, recreation, timber production - all those services derive from forest ecosystems more effectively than from singular trees. In the same way as the degree of 'wildness' is described as a spectrum or 'continuum' rather than a binary system (Carver, Comber, McMorran, & Nuttera, 2012), urban forestry acts closer to the natural end of the spectrum of nature and culture while landscape architecture deals more with the cultural aspect of landscape (Figure 1).

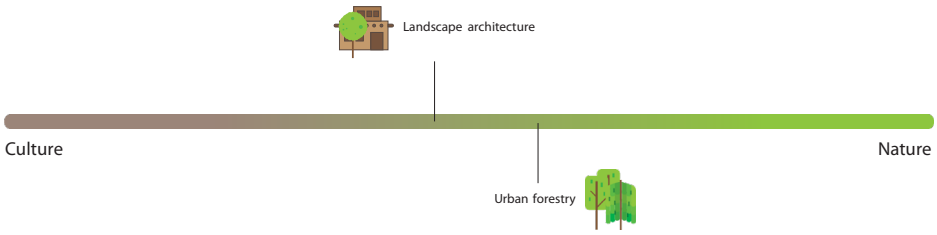

FIGURE 1 POSITION OF URBAN FORESTRY AND LANDSCAPE ARCHITECTURE ON THE CULTURE-NATURE SPECTRUM

What is meant by 'nature' in this sense can be described by biodiversity and of complexity ecosystems. The bigger the biodiversity is and the more complex the relationships between the species in an area, the more 'wild' or natural it is perceived (Müller, Bøcher, Fischer, & Svenning, 2018). Urban environments, as localities of high cultural imprint, often entail reduced biodiversity and ecological complexity (Wu, 2008). As we move away from a city into the forest ecosystem, along with the reduction of the built environment, we will be met with increased biodiversity (Müller, Bøcher, Fischer, & Svenning, 2018). With all the benefits associated with biodiversity in cities, it is clear that we need to work on bringing closer wild areas to our own habitat.

On the other hand, although it is important to aim for preserving biodiversity, what is natural does not have to always be complete wilderness and thinking in this way might only stray us from behaving ecologically responsible. Such criticism comes from the case of the American frontier as described by William Cronon (1996). Cronon criticizes the irrational obsession and romanticizing of wilderness of the frontier as a paradise that has been lost forever, spoiled by man's cultural intervention. He argues that the deification of this concept only sets humans apart from the natural and makes it harder to address contemporary environmental issues as it creates an unrealistic idea of nature as something uninhabitable by humans: "*Any way of looking at nature that encourages us to believe we are separate from nature - as wilderness tends to do - is likely to reinforce environmentally irresponsible behavior"* (Cronon, 1996, p. 22). Therefore, we still must be careful not to delude ourselves with wilderness as a concept outside of the scope of human existence.

1.2.1 THE MORPHOLOGY OF URBAN ECOLOGY

Humans have always changed the environment to better fit their societal needs, but only from the beginning of 20th century have we started to worry for the loss of natural and cultural values (Antrop, 2005). We can see these shifts in perspective of environmental concern in urban morphology, where the dichotomy of socio-economy – ecology is used to describe the result of the physical landscape of cities.

> *A major goal of urban ecology is to understand the relationship between the spatiotemporal patterns of urbanization and ecological processes. Thus, the study of urban morphology and its evolution is critically important* (Wu, 2008, p. 14)

The landscape in cities can been defined as a ground of struggle between physical, socio-economic and ecological processes. Along with the raising awareness for environmental issues all over the world, urban ecology has gone through an evolution of perspectives of the matter (Wu, 2008). The evolution presented a change of understanding urban ecology from a force on which socio-economy has little impact, to an understanding of the inevitably close interaction between the two (Figure 2).

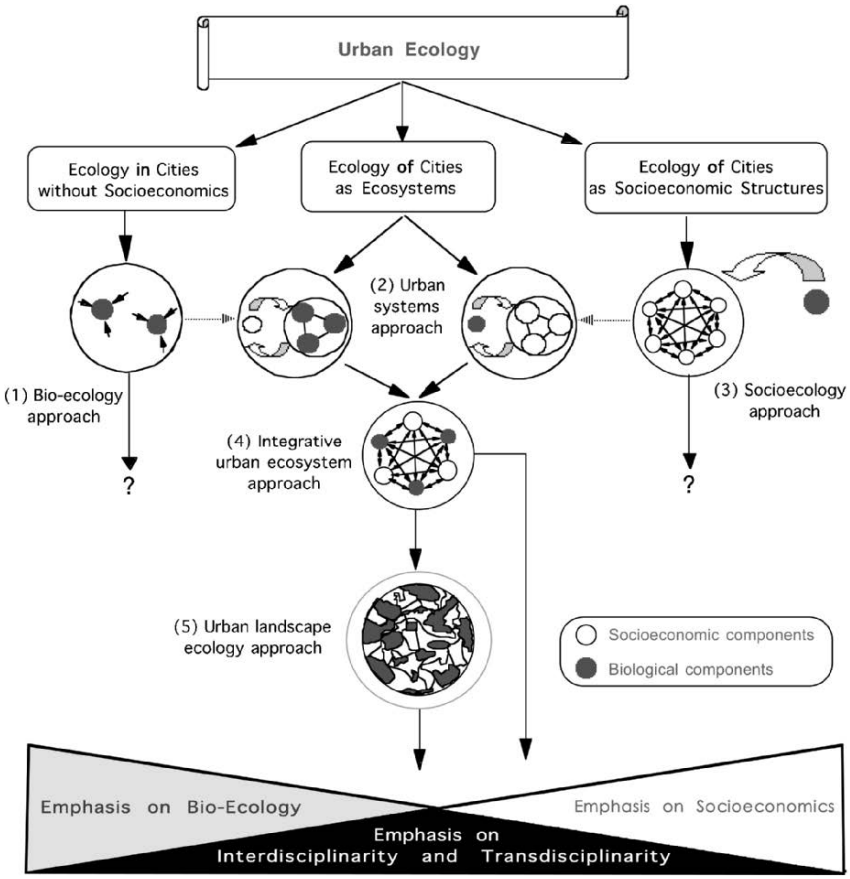

FIGURE 2 EVOLUTION OF PERSPECTIVES OF ECOLOGY FROM ECOLOGY IN CITIES TO ECOLOGY OF CITIES (WU, 2008, P. 15)

The fifth approach – urban landscape ecology – emphasizes the diversity and the interactions of bio-ecological and socio-economic components of the city, but also spatial elements and the ecological consequences from the level of patches up until the landscape level (Wu, 2008). This approach seems to be most balanced in terms of addressing the two aspects of the landscape and acknowledges the morphological expressions of these interactions in cities. This type of power struggle reminds of the nature – culture dichotomy explained in section 1.2 - Urban forestry, where landscape architecture was favored over urban forestry in nature design of cities (Figure 3).

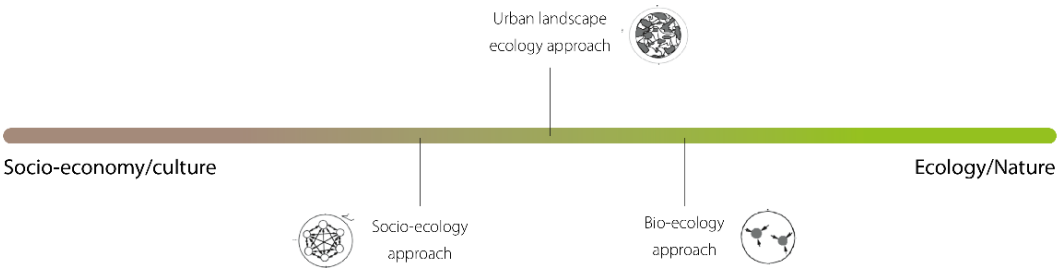

FIGURE 3 THE RESEMBLANCE BETWEEN THE CULTURE - NATURE DICHOTOMY AND THE EVOLUTION OF URBAN ECOLOGY

1.2.3 RESTORING BALANCE

When we try to imagine an ideal living space of people, it is usually a place where the built and the grown environment are equally as present – somewhere in the middle, signifying balance. We can trace the idea of balance as an ideal living space for people back from the biblical stories when Adam and Eve were cast out from the garden of Eden into the wilderness and forced to fend for themselves in the unknown, in the chaos (Peterson, 2018). Contrary to the modern fetishization of wilderness

described by Cronon, this early notion was presented as a place of danger where few wanted to reside in. Upon leaving Eden, they have also left a place constructed by God himself as their perfect habitat, a place of balance between man's biological and spiritual elements, between nature and culture, a tempting but eternally unreachable balance between chaos and order. If we want to strive for the ideal living space, we need to learn to recognize the expressions of natural and cultural forces, representing the socio-economic and ecological aspects of the landscape, so we can act to restore balance.

Urban forestry and other biological-based disciplines should be encouraged to have a larger influence on the design of nature in cities, but forms of nature that would not linger on the shallow aesthetic values but would have a higher, utilitarian purpose and the purpose of preserving natural integrity. As mentioned before, although there are many actors that deal with planting trees in cities, the 'landscape architecture approach' is dominant in nature design, and for this reason cities require pushback from urban forestry (Figure 4).

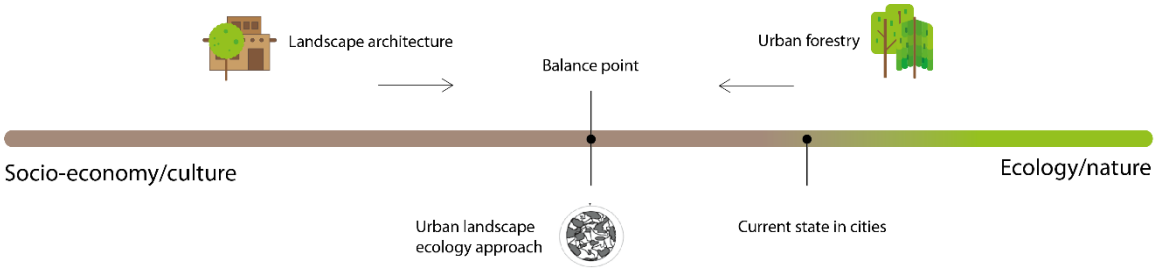

FIGURE 4 URBAN FORESTRY AS A BALANCER FORCE TO BRING THE URBAN LANDSCAPE ECOLOGY APPROACH

1.3 ECOLOGICAL SUCCESSION AND NEW METHODS OF AFFORESTATION

To understand what can urban forestry bring to the table to contribute to balance in cities, we look into forests themselves as ecosystems, their behavior and change. Here I attempt to challenge conceptualizing trees as something static and individual while encouraging thinking in forests as systems that can exist in many different forms.

1.3.1 PIONEERING COMMUNITIES

Nature is not an unchangeable state, but rather constantly progresses and regresses in a cyclical manner. Even degraded ecosystems create unique environments that host specific species as different plant species are designed to thrive in different stages of ecological succession or ecological change. For example, the birch tree (*Betula pendula*) is considered a pioneering plant because it is not so picky in terms of soil requirements, grows quickly but lives for a relatively short time (up to 100 years) and relies on the wind to disperse its seeds (European Comission, 2016). These species spread quickly and are adapted to succeed solely, on open and barren lands, with poor soil and exposed to a large amount of light. Some pioneers act invasively outside of their native zone, spreading and suppressing the autochthonic nature, like the 'tree of heaven' (*Ailanthus altissima*). This specific species was brought more than 260 years ago to Europe from China by the French missionary Pierre d'Incaville. However, this tree did not represent heaven to many who dealt with urban gardening in Europe. It has violently spread over all continents except Antarctica since it can grow on very poor soil, easily outcompeting the local flora and making it almost impossible to eradicate due to its ability to spread vegetatively through roots (Enescu, Durrant, & Caudullo, 2016). Because pioneers are not demanding in terms of growth conditions, they are easy to implement in the city environments. However, along with the modest demand of these species, they also contribute with the least amount of biodiversity and grow a lower quality wood.

During the ecological succession, as times passes, these plants change the conditions of the soil below them over time by slowly creating a layer of organic matter, stabilize pH levels and fixate nitrogen from the air. In a span of hundreds of years, they change their own environment so much that they eventually become replaced by new species, belonging on the other side of the spectrum of the ecological succession – climax communities (Figure 5).

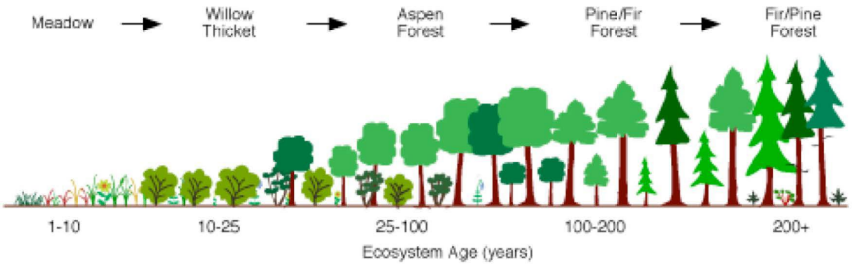

FIGURE 5 A SUCCESSIONAL SEQUENCE OF VEGETATION COMMUNITIES DESCRIBED IN THE COLORADO FRONT RANGE (KLINGER, 2009)

1.3.2 CLIMAX COMMUNITIES

In theory, climax communities are considered the final stage in ecological succession or change and are also the most stable stage, lasting until met with external disruptions, which often come from intense or frequent anthropogenic disturbances (European Comission, 2016). As opposed to pioneering species that can grow independently, these communities require specific conditions of the soil in order to succeed. On a level invisible to the naked eye, many climax trees are dependent on microorganisms that make hummus and mycorrhizal fungi, which collect water and food for the trees (Wohlleben, 2015). On average, in the forest environment, the top 20 centimeters of fertile soil contains almost 5 metric tons of fungi and bacteria per hectare (Raven, Evert, & Eichhorn, 2005). The top 20 centimeters layer (often called topsoil) is the most valuable to trees as it contains the most fauna, moisture, and nutrients (Miyawaki, 2008).

Climax trees are more connected to their environment – there has even been evidence that their saplings, or tree babies, even get tended by the tall mother-trees (Wohlleben, 2015). They are able to host native plants that could never grow successfully in the 'unfriendly' conditions our street trees live in. The soil in these communities is the most nutrient rich because of the accumulation of organic material on the surface. In fact, 54.1% of carbon sequestrated in forests is contained in the soil, while only 28.5% is in the biomass (trunks, branches, leaves, roots) (European Comission, 2016). Being the most stable, these communities also take the most time to regenerate after a disruption and are therefore considered valuable. There are many benefits to complex communities are listed below, as described by Babu (2016):

- They have high tolerance to ecological disturbances. They do not go down easy.
- They have a "middle path", i.e., they have moderate conditions, also called mesic conditions.
- They have high species diversity, and transfer of energy is in the form of complex food webs, not simple food chains.
- The size of organisms in the community is large, and they all have their specific niches.
- Net community production is low, while biomass and organic matter is high.
- Mineral cycles and nutrient exchange in the community is slow.

If we wish to enable native species to thrive in cities, we need to learn from complex communities. As mentioned before, this is especially significant for regions such as Scandinavia with a natural low biodiversity and a small array of native species to choose for planting. Climax communities are very valuable but, at the same time, very underrepresented in cities for the reasons of being too complicated to establish, take too long to evolve and would take up large amounts of space. The soil conditions

they require can rarely be found among street trees, where there is little to no energy cycling, and oftentimes topsoil is covered with concrete or completely degraded. This is the reason many trees, especially of native origin, struggle and eventually dry out prematurely.

However, we do not need to wait hundreds of years to establish a climax community artificially, as new methods incorporate knowledge of natural forest succession, and prove it is possible to establish a functional climax community in just a few decades, right in the harsh urban environment.

1.3.3 The Miyawaki method

Akira Miyawaki, a Japanese botanist, has developed a method of afforestation into indigenous ecosystems. While reforestation means re-creating forests on de-forested land, afforestation implies creating forests on land where there were was no previous tree cover. The method is based on the deep understanding of natural succession of forests, reaching dense, climax communities in decades whereas it would usually take centuries (Figure 4). Vegetation is restored based on the 'potential natural vegetation' (PNV) which is surveyed beforehand. PNV is an imagined plant ecosystem that could potentially grow in an area were there no human interference (Tüxen, 1956). Although the PNV concept has been criticized for being ill-defined and unfeasible for practical use (Zerbe, 1998), Miyawaki uses as reference the native forest ecosystems that exist naturally in the surrounding area, which is then imitated on the site of regeneration in terms of soil and topography (Schirone, Salis, & Vessella, 2011). To prepare the soil for the intermediate and complex successional stages, it is regenerated by adding natural perforation and water retention materials, nutrition, and mulch. Native trees are then grown in pots and left on the site before planting to acclimate to the local conditions. When planted, they are done so with little space between each other, which encourages competition and cooperation, vertical growth, reduces weed growth success, increases resistance to strong winds, changes in temperature and low humidity (Miyawaki, 2008).

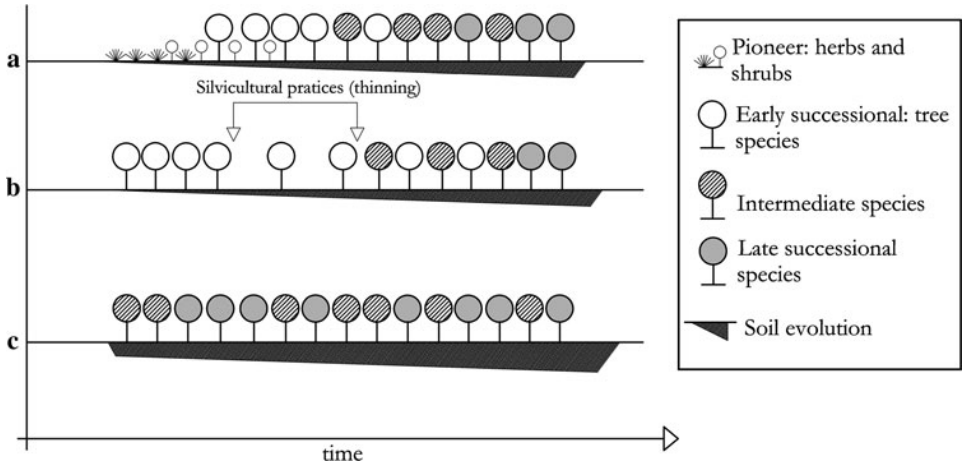

Figure 6 Successional processes in a) natural conditions, b) traditional reforestation methods, c) Miyawaki method (Schirone, Salis, & Vessella, 2011, p. 2)

Until 1998, 600 sites have been restored by Akira Miyawaki himself around the world (Miyawaki, Restoration of urban green environments based on the theory of vegetation ecology, 1998), and many of them demonstrated the ability to restore degraded areas, growing multilayer, quasinatural forests in a few decades (Schirone, Salis, & Vessella, 2011). The method itself does not only entail an afforestation technique, but also public participation as a driving force of re-wilding and sensibilisation towards tree planting (Miyawaki, 2008). While the method is gaining popularity, Miyawaki's heritage is continued as it is increasingly being used commercially by reforestation service providers such as Afforestt, Sugi and Forestcreators.

FIGURE 7 AFFORESTATION WITH MIYAWAKI METHOD DONE IN FRONT OF THE MAIN GATE OF YOKOHAMA NATIONAL UNIVERSITY (SOURCE: AFFORESTT)

Apart from the speed of establishment, the method is superior for numerous reasons. It is estimated that the green surface area of Miyawaki forests is around 30 times larger than on mono-stratal or single layered areas (Miyawaki, Restoration of urban green environments based on the theory of vegetation ecology, 1998). Although the planting process is more complex than in traditional methods, experience has shown us that the forests require no further maintenance after the 3rd year of growth (Afforestt, n.d.). Afforestation service providers also promise 300% more species compared to conventional plantations, up to 30x more carbon absorption and an increase of 3000% of noise and dust isolation (Forestcreators, 2020).

1.4 CASES OF DENMARK AND COPENHAGEN

1.4.1 FORESTS IN DENMARK

As it is with most of other European countries, Denmark was once teeming with forests. The climate in Denmark may not be very kind to vegetation in because of oscillating temperatures and sometimes insufficient sunlight that is essential for plant growth, but the large amount of moisture and accumulation of organic material enabled the development of valuable ecological communities. Deciduous trees such as oak, elm, linden and beech trees were predominant trees in most of the forests of Denmark, but aggressive logging in favor of agriculture has left only 2-3% of forest land in 1805, when the Danish Forest Act banned free clearing of forests and put effort in restoring these habitats (Ministry of environment of Denmark, n.d.). Forest ecosystem has then started its comeback, albeit in somewhat different form. Because of their fast growth and high resistance, there was great incentive to plant coniferous trees such as the Norway spruce, which resulted in more than 50% of today's forest cover made of coniferous trees (Ministry of environment of Denmark, n.d.). The Danish Nature Agency or Naturstyrelsen is responsible for nature management in the country and facilitates countless projects of restoring and improving natural habitats, especially close to towns and cities. Today, forest covers 14.1% or 608,078 ha of Denmark (Forests of the world, n.d.), and thanks to the efforts of Naturstyrelsen, it continues to grow.

1.4.2 Planting practices in Copenhagen

In Copenhagen, the Municipality is responsible for planting trees in public spaces. In an email exchange, Lars Christensen, the planting specialist working at the Municipality, has provided the framework used by the Municipality when deciding what species should be planted and where. There is a difference in planting strategy for parks and street areas. In parks, there is an incentive to plant native species of trees as they have proven to be high contributors to biodiversity, high ecological value and conserve the natural identity (Copenhagen Municipality , 2017). However, many of the same species proved weak to endure the harshness of street environment, dying of disease, drought, and other afflictions. Until the 1990s, Copenhagen was full of elm trees (*Ulmus minor, Ulmus glabra*), which were all affected by the Dutch elm disease (*Ophiostoma ulmi*), resulting in 4000 trees dead, or 20% of all street trees (Copenhagen Municipality, 2020). Because of this, the framework suggests planting species that are proved to be resistant on the streets, and diversify the genera planted as much as possible to reduce risks of disease and to enhance biodiversity. Naturally, most of these species are not native, and individually, they contribute less to biodiversity than native species. In the following, the preference of street tree species selection is listed, as stated in the policies provided by Copenhagen Municipality (2020, p. 1; translation by author):

Experience	Species
Good growth experiences	Oak, elm, emperor tree, cherry, linden, plane tree, pear, black locust, rowan, hawthorn and apple.
Few growth experiences	Amber wood, hornbeam, berry medlar, pine, ginkgo, golden rain, Chinese tree, holly, pagoda tree, silver leaf, tulip tree, water spruce and real chestnut
Poor growth experiences	Birch, beech, spruce, hazel, dogwood, larch, maple and walnut.
Disease / aggressive root growth	Ash, horse chestnut, willow, poplar, cloud rows and thorn

1.4.3 The morphology of Copenhagen

As concluded so far, urban forestry can contribute to re-balancing the natural and cultural elements in the city by implementing climax communities of native trees in the form of Miyawaki forests, which can bring countless ecological, social and health benefits. The current nature management practices in Copenhagen create similar landscapes only in parks and nature areas, concentrating native communities in certain areas and resulting in an un-balanced cityscape. Native communities need to be spread out and integrated in the fabric of the cityscape.

Being able to read and interpret the morphology of the landscapes that we build, we can plan where to implement more complex nature with utilitarian value instead of only aesthetical. By looking at the map of Copenhagen, the socio-economic elements are much more prevalent than the ecological (Figure 8), as only some of the areas marked in green are parks and nature areas (see legend), which are the only areas where native communities are planted and encouraged.

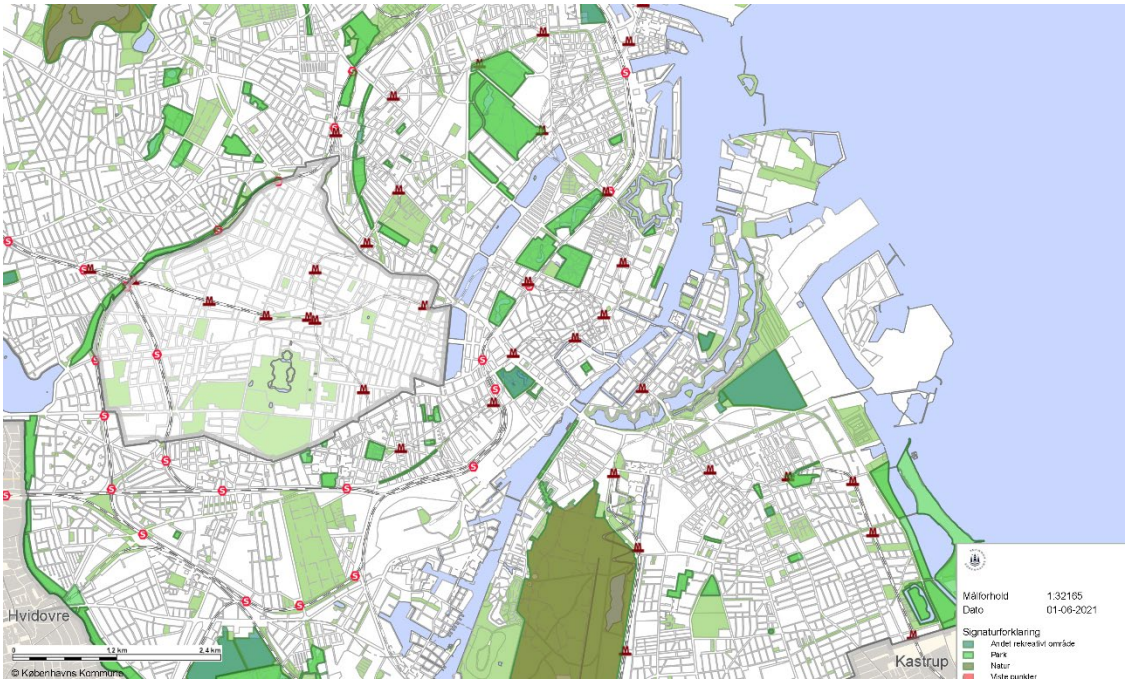

FIGURE 8 MAP OF COPENHAGEN WITH THE LAYERS OF RECREATION AREAS, GREEN SPACES, PARKS AND NATURE AREAS

However, looking at the map gives us very limited information about the environment, as cities are vastly complex and can be observed in countless ways. Therefore, in this research, I first attempt to develop a method of noticing the urban morphology of Copenhagen. This method must encourage noticing the power struggle between ecology and socio-economy or nature and culture so to create a framework for their rebalancing. Inspired by the urban landscape ecology approach, the method should encompass a fair amount of the city's landscape so to make viable conclusions and consider re-balancing for the scope of the city.

In order to implement the highest value of nature in cities, we need more complex communities instead of only pioneering species and empty lawns, and we need them to be distributed across the entire cityscape. Considering that the face of the city is heavily cultured, we are considering areas that are still uninhabited or unutilized. These areas should already have some characteristics of a 'green area', and, if left alone for a long period of time, would be engulfed by the successional traits of forest ecosystems, as it happens in nature. In order to systematize the findings in a articulate way, once the data is collected, in this paper I process and extract the reoccurring patterns of potential in the city's morphology where the force of urban ecology could be restored. In this case, this restoration is considered using Miyawaki forests as they have been proven effective in the urban context and enable the flourishing of unmanaged, native communities. Additionally, rebalancing the cityscape is a visionary and abstract concept, but if we want to make it suggestive, we must give structure to this vision and present it as a reachable goal. Therefore, I will be using illustration to depict some of these landscapes so to not only discover 'what is' but also 'what could be', with the goal of breaking abstraction and as an encouragement to city planners and designers to feel free to view cities differently.

2 PROBLEM FORMULATION

What can we notice about the culture – nature struggle in the landscape of Copenhagen?

How do we use patterns of urban morphology to encourage rebalancing and how could it look like?

3 THEORETICAL FRAMEWORK

In the first part of the theoretical framework - 3.1.1 A vision of a charming Anthropocene, a framework is constructed to enable envisioning a better future. The framework presents the concept of the Anthropocene and why it is important to change its connotation. Furthermore, it includes the assumption that cities are unbalanced in terms of natural and cultural elements, which results in environments that are out of the human scale.

In the second part 3.2.3 The morphology of the Anthropocene, I attempt to construct a tool that enables me to view the city from a certain aspect to reveal the morphological patterns. We present the concept 'patches', as the main morphological unit used to discern the urban morphology in the analysis.

3.1 A CHARMING PATCHY ANTHROPOCENE

3.1.1 A VISION OF A CHARMING ANTHROPOCENE

Anthropocene is a term coined for the geological epoch in which human activities are imprinted in Earth's geological record. The term is increasingly mentioned in negative connotations and, upon mention, conjures images of resource depletion, pollution, blind accumulation of capital, species extermination and many other uncanny scenarios. The Anthropocene is usually tied to the degraded nature of grey, monotonous urban environments, and Buck (2015) talks about re-wilding as a way of establishing a better version of the Anthropocene. However, it has proven very hard to incorporate abundant nature in cities for many reasons, for a city is not a forest and was never meant to be one. Its landscape is characterized by pavement, concrete, asphalt, metal, glass, and many other elements hardly decomposable in nature. It is the strongest symbol of our science-based, technological civilization. When we compare ourselves to the rest of the animal kingdom, we are unique in a type of expression and organization that we sometimes call culture. Never before in evolutionary past has Earth had to deal with anomalies such as language, art, symbolism, construction, and a plethora of other activities that specify the *Homo sapiens*. It seems that no matter how convincing the evidence for the evolutionary theory of the origin of our species is, no matter how grounded we are in the world of biology, we struggle to explain our cultural habits and the need to constantly create something that is of another world. These cultural undertakings have raised *Homo sapiens* to the top of the food chain and enabled us to, in a relatively short time, completely terraform the surface of the earth. Oftentimes, we are not careful and cultural creations start to serve something other than ourselves, resulting in environments outside of our scale. This idea has been toyed with by the Danish architect Jan Gehl, who dedicated a substantial amount of his career to re-direct architecture and city planning towards the human scale (Matan & Newman, 2016). He argued that planners have fallen out of touch of the basic mental and physical dimensions of the human being and made a disconnection between how we manage space and our deeply innate biological foundations. He has criticized the focus and attention given to car infrastructure that puts a common walker in a trivial position. Since people are losing valuable walkable space to roads, it has become unclear as who is, in fact, superior here, the human or his vehicle. This unaware approach can also be noticed in design of buildings. The multi-story, monotonous behemoths that are erected in cities are by no means calibrated according to the human scale. One must almost break his/her neck to glance at such a construction from down below and be met with a painful lack of details in form and décor that the human senses are attuned to. Such bland design and monolithic dimensions are made with the car in mind and might only seem remarkable when the site is viewed from afar or from helicopter (Gehl, 2015).

The human scale is a multi-layered concept, but in order to imagine the better Anthropocene, we have to remind ourselves that the deficiency of wilderness in our everyday lives is also outside of our scale. As we can conclude from the problems in section 1.1 Nature in cities, the human scale entails a stronger contact between man and biodiversity. As the story of Anthropocene is often a scary story

of doom and alienation of humans from the natural world (Buck, 2015), the discord that we have with the human scale could be contributing to producing the current image. Many environmental movements use apocalyptic motives to 'enchant' the audience with pessimism about our reality, however, this approach may work against the efforts of building a better future because it lacks a positive vision to strive for. Enchantment can be used the other way around as well. To tackle this, we must work on changing the meaning of the Anthropocene and how we discuss it. If speculative futures are created through word or image (Buck, 2015), and, in this project, I use illustrative methods to contribute to the retelling of Anthropocene story and present a glimpse of the future which is more in line with the human scale.

3.2.3 The morphology of the Anthropocene

In order to deconstruct and study the imprint of the Anthropocene, Tsing, Mathews and Bubandt (2019) propose a conceptual tool, something called landscape structure or 'the patterns of human and non-human assemblages'. In other words, landscapes are places of different kinds of systems rubbing against each other, be they of human or nonhuman origin. Two kinds of landscape structures are said to be key for anthropogenic disturbances: modular simplifications and feral proliferations. To explain modular simplifications, Tsing, Mathews & Bubandt (2019) use the example of plantations as an ecologically simplified landscape. What once was a variety of species, interesting form and detailed structure is now a monocultural and monotonous modular simplification. The Anthropocene is characterized with this pattern of reducing diversity to boost a certain kind of individuals. The results of modular simplifications are feral proliferations, which are a kind of a retribution by the simplified system. In the case of plantations, feral proliferations are plant diseases that are created and exacerbated by the simplifications of agriculture. The monocultures make it possible for diseases to thrive and pests to multiply much more successfully, creating a problem that challenges even the natural environments.

> "*Throughout history, humanitarian calamities and global inequalities have been enacted through nonhuman agency that reacts to human design*" (Tsing, Mathews, & Bubandt, 2019, p. 188).

Although the Anthropocene is a global phenomenon, it is expressed locally in situations around, as the structure of urban form is a hierarchy of levels related part to whole (Evans, 2005). The level used for the purposes of this research is the level of 'patches'. Patches are the places of interaction between modular simplifications and feral proliferations, places that carry histories of multispecies relationships and where the inequalities between humans are evident (Tsing, Mathews, & Bubandt, 2019). Apart from farms and plantations as the examples of modular simplifications, the classification can also be translated to work for the urban environment. If a chicken farm is a simplification in the sense that a complex, multispecies ecosystem has been turned into a domination of one species of chicken, how is the asphalted patch in the city not a simplification considering the complexity of the ecosystem that was once covering the landscape? If studying urban morphology is essentially equivalent to studying urban history (Evans, 2005), the legibility of a part of urban landscape is inevitably tied with the previous characteristics of the landscape and what brought it to the current state. Therefore, the concept of patches of modular simplifications is a useful classification tool to describe the morphology of the Anthropocene.

Although it is not revolutionary to say that cities should include more biodiversity, if we want to invite more wilderness, we need to avoid creating patches of modular simplification whenever possible so to reduce the impact of feral proliferations. Feral proliferations have already wreaked havoc to the street trees of Copenhagen by inducing tree-killing diseases, but they are also reflected in the effects on human health and the environmental degradation. In order to have resilience, it is not enough to have concentrated, large parks in the center, but to identify patches of modular simplifications and incorporate the most beneficial natural forms in the skeleton of the city itself. When studying morphology, apart from considering the history a patch, it is useful to consider the

current qualities and the relationships between the patch and other levels of morphological hierarchy (Evans, 2005). Therefore, if patches of modular simplifications were to be considered for Miyawaki forests, examining current purpose use of the patch enables us to judge if a forest would affect other levels of morphological hierarchy negatively. Patches of modular simplification that are uninhabited by other actants in the city would be a perfect opportunity for re-balancing, as we want the force of nature to take over available space in the city.

4 METHODOLOGY

In this section I talk about drifting as a methodology of city exploration, and then continue to elaborate on the modified version I termed 'controlled drifting'. This methodology enabled me to justify the subjective city exploration technique while still being in somewhat controlled manner in order to find the desired patches. Furthermore, I mention how I used mapping software (A-GIS tracker) to track my movement and store photographs.

4.1 DRIFTING (DERIVE)

Cities are localities of enormous complexity of visual stimuli, sounds, smells and even tastes. They are full of surfaces and events that induce emotional and psychological reactions. For a curious spectator, the city can never run out of novelty that provide amazement, shock, or intrigue. Quite comprehensively in his paper, Alexandros Daniilidis (2017) has provided a historical overview of the development of the art of tracking the urban stimuli. Baudelaire, in *'The Painter of Modern Life'* in 1863, has been titled *'flaneur'* or the urban explorer. This term was coined after his journals, and his interactions with the city were meant to be a type of a political or artistic expression in response to the city as an increasingly hostile environment and the overwhelming nature of modern life. Just as Baudelaire aimlessly drifted and strolled through Paris, E. A. Poe explored London, thusly writing '*The Man of the Crowd'* in 1840. Poe was, as much as Baudelaire, trying to detach himself from the ruckus of the city while examining it at the same time. Both authors claimed that the 'spirit of the place' or *genus loci* can only be unlocked and observed if the drifting is done with no specific goals in mind, driven solely by the senses and giving in to instincts. Derive is a rebellious act exactly because an opposite way of interaction with the city was practiced by many citizens of Paris and London. Going from point A to reach B often meant missing out in everything in between, especially with the increasing use of cars and public transport whose speed and isolated interior left little opportunity to engage with the environment. This modern type of movement changed the way humans structure their internal mental maps of the environment, something that is referred to as psychogeography. British author and journalist William Self (2020) talks about the problem of fragmentation of human psychogeography in modern life and walking as a way to restore and complete mental maps. Furthermore, he suggests drifting as a remedy for the struggle of isolation in pandemic Britain, which suggests that the method is still relevant today.

4.2 CONTROLLED DRIFTING

Because landscapes are complex, they can be valued in different ways, depending on the eye of the observer: "*Most people experience landscapes also in a holistic way and integrate what they perceive immediately with what they know and remember"* (Antrop, 2005, p. 27). Therefore, it is plausible to say that drifting is somewhat a subjective method of forming specific images of the environment. The environmental image is the mental image of the physical world in the mind of an individual. The forming of this image done both by the observer and the environment, as while the environment suggests distinctions and relations, the observer gives his/her own meaning to what he/she sees (Lynch, 1960). However, in this research, this subjectivity was welcomed and viewed as a benefit. Considering my background in urban forestry, what I 'know and remember' enabled me to notice details that would possibly escape others. The free nature of drifting also enables free evaluation, instead of making quantitative conclusions. However, although the point of a derive is to be done without much structure in mind, for the purpose of this research there are several key modifications to the traditional methodology. Considering the controlled setting in this modified approach, the methodology is referred to as 'controlled drifting'. The goal of these modifications is to preserve some of the useful traits of derive as a research methodology while still achieving the desired result.

4.2.1 Search objectives

Firstly, the derives in this project are not done with the only goal being taking in the impression or the 'spirit' of the place but with keeping in mind the specific search objectives. These objectives are locating patches and describing them afforested with Miyawaki forests, with the goal of re-imagining the Anthropocene, and not to make hard measurements, plan, and project. However, there is still a need to roughly specify what was exactly sought for during the derives, therefore, a list of preference is shown below:

- The patch is a modular simplification (lawns, places of low species variety …)
- The patch is of a minimum size.
- The patch is on public land.
- The patch does not have a current cultural purpose or use.

The size of patches was never measured but evaluated on the spot. According to Miyawaki, forests can be planted on 1m wide strips (Figure 3) (Miyawaki, 2008), and the recommended minimal size for afforesting according to Afforestt (n.d.) is 100 m^2. With this variety of opinion, size was never considered the decisive factor, although some patches were obviously too small for afforestation.

Figure 9 Students planting a complex Miyawaki forest on an island patch in Japan (Miyawaki, Restoration of urban green environments based on the theory of vegetation ecology, 1998)

Moreover, during the walks, it was not always obvious patches were part of public space. However, it was easy to check ownership in the spatial map of Copenhagen afterwards (*www.kbhkort.kk.dk*). However, some of the patches described were owned by developer companies that were responsible for significantly affecting public space. Therefore, ownership was also not a strict selection criterion except for a preference for public space. As for the current uses, many green patches were not of interest because of an existing cultural use by the citizens. For example, areas such as parks were not considered because, although citizens visit parks to enjoy nature, they employ ecological simplification (e.g. green lawns) to enable citizens to rest on grass, recreate, attend events, concerts. Dense and messily diverse Miyawaki forests would challenge the current use of parks.

Additional soft criteria when examining patches for afforestation:

- The canopies of trees would not touch or cover the view of a significant building or object.

- The canopies and the roots of the trees would not harm nearby infrastructure.
- The trees would be in contact with favourable light and moisture conditions.
- The trees would act as a wind shield or cover an unwanted sight.
- The patch was already covered with soil and grass.

4.2.2 Movement structure

For the purpose of this paper, a rough movement structure of the explorer was pre-defined. Considering that there are five different derive routes starting from a same point, there are five directions I followed to ensure good coverage of the five-kilometre-radius area. Keeping track of the directions is done with the use of the compass (Figure 4), on which the direction trajectories correspond to different azimuth angles on the compass: 10°, 72°, 138°, 191° and 251° (Figure 5). The azimuth angles are chosen with care to be approximately equally distanced from each other (~60°) and cover the area with the centre being the King's Square or 'Kongens Nytorv', for it was the centre of the historical part of the Old Town of Copenhagen for many years in the history of the city. This part of the city has been ringed around by city walls or moats, which can be seen on the map describing the invasion of Swedish forces on Copenhagen in 1659 (Figure 10).

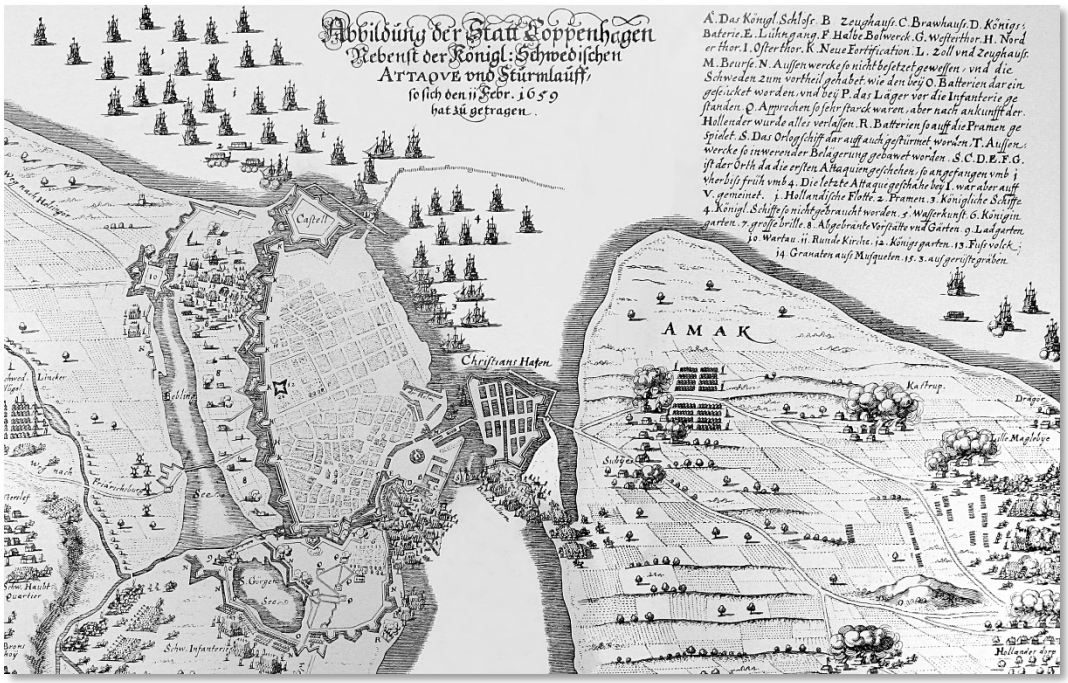

FIGURE 10 SWEDISH INVASION ON COPENHAGEN SHOWS THE BORDERS OF THE OLD CITY (SOURCE: FR-ACADEMIC.COM)

Furthermore, to keep the nature of derive, the movement did not blindly follow the azimuth angle. For example, if the researcher was 'locked-in' in a certain street for a longer than desired time, he has broken away from it by switching to adjacent streets, while keeping the general direction. Additionally, if there appeared objects of interest in my viewing distance, I took the liberty to approach them, with the condition of coming back to the original path after their examination, if I estimated to have strayed too much.

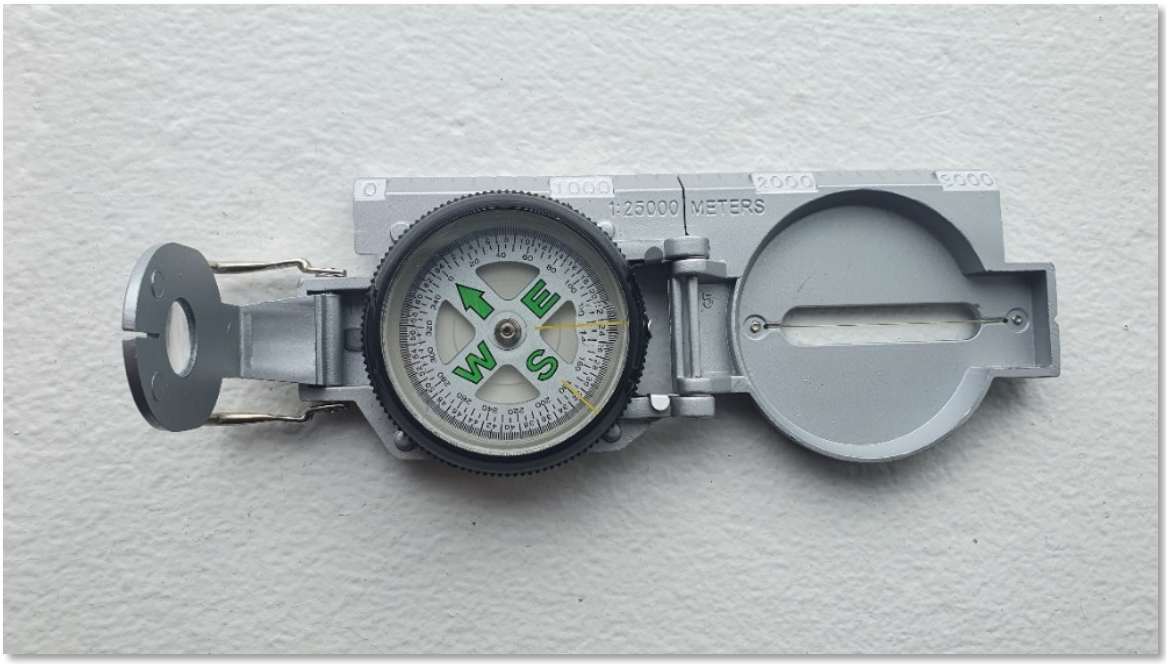

FIGURE 11 FIELD COMPASS USED DURING THE DERIVE

FIGURE 12 MAP DEPICTION OF FIVE AZIMUTHS FOR FIVE DERIVE ROUTES

TABLE 1 SUMMARY OF DIFFERENCES BETWEEN DRIFTING AND CONTROLLED DRIFTING

	Drifting	*Controlled drifting*
Aimless/intuitive wandering	✓	✗
Full attention to the senses	✓	✗
Noticing the spirit of the place	✓	✗
Empowers subjectivity	✓	✓

Semi-intuitive wandering	✗	✓
Covers a specific area	✗	✓
Search objectives	✗	✓

4.2.3 A-GIS TRACKER

To note the impressions during the derive, the route has been tracked digitally with the use of the android software 'A-GIS Tracker'. The movement of the researcher is marked on the map with blue lines. Furthermore, it includes to option to take photographs, which are automatically placed spatially on the map, along with a description of the photograph. Considering that the main idea of derive could be phrased by 'notice when you notice something', taking a photograph and then adding a short description to it showed to be a really effective way of capturing the moment and noting its significance. The drifting was halted after the five-kilometre distance threshold which was also tracked by the application at the top-right corner (Figure 13).

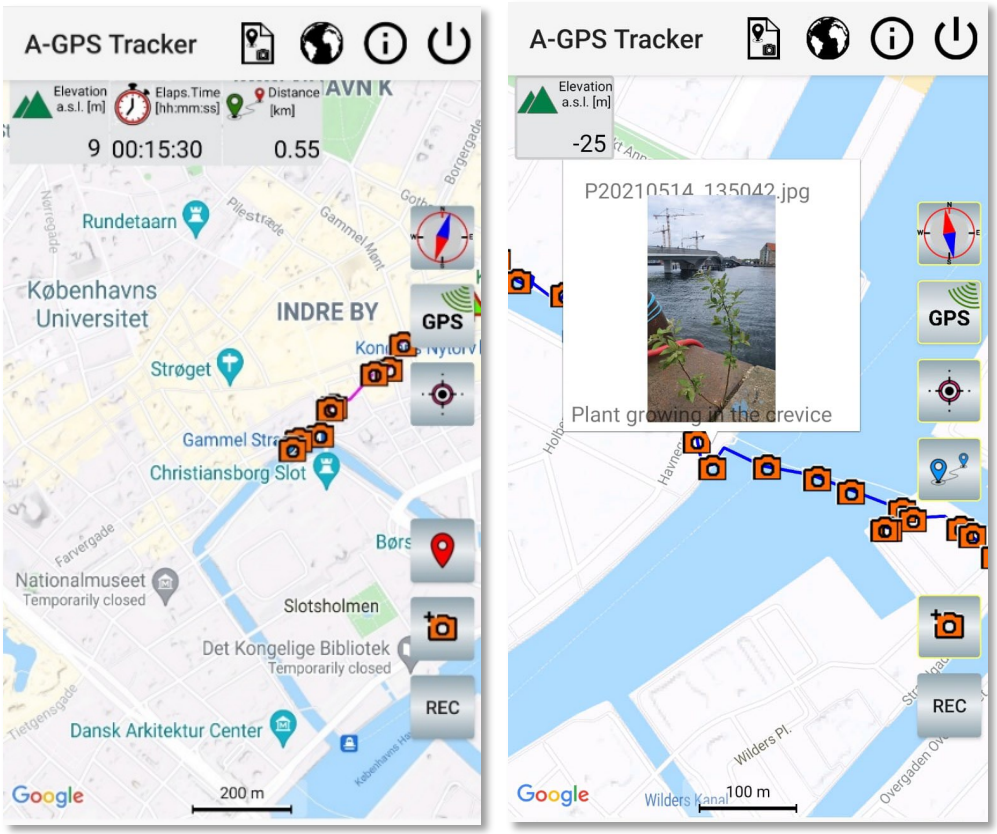

FIGURE 13 A-GPS TRACKER. LEFT: SCREENSHOT DURING ROUTE 2; RIGHT: EXAMPLE OF PHOTOGRAPH DESCRIPTION DURING ROUTE 5

5 ANALYSIS

In the first part of the analysis 5.1 Controlled derive, I describe chronologically five derives done in order to cover a 5km radius area. Each is done on a different day in April and May 2021. The form of the analysis is story-like - it is a description of my movement as tracked with the GPS tracker, my thoughts (as drawn from memory and from written sources), and the description of interesting patches. Many localities mentioned in the analysis are accompanied by photographs taken by the author, attached to a map to increase clarity. Many photographs are contained in the analysis while most are linked to Appendix 1 to avoid clutter. Furthermore, part 5.2 Reflection is where I tackle the first research question, and it is a reflective part about the methodology I have used and to what degree it was successful.

Secondly, in 5.3 Patch pattern systematization and re-imagining, I tackle the second research question. Firstly, it sums up what was encountered during the walks and explores which discovered patterns of urban morphology could be of use to restore balance of nature and culture. Patterns of patches are explored further by describing the reoccurring examples along with illustrations of a typical example of shape and location. Finally, along with the most significant patch types, illustrations of rebalanced landscapes are done so to present an image of a charming Anthropocene.

5.1 CONTROLLED DERIVE

ROUTE I

The first derive started from the King's Square, at 11 AM on the 23rd of April 2021. Weather conditions have worked in favour with a maximum temperature of 11°C and a clear, sunny sky up until late afternoon. The square was habited by linden trees in circular formation that resembled scarecrows with their barren branches (Figure appx. 1). As determined beforehand, the trajectory of route I followed the 10° azimuth, so without further ado, I started my stroll in Gothersgade street, which seemed to correspond most to that direction. In the search for natural forms, I was fooled by a plastic plant imitation above a shop that I interpreted as a display of longing for nature by citizens in the harshness of the city (Figure appx. 2). There was little space for trees along the way, and when it was found, the transition between the tree and the cultured surrounding was painstakingly abrupt (Figure appx. 4). Small, raised gardens were the occasional refreshment, but these were fit for a single trees, small flowering plants, and vegetables (Figure appx. 3). Finally, in Sankt Annæ Vester Kvarter, the local church was decorated with two green patches on the south side, marked as 'byhaver' or city gardens on the spatial map of Copenhagen. Both patches were fenced around, however, the western patch did not have any elements to it besides the three linden (*Tilia cordata)* trees (Figure appx. 5) that are marked under the category 'iconic trees' on the spatial map. The eastern patch was not of such interest since it had raised garden beds that were used for growing vegetables. Finally, behind the church, another patch on the north side looked more interesting since it was not categorized as a garden, there were no existing iconic trees, reforesting it would not visually cover the church and the plot seemed completely unmaintained (Figure 14).

FIGURE 14 PATCH BEHIND THE SANKT ANNE CHURCH

Further roaming to the north has brought me to the Øster Voldgade street, where I found prime examples of conflict between street trees and culture (Figure appx. 6). Many street trees are expected to grow their roots underground and not disturb the flat cultured environment. However, trees usually have little interest in the depth of urban soil, as it is often compressed to the degree that there are no air pockets necessary for the plant's metabolism. Furthermore, trees generally prefer surface soil for its richness in organic matter and water, and they consider this so seriously that their roots will break concrete and shatter infrastructure just to practice this ages-old evolutionary habit. After a few minutes of minimal sightings of trees, my semi-intuitive wayfinding has brought me to the wide, multiple-laned Strandboulevarden street. The lanes were separated by patchy islands of green lawns that are categorized as 'other green area' in the Copenhagen spatial map. The atmosphere in the street had a subtle, unfriendly undertone that day. It might have been because of the fast-paced lanes that produced a constant thunderous rattle with cars passing by, or the relentless wind from the north that seemed to be channelled and even strengthened by the colossal and linear architecture on the sides (Figure appx. 7). Some of the green patches had tracks of stepped grass formed in the middle, which is a sign of their occasional use by walkers (Figure 15). These areas were interesting as there was plenty of space for a forest to soak in some of the annoying noise coming from the highways and would weaken the northern wind which was freely passing through the street (Figure 15).

FIGURE 15 STRANDBOULEVARDEN SET OF PATCHES

Intimidated by the wind in Strandboulevarden and careful not to lock myself in one street during the derive, I wandered off a bit to the left and stumbled upon Melchiors Plads square. Several hybrid linden trees (*Tilia Europaea*) - a crossbreed between the native trees *Tilia cordata* and *Tilia platyphyllos* - seemed to be fighting with the cultured surrounding (Figure appx. 8). Fortunately, this kind of tree planting can only be found on old sites such as these, as the understanding of the complexity of trees' biology has evolved. With more space given to the tree, its health and resistance to disease is greatly improved, so the need for a premature felling (Figure appx. 9) is eliminated. At my surprise, Strandboulevarden appeared again before me, which now stretched east – west, and presented once again the familiar patches of sycamore-covered green areas. However, we were quick to separate, and Østerbrogade has become the new exploration ground. Considering its north – south orientation, the winds there were cold and merciless too, and there were no evident patches that could one day host the wind-blocking forests. However, one area by the road has sparked interest as it looked un-utilized and poorly maintained. It was another fairly large plot in the category 'other nature areas', while the only nature on it being a few blades of grass (Figure 16). Although the ground seemed degraded, a multi-stratal, tiny wilderness would be possible to create if the proper soil restoration techniques would be employed.

FIGURE 16 ØSTERBROGADE PATCH

Continuing, Østerbrogade did not treat me with nothing but concrete, so the route was adjusted eastward, where in Kildevældsgade a local birch tree stood out with its hanging canopy and gave a glimpse of how the order-inducing, sharp corners of city streets could be rounded for a more organic atmosphere (Figure appx. 10). As I was nearing the 5-kilometre mark, my walk was ending in Sibeliusgade, where a large patch in front of the Borgervænget recycling station (Figure 17) took my interest. The exposure to sunlight on this patch made me wonder why it is kept so simplified still.

FIGURE 17 BORGERVÆNGET RECYCLING STATION PATCH

ROUTE II

The clear sky on the 26th of April allowed the sun to warm up chilly Copenhagen during its high position at 1:20 PM. With the highest day's temperature being only 8°C, I decided to warm up by starting drifting to the west-northwest. The way was zigzagging among the small streets of the inner city, where it was once again evident that the area of the old town had little opportunity to be reforested because of content density and lack of space. The street trees that did exist were often used for bicycle parking (Figure appx. 12). This type of behaviour is discouraged among urban foresters as even a small scratch wound on the bark can lead to infection from fungi or bacteria and shorten the tree's lifespan significantly. During the drift, the Gammel Mønt street transitioned into Vognmagergade and finally Åbenrå but kept the same atmosphere created by tall office buildings and surface car parking. The only expressions of vegetation were blooming cherry trees imprisoned in cages (Figure appx. 11) and climber plants holding on to dear life with barely any soil underneath them. Eventually, arriving towards the opening of the Nørreport train station, the light and the change of atmosphere stimulated the senses, invoking hope of leaving the concrete clutter of the inner city and finding interesting patches. The new city construction included a more modern approach to tree planting with more protected surface soil given to the trees (Figure appx. 13). Passing through Gothersgade also meant passing by Copenhagen's botanical garden and many potted trees of cedar (*Cedrus atlantica*), Douglas fir (*Pseudotsuga menziesii*) and cherry laurel (*Prunus laurocerasus*) (Figure appx. 14). Not many objects of interests were in sight until arriving to the Dronning Louises bridge that stands over the Peblinge lake. At the root of the bridge, horse chestnut (*Aesuculus hippocastanum*) and lilac (*Syringa vulgaris*) trees decorated artistic installations and the space was used by curious citizens. However, a long ecologically simplified patch stretched along the side of the canal, acting as a height transition between the upper cycling track by the road and the trekking path by the canal (Figure 18). Considering this patch followed the noisy Søgade road, a Miyawaki forest could lessen the chaotic sounds of traffic and give citizens peace to enjoy the watery view.

FIGURE 18 PEBELINGE LAKE PATCH

Crossing the bridge, I entered the crowdy Nørrebrogade, which cuts through one of Copenhagen's most eclectic neighbourhoods - Nørrebro. An interesting anomaly on this road was the Elmegade bus station area, which was reserved only for public transport, and was marked with red paint. It made me think, should the trend of limiting car use in the city increase, more space is liberated and consequently more patches available for rebalancing in the future. Nørrebrogade is not blessed with greenery, but the touching points with the lushness of Assistens cemetery, the resting place of H.C. Andersen and Søren Kirkegaard, were tempting for a nature lover such as myself. After following the cemetery walls to its end, the route took a slight left to leave Nørrebrogade in search for some novelty. I was in for a delight when coming upon a charmingly unmaintained, open garden between two buildings soaked in graffiti paint, which I later found to be called 'Byhave 69' (Figure appx. 15). The garden is used to host events of urban gardening and education, but along with apple trees and vegetables, some conscious individuals have also planted native trees such as Norway maple (*Acer platanoides*) and goat willow (*Salix caprea*). Continuing into Søllerødgade, raised garden beds contained degrading organic material (Figure appx. 16), somewhat similar to the soil in complex forests, where nutrients move in a cyclical manner from the soil into the plants, and eventually back to the soil again. Such a cycle of energy is lost around street and even park trees, so they need constant care by adding nutrients, irrigation, and additional protection. Approaching Nørrebroparken, there was an unpleasant pulse of cold wind coming from its direction. Despite not being of interest for the derive, I noticed a potential patch in the belt of tall linden trees surrounding the park, which were later found to belong to the 'protected trees' category (fredede træer) in the spatial map of Copenhagen, therefore I spared them the re-imagining. The next finding on Hillerødgade was a patch on the crossing with Lundoftegade street, which was a green corner of a block with a resting bench and a path that cuts through it. The idea of the patch seemed to be to create privacy and peace but was not protected sonically or visually from the traffic. Therefore, there was potential to add native wilderness, fill the blank space and make this little haven more enjoyable (Figure 19).

FIGURE 19 HILLERØDGADE X LUNDOFTEGADE PATCH

The area later proved to belong to the 'other green areas' group in the spatial map. Another patch of the same category was found a few minutes later during the walk, but this one was much larger and was integrated inside the block, surrounded by residential buildings (Figure 20). This green area surrounds the Bispeengen playground and was not particularly maintained. Since there was a large portion of the patch unused, there was space to be filled with trees that would increase life quality of the neighbourhood.

FIGURE 20 BISPEENGEN PLAYGROUND PATCH

Shortly after on the same street, by the s-train tracks of the F-line between Fuglebakken and Nørrebro stations, a familiar patch was found. It was familiar in shape to the 'level change' canal patch on Nørrebro bridge, but this one seemed to be a a reoccurring theme when it comes to the surrounding of the S-train tracks. The area is fenced and unmaintained and was being consumed by pioneer species of bushes and trees, creating an unwelcoming, chaotic arrangement. The level-changing patches by the s-train are not registered as any type of green space in the spatial map of Copenhagen, and the steepness of the terrain would be beneficial for species growing on slanted and well-drained soil, such as beech (*Fagus sylvatica*) (Figure 21).

FIGURE 21 FUGLEBAKKEN - NORREBRO S-TRAIN PATCH

Shortly after, another interesting area was spotted on Rørsangervej, a branch of Hillerødgade. This was a courtyard that stood out in its unjustified ecological simplification, serving only as a display platform of a few magnolia (*Magnolia soulangeana*), hawthorn (*Crataegus laevigata*), and a few maple trees (*Acer pseudoplatanus*). It was surrounded by roads, but some parts of it were used as a park (Figure 22). Nearing the end of the walk, close to the five-kilometre distance from the centre, the patch frequency drastically increased in form of corner and island patches. Such are cases of Blåmejsevej (Figure 23), where a corner was simplified, and on the large crossing between Hillerødgade and Bispeengbuen that has had its share of corners too (Figure 23).

FIGURE 22 RØRSANGERVEJ PATCH

FIGURE 23 HILLERØDGADE X BISPEENGBUEN CORNER (LEFT) AND BLÅMEJSEVEJ CORNER (RIGHT)

Route III

On the 27th of April, 2021, another clear and warm day called for another derive starting from Kongens Nytorv at 10:20 AM. The descent towards the south-southwest began in the famous Strøget street, which used to be a busy car-dominated area but was now a symbol of the liberation of public space in favour of pedestrians. Apart from potted forms of urban nature (Figure appx. 17), the street did not offer much so I have been quickly attracted a tad southward to reach Nikolaj Plads and the surrounding lindens (*Tilia cordata*) that were lined up in geometrical precision like soldiers at a march (Figure 24). The lindens were integrated into the stony ground and seemed to be holding out well, despite the seemingly compressed and lifeless soil beneath them (Figure appx. 18).

Figure 24 Nikolaj Plads

Another linden army appeared quickly after, in Højbroplads square, when I realized that none of the lindens seen so far flushed out their leaves, despite it being mid to late spring. This is one of the reasons the species is so resistant and preferred as a street tree, as lindens are thus protected from late spring frosts that might destroy the young and vulnerable leaves and make the tree lose a yearlong worth of light. Following the compass and a breeze of fresh air, I found myself by the canal surrounding Christiansborg castle. Apart from the out-of-place, modern-looking entrance of the Gammel Strand metro station, the rustic aesthetic was still signalling that I have not yet left the old town (Figure appx. 19). Even the plants were housed in barrels, like they belonged to some medieval tavern (Figure 25). Gammel strand street was full of plants each one in their own piece of soil, their own little isolated universes floating in the endless concrete sea, never to experience the richness of a vast network of complex root systems, fungi and microorganisms that is the forest soil. Nevertheless, the cedar (*Cedrus atlantica*) and Norwegian pine (*Pinus sylvestris*) trees in barrels were a tiny reminder of ecosystems that once dominated the land and a sneak-peek of a potential enchantingly rewilded Anthropocene.

FIGURE 25 GAMMEL STRAND STREET

While hurrying through the unnerving car exhaust stink and noise of Stormgade, I was stopped to examine a diversity of street plants that coloured Vester Voldgade, a street leading to Rådhusplads or the City Hall Square (Figure 26). Numerous flower beds and pots gave the place a formal type of representability, which was only natural with the many institutions in the vicinity such as the City Hall, National Museum, and the Museum of Fine Arts. An interesting conflict to the orderly structure of the flower beds were the eucalyptus and horse-chestnut trees sticking out from them, as if admiring the height of the nearby black locust trees and hoping to reach their greatness someday.

FIGURE 26 VESTER VOLDGADE STREET

As soon as I came upon the large H.C. Andersen Boulevard as a final obstacle to breach before the famous Tivoli amusement park, there was an abrupt change in patch type and size. The first interesting patch was in the middle of the boulevard by the statue of Dante's Beatrice, erected at the 600th death anniversary of the poet Dante Alighieri (Figure appx. 20). Passing in between Tivoli's walls and the yew trees surrounding Ny Carlsberg Glyptotek (Figure appx. 20), Tietgensgade street did not offer much nature to admire. Therefore, I decided to stray to the south after passing over Copenhagen's central station, a great disruption in the, until then, orderly landscape (Figure 27). Mesmerised by the anomaly created by train infrastructure, I have decided to follow it down the Ingerslevsgade street, which was also aligned to my, initially set, direction. A line of common hornbeam trees and a tall metal fence divided me and the track-inscribed canyon below. The inaccessibility and the smell of urine did not stop me to try and see what were ominous-looking patches on the periphery of the railway (Figure appx. 22), but however ominous and unmaintained, they were a reminder that the railway infrastructure produces simplified patches that are for multiple reasons perfect for rewilding with Miyawaki forests. The patches act as the already mentioned level changers, stretching along the length of the railway, and acting as a kind of a buffer zone between the rest of the city's landscape and the heavy simplified environment.

FIGURE 27 COPENHAGEN CENTRAL STATION

Additionally, another patch that contributed to my joy was on the other side of Ingerslevsgade, and it contained newly planted examples of sessile oaks (*Quercus petraea)*, native trees that produce complex forest communities (Figure appx. 23). Even though the method of planting did not correspond to Miyawaki the method, it is significant as this species is not a common sight among all the lindens and black locusts, and it meant that the planting specialists still have it in their practice to use oak trees for the street. Having enough wondering at the railway and wanting to stay true to the method of controlled derive, I have used the chance to cross over the rails using the Dybbølsbro bridge that led to Fisketorvet or the fish market which really had little resemblance to a fish market. The bridge crossing was a symbolic transition to another dimension of the city, but also literal, I was met with the roaring sounds of pneumatic drills and construction machinery. I was witnessing the force of culture in its strongest, the city shedding its skin to come anew as it did countless times before (Figure appx. 24). The bridge brought me to Kalvebod Brygge, a wide and rapid-paced avenue with an island patch dividing the two lanes moving in opposite directions. The patch is not so simplified as it is occupied with undergrowth such as boxwood (*Buxus sempervirens*) and occasional hawthorn trees (*Crataegus monogyna*). Both of the dominating species are native to Europe but are not registered to have been planted, therefore, it is a case of the force of nature engulfing a simplified landscape, which was a good example of the fate of any simplified patch if they were to be left alone (Figure 28).

FIGURE 28 KALVEBOD BRYGGE ISLAND PATCH CONQUERED BY NATURE

However, hybrid linden (*Tilia Europaea*) trees were planted and registered in a patch I have found shortly after (Figure 29). The location is perfect for a Miyawaki forest as it has no current uses and would act as a buffer zone between the road and the residential area. The avenue proved to be profitable in terms of patches as, in the same area, a mysterious large patch appeared behind a residential block. This area, called Kalvebod Brygge Vest, is planned to be turned into different kinds of nature forms that would accompany the residential units (Figure 29). In the local urban plan for the area, the architects from Arkitema and SLA have included impressive suggestions about the planned natural forms. However, considering none of them look as dense and wild like Miyawaki forests are, I have allowed myself to imagine the patch exactly that way.

FIGURE 29 KALVEBOD BRYGGE ISLAND PATCH (LEFT) AND KALVEBOD BRYGGE VEST RESIDENTIAL AREA PATCH (RIGHT)

After Kalvebod Brygge, the street had renamed to Vasbygade, and the baton has now been passed to it to lead me to Sydhavn or the South Harbor. Several island patches started appearing in the middle of the road (Figure 30). These were not part of the Kalvebod Brygge project, but it made me realize that the way to Sydhavn is packed patches of ecological simplification. This might be because of its industrial past and the fact that the urban redevelopment of the area is just beginning. I have been nearing the end of my walk, but I could not resist to investigate the largest patch yet right behind the headquarters of Banedanmark, the government agency for railway maintenance, which again reminded about the tight relationship between the patches I was looking for and the railway. The area, of 1 ha in size, is not registered as any kind of green space, had almost no pedestrian trails and was inhabited by spontaneously placed black locusts (*Robinia pseudoacacia*) and a few planted Himalayan birch trees (*Betula utilis*). Considering the size of the patch and its under-utilization, the derive ended with the vision of a large forest that would refresh the industrial atmosphere (Figure 30).

FIGURE 30 BANEDANMARK ISLAND (LEFT) AND VASBYGADE ISLANDS (RIGHT)

ROUTE IV

On the 10th of May 2021, on the square of Kongens Nytorv, king Christian V was facing Holmens Kanal street on the south, as if he was pointing to the direction of my next walk. The spring warmth that day was also accompanied by the spring rain but walking through rainy Copenhagen is certainly an authentic experience as the city has had its share of bad weather. Ash trees in the streets knew this and were still careful, waiting the right moment to flush out their leaves and start the season (Figure appx. 26). Having followed the street towards the Holmensbro bridge, I passed by the monument of seadog Niels Juel (Figure appx. 25), ignoring his advice for my next direction, and turned southwards to face Børsbro bridge. The walled-off property of the Danish National Bank had some interesting nature forms; however, they were a prime example of how plants are sometimes forced to adapt to the rigidity and the sharp angles of the urban landscape. There, the sycamore trees resembled a skeleton of their true nature as they were pruned with the 'pollarding' method, not allowed to grow healthy branches, and resembling more lighting poles than trees (Figure 31).

FIGURE 31 WHAT ARE THE ECOLOGICAL BENEFITS OF POLLARDED SYCAMORES LIKE THESE?

Around the corner, shaved linden trees were a floating green rectangular mass (Figure appx. 27), trading playfulness and freedom of nature with something which could have easily been achieved using artificial materials. Upon crossing the bridge, I reached Børsen, a former stock exchange and one of the most iconic buildings in the city (Figure appx. 28), and was tempted to circle around the building, following the spiralling motion of the tails of the dragons on the building's tower. Coincidentally, rain had started drizzling again just as I approached a European hornbeam tree (*Carpinus betulus*) in Slotsholmsgade street and hid under it, while examining its flowers from up close, and then continued through the street, following the endless line of leafless black locust trees (*Robinia pseudoacacia*) (Figure appx. 27). The canal network conditioned my movement significantly since it was dependant on bridges, while my mind was crowded with plans about finding them. Over the Knippelsbro bridge I was met with a terrifying instance of architecture which was the Danish Ministry of Foreign Affairs (Figure appx. 30), the building carried an image that was successfully filling its role – instilling authority. Similar atmosphere was prevalent in rest of the area – visuals of tall grey buildings and sounds of construction hurried up my walking pace in desire to leave. An interesting find was a patch behind Christian's church, which was in reconstruction at that time. Two lawn patches, one smaller than the other, were not registered as any kind of green area (Figure 32). They stood simplified and did not have any purpose except of a rusty artistic installation at the bottom of the larger patch. Despite the art, I that a significant part of the larger patch was inviting for afforestation.

FIGURE 32 CHRISTIAN'S CHURCH

Moving on, I entered a quiet residential part of the island. Further natural forms were limited to uncannily ordered rows of Norway maple (*Acer platanoides*) (Figure appx. 31), raised beds of wildflowers (Figure appx. 32), and hybrid lindens (*Tilia* x *europaea*) by the canal (Figure appx. 33). Cirkelbroen or the 'five circles bridge' reminded me of sailboat masts which consequently made me aware of the strong but warm northern wind. I continued strolling along the canal until having reached the Danish sugar factory, marking the beginning of the Christianshavn moat, which was once protecting the city from invaders but was now a real wilderness (Figure 33).

FIGURE 33 CHRISTIANSHAVN MOAT

I was mesmerized by the variety of species – the hawthorn (*Crataegus monogyna*) was dominant, forming the tree layer along with the common ash (*Fraxinus excelsior*) and Norway maple (*Acer platanoides*), and the soil resembled real forest soil enabling different spring flower species to thrive (Figure appx. 34). I have decided to stray off my direction just to explore the nature I have just come across. Although it was a pioneering – intermediate community, I have gotten inspired by the messiness of this urban forest (Figure appx. 35), and it made me think how Miyawaki forests could feel like in other parts of the city that needed them. In an attempt to conclude a pattern of the appearance of nature patches like these, I made it to be a level change patch – as the vegetation was concentrated on the slated parts (Figure appx. 36). Soon after, having officially left the moat and stepped on Amager, the cultured atmosphere had a comeback. I continued southwards, crossed the Amager Boulevard through an underpass. On Throshavnsgade and Isfjordsgade there was the usual arrangement of urban nature – lonely cherry trees (*Prunus avium*), English ivy carpets (*Hedera helix*) and mutilated lindens (*Tilia cordata*) (Figure appx. 37). A green oasis was once again found around a church, this time Hans Tausens Kirke, which I did not access due to barriers. I experienced a sense of calm in the neighbourhood, it was quiet enough for me to hear childish laughter which made me suspect of a nearby kindergarten. The laughter and sounds of play continued when I reached what I later found out to be the Amager Fælled park, one of the largest parks or nature areas on the island. I strafed around the park, walking through Artillerivej and examining the ongoing cultural and recreational activities in the park (Figure appx. 38). Regardless of this, on the other side of Artillerivej, I have found island patches splitting the Axel Heides Gade. Large, elongated simplifications had no evident purpose, not even a trodden path through them (Figure 34).

FIGURE 34 AXEL HEIDES GADE PATCHES

I drifted to away from the Amager Fælled Park and found myself in a place of booming residential development. Several lawns between housing units provoked my interest (Figure appx. 39) but leaving them trimmed as they were would probably be for the best as tall vegetation would interfere with the comfort of residents. Modern architecture sprouted around the neighbourhood like mushrooms in the rain (Figure appx. 40), and there was no lack of simplified patches surrounding the residential areas. However, nearing the end of the drift I discovered another island patch between Hilmar Baunsgaards Blvrd and Thorvald Borgs Gade (Figure 35), which was mysterious as it was not mapped in any way as a green space, possibly because of the recency of its creation. Although the patch had some species planted – possibly of the *Prunus* genus – a real urban wilderness would enrich the neighbourhood much more.

FIGURE 35 HILMAR BAUNSGAARDS BLVRD - THORVALD BORGS GADE

ROUTE V

It was Friday, 14th of May when I started my final derive. The skies threatened with rain, but the pleasant 17 °C and the arrival of the weekend made many citizens (and animals) (Figure appx. 41) enjoy the outdoors that day. The cultivated, wall-forming crossbred lindens (*Tilia x europaea*) around Kongens Nytorv were taking their final form (Figure appx. 42), stretching their two-dimensional canopies in a circle around Christian V. I was happy to realize that my walk starts through Nyhavn, probably the most known landscape in the city. At the entrance of the streets, I halted next to the Danish navy anchor memorial to let the overwhelming sensations sink in (Figure 36).

FIGURE 36 DANISH NAVY ANCHOR MEMORIAL

Through the thick fragrance of fudge candy and chattering of people from all over the world, I discerned the struggle of linden trees and their deteriorating cube-like canopies (Figure appx. 43). Trees form shoots from the trunk as a response to some kind of injury, and considering these trees grew shoots so close to the base, there is probably stress on the roots, which tells us again of the hardship a street tree endures in the city. Passing on the northern side of the canal, the collage of buildings on my left side along with the scent of the countless restaurants garnered my attention. The city's vitals were strong, and I was a drop in the stream of urban vigour. Different natural forms served the restaurants as decoration and as a tool used to stand out from the rest and attract hungry passers-by. My willpower was strong enough to resist the temptation to sit down, so I crossed to the other side while being greeted by the drifting flower petals of a potted magnolia tree (Figure appx. 44). When I looked toward Inderhavnsbroen bridge, I saw its jaws open wide to let a sailboat pass underneath, so I took my time to appreciate the sessile oaks (*Quercus petraea*) planted on Havnegade. Pedestrians, cyclists, joggers - they were all waiting for the signal to begin the race over the bridge once it transforms back into a walkable state. My slow, aimless movement seemed to have been an obstruction on their path, but I was enjoying the view of green roofs on the residential buildings (Figure appx. 45). Having my feet step on land, I noticed the design of the landscape in front of the cultural house 'Nordatlantens Brygge'. The landscape stood out in its variety of shape, organic aesthetics, and lack of symmetry (Figure 37).

FIGURE 37 LANDSCAPE IN FRONT NORDATLANTENS BRYGGE

Large signs on the walls revealed to me I was in Papirøen or 'the paper island', a new neighbourhood dedicated to temporary urbanism. In order to escape the fragrances of lovely food and the mixture of music and construction noise, I crossed yet another bridge. Stripes of sea cut deep and shaped the landscape around me, it induced a feeling of freshness and cleanliness. Apart from a few pollarded and mutilated willow trees (Figure appx. 46), there was a feeling that the level of wilderness increased as I went on. The first interesting patch I have found was a small corner patch with two white willows (*Salix alba*) which acted as a transition to the sea (Figure 38). The babbling of birds grew so loud that it forced me to find its source, which were sparrows hanging in the canopies of wild service trees (*Sorbus torminalis*), fruit trees that will, one day autumn day, treat them with delicious berries. Christianshavn is a place of abundant nature and recreational areas, and the walkway by the canal parallel to Arsenalvej was a unique experience of unmaintained and unregistered wilderness (Figure 38).

FIGURE 38 WHITE WILLOW CORNER (LEFT) AND ARTILLERIVEJ (RIGHT)

A dense diversity of plants like the sycamore maple (*Acer pseudoplatanus*), the ash tree (*Fraxinus excelsior*), English hawthorn (*Crataegus Laevigata*) and some species of the *Rosa* genus. The density of content on such a tight plot re-established my confidence of imagining Miyawaki forests in patches of similarly limited size.

Soon after, I was entering another realm, and by the psychedelic graffiti and toy sculptures, I could tell I was nearing Christiania (Figure 39). The atmosphere of the famous squat was unworldly with spiritual motives blended in pioneering nature (Figure appx. 47).

FIGURE 39 ENTRANCE TO CHRISTIANIA

Although it lacked forest management, Christiania did not need Miyawaki forests, as thick forest soil and native species were abundant. The hawthorn, a plant usually in the sub-tree layer, had the dominant role here which proved it was a young forest. As I was passing bridge after bridge, I was slowly leaving Christianshavn archipelago and its natural wonders. Finally, before reaching the clearing, I had glanced once more at the final layer of moat I had to cross, one I named the Copenhagen Amazon (Figure appx. 48). Kløvermarksvej was under my feet, a street framing the giant recreational lawn - Kløvermarken. Although I was not interested in recreational areas and parks, I noticed a fair amount of unnecessary simplification at the periphery of the plot. Wild aspen trees (*Populus tremula*) were sporadically scattered along the way. Their egg-shaped leaves trembled and fluttered with the breeze of wind, which was indicated by their scientific species name '*tremula'*. Apart from one bench in the 1,2 km of my walk, most of the strip was empty and unused (Figure 40).

FIGURE 40 SIMPLIFICATIONS AROUND KLØVERMARKEN

Continuing the circumvention of the recreational park through Raffinaderivej street, new patches appeared, starting with a scene of patch simplification in the making by a worker with a lawn mowing machine (Figure appx. 49). On Amager Strandvej, a large clearance showed its pointless character (Figure 41), the size of which made me wonder what this area is dedicated to be used for. I turned towards the sea, following Prags Boulevard, to find simplified green space, the signs of which became bountiful (Figure 41).

FIGURE 41 AMAGER STRANDVEJ CLEARANCE (LEFT) AND PRAGS BOULEVARD (RIGHT)

At this moment, I speculated that this area used to be a managed forest, as all older trees were coppiced. Coppicing is a technique of tree cutting which enables it grow many peripheral shoots, resulting in trees of peculiar shapes (Figure appx. 50), (Figure appx. 51). I was now entering a large plot belonging to the 'other green areas' category in the spatial map of Copenhagen, forming a grid-like shape in between residential units. I spotted the open sea in front of me and was attracted to approach it, charmed by the smell of barbecue and led by my curiosity (Figure 42). The number of dogs and their owners made me realize I arrived at a dog park, so I stayed there a while to admire their playful spirit and the seaside view before heading back.

FIGURE 42 LAST SIGHT OF ROUTE V

5.2 REFLECTION

The free form of the derive methodology, coupled with a slight movement structure, and search objectives articulated through the theory of the patchy Anthropocene, has enabled me to make very raw observations about the city's morphology. These conclusions are raw because they were not affected by pre-existing data and/or classifications but are formed through an immediate and personal interaction between the observer and the environment. Using this methodology and having the theory in mind, I was exploring the relationship between the city's cultural and natural expressions.

Considering that the cultural aspect of the city was emphasized more, natural forms stood out like black dots on a white sheet of paper. Therefore, looking back, I have dedicated increased attention to the natural aspect of the city. The relationship between the two aspects was often perceived as the subduing effect of cultural practices on plants, which were limiting their development, degrading health or preserving pioneering successional stages.

In total I have taken 499 photographs, out of which only a small portion is presented here. Photographing was a very effective way of capturing the moment, although it sometimes detracted from experiencing the city fully. During the walks, it became especially clear my movement will miss large portions of the city, but since one of the tasks was recognizing patterns, there were only so many examples needed to establish them.

Natural forms stood out especially in the historical centre of the city, where their expression heavily depended on the way it was managed and designed. Forms were also dictated by the historical background of urban development. For example, there was an evident gradual increase of 'spontaneous' nature appearance when moving away from the old town centre - Kongens Nytorv.

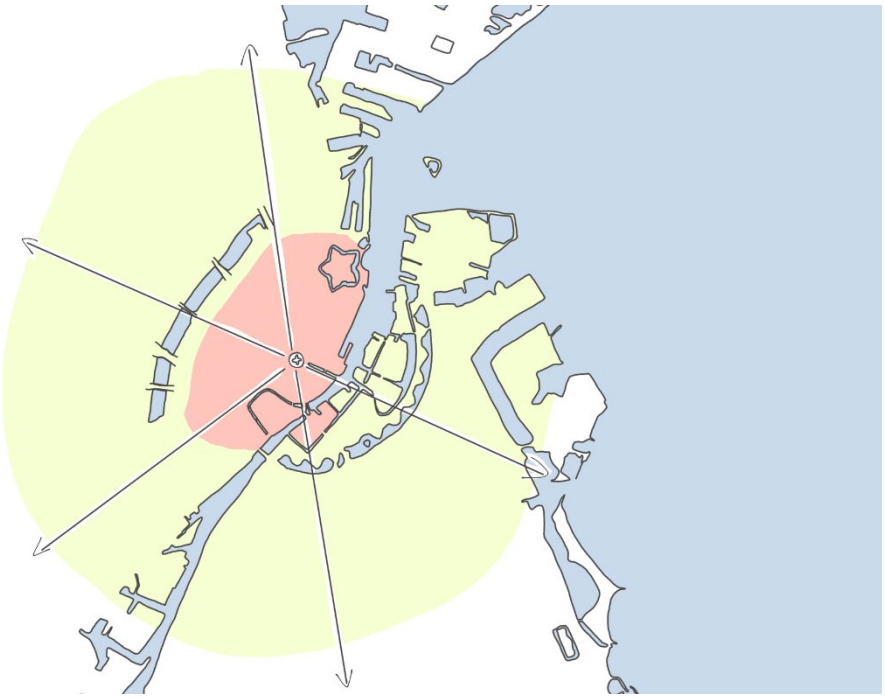

FIGURE 43 ILLUSTRATION OF THE ZONE OF THE OLD TOWN AND THE SURROUNDING AREA, WITH ARROWS POINTING TO THE DRIFTING DIRECTIONS

As can be seen in the analysis, the cultural elements in the vicinity of the old town (marked red) are overwhelming and mostly allow tree growth only when resistant species are planted in individual plant beds and proper maintenance methods are used (Figure appx. 1). This observation did not include parks and nature areas, which were not of interest for the analysis. Furthermore, the exception here were 'church patches' and patches on the periphery of parks and nature areas, which were not parks and were the only areas large enough to host forest ecosystems in the area of the old town. It

seemed that most of the trees that were struggling, with their soil degraded and conquered by concrete and asphalt (Figure appx. 4), were of older age, which suggests some type of awareness development of planting specialists about these issues. Trees could also often be found in pots, barrels or raised beds. Because of this lack of natural soil in the centre, there are efforts by the citizens to use the third, vertical dimension and grow climber plants or creeper plants.

Outside of the old town, trees started appearing more often in patches, in plots that were visibly different from the surrounding cultured environment with the presence of vegetation. Some of the patches were designated a class of 'green area', found in the spatial map of Copenhagen Municipality, and some had trees that were planted and mapped. Some of these patches were used by citizens for social reasons, as corridors, or other.

However, many patches were flat lawns of grass with no apparent use, no or few trees planted but seemed to be mowed periodically so to remain simplified. These are the patches of modular simplification that were interesting for placing Miyawaki forests. Interestingly, these areas were often located between different cultural imprints in the city, acting as types of borders or were there just to fill the void in between. Consequently, their existence often seemed trivial in terms of use and maintenance compared to the surrounding area. This triviality could also be noticed in the prevalent classification of these patches as 'other green area', a class whose only connection to green areas was often the colour green. In order to consider them for rebalancing purposes, they must be pulled out from the shadow of their triviality, they must be made visible, named, classified and given attention to. Only then can we start to assign purpose to these areas. What comes next is an effort to highlight these areas through systematization depending on their shape and location.

5.3 PATCH PATTERN SYSTEMATIZATION AND RE-IMAGINING

5.3.1 ISLAND PATCHES

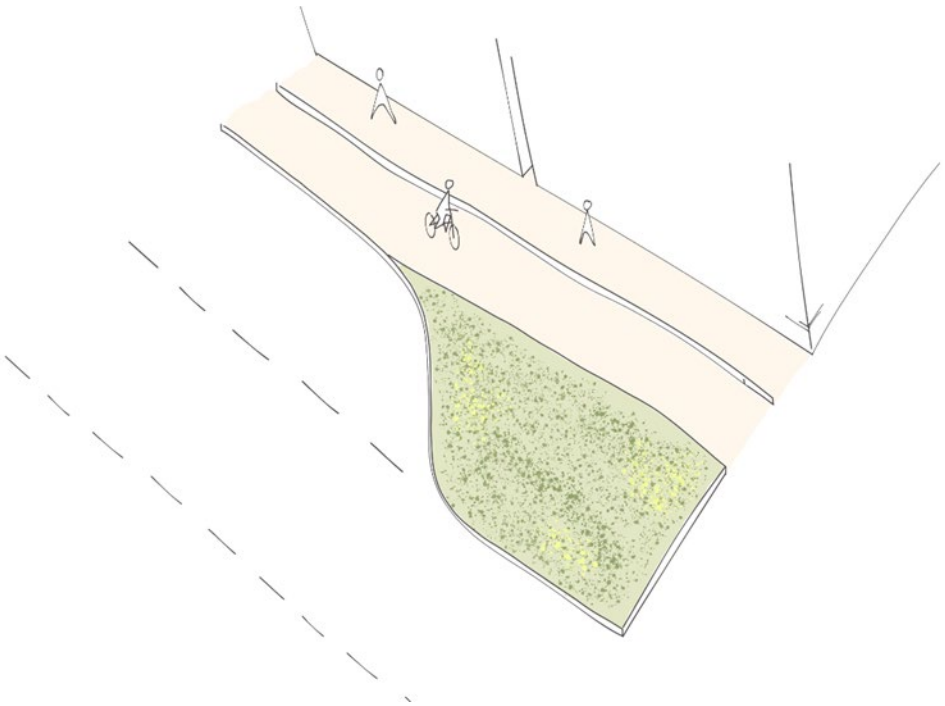

FIGURE 44 ILLUSTRATION OF AN EXAMPLE OF AN ISLAND PATCH

Island patches reminded of green islands in the sea of concrete that surrounded them and were therefore referred to using this name for the purpose of systematization. They are strictly tied with traffic routes and often act as types of 'buffer zones' between roads of different modes of transportation. They are ubiquitous on roads and come in very variable sizes and shapes since they are conditioned by the road infrastructure surrounding them. Island patches were the most common type of modular simplification patches and had the biggest degree of simplification, although they sometimes contained sparsely planted trees or flowers. The relationship with traffic that these areas have is important for their use for afforestation. While planning transport and building infrastructure, these areas should be taken into consideration as well. However, these areas are often overlooked because of their location. Be they in the middle of the road as in Strandboulevarden or on the side as in the case of Banedanmark patch, they are not considered by pedestrians because of their unapproachable nature, and only glanced at from the perspective of a moving car.

TABLE 2 LIST OF ENCOUNTERED ISLAND PATCHES

LOCATION	ROUTE	CATEGORY
Strandboulevarden	I	Other green area
Østerbrogade	I	Other green area
Borgervænget recycling	I	Other green area
Kalvebod Brygge	III	/
Banedanmark	III	/
Vasbygade islands	III	/
Axel Heides Gade	IV	Other green area
Hilmar Baunsgaards Blvrd - Thorvald Borgs Gade	IV	/

CHARMING STRANDBOULEVARDEN

Strandboulevarden is a street where a set of island patches were discovered during route I. They were of fairly large size, large enough for citizens to use some of them as corridors, almost like they would use a recreational area. As mentioned during the derive, a Miyawaki forest here could encourage use of the space, weaken the relentless wind in the street and reduce noise and air pollution.

Figure 45 Strandboulevarden patch

Figure 46 Afforested Strandboulevarden

5.3.2 Level change patches

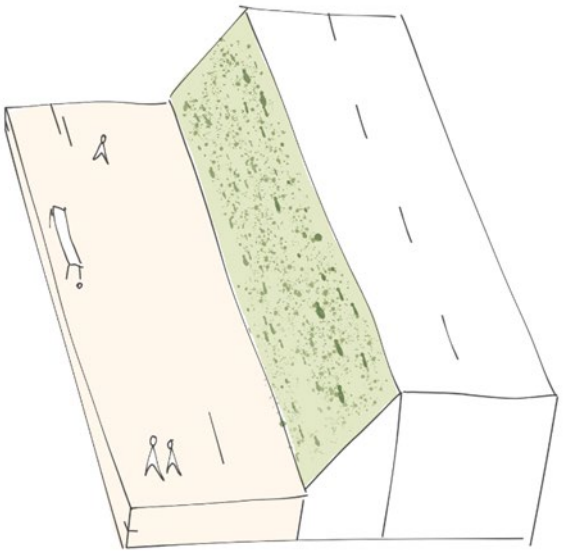

Figure 47 Illustration of an example of a level change patch

Level change patches are also used as types of 'buffer zones', often between traffic infrastructure, but they are often used to change the height level between two platforms. These patches were also observed outside the context of the road, as there seemed to be some preference of modular simplification on patches that are slated to a higher or lesser degree. These geo-morphological traits would complicate repurposing these areas. However, forming cascades could be used to hold the soil, which is something already demonstrated by Akira Miyawaki (Figure 7). Furthermore, specific species would need to be chosen for planting here, ones that tolerate slated and well-drained soil, such as beech. Interesting level change patches were along the railway that cuts through the city. Although they were hard to approach and due to blockages and the limits of the controlled derive methodology, it that seemed the railway patches were of large potential considering their size and unmaintained nature. The slated nature of these patches could also be connected to the transition between land and water, as was observed in the case of Pebelinge, the Christianshavn moat and Artillerivej.

Table 3 List of encountered level change patches

LOCATION	ROUTE	CATEGORY
Pebelinge lake	II	/
Fuglebakken – Norrebro st.	II	/
Christianshavn moat	IV	Other green area
Artillerivej	V	/

CHARMING PEBELINGE LAKE

The Pebelinge Lake has much space that could be used for afforestation. The patch is long and splits the level of car traffic from the walking trail by the lake below. Afforestation of this area would create a blend of blue and green motives, which usually go very well together in nature.

FIGURE 48 PEBELINGE LAKE PATCH

FIGURE 49 AFFORESTED PEBELINGE LAKE

5.3.3 CORNER PATCHES

Patches of modular simplification were often found on the corners of street blocks. Their shape was usually triangular as it was formed by the crossroads where these patches can be found. Although similar to island patches in their connection to roads, they were not entirely floating on them and had more resemblance with typical green areas, as they would sometimes contain benches or other types of use potential. Their triangular shape, instead of a linear one, offers more opportunity for

afforestation than in island patches. One of the possible reasons why these patches are simplified is to enable clarity of vision to drivers when taking a turn on the crossroads. However, in all observed situations, the crossroads were regulated by traffic lights, therefore the reason of their simplification is unclear.

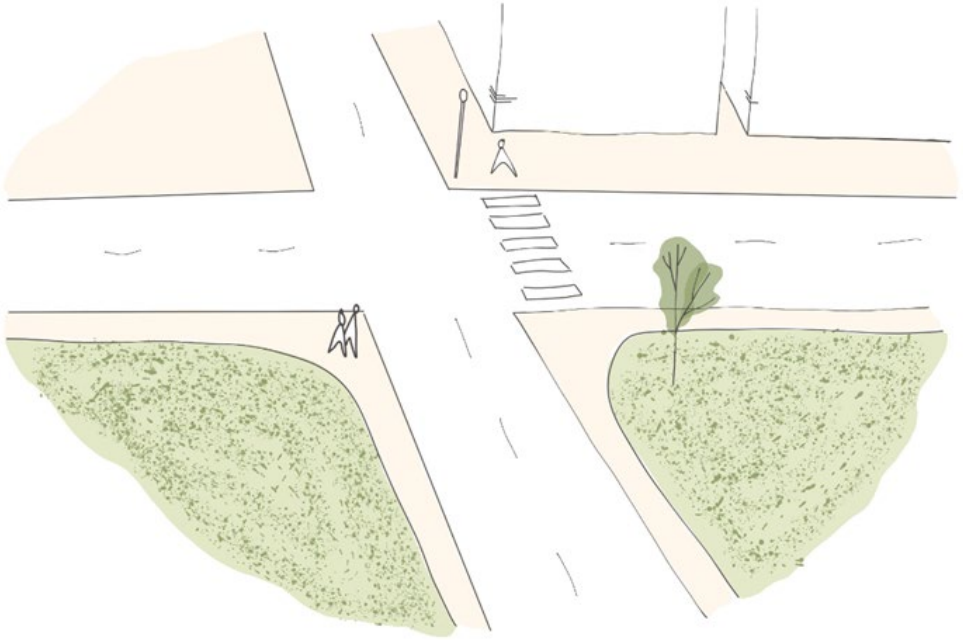

FIGURE 50 ILLUSTRATION OF EXAMPLES OF CORNER PATCHES

TABLE 4 LIST OF ENCOUNTERED CORNER PATCHES

LOCATION	ROUTE	CATEGORY
Hillerødgade x Lundoftegade	II	Other green areas
Blåmejsevej	II	/
Hillerødgade x Bispeengbuen	II	Other green areas
Værftsbroen bridge	V	/

CHARMING HILLERØDGADE – LUNDOFTEGADE

Although the corner of Hillerødgade – Lundoftegade contained some trees, it was, like many similar corners, underutilized. In this case, a tiny forest can create new environments isolated from the noise coming from the roads.

FIGURE 51 HILLERØDGADE – LUNDOFTEGADE CORNER

FIGURE 52 AFFORESTED HILLERØDGADE – LUNDOFTEGADE

5.4 OTHER INTERESTING PATTERNS

5.4.1 PATCHES AROUND PARKS AND NATURE AREAS

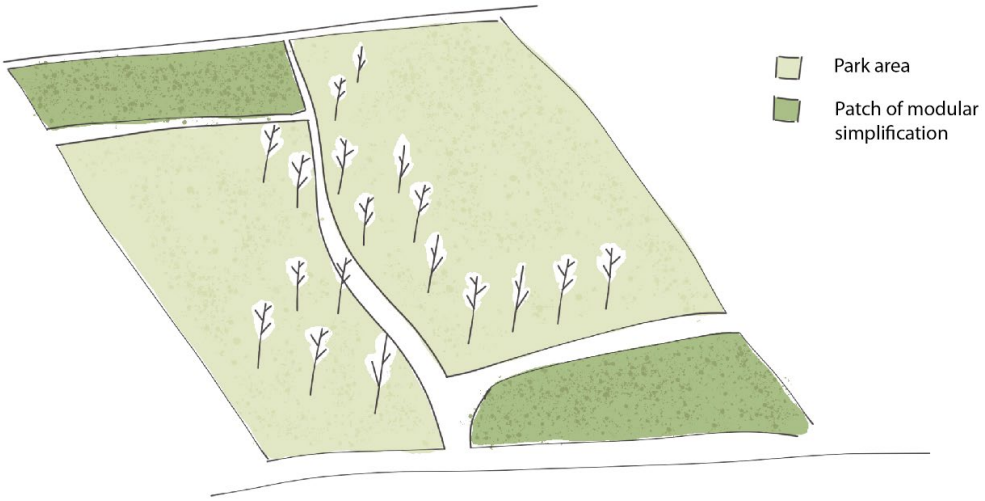

FIGURE 53 ILLUSTRATION OF AN EXAMPLE OF PATCHES AROUND PARKS AND NATURE AREAS

On the periphery of parks and nature areas there were often patches different from the park itself in the sense that they were not utilized to the extend parks were and often categorized differently, often with 'other green area'. Although parks and nature areas were not of interest, some areas around them were worthy of mention and were interesting modular simplifications for the analysis.

TABLE 5 LIST OF ENCOUNTERED PATCHES ON THE PERIPHERY OF PARKS AND NATURE AREAS

LOCATION	ROUTE	CATEGORY
Bispeengen playground	II	Other green areas
Rørsangervej	II	Other green areas
Kalvebod Brygge vest	III	/
Kløvermarken	V	Recreational area
Amager Strandvej	V	/

5.4.2 CHURCH PATCHES

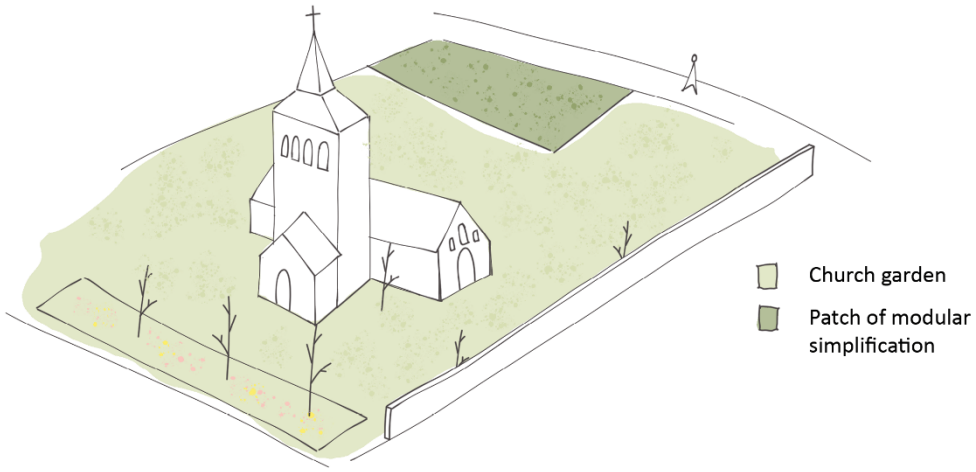

FIGURE 54 ILLUSTRATION OF AN EXAMPLE OF A CHURCH PATCH

Although green space around churches was often heavily cultured with iconic or protected trees and gardens, churches tend to present simplified patches around them. Church patches were also one of the only simplified patches in the old town of Copenhagen, as they were rare to find among the lack of green space in the area. Although only two examples were found, they might be significant as they are one of the only areas that can host forest ecosystems in the Old Town.

TABLE 6 LIST OF CHURCH PATCHES ENCOUNTERED

LOCATION	ROUTE	CATEGORY
Sankt Kvarter Anne church	I	/
Christian's church	IV	/

6 - DISCUSSION

WHAT DO THE RESULTS MEAN?

The results of the analysis have revealed multiple important truths. Firstly, observing urban morphology through the lens of the culture – nature dichotomy can yield conclusions that can help us rebalance the city. In Copenhagen, there exist areas that are purposeless both to the cultural or natural uses. Some of these areas are created almost accidentally, as is the case with island patches - which exist only as an addition to road infrastructure, or corner patches – which are strictly tied with the form of crossroads. They all share the trait of triviality, acting as a void-filler or a buffer zone. Although they are neglected in this sense, they are maintained in the sense that they are constantly simplified. Natural succession is not allowed to progress on them, mostly for the sake of the 'maintained look' of mowed lawns. The reasons for the constant simplification have not been concluded in this paper, so the assumption stays that it is a form of habit or ignorance of the fact that it is possible to create wild, tiny forests with a maintained look such as the Miyawaki forests. The project could have taken the approach of learning about the reasons of the current management of these spaces, through conducting interviews and reviewing literature. However, the simplicity of the 'visionary' approach, the raw experience of the environment acquired through drifting, and the straightforward thinking in two concepts, nature and culture, has proved to be useful for making very basic but deep conclusions of the characteristics of the environment. Therefore, the purpose of this project is to be a wake-up call for urban planners, to remind them of the baseline values of human existence in cities. In order to know where we are and where we should be going, it presents both criticism of the current and a vision for the future. The vision of rebalancing is coupled with the vision of the charming Anthropocene to emphasize the importance of having a vision to begin with. In the same way as retelling the story of the Anthropocene and changing its connotations to a more positive tone might steer us to a better future, the retelling of the grayness and harshness of the city's streets changes perspective and increases the chances that we will see potential for something charming in them. This is the reason for the illustrations provided as an answer to the third research question: 'What is a vision of a balanced Copenhagen?'. The results mean that, in order to bring balance, we have to be more critical to the purpose of urban space and ask ourselves more often: 'why do we use certain space the way we do?'. We need to be aware of the relationship between the elements affecting the morphology, not only the natural and cultural but also on different levels – the collision points between two types of roads, a walking trail and the sea, or train infrastructure and the rest of the city. Furthermore, we must ask ourselves if it is really inevitable for natural forces to be harassed by cultural or vice versa? The vision of the charming Anthropocene should suggest that it does not have to be so. Knowledge and experience of urban ecology should be implemented deeply in urban design so to enable complex forests to run their course in our cities, to maximize their lifetime as well as ours.

WHAT DID THE ANALYSIS NOT REVEAL?

However, the results did not reveal exactly where Miyawaki forests can be planted in the city. Trees need many conditions for growth, many of which were not investigated in the analysis. In order to plant a forest, the soil needs to be examined beforehand to determine if such a thing is possible there. Some characteristics can be improved by adding hummus and different materials, but it is hard to restore degraded soil back to life. Furthermore, considering all the underground infrastructure in cities such as water pipes, electricity cables, etc., the possibility of tree roots damaging these exists, as it usually happens that trees dig their roots into underground waste pipes and clog them. Trees next to the roads could present danger in form of dropping of wood on them, or even collapsing altogether on the road. Although the chance of collapsing is reduced with the Miyawaki method, as the trees are, as mentioned, more protected from the wind, the situations should not be left to chance. Additionally, the exposure to sunlight and irrigation possibilities were not a factor for considering patches, as well

as the pollution of heavy metals and anti-freezing salts on the soil was not elaborated. This is why further research about these areas is necessary to determine the feasibility of their use for this purpose.

Trains and patches of modular simplification

Despite perceiving it in this project as just another level change patch, there is much potential in exploring the area around the train infrastructure and the opportunities for rebalancing. The need to move in a constant direction and the concept of patches did not allow for exploring a linear belt that cuts through the city such as the train. Much of the area seemed to have already been colonized by pioneering nature, and the unmaintained appearance was especially given away from the perspective of the moving trains.

Figure 55 Photograph of the level change around the railway, taken from Carlsberg station

If most of the railways come with a similar type of simplified landscape, they could be significant for rebalancing as the ‘five finger’ development strategy made railways cut deep through the city.

7 - CONCLUSION

What can we notice about the culture – nature struggle in the landscape of Copenhagen?

How do we use patterns of urban morphology to encourage rebalancing and how could it look like?

In the analysis, with, I have attempted to identify the struggle of nature and culture in Copenhagen. This has been done using a modified version of the 'drifting' method that I named 'controlled drifting'. I have drifted in five different directions to cover a 5 km radius area, tracking the route with GPS tools, taking photographs, and textually noting of impressions of the landscape. Moreover, I have discerned specific patterns or 'patches' of unnecessary simplification and illustrated Miyawaki forests on some of them as a suggestion for balancing nature and culture in the city and present an image of a charming Anthropocene.

WHAT CAN WE NOTICE ABOUT THE CULTURE – NATURE STRUGGLE IN THE LANDSCAPE OF COPENHAGEN?

Firstly, it was important to define what might be the expression of nature and what of culture. In this paper, biodiversity and ecological relations existing in climax communities signified a strong expression of nature. As a counter this, the concept of modular simplification was used to represent the imprint of the Anthropocene, a killer of diversity which often comes hand in hand with urban areas, areas that are heavily cultured. Noticing the relationship between culture and nature in the landscape can be best done by close, personal observation. As was done in this project, the drifting methodology enabled just that kind of observation but lacked some structure in order to try to quantify conclusions. Therefore, the 'controlled drifting' modification was employed to enable mapping of what was seen, where and how often was it seen. Starting from Kongens Nytorv, in the area of the Old Town, nature that was not in parks was potted, in raised beds, and older planted trees were often struggling with the cultured surroundings. Trees were planted as individuals, instead of as parts of a system, which left many of them suffering. When moving from Kongens Nytorv to the periphery, the prevalence of culture subsided, and nature started appearing in terms of patches. Some of these patches were more utilized than others, but many of them were simplified unnecessarily. These patches of modular simplifications were used to tackle the second research question.

HOW DO WE USE PATTERNS OF URBAN MORPHOLOGY TO ENCOURAGE REBALANCING AND HOW COULD IT LOOK LIKE?

From the data collected from controlled derives, I was looking for practical use of morphological patterns to encourage rebalancing of nature and culture of the city. These areas had to be able to host complex communities such as Miyawaki forests. What was revealed were spaces in the morphology that were found to be particularly interesting for this purpose, called patches of modular simplification throughout the analysis. These areas are overlooked voids in the cityscape, and the effort was to make them visible so they can become a part of urban planning, instead of just existing as gap in the sea of concrete. To bring these areas into light for future consideration, they have been sorted into different classes based on location and shape: island patches, level change patches, corner patches were the most interesting for the purpose of rebalancing, while patches around parks and nature areas and church patches were honourable mentions. Island patches are the most common type and are located in the middle of or by the side of roads and are strictly tied with traffic infrastructure. Level change patches are used to increase or decrease height between cultured platforms, and they were often used as transition from land to water. Similar to island patches in their connection to traffic, corner patches are located on the corners of a crossroads. However, their shape and accessibility makes them more accepting for afforestation than island patches.

The Miyawaki method has been proven to succeed on tight patches in urban areas, and their ecological benefits heavily outweigh the ones provided by parks and lawns especially. This is done by cultivating nature systems instead of individual tress and creating forests that are not only hosting pioneering species but create abundant complex communities. Miyawaki forests, with their dense but maintained wilderness, provide ecological benefits, and preserve the natural integrity, but are not meant for recreational and social uses as parks are. Therefore, placing them on patches of modular simplification would create a nice fit, as these patches are often buffer zones between roads, walking and cycling trails and on other unreachable areas such as around train tracks. Additionally, since Miyawaki forests require no maintenance after the third year, maintenance would not present problems concerning the logistics and would, in the long run, prove to be cheaper to maintain than other, simpler green areas. Considering that these patches are scattered around the city, rewilding them would be a way of tapping into the ecosystem benefits of trees throughout the entire city, as opposed to centralizing nature in parks, which affect only the surrounding area. Miyawaki forests on patches of modular simplification could be the living infrastructure of the city, subtly tied in the tissue of the city's landscape while providing the natural force to challenge the overly cultured environments which proved to negatively affect the health and wellbeing of citizens.

A vision of a charming Anthropocene is a vision of balance. In this vision, nature is perceived as a system and is used as a design tool, a force saving us from the overwhelming rigidity and comfort of our cultured landscape. It is given its rightful place in close proximity to our everyday lives. No space is wasted, as patches are of modular simplifications are now forests. To envision this, the observed island patch at Strandboulevarden street, the level-changing surrounding of the Pebelinge Lake and the corner on the crossing between Hillerødgade and Lundoftegade streets were illustrated in their potential afforested state.

APPENDIX

PHOTOGRAPHS ROUTE I

FIGURE APPX. 1 SCARECROW LINDEN TREES, STILL WAITING TO FLUSH

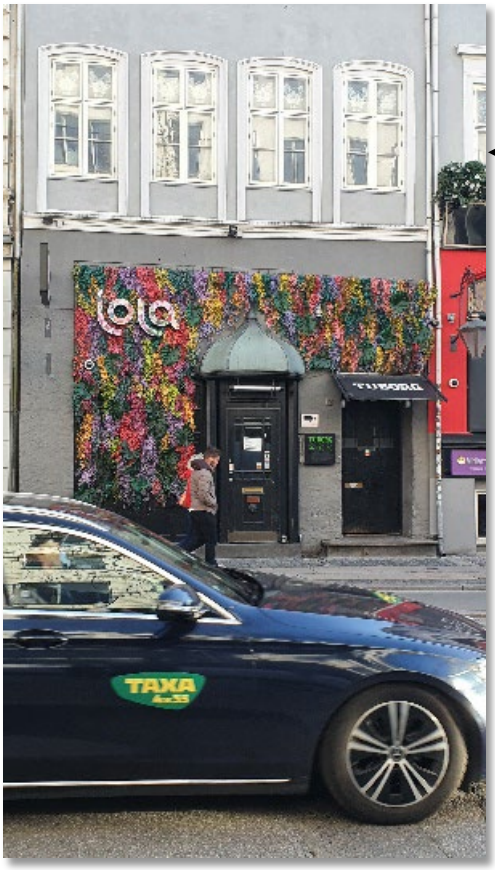

FIGURE APPX. 2 PLASTIC IMITATION OF CLIMBER PLANTS

FIGURE APPX. 3 RAISED BEDS WITH ENGLISH IVY (*HEDERA HELIX*)

FIGURE APPX. 4 THE CONCRETE SEEMED TO CHOKE THE BASE OF THE SYCAMORE TREE, WITH LITTLE TRANSITION BETWEEN THE CULTURED AND NATURAL FORMS

FIGURE APPX. 5 WESTERN PATCH OF SANKT ANNE KVARTER

FIGURE APPX. 6 THE ROOTS OF THE TREE BREAKING ASPHALT IN ORDER TO ACCESS FOOD AND WATER

FIGURE APPX. 7 ONE OF THE FIRST IMPRESSIONS OF STRANDBOULEVARDEN

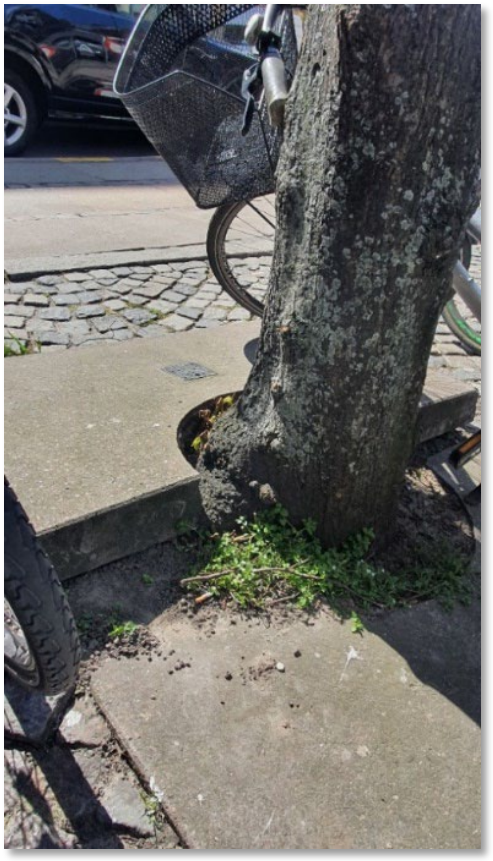

FIGURE APPX. 8 MELKIORS PLADS TILIA TREE FIGHTING WITH SLABS

FIGURE APPX. 9 EUTHANIZED TREE IN MELKIOR'S PLADS

FIGURE APPX. 10 THE SHAPE OF A BIRCH TREE IS ALL THAT IS NEEDED TO BEND THE RIGID MORPHOLOGY

PHOTOGRAPHS ROUTE II

FIGURE APPX. 11 'IMPRISONED' CHERRY TREES

FIGURE APPX. 12 BICYCLES AND TREES OFTEN SHARE THE SAME SPACE IN COPENHAGEN

FIGURE APPX. 13 MODERN PLANTING PRACTICES ARE MORE CAREFUL FOR THE TREE

FIGURE APPX. 14 A POTTED CEDAR TREE

FIGURE APPX. 15 BYHAVE 69

FIGURE APPX. 16 RAISED BED WITH DEGRADING ORGANIC MATERIAL

PHOTOGRAPHS ROUTE III

FIGURE APPX. 17 POTTED NATURE IN THE CENTRE

FIGURE APPX. 18 LIFELESS SOIL BELOW A LINDEN TREE

FIGURE APPX. 19 GAMMEL STRAND METRO STATION

FIGURE APPX. 21 BEATRICE ON H.C. ANDERSEN BLVRD.

FIGURE APPX. 20 YEWS AROUND THE GLYPTOTEK

FIGURE APPX. 22 PATCHES ON THE PERIPHERY OF THE CENTRAL STATION RAILWAY

FIGURE APPX. 23 SESSILE OAKS IN INGERSLEVSGADE

FIGURE APPX. 24 THE CITY SHEDDING ITS SKIN NEAR FISKETORVET

PHOTOGRAPHS ROUTE IV

FIGURE APPX. 26 ASH TREES STILL WAITING WARMER WEATHER TO START FLUSHING

FIGURE APPX. 25 NIELS JUEL MONUMENT

FIGURE APPX. 28 CUBE-LIKE LINDEN

FIGURE APPX. 29 BORSEN STOCK EXCHANGE AND ITS TWISTING DRAGONS

FIGURE APPX. 27 ENDLESS ROBINIA ROW

FIGURE APPX. 30 THE DANISH MINISTRY OF HORRIFYING ARCHITECTURE

FIGURE APPX. 31 NORWAY MAPLES BEHING CHRISTIAN'S CHURCH

FIGURE APPX. 32 BEDS OF WILDFLOWERS BROUGHT FRESHNESS

FIGURE APPX. 33 LINDEN TREES NEXT TO THE 'FIVE CIRCLES BRIDE'

FIGURE APPX. 34 FLOWERS FOUND THEIR PLACE ON THE SOIL OF THE CHRISTIANSHAVN MOAT

FIGURE APPX. 35 THE WILDERNESS OF CHRISTIANSHAVN

FIGURE APPX. 36 WHAT IS SLATED IS WILD, WHAT IS FLAT IS CULTURED

FIGURE APPX. 37 MUTILATED LINDENS

FIGURE APPX. 38 INSTALLATIONS IN THE AMAGER FÆLLED PARK FOR HOSTING ACTIVITIES

FIGURE APPX. 39 PRIVATE GARDES WERE NOT OF INTEREST FOR THE ANALYSIS

FIGURE APPX. 40 SPROUTING OF BUILDINGS IN AMAGER

PHOTOGRAPHS ROUTE V

FIGURE APPX. 41 PIGEONS ENJOYING THE COYNESS OF THE WEATHER

FIGURE APPX. 42 TWO-DIMENSIONAL TREES ON KONGENS NYTORV

FIGURE APPX. 43 SUFFERING LINDENS NEAR NYHAVN

FIGURE APPX. 44 FLOWERING MAGNOLIA TREE

FIGURE APPX. 45 ONE OF THE RARE OCCASSIONS TO BE IN A POSITION TO SEE A GREEN ROOF

FIGURE APPX. 46 MUTILATED WILLOWS IN PAPIROEN

FIGURE APPX. 47 CHARMING KITSCH OF CRHISTIANIA

FIGURE APPX. 48 THE AMAZON OF CHRISTIANIA

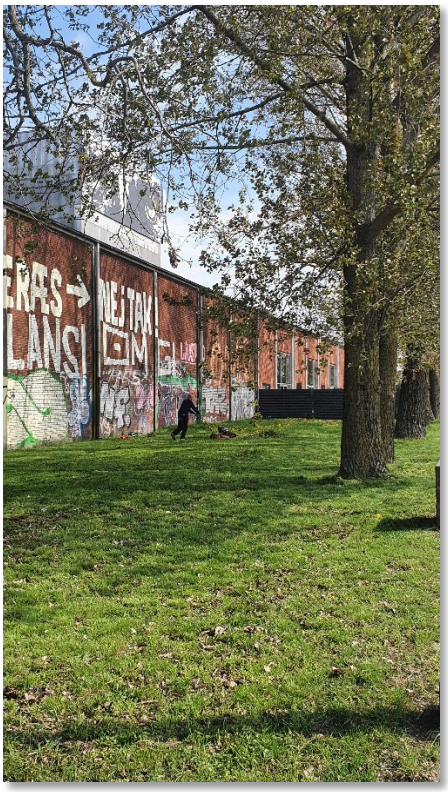

FIGURE APPX. 49 SIMPLIFICATION IN THE MAKING

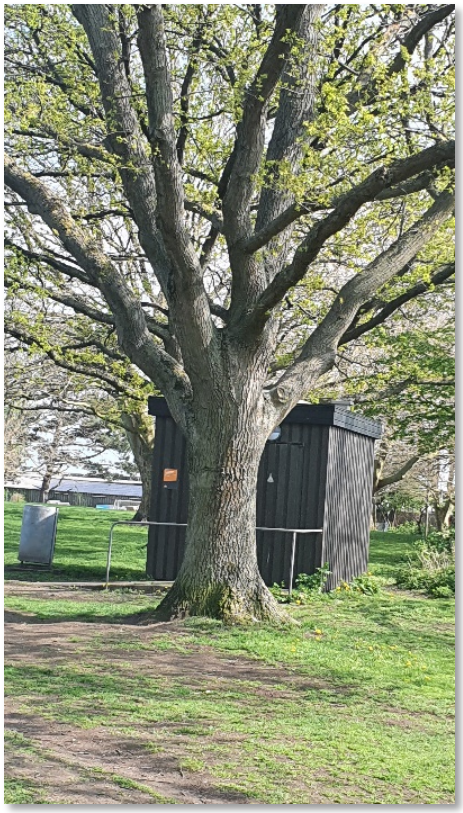

FIGURE APPX. 50 COPPICED TREE NO. 1

FIGURE APPX. 51 COPPICED TREE NO. 2

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