A Historical Perspective on Resilient Urbanism
The 'Sociobiology of Cities' and 'Ecosystem Urbs' in Belgium, 1900-1980

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In one of the first books written on urbanism and spatial planning in Belgium – published in 1916 under the title *Preliminaries of Civic Art in Relation to the 'Clinical Case' of Belgium* (hereafter *Preliminaries*) – landscape architect and urbanist Louis Van der Swaelmen (1883-1929) stated that a crisis had struck the country. "Entire cities have been destroyed," he lamented, comparable to the power of multiple "London fires" or "Messina earthquakes" (Van der Swaelmen 1916: 6). The crisis Van der Swaelmen was refering to was the destruction caused by World War I; a destruction he sought to address and overcome in *Preliminairies* with a reconstruction agenda that was based on what he called his "sociobiological" theory (Van der Swaelmen 1919). Although the foundation of this theory was somewhat vague, a close reading of Van der Swaelmen's writings reveals that it was based in mainly French environmental thought of that period, leaning on early ethological and sociobiological research (Thomas 2003; De Bont 2008 and 2010). Early ethology is understood as a branch of biological research concerned with the "interactions between organisms and their environment," a kind of proto-ecology (De Bont 2010: 4), while sociobiology in France and Belgium was specifically concerned with the "continuity between animal and human societies" (Thomas 2003: 109).[1] Van der Swaelmen's sociobiological take on urbanization was based on the same observations. He believed that the environment was crucial for urbanization processes. Using a biological analogy, he even compared cities to natural organisms. Coupling this kind of environmental thought to architecture and urban planning was not unique in the Belgian context - it was a widespread international phenomenon during the late 19th and early 20th centuries

1 In the context of this chapter, ethology is not the discipline developed in the 1930s that was concerned with animal behavior, but a "scientific attitude" developed earlier in France, in which environmental factors were of the outmost importance for studying organisms (De Bont 2010). Sociobiology is a general term, not used at that time, but applied by historians of science like Marion Thomas (2003). However, Louis Van der Swaelmen did posit that he studied the "sociobiology of cities" (Van der Swaelmen, 1919).

(Welter 2003; Platt 2015). In addition, Kenny Cupers has demonstrated in his work on *Bodenständigkeit* that new biological theories that were mobilized in urban thinking in early 20th-century Germany reinforced widespread nostalgic beliefs of the loss of an original cultural and natural landscape due to industrialization (Cupers 2016: 1234). Van der Swaelmen's work shows that in Belgium, the same logic was at play. In *Préliminaires* it was his diagnosis of the disaster of wartime destruction that revealed the ongoing conflict between modern urbanization and industrialization, on the one hand, and the original natural and cultural environment, on the other. Van der Swaelmen's new urban theory was therefore geared towards redefining and reconfiguring the relation between city and countryside in order to solve, or at least curb, the devastating side-effects of the urbanization of nature on both the natural and social worlds. His self-proclaimed sociobiological theory not only responded to the urgent crisis caused by wartime destruction but also sought to tackle the shortcomings of 19th-century industrial cities (Van der Swaelmen 1921).

Half a century later, Brussels-based urban ecologist Paul Duvigneaud (1913-1991) laid the foundation for a theory of the city as an ecosystem. Like Van der Swaelmen, he lamented the "pathological" state of the modern city (Duvigneaud 1974). More specifically, the environmental crisis caused by large-scale resource extraction, accelerating industrialization, and urban consumption prompted him to formulate a socio-ecological theoretical framework that could cope with the 'overheating' of the urban metabolism (Duvigneaud 1974: 6). Thorougly based in the ascent of ecosystem science, he claimed that his *écosystème 'urbs'* would reconnect the city to its natural substrate, thus short-circuiting such overheating. Duvignead believed that a renewed, sustainable city could be created by analyzing the city's flows in detail, re-rooting them in a metabolic framework, and operationalizing this analysis in planning policies.

Although Duvigneaud and Van der Swaelmen had different disciplinary backgrounds and mobilized different discourses, both articulated a spatial reaction to what they perceived as a 'crisis' of the modern city and landscape. Each approached this crisis with a theoretical framework fusing the natural and social sciences in order to reconnect society and nature. Both Van der Swaelmen and Duvigneaud criticized the unbalanced interaction of the historical and natural landscape with modern processes like industrialization and urbanization, and in that sense they perceived the same sort of crisis. By blending their disciplinary expertise with scientific research and an urban planning agenda, they both hoped to rebalance the built environment by reconfiguring its spatial layout. Linking terms such as 'destruction' or 'pathology' to the concept of crisis enables us to draw attention to similarities and differences between their strategies to balance society-nature relationships. In this chapter we will use 'crisis' as an operational concept to analyze the discourses mobilized by Van der Swaelmen and Duvigneaud. Crisis, as Reinhart Koselleck argued, always has subtle deviations in its meaning and can be both

"imprecise and vague" and is used to describe "vaguely disturbing moods or situations" (Koselleck 2006: 399).[2] Koselleck therefore cautioned scholars in their use of the word, but still we mobilize it freely because "this lack of clarity is often welcome, since it makes it possible to keep open what it may mean in the future"(Ibid: 399).

Nowadays, crisis is again high on the agenda of the discipline of urbanism. Indeed, it seems to be a central component of resilient urbanism: one of the newest 'isms' geared to remedy today's ecological "apocalypse" (Swyngedouw 2010). In his essay *Notes on a Resilient City*, Ross Exo Adams analyzes the project *Rebuild by Design (RBD)*, an ambitious design initiative created by the Bloomberg Foundation that tried to "implement strategies for rebuilding a city [New York] severely damaged by 'Superstorm Sandy'" (Adams 2014: 127). Adams uses the RBD project as an example of so-called 'resilient urbanism,' and argues that ünder the regime of resilience the spatial order of the urban begins to exhibit radically new tendencies."This new regime of resilience draws its force from ïts ability to incorporate a concrete crisis in its own discursive and political formation,änd ünlike sustainability or ecological urbanism, [resilient urbanism] immediately frames itself as a program of response to crisis"(Adams 2014: 127).

In this chapter, we study the relationship of urbanism and spatial planning to crisis, as an entry into the history of resilient urbanism before Crawford Holling introduced the term resilience in ecological science (Holling 1973) and before it was coopted into urban design in recent years (Eraydin/Taşan-Kok 2013). We analyze the two historical figures of Louis Van der Swaelmen and Paul Duvigneaud who proposed a resilient urbanism *avant-la-lettre* and link it to the use of the concept today in order to better understand the current relationship between urbanism/planning and crisis. Firstly, we demonstrate that these earlier theories of resilient urbanism were produced by the interplay of environmental sciences like biology and ecology on the one hand, and design disciplines including landscape architecture and urbanism on the other. Secondly, a comparison of these historical responses to crisis with current notions of resilience aims to uncover the historically specific relationship between urbanism and crisis. Moreover, this essay will focus on how interactions between city and nature, urbanization and the natural environment, were thought in relation to specific crises. In addition to previous meaningful contributions to the analysis of the concept of resilience and practices of resilient urbanism (Bankoff 2001 and 2019; Kirchoff 2010; Walker/Cooper 2011; Braun 2014), our analysis will show how the alliance of the natural and design sciences in history is rehearsed today. We argue that resilient urbanism is not as new as is often proclaimed, rather it is deeply rooted in a crisis of modernity.

2 In his paper on the Eco-city, Ross Adams also refers to the work of Koselleck on crisis and relates it to the history of urbanism and planning (2010).

With the analysis of the two case studies, we do not aim or pretend to compose a continuous timeline until present-day resilient urbanism approaches. These cases are but snapshots, two (Foucauldian) genealogies, with which we aim to demonstrate how elements of a resilient approach to urbanism are already present in the discipline before the birth of the present resilient urbanism. As David Garland already argued, Foucauldian genealogies or 'histories of the present' try to uncover "hidden conflicts and contexts as a means of re-valuing the value of contemporary phenomena" (2014: 365). In the first part, we offer a close reading of the book *Préliminaires* by Van der Swaelmen. In the second part, we examine Paul Duvigneaud's work on urban ecology and his influence on Brussels planning policy. In the conclusion, we return to the question of crisis and the influence of environmental science in current-day discourses on urbanism.

Sociobiological Theory: The Crisis of the Modern City

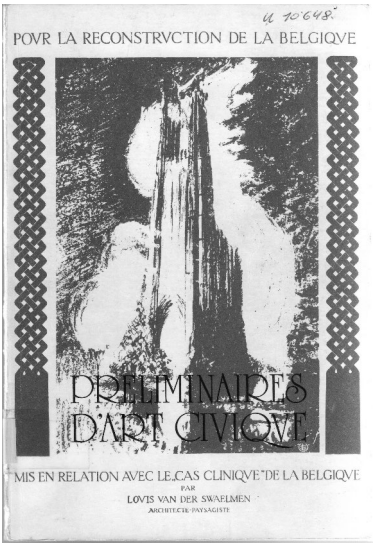
The German invasion of Belgium in August 1914 caused vast destruction of the built environment (Horne/Kramer 2001). Many urban designers immediately began to think about reconstruction (Smets 1985). Louis Van der Swaelmen, exiled in the Netherlands during the occupation years, was one of them. Before the war, he had been active both as a theoretician as well as practitioner in the field of landscape architecture (Stynen 1979). His work focused primarily on ideas regarding the creation of a modern aesthetic for gardens (Notteboom 2009). However, following a congress on urbanism and urban governance during the Ghent World Exhibition of 1913, Van der Swaelmen began to reconsider the urban question. At the Ghent conference he got acquainted with a wide range of influential urbanists and planners of that period, not least biologist and urban planner Patrick Geddes and his 'Cities and Town Planning Exhibition' (Van Acker/Dehaene/Uyttenhove 2013). After the outbreak of the World War that had forced him into exile, Van der Swaelmen started to think more concretely about the question of urbanism and its potential as a discipline and policy domain. In 1916, he wrote *Préliminaires d'art civique, mis en relation avec le 'Cas Clinique' de la Belgique* [Preliminaries of Civic Art in Relation to the 'Clinical Case' of Belgium], which examined the problem of wartime destruction alongside the long-range impacts of the industrial revolution and transformation of the agricultural economy on urbanization (Van der Swaelmen 1916). Van der Swaelmen used a series of reports by the Royal Commission of Art and Archeology to diagnose the state of his Belgian homeland. These reports were concerned with both the wartime destruction but also with the disappearance of the original Belgian landscape (Lagasse de Locht/Saintenoy 1914). The Royal Commission reports showed how chemical fertilizers, large agricultural corporations, and local railways were transforming the countryside at an unprecedented pace (Com-

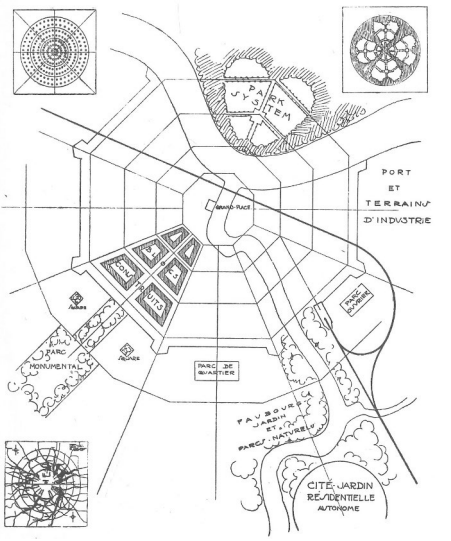
missions Royales d'Art et d'Archéologie 1914). The problematization of widespread war-damage and the disappearance of the 'original' landscape was further substantiated by referring to a report by Jean Massart – a biologist and geobotanist – who claimed that after the disasters of the war it was necessary to conserve traditional elements "so that we don't need to deplore the fact that the traces of the past will be irrevocably lost" (Commissions Royales d'Art et d'Archéologie 1914: 254). In the discussions between 'modernists' and 'traditionalists' that would dominate the debate on the reconstruction of the country during and after the war, the Commission demanded that the Belgian landscape be rebuilt according to its earlier nature (Smets 1985). While Van der Swaelmen endorsed such a policy, he also wanted to go further to counteract modern society's disconnection from the natural landscape through a new linkage between landscape architecture and urbanism. Van der Swaelmen believed that the "historical growth of the city" was "opposed" to the "functioning of the modern city", which resulted in "conflicts" (Ibid: XI). Van der Swaelmen therefore wanted to "achieve […] harmonies between the things of Nature and the Creations of Man" (Ibid: 100). Unlike the approach advocated by the Commission, he argued that the new spatial lay-out should follow from the recoupling of the natural landscape to modern urbanization patterns: instead of a historicist reconstruction, he imagined a new landscape that would incorporate the historical city while also making way for new settlements based on the natural and cultural environment.

Urbanism, Science, and Politics

In *Préliminaires*, Van der Swaelmen used the work of contemporary ethological scientists to tackle this case study of Belgium and create what he called a "sociobiological" approach that grounded urban theory in biological laws and environmental considerations. In his analysis, the city functioned as a biological organism determined by environmental factors, ideas that could be traced back to the philosopher of biology Félix Le Dantec (1869–1917) (Van der Swaelmen, n.d.). Van der Swaelmen explained the growth of cities using biological laws, assigning biological functions to different aspects of the urban environment. In his archival notes, Van der Swaelmen noted that Le Dantec's theorem could be "applied to the city" (Van der Swaelmen, n.d.). As a neo-Lamarckian, Le Dantec "held to a hard-and-fast determinism", and studied the continual "trafficking" of the organism with its environment ("Dr. Felix Le Dantec" 1917: 489). By constructing the idea of what he called a "*organisme-cité*" (city-organism), Van der Swaelmen equated the urban environment with various biological functions: buildings were cells, road networks worked like veins, and parks were the city's lungs (Van der Swaelmen 1916: 78). In this *organisme-cité,* environmental factors had a determining influence on the growth and development

Figure 1: Cover of Préliminaires d'Art Civique (Louis Van der Swaelmen 1916). Figure 2: The Organisme-cité (Louis Van der Swaelmen 1916).



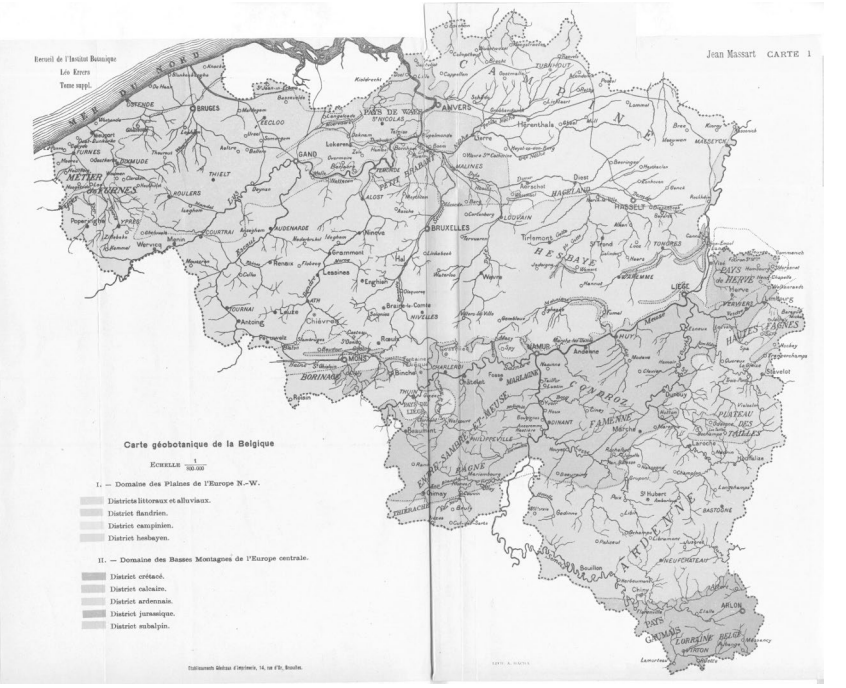


of the city. The fundamental organizing principles of the built environment were the "horizontality of the terrain," the "water regime," and the "draining system of the soil." The "geographical condition" would put its "indelible imprint on the future physiognomy of the city," and "inevitably determine the internal law of its future development" (Ibid: 9). Van der Swaelmen believed in an "absolute determinism" of the laws of nature (Ibid: 10).

As a tool to help the planner or designer understand the characteristics of the Belgian environment, Van der Swaelmen proposed to base the growth of the built environment in "physionomical districts" (Ibid: 101). These districts were copied from the work of Jean Massart, a geobotanist, ethologist, and professor at the Université Libre de Bruxelles. Massart divided the Belgian territory in geobotanical regions and attached natural and cultural characteristics to these areas. These regions were differentiated by their conditions of climate and soil, the present vegetal associations, but also by the nature of human interventions in the area (Notteboom 2009: 111). Massart's social-ecological analysis of these geobotanical regions became a tool for Van der Swaelmen as he worked towards a new urbanism in the postwar reconstruction of Belgium (Massart 1910; Notteboom/Uyttenhove 2018).

Both Van der Swaelmen and Massart can be considered part of a broader Belgian reformist movement that consisted of experts and technicians who tried to

Figure 3: The Geobotanical Map of Belgium (Jean Massart, Esquisse de la géographie botanique de la Belgique 1910).



improve the living conditions of the working-class without rejecting capitalist development (Uyttenhove 2011). Van der Swaelmen's theory illustrated how naturalistic conceptions of the social realm, which he incorporated into his notion of the 'ideal city,' were part of this reformist movement. In his ideal city, for example, so-called workers' parks were an integral part of the city. Social classes were to be neatly separated in the city-organism in much the same way that organs occupied distinct places in a body. The "democratic society of the future" would find its spatial representation in the newly created balance between city and natural environment (Van der Swaelmen 1921). These ideas were quite common in modernist architectural circles at the time. Van der Swaelmen, for instance, was deeply influenced by the Dutch architect and writer Hendrik P. Berlage (Berlage 1913; Stynen 1979; Berlage/Whyte 1996).

After the war, Van der Swaelmen became active in the rethinking of the Belgian housing policy by giving lectures on cooperative housing. He had good contacts in socialist circles that supported a policy of financial subsidies for workers' housing

through the formation of cooperatives, culminating in the establishment of different garden cities in Belgium (Van der Swaelmen 1920; Smets 1977; Danneels 2019). Van der Swaelmen himself designed some of these garden cities where he tried to combine sociobiological design with the socio-political goals of a cooperative housing strategy (Danneels 2019). For Van der Swaelmen, such socio-political ideas were of equal importance to the biological and scientific metaphors when it came to formulating his design theory.

With his design theory, Van der Swaelmen responded to the crisis he perceived in long-range urban development, but he also addressed the more immediate concerns following the First World War. He believed that a sociobiological theory of urbanism and urbanization with its reattachment of environment to the urban fabric would lead to a new equilibrium in which man and nature, the city, the environment and society would find a balance within one organic whole. What is also clear in Van der Swaelmen's case, and can be observed today in resilient design theory and practices, is the envisioning of "the social as a product of an all-encompassing, dominant natural development of systems to a sustainable state of equilibrium" (De Block 2016: 377). The biological determinism present in Van der Swaelmen's work can, in fact, be understood as a mobilization of scientific discourses to empower design language and political – in Van Swaelmen's case socialist – beliefs. This can be problematic because biological theories have been invoked by all sides of the political spectrum to underscore their ideological agendas (Daston 2014, 2019; De Bont 2008). Today, similarly, the mobilization of ecological resilience theory, which infuses "immunology" in resilient and sustainable design practices, is sometimes criticized for its intrinsic neoliberal agenda (Swyngedouw 2010; Walker/Cooper 2011; Kaika 2017; Swyngedouw/Ernstson 2018).

The City as an Ecosystem: Ecology and Planning during the Seventies[3]

More than fifty years later, Paul Duvigneaud developed the concept of the 'city as an ecosystem' in response to the environmental crisis facing Belgian cities in the 1970s. In the post-Second World War era, Brussels witnessed a period of large-scale demolition that was spurred by both by the city's position as a central node in the national road and railroad infrastructure and its role as the new capital of Europe (Ryckewaert 2011). Carola Hein captures the situation by stating that: "Brussels,

3 Parts of the content on Duvigneaud in this chapter was previously published as a conference proceeding (Danneels 2018). Jens Lachmund also studied the 'Duvigneaud group' and analyzed how "urban ecosystem analysis took shape in one particular city," showing how urban ecosystem science was appropriated by Duvigneaud in the Brussels context (Lachmund 2017: 141-142). Other recent publications that mention Duvigneaud are, among others: Gandy (2015: 151) and Bortolloti/Ranzato (2016).

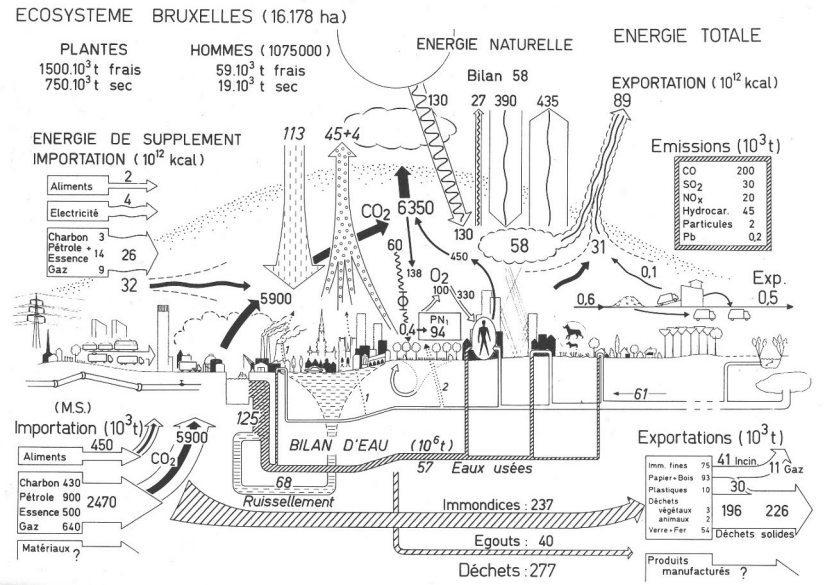
although spared by two world wars, resembled German or Japanese cities rebuilt after World War II" (Hein 2004: ix). The increasing importance of the city center as a base for Belgian and European governmental institutions, and the rapid construction of office buildings led to demolition and population decrease in the city center; but it also enhanced urban sprawl, which in turn eradicated open and natural spaces in and around the city (Sterken 2013). These (urban) problems caused widespread discontent among citizens. Among other things, citizen initiatives opposed governmental plans for high-rise building in the historical inner-city and spoke out against the destruction of regional green spaces (Demey 1992; Leloutre 2009; Doucet 2015).

This period of radical urbanization plunged both the city center and the outskirts of the city into environmental distress. Duvigneaud made extensive use of data to map these changes in the 1970s (Duvigneaud 1974: 6). The city of Brussels was the primary place to build a theory of a distinctively urban ecosystem – the *écosystème urbs*. Duvigneaud spatialized his data-driven approach derived from plant ecology and ecosystem theory by grounding it in concrete ecological observations in Brussels (Lachmund 2017). As Lachmund has argued, Duvigneaud was not only a scientist concerned with scientific data and publications, but he was also active in both planning and policy in the Brussels region. He was able to connect the work of his lab to Brussels' regional politics through the *Agglomeration Bruxelloise,* a new regional governmental agency responsible for metropolitan issues concerning planning and the environment (Apers 1982: 342).

Duvigneaud was trained at the Université Libre de Bruxelles (ULB) as a botanist and chemist and finished his PhD in botanical sciences in 1940 (Pierart and Duvigneaud 1992). As a professor at the ULB, he was the successor of Van der Swaelmen's contemporary Jean Massart. Throughout the 1940s and 1950s, Duvigneaud was involved in research in the Belgian Congo where he specialized in plant sociology and lichenology. He perceived the Congo as a place of untouched nature, where he could perform research into the "basic principles of plant sociology" (Duvigneaud 1953: 172). Although his work on the Congo continued into the 1950s, he shifted his attention to European ecology during those years. He became a professor at the ULB in 1952, and from 1959 onward he focused on fundamental ecology, or systems ecology. He founded the *Centre national d'écologie Générale* (CNEG), and in 1963 established an experimental station at Virelles-Blaimont, and later another one on the site of Mirwart in the Belgian Ardennes (Pierart/Duvigneaud 1992). The research was conducted under the auspices of the International Biological Program (1964-1974) where Duvigneaud was the director of the Belgian section (Duvigneaud/Kestemont 1977). The research center measured all incoming and outgoing biomass and energy flows on site. Duvigneaud and his colleagues published widely based on the data collected over a period of several years (Duvigneaud 1971). In his studies on the site of the Walloon community of Mirwart, however, he did not just

study the "natural" landscape, but also the 'rural ecosystem,' which he treated as a closed agricultural ecosystem (Duvigneaud et al. 1977). Unlike earlier researchers, Duvigneaud incorporated human activity and buildings in his analyzes, describing how heating a farm, for example, made it necessary to import energy from nearby forest systems. Additionally, some flows were "exported," in the form of meat or milk, while others where "discarded," like dung or urine (Duvigneaud et al. 1977: 482). Rhetorically, Duvigneaud remained an ecologist, and even when he incorporated human activity, his language effectively incorporated the presence of these cultural activities in his ecological models. Duvigneaud became particularly well known for his visual depictions of the ecosystem, which were based on earlier drawings by Odum in which energy flows were shown as energy circuits (Taylor/Blum 1991). By a method of the cross-section, he documented how flows of energy traveled through the system, effectively constructing a new way of mapping territorial metabolic relationships. Throughout his career, these drawings grew in both complexity and graphical quality, making them an excellent reference both for teaching and popularizing ecological knowledge.

Figure 4: The Ecosystème 'Urbs' and its Metabolic Flows (Paul Duvigneaud and Isidore Goedhuys in L'Écosystème urb: l'Ecosystème urbain Bruxellois 1977).



The Ecosystème urbs: From Science to Policy

From the 1970s onwards, Duvigneaud increasingly turned his attention towards the city itself (Duvigneaud 1974). Given his continued attention to human activity in the Ardennes studies of forest ecosystems, his hometown Brussels appeared like another worthy place for studying the functioning of ecosystems. He called this the *écosystème urbs*, opposed to the *ecosystème 'silva'* (forest ecosystem). When reading his contribution to the study of the urban ecosystem, it becomes apparent that one of his explicit goals was to influence the city's urbanization process. In a time of increasing regionalization, the ecological laboratory of the ULB "could not ignore the urban ecosystem of Brussels" (Duvigneaud 1974: 7). Therefore, a study center for the urban environment was created. Duvigneaud insisted that serious regional planning had to incorporate the work of ecologists. He clearly searched for a place at the table of planning services, engaging ecologists in the governmental apparatus of the recently formed Brussels Agglomeration. In addition, the new regional government also proved to be a financial opportunity for Duvigneaud's lab, a public client with ample resources that was eager to receive quantitative ecological data upon which it could build its new planning policy. Duvigneaud was ideally placed to bring this ecological expertise into the Brussels Agglomeration given his expertise as an ecologist, but also his political activities in the FDF (the Democratic Front of Francophones). The Agglomeration council was dominated by the FDF, and the alderman for the environment, Pierre Havelange, was a party member as well. Duvigneaud was therefore welcomed both as an expert and political player.[4]

Duvigneaud and his colleagues published widely on the *écosystème urbs*. What made this ecosystem different, in their view, was the predominance of human activity, or *anthropocénose*. But human activity was not the only factor shaping the urban ecosystem. The *biocénoses reliques*, or the original biological communities, and the *biocénoses urbanophiles* – biological communities for which the urban environment is beneficial and necessary – were also core elements of the systems upon which Duvigneaud and his colleagues worked (Duvigneaud 1974: 13). The 'weight', or 'biomass' of these different communities was measured in tons and displayed on a cross-section like that of the forest ecosystem. Additionally, the energy balance was calculated in both natural energy (e.g., sunlight) and subsidiary energy (e.g., carbon). Because of the great amount of subsidiary energy imported into the city, the amount of flows out of the city were high as well. To understand these flows, Duvigneaud stated that it was important to study the sub-systems of the city, outlining a future research agenda. In an early image, Duvigneaud exemplified these diverse sub-systems by providing a sort of Geddessian Valley Section that

4 Duvigneaud's extensive political work and network will be the central subject of a future paper.

matched energy in- and output (Duvigneaud 1974: 20). The subsystems were inhabited by different socio-ecological groups of people, parallel to socio-ecological groups of plants and animals. These ideas had first been investigated by geographer Bernard Jouret, who had claimed that the link between the population and its habitat was "analogous to botany, where a vegetal group corresponded with a particular soil." Building on categories used in the botanical sciences, a socio-ecological group was defined by its habitat and position, its ethnic composition and its employment (Jouret 1972: 85). Here, Duvigneaud went quite far with his ecological take on the city by claiming that cities not only functioned like ecosystems, but that their inhabitants could also be understood as "socio-ecological" (Duvigneaud, 1974: 19). In other words, he implied that people – much like plants – were bound to their environment.

Duvigneaud also identified some of the major problems he perceived in the urban metabolism. Most notably, he admonished the extensive use of fossil fuels to energize the urban system. Contrasting the metabolism of *écosystème urbs* with the circular and low-energy consumption of the *écosystème 'silva,'* he criticized the high levels of urban energy consumption as well as the urban dependence on external energy imports. Instead, he used his data-driven metabolism models to call for more circular energy flows.

But there were problems with Duvigneaud's system approach as well, most notably with his attitude towards the role of human subjects. Even though people were an important component of his data-driven research, he did not seem to treat them as real political stakeholders, a perspective that is frequently criticized in other resilient urbanism contexts as well (Kaika 2017). Even at the time, citizen initiatives were one of the main forces that helped to redirect urban planning debates in Brussels (Demey 1992; Doucet 2015). Instead, he mainly looked towards governmental planning policy as an active agent in urban development.

Ecological Zoning for Brussels

Duvigneaud's data-driven framework was linked to a variety of strategies that were designed by the Brussels Agglomeration to help build a more balanced urban landscape. Through his active work in the *Commission des Espaces Verts* (the Commission for Green Spaces) at the Brussels region, he tried to establish multi-layered strategies to deal with the environmental problems of Brussels. On the building-scale, the commission advised on the need for green spaces to counterbalance the negative effects that new (and often large-scale, high-rise) buildings often had on the environment of Brussels' inner-city. On a regional scale, Duvigneaud actively sought to introduce biological and ecological considerations into the planning apparatus by providing survey studies. A map showing the occupancy of the soil and the degree

Figure 5: The Carte écologique de l'occupation du sol et des degrés de verdurisation de l'agglomération Bruxelloise (CIVA).

of green areas was the most impressive example of this research (Duvigneaud 1977). The map was ordered by the government of the Brussels region as a tool to be used in future planning policies. By creating an overview of the problems of the city on a regional scale, the alderman for the environment, Pierre Havelange, believed that the map would help the Brussels Agglomeration to reach its goals for more green space (Ibid.: preface). The map used existing aerial photography, official structural plans, and photographic images taken from a zeppelin. These photos were essential because they showed the biological productivity of the green spaces in terms of biomass volume. The map showed the amount of greenness of certain areas, visualizing Duvigneaud's theory of biological productivity onto a spatial plane. The map was supposed to serve as a planning tool to identify the most ecologically important areas. It was a tool that could be used to evaluate the potential of further urbanization areas in the Brussels region while also protecting the green, biomass-rich areas of the region.

On the sub-regional level, the *Plan Directeur de la Vallée de la Woluwe*, (the Directory Plan for the Woluwe Valley) was the most telling example of Duvigneaud's quest to mobilize ecological science for planning policy. The Woluwe valley, located in the South-Eastern fringe of the city, was rapidly urbanizing during the 1970s. The Agglomeration commissioned a round table to prepare a zoning plan for the area. In this round table, Duvigneaud, his collaborator Martin Tanghe, and the architect Pierre Puttemans played a key role in drawing up the necessary maps and surveys. Duvigneaud and his collaborators hoped to minimize the impacts of further development by protecting the areas that were most productive in terms of biomass. In doing so, he was able to balance the claims of local politicians with the need for new construction advocated by private as well as governmental actors. Duvigneaud and Tanghe were not only active in the political negotiations, but they also made an ecological survey of the valley and published it as a scientific paper (Tanghe/Duvigneaud 1978). In that paper, Duvigneaud and Tanghe used topographical maps, aerial photographs, and local observation of the terrain to create a detailed and comprehensive map of the valley (Ibid: 6).

The lab of Duvigneaud made two survey mappings. First was a map with the ecological occupancy of the soil that also demarcated forests, vacant land, and apartment buildings, among others. The second map visualized the biological value of the area. Here, they indicated which areas were of high ecological value, and which of lesser ecological value. Duvigneaud and Tanghe drew inspiration for their mapping work from Herbert Sukopp, the Berlin ecologist who had drawn up an ecological map of West-Berlin to serve as a government tool in the early 1970s (Lachmund 2013). Sukopp proposed a mapping system with degrees of *hémérobiose*, the degree of "human modifications to the natural system." In this system, the territory did not possess any "true natural areas" anymore. Everything was in some sense influenced by human activity. Apart from these purely ecological delineati-

ons, some areas were designated as "of little ecological value, but of great esthetical and socio-cultural value", thus adding to a social and cultural evaluation. Although these maps where clearly made by ecologists, it is also true that their mapping practices were guided by the need to produce a general zoning plan. In other words, Duvigneaud's metabolic perspective did not result in a rejection of the conventional zoning plan.

In the conclusion of their study, Tanghe and Duvigneaud stressed that the proposed maps should orient urban planners in their project of modifying space by highlighting both bio-ecological and socio-cultural values. The maps established a distinction between spaces that could be designated for construction without affecting the natural and social benefits of the valley. In their view, construction in areas designated as "wild" or buffer zones should be deferred or at least pursued with additional precautions. Semi-natural areas, in particular, had to be protected completely from urbanization because of their great value in vegetation, soil or wildlife. In addition, artificial green spaces, like the riverbanks of the small lakes or the Woluwe, should be upgraded in an ecological and biological way (Tanghe/Duvigneaud 1978: 29). Works on public paths in the different parks had to be kept at a minimum (Ibid: 30). Apart from its significance for ecological planning, the *Plan Directeur* clearly documented the capacity of the ecological viewpoint to overcome existing power relations in the area. The functioning of the river-ecosystem of the Woluwe, for example, clearly transcended the competing interests of both the communities and the Agglomeration. By highlighting the shared natural capacity of the river and its valley, Duvigneaud and the Agglomeration were able to highlight the need for integrative planning and thwart the political goals of local politicians. Paradoxically, though, the *Plan Directeur* actually incorporated both the urbanization processes and natural protection in the valley through zoning, rather than refurbishing the development of the built environment in the region in a more integrated way.

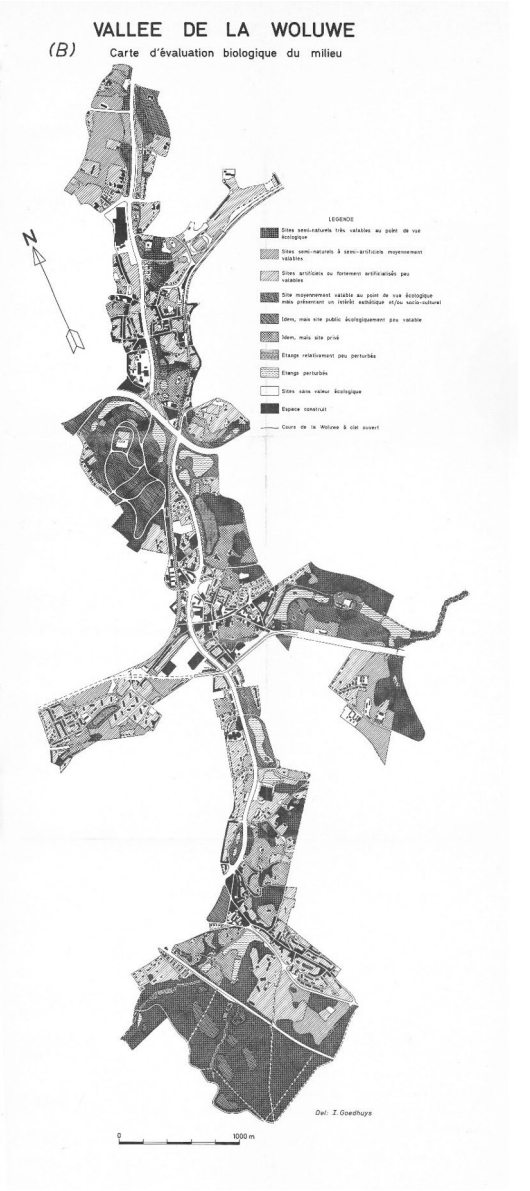
Although Duvigneaud did not use the work of Holling in his *écosystème urbs*, many of the theoretical assumptions and governmental tools he developed were in line with the resilient urbanism approach pioneered by Holling. Firstly, by applying the medium of the energy scheme – usually the depiction of natural ecosystems in 'natural' areas outside the city – he 'naturalized' the urban environment. Duvigneaud wanted to mobilize his knowledge into the planning apparatus of the Brussels government by combining society and nature into one framework. However, upon closer inspection, when transposing these eco-systems notions of the city towards the regional government's planning policy and subsequent zoning maps, we see that in fact it treated urban and natural phenomena as mutually exclusive rather than as a socio-natural hybrid.

Conclusion

The past and present search for an answer to 'crisis' by urban designers and natural scientists alike is one that attempts to establish an equilibrium between nature and the city by incorporating both systems into one model. In Van der Swaelmen's case, the city and the socio-natural environment are reconfigured to fit together in an organic city, or *organisme-cité*. In the case of Duvigneaud, his metabolic schemes for the *écosystème urbs* simultaneously critiques the use of energy in the modern city, while also bringing nature and city together into one model. His zoning schemes juxtaposed the built and the natural environment, trying to establish an equilibrium between them. Although resilience thinking in ecology moves "away from the notion that a 'balance of nature' exists" (Walker/Cooper 2011: 145), our historical analysis of resilient urbanism shows that designers have long searched for a balance – either with regard to the landscape as in Van der Swaelmen's case or with regard to natural energy flows as Duvigneaud advocated.

In summary, we propose that the scholarship on resilience should not only consider the past use of the word 'resilience' in urbanism, but should also pay tribute to similar debates and their influences on the development of resilience practices. Historically, many different experts have used crisis to propose a reconfiguration of the society-nature nexus. Juxtaposing these cases uncovers specific logics at play in resilient urbanism, both in the past and today, as well as different stances towards the socio-political. The socio-politics of resilient design theory and practice underscores how the environmental sciences can be paired with planning and design. But they also show how the fear of environmental crisis and loss of socio-natural landscapes might turn out to be a "fear of loss, not of a threatened nature and its capacity to sustain life, but of the conditions which sustain a threatened liberal utopia" (Adams 2010: 7). The cases of Van der Swaelmen and Duvigneaud demonstrated how they tried to mitigate the negative and detrimental side-effects of capitalist development and unbridled urbanization by finding alternative ways of reconfiguring the urban landscape through new modes of ecological planning. But these cases also show how they failed to thoroughly critique the political and economic bases of these environmental crises. If we want to understand the ecological and resilient urbanisms of the past, a broader emphasis on the historical interaction between the scientific and planning fields including their ideological beliefs is necessary.

Figure 6: The Carte d'evaluation biologique du milieu of the Woluwe Valley (Paul Duvigneaud, Martin Tanghe and Isidore Goedhuys 1978).



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