

The Copenhagen Finger Plan

Keeping a green space structure by a simple planning metaphor

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HENRIK VEJRE • JØRGEN PRIMDAHL • JESPER BRANDT

THE COPENHAGEN FINGER PLAN

KEEPING A GREEN SPACE STRUCTURE BY A SIMPLE PLANNING METAPHOR

Like most other major conurbations in Europe, Copenhagen experienced rapid growth during the 20th century, eliminating extensive tracts of rural landscapes. There is a general trend of urban sprawl, and European cities have employed various development models to safeguard parts of the existing landscape, or at least a green structure. Some cities, like Helsinki or Stockholm, are characterised by urban development concentrated along fingers, whereas other cities, like London and Barcelona, have developed a non-urban ring around the city to provide a green belt. A central green area to be shared by a ring of surrounding urban areas was adopted by the Randstad region in the Netherlands as a green space model. Growth of cities with no such planning tradition have often resulted in an amalgamation of urban areas with few and fragmented green areas, like Antwerp and Milan. It should be noted that spatial models for urban development can be greatly influenced by the differences in natural conditions (e.g., hills or wetlands) that impose constraints on urban development. However, such conditions can also strongly support a chosen urban development strategy, if they can be socially embedded as a "deep structure" (Spirn 1998).

Around Copenhagen, planning and landscape management safeguarded a network of green space that today penetrates the massive urban fabric. The landscapes of these green areas have been subjected to profound changes, although their rural past is often traceable. The landscape transformation of green space follows several different pathways - some changes were the result of deliberate decisions, others have been more incidental. In any case, the changes represent typical transformation processes characteristic of urban fringe landscapes through the 20th century. Since much of the transformation has been guided by planning provisions of various kinds, it is essential to scrutinise the effect of the various plans for greater Copenhagen in order to be able to deal with the development of its fringe landscape.



Figure 1. The original sketch of the 1947-Fingerplan of Copenhagen. The palm is resting on the city centre of the 1940's. The fingers point in five directions, the shaded areas represent both existing and future cities. To the north the existing urban fabric did not fit completely to the little finger, as these areas were already under development.

Visions and plans for the green space of Copenhagen

In 1947, after two years of intense work, the Danish architects and town planners Peter Bredsdorff and Sten Eiler Rasmussen and their team presented a new vision for the urban development of greater Copenhagen (Bredsdorff *et al.* 1947). The front page of the plan visualised the future urban areas as a hand – the palm resting on the existing compact city centre, and the fingers pointing along future cities, draped on infrastructural corridors that radiated in five directions from the centre (Fig 1). The plan was logically nicknamed “The Finger Plan” and soon became an icon in Danish and international planning debate (see e.g., Rasmussen 1969; Hall 1989; Jensen 1992; Gaardmand 1993; Anon. 2004; Hansen & Winther 2006 and Ravesteyn *et al.* 2005). For 60 years, the Finger Plan has guided the urban development, infrastructure and green space in Copenhagen, and the impact is clearly visible in the contemporary landscape.

How has a visionary planning metaphor managed to survive chaotic planning systems, a diffuse institutional framework, a turbulent era of rapid economic growth and expansion of the urban population, which went far beyond the imagination of Bredsdorff and Rasmussen? What in fact were the concrete visions embedded in the plan: and how has the plan functioned as a framework for urban change and the development of urban green space? The Fingerplan was a city plan with clear ideas of urban land uses, recreation and infrastructure, but it was less instructive about the open landscapes outside and between the fingers. So, during those 60 years, what actually happened to the landscapes between the fingers?

This chapter aims to present a brief overview of milestones in Copenhagen urban planning practice, and to provide insight into the visions and missions of the Fingerplan – all seen from a countryside and landscape point of view. Furthermore, urban green space is elaborated in detail for three selected areas and also in general. The conclusion explores how the Fingerplan relates to landscape ecological models for nature and landscape planning.

Beyond the fingers, in the greater Copenhagen urban fringe zone, there is currently a highly dynamic situation in the open landscapes. The struggle for land and the competition between interests is fierce, and

1 : Contemporary Copenhagen

Greater Copenhagen (Fig 3) essentially covers the north-eastern corner of the island of Zealand, it houses some 1.8 million inhabitants, a third of the Danish population. The landforms vary from fertile plains dissected by valleys in the southern and western part, to the undulating and hilly terrain of northern Copenhagen. The urban landscapes proper of Copenhagen comprise densely built parts in the city centre and in the local centres along the major traffic route. Huge areas of detached single family houses, apartment blocks and modern industries characterise the suburbs. The green space consists of a mixture of recreational facilities, including sports grounds, forests, grassland and agricultural land. The peri-urban areas are mostly open agricultural land, and to the north, and north-west there are extensive forests. Despite the open character of the land, the major part of the rural population are urbanites living in farm houses or cottages. The number of full time farmers in the peri-urban zone is very low.



Figure 2. The 1928 Green Structure Plan with the designated areas for nature protection shown in black. Most of these areas are now under nature protection orders and evaded urban sprawl. Dotted areas are protected forests

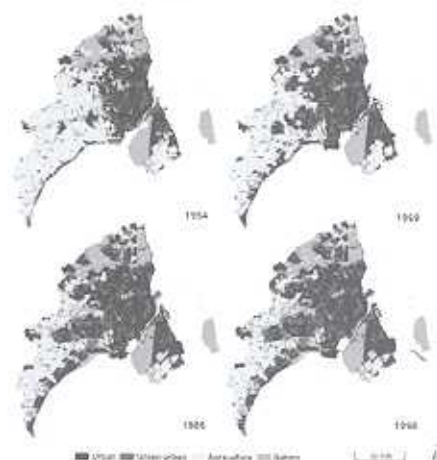


Figure 4. Development of Copenhagen 1954 - 98 (Courtesy Caspersen *et al.* 2006)

the landscapes are by no means becoming more stable in respect of functions and patterns. Although most of the fringe areas were traditionally agricultural landscapes, agriculture was only sporadically dealt with in the original Fingerplan, as well as in subsequent plans. The current critical question is consequently how the traditions of the Fingerplan will be maintained and improved in future urban areas?

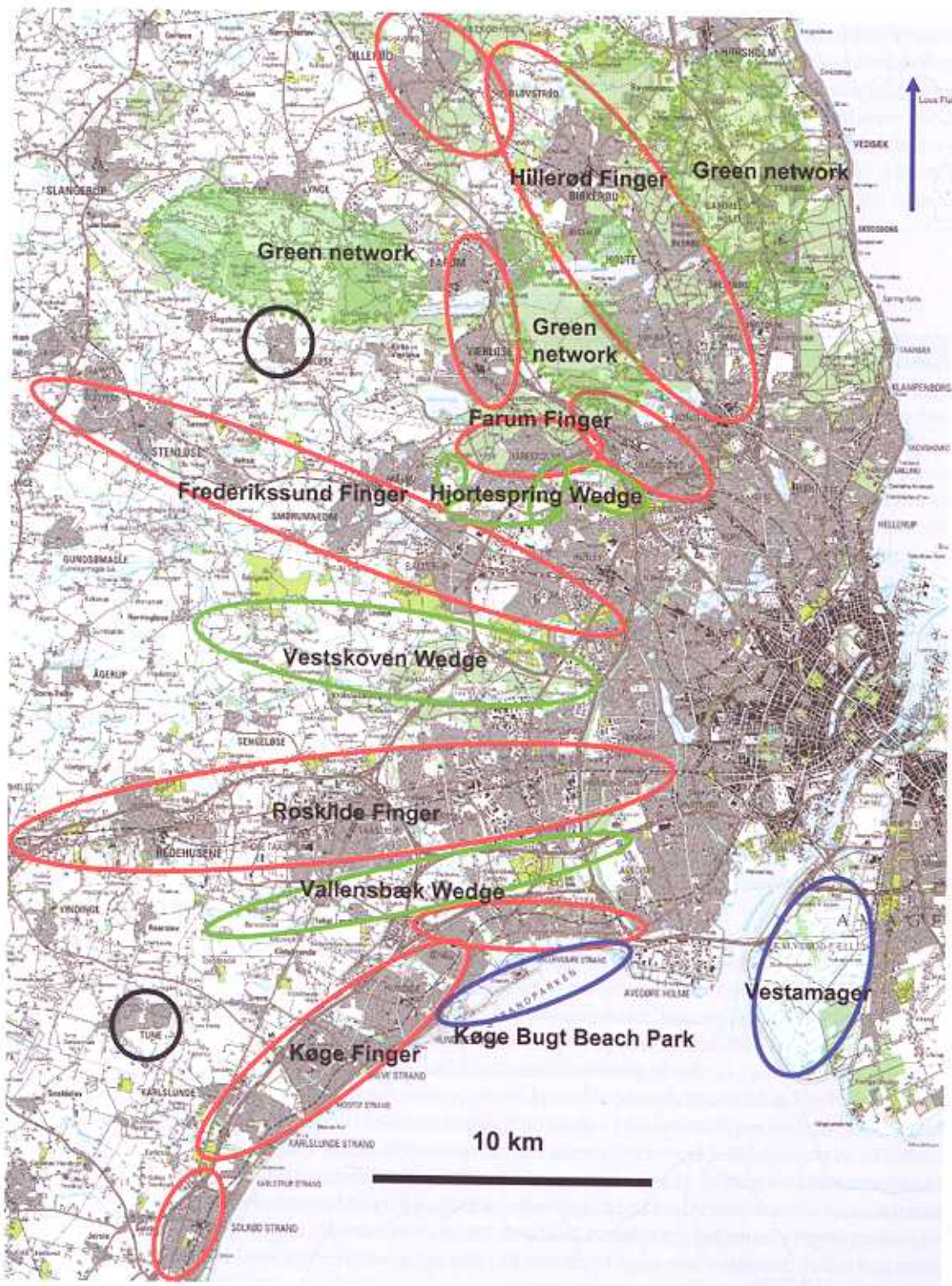


Figure 3. Contemporary map of greater Copenhagen. Green = wedges and green network; red = urban fingers, blue = reclamation projects, black = case study areas in urban fringe project

COPENHAGEN URBAN DEVELOPMENT 1850 - 2000

After the fortification around the city of Copenhagen was demolished in 1856, the immediate surroundings of the city were subjected to rapid urban growth with little or no public intervention. In the late 19th century this spontaneous growth, with its accompanying problems of poor housing and poor sewerage, spawned urban planning, which set guidelines to control the sprawl. However, the growth pattern remained as a 'layer upon layer' structure, emphasised by the Copenhagen City Council's acquisition of neighbouring villages covering several square km. These new areas became more or less urbanised during the 1920s, and no clear open space network was developed. The earlier social segregation within the walled city was replicated in the resultant growth pattern, with an expansion of upper class neighbourhoods to the north, middle class subdivisions to the north-west, and the evolution of working class districts to the west and south.

2: Søllerød Nature Park

The Søllerød area represents the landscape development in the first half of the 20th century (Fig 5). The rolling, forested landscapes with scattered lakes north of Copenhagen were considered very attractive for settlement. Hundreds of years ago, the noble classes and the royal family dominated the area, and during the 19th century the bourgeoisie built summer residences in many of the most attractive areas. During the 1920's the northern fringe was increasingly urbanised and the landscape attracted still more recreational activities; e.g., hiking, angling and cycling. Prior to the 1936 Green Network Plan the landscape was carefully scrutinised by Forchhammer and his team for so-called landscape values, which were primarily aesthetic quality (Forchhammer 1936). In the central part of Søllerød parish, a larger area was designated as particularly valuable, and land was designated as corridors to connect them (see Figure 2). From 1936 to 1970 the entire designated area of the 1936 plan was subject to nature protection declarations. It is important to stress that the declarations primarily stated that the land should remain open, that is, it was a protection against structural urbanisation. In the 1960s the area became known as Søllerød Nature Park. Since the 1950s the landscape has been subjected to various changes, but in contrast to the surrounding non-protected land, it has retained its open character as a rural landscape with mixed rotation fields, pastures, minor wetlands and small woodlands. Part of the pasture land has been converted to a golf course. An extensive network of bike- foot- and bridle paths was established from the 1950's onward. The landscape functions have gradually shifted from being primarily productive to the present recreational, serving thousands of households in the local municipality, but also day visitors from the region. The recreational activities comprise primarily golf, cycling, horse riding and hiking. A limited number of people live in the landscape itself, while its quality as a wildlife habitat has increased over the past 50 years. Outside the protected areas housing, combined with industrial and retail areas, now completely cover the land.

The process of protection has been facilitated by a mixture of private and public initiatives. The majority of demands for protection declarations were public initiatives, but the core area was protected voluntarily by the owner in the 1950s. The area is now owned by the public, apart from about 10 % under private ownership. There are strict regulations for private owners, governing such activities as construction and land cover changes. The resulting landscape may be described as a landscape park with a strong focus on leisure. The public part of the area is managed by the Danish Forest and Nature Agency.

The prospects of continued growth worried planners during the 1920s; not least because of the lack of provision for access to recreational areas for the expanding urban middle and working class populations. As a response to these developments, Forchhammer (1936) published a comprehensive and detailed plan for the development of green structures around Copenhagen (Fig 2). This plan was partly built on a prize-winning proposal for an urban plan for Copenhagen from 1929, and partly on a precursor of the 1947 Finger Plan (Hauxner 1993). World War II interrupted the planning process, but during the last months of the war a group of planners gathered to initiate the work that eventually materialised in the Fingerplan.

The 1947 Fingerplan represents a vision for the pattern of future urban development - an innovative combination of a centre and a band structure which addresses the demand for urban growth, infrastructural functions and recreation in a clear and simple manner. In its original version the Fingerplan was an urban plan and not a comprehensive regional plan. It dealt with the open countryside only to a small extent. More recent plans and policy initiatives have tried to remedy this lack of concern for the rural areas on the urban fringe, although agricultural landscapes were never subject to planning measures: neither the farming functions nor the agricultural structures.

During the 1950s and 1960s development doubled the population of greater Copenhagen and expanded the urban area dramatically (Fig 4; adopted from Caspersen *et al.* 2006). Migration from the rural areas and a dilution of the compact city centre contributed to the growth of the suburbs. Various development plans respected the overall principles of growth in the fingers and conservation in the wedges between the fingers, although the fingers became successively thicker than stipulated, and in some cases the wedges were reduced to narrow corridors. During the late 1960s and 1970s, initiatives at local, regional and national levels safeguarded the remains of the wedges and, when the first municipal plans under the new planning laws in the 1970s were approved by government, the wedges were safeguarded - formally and in practice - against further urban expansion. As described below, the finger structure has in essence been respected till today.

SAFEGUARDING COPENHAGEN GREEN SPACE - A TIME SERIES OF EXPERIENCES

Urban sprawl without control 1856-1936

Only forests, lakes and wetlands diverted the direction of sprawl in the first decades after the dismantling of the inner city fortification. From 1805 the forests were subjected to the Forest Protection Act, which has proved one of the most effective landscape protection measures ever to be implemented in Denmark. The large lakes and extensive wetlands did not invite reclamation for urban development in the 19th century, but instead attracted the location of country houses for the city dwellers. Forests, lakes, and the coastlines constituted the "deep structure" (Spirn 1998) upon which urbanisation developed. In contrast, the open countryside was subject to almost unlimited urbanisation. In the first decades of the 20th century numerous country houses and small estates were erected on the most attractive sites along the coast and lakesides, close to forests, and near the stations of the newly constructed railways. In the heydays of Danish mercantile trade taking advantage of Danish neutrality during the First World War, merchants invested their quick and dirty money in estates along the coast, settling some 20 km of coastline within a few years. This development resulted in an outcry for controlled urban development in the 1920s.

3: Vestsøken

Vestsøken (i.e., literally Western Forest) represents the landscape transformation of the second half of the 20th century (Fig 6). The western fringe of Copenhagen lacked the landscape qualities of the northern fringe; hence there was a decade-long drive to offer recreational opportunities to the growing population in the west, which could rival the attractive landscapes of the northern suburbs. Several afforestation initiatives were taken, but no trees were planted until 1967, when parliament passed an act specifically requiring a public forest to the west of Copenhagen. The management of the proposed forest was strictly circumscribed by leaving it entirely to the State Forest Service. The financing of the first five years of afforestation was divided between the Danish state, Copenhagen City and the local municipalities. Later the forest district created an income by offering a dump site for rubble and earth - later to become the artificial hills of Herstedhøj.

The vision of the land transformation was a complete conversion of the existing generally low quality (in terms of recreation) agricultural and horticultural landscape to a leisure landscape of 1,500 ha. The original master plan aimed at planting trees on half of the area, leaving the other half as open land with pastures. Forests were primarily planted along the margins, and pastures established in the interior. From 1967 to the end of the century, a total of 1,400 ha was acquired from private land owners and gradually converted according to the master plan. The land acquisition was smoothed by a parliament act that stipulated that land could only be sold to the state forest district. The 1973 energy crisis precipitated the bankruptcy of dozens of greenhouse growers, leaving them no alternative but selling to the afforestation project.

In 2007 the master plan is almost accomplished. Some 50 ha is still under private ownership. The landscape has completely changed and very little remains of the former open landscape. Artificial hillocks have been created; lakes have either been dug out or spontaneously established with the gradual collapse of the agricultural drainage system. Numerous plant and animal species have found their way to the naturalised area. Despite much criticism over the years concerning the landscape design, the clashes with motorways cutting up the area, the forest management and other issues, the Vestsøken remains the most successfully managed of the three proper Copenhagen Fingerplan wedges. Its most important achievement is the status of the area as inviolable recreational land. Future generations may set new targets for management, but currently Vestsøken provides 1,500 ha without urban development; unlike the two other wedges, the Højerslev and the Vælsbæk.

Today Vestsøken fulfils several functions including recreation, timber production, groundwater protection and ecosystem services, such as carbon sequestration. This is in sharp contrast to the intensive agricultural and horticultural production prior to the afforestation.



Figure 5. Landscape development in Søllerød parish: 1890 (top), 1930 (middle) and 2005 (bottom). The typical development of the urban fringe north of Copenhagen. The 1890 map shows urban summer residences at the north bank of Søllerød Sø (=lake) and the initial development of settlement at the train stations at Nærum village. In 1930 the areas north of the lake and the hilly terrain east of Søllerød have been settled by summer houses, whereas the area north of the Station has developed to a residential area. Shortly after this stage the 1936 Green Structure Plan was formulated and the process of nature protection declarations was initiated. The contemporary map shows the fully urbanized residential areas, and the remaining open countryside that was protected according to the 1936 plan. Note that forests are protected from urban sprawl throughout the period. Red bar = 1 km

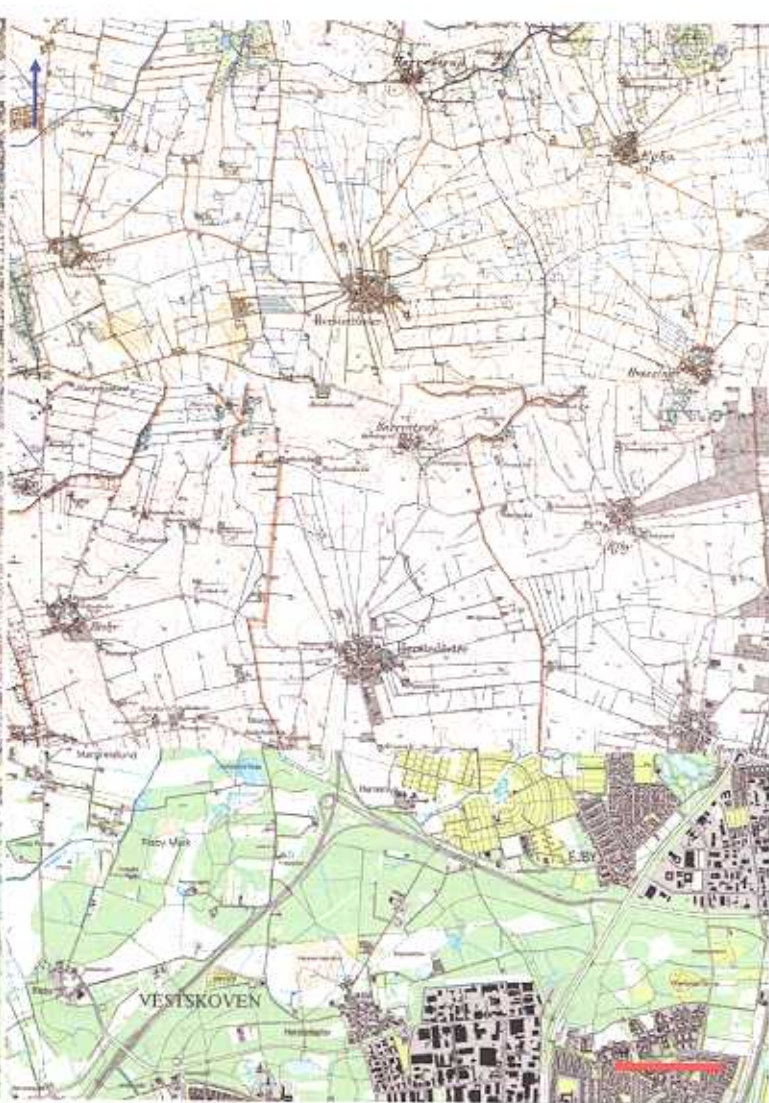


Figure 6. Landscape west of Copenhagen: 1890 (left), 1930 (middle) and 2005 (right) showing the development of the Vestskoven wedge. The 1890 map shows the complete rural environment with the intensively grown open landscape, hundreds of open drainage ditches and a few wetlands (green). In 1930 the ditches have to a large extent been substituted by closed subsurface drains, and the wetlands have partly been eliminated. Between the villages a few signs of urbanization are visible, e.g. the radio transmission station, and to the east large greenhouses and orchards (gray shade) appear, but the landscape is still absolutely rural in character. The contemporary map shows the complete transformation of the landscape with the urban fingers to the north and south, and the forested area in the middle, alternating with open pastures. Light green areas are allotment gardens. Red bar = 1 km

The 1936 Green Network Plan

In 1936 concern over the gradual consumption of the open countryside resulted in a thorough landscape analysis and the above mentioned comprehensive plan for a recreational network – a connected system of nature parks – to the north and north-west of Copenhagen (Forchhammer 1936) (Fig 2). The aim of the Green Network Plan was to create access routes to the landscape; forests, lakes and coasts; for the growing urban population, and to impose landscape and nature protection declarations on the most important open landscapes. The plan comprised designations of areas of high landscape quality and corridors that connected them – much in line with the greenways and ecological corridors that became a guiding principle in landscape management many decades later. The plan primarily targeted the northern and north-western landscapes, because the most varied landscapes and the strongest urbanisation pressure were found here. The flat and open



Figure 7. Landscape development at the south coast; 1890 (top), 1930 (middle) and 2005 (bottom). The typical development of the coast of Koge Bugt. The 1890 map shows the salt marsh areas in green and the intensively cultivated areas of the rural landscape in white. A few summer houses have been established along the badly maintained road. In 1930 the new road has just been finished and the effect on settlement is almost immediate. Almost all the open coast area has been settled, except for the delta of the watercourse to the west. The contemporary map shows the fully urbanized residential areas of the Koge Finger, and the new beach park established by land fill off the former coast. Red bar = 1 km

western and south-western agricultural landscapes were not considered particularly attractive, and were not subjected to the same degree of pressure at that time.

The detailed designations of the 1936 Green Network Plan did not comply with the rigid pattern of broad wedges of areas reserved for recreational use in the 11 years younger Fingerplan. However, this Fingerplan pattern was not applied to the northern Copenhagen periphery for the reasons which follow.

- 1 The urban development was already advanced to the north – and the urban patches followed a scattered patch pattern – located both along traffic corridors, and in clusters scattered over the most attractive landscapes. The idea of wedge-shaped, connected, open landscapes was already too late to apply.
- 2 The existing protected forests are often located along the major traffic corridors to the north, and it would be futile to superimpose the urban finger pattern on the forested areas in this region.
- 3 The attractive open landscapes are found in scattered patches; a rigid, finger-approach would leave attractive landscapes open to urban development and would include less attractive landscapes in the protected areas.

Hence the general perception of the Fingerplan as a homogeneous pattern became flawed, because the northern fingers and accompanying green wedges were superimposed on landscapes already subjected to random development. The deviation from the ideal pattern is in fact visible in the first sketch of the Fingerplan (Fig 1). In contrast, the western fingers and wedges developed more regularly, but still following very different pathways of development. The contrasting development is seen on Fig 3.

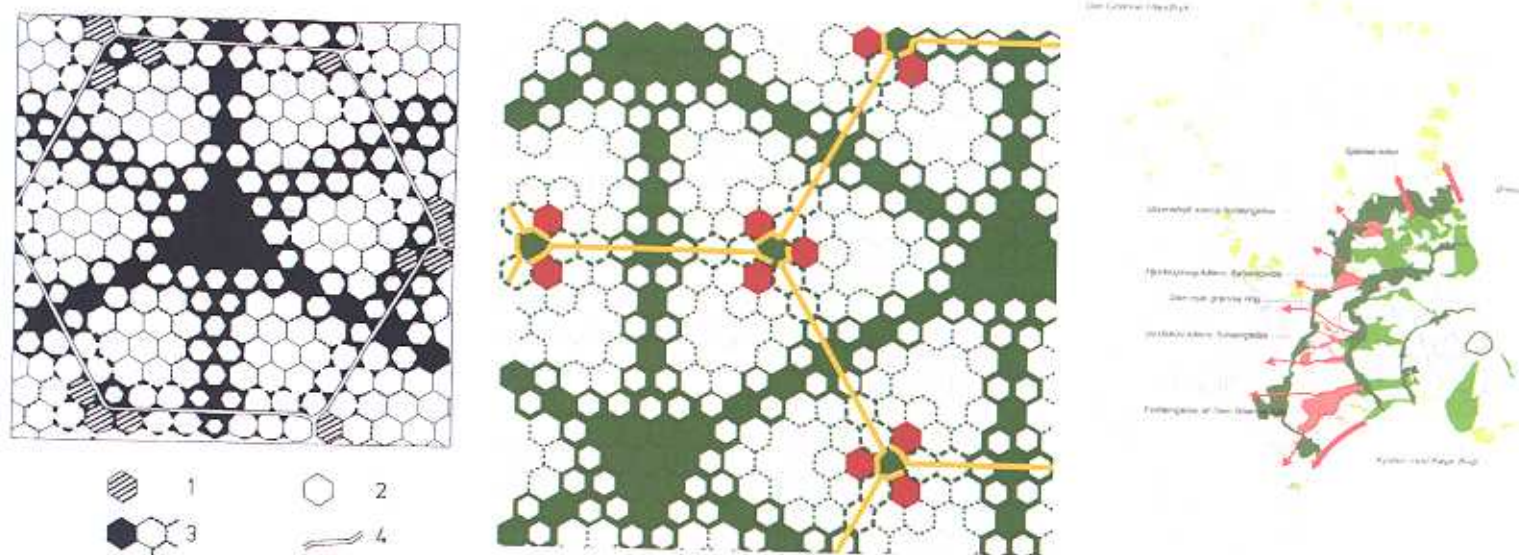


Figure 8. Conceptual landscape model (left) depicting a heterolevel structure of ecotones in a network of compensative areas, forming a radial structure – like fingers pointing out from the centre. Adaptation of the conceptual model (right) – the system of fig 9 is extended and seen from a central urban point of view – the radial ‘Fingerplan’ structure becomes much less pronounced, however not totally absent.

4 : Køge Bugt Beach Park

The Køge Bugt Strandpark (Beach park) is a complete artefact created during the 1970s as a response to the recreational demands of the exploding number of inhabitants in greater Copenhagen, and as a reaction to one of the most fatal lapses of planning in Danish history.

In the 1930s a new road was constructed along the coast between Copenhagen and Køge, some 35 km to the south. It was a precondition for the construction of the road that the public acquired the major part of the most attractive beach areas along the coast to give access for the public. However, before these acquisitions could take place, the local farmers sold the land piecemeal to Copenhageners, who soon put private summer houses on their properties. Several thousand summer houses were built within a short period of time, more or less closing the coastal zone for a distance of more than 20 km from Copenhagen. The public planning and legislation was not capable of halting this development. The complete loss of the open coast and the limited public access to beaches inspired the establishment of the beach park, which was created in the 1970s as a landfill on barrier islands off the coast (Fig 7). The landfill was not completely uninspired by nature – in the 1940s natural barrier islands gradually emerged from the sea further to the south.

Both in the 1936 Green network Plan and in the Fingerplan, an extensive beach park along the Køge Bugt coastline was an important issue. Its realisation in the 1970s completed the Fingerplan vision for the southernmost urban finger, which today is bordered by open countryside to the north and west, and the beach park to the south.

The beach park provides space for hundreds of thousands of visitors on summer days, and facilities for yacht owners, cyclists, and other kinds of leisure. In the 1990s an art museum was built in the park.

The Fingerplan and the landscape stabilisation tradition

Although both the greenway and the nature conservation traditions have been in focused on in later interpretations of the green Fingerplan, the landscape stabilisation tradition might be of more fundamental interest than the previous two for understanding the nature-society aspects of the Fingerplan and its later accomplishment.

In the landscape stabilisation tradition within landscape ecology, the necessarily intensive use of urban areas, characterised by sealed ground cover, has to be compensated for by areas of extensive use which permit basic metabolic processes to take place in a territorially efficient way; which means leaving as many of these processes as possible to nature. A basic concept in the landscape stabilisation tradition is the anthropogenic ecotone defining the landscape-ecological aspects of the transition between areas of intensive land use, including sealed ground cover, and areas of less disturbed cover and land use. The functioning of such an ecotone presupposes a transition zone of a certain width, which influences the minimum width of corridors regarding their stabilising effect. Based on such principles the ideal structure of a rural landscape has been presented in Figure 8 (adopted from Mander et al 1988). The ecological diversity and functionality of the landscape is guaranteed by a heterolevel structure of ecotones in a network of compensative areas, forming a radial structure – like fingers pointing out from the centre. However, this is seen from a perspective based in nature, trying to incorporate a settlement structure and a system of intensified agricultural areas in an ecological compensatory system, shown in black. If the system is extended and seen from a central urban point of view (see Figure 9) the radial ‘Fingerplan’ structure becomes much less pronounced, however not totally absent.

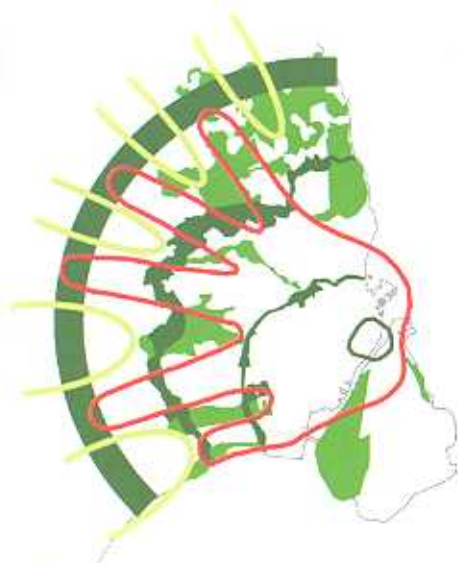


Figure 9. The Finger plan icon is repeated in contemporary planning. The contemporary regional plan of greater Copenhagen include new green belts around Copenhagen (dark green), and extension of wedges (light brown) radiating from the original wedges and green network (light green). Courtesy Forest and Nature Agency



Figure 10a,b. Landscape in Søllerød Parish (Around "Attemosegård", Fig 5) - exactly 100 years span the two photos. The 1907 landscape is open with scattered forests and sparse settlement. The landscape represents the values that were crucial to protect in the 1936 plan (Fig 2). The photographers' vantage point was to become the border for the designation of the protected areas. In 2007 the effect of the landscape protection measures are obvious. The open character is essentially preserved between the residential areas of the foreground and the background - the latter almost disguised in the vegetation. Courtesy Rudersdal Museum (10a)

The 1936 Green Network Plan (Figure 2) was implemented successively during the following decades, initially with the establishment of parkways radiating from the city centre. Later, conservation orders protecting valuable habitats and scenic areas were approved and have effectively prevented urbanisation. The current status of the planned area to the north is a mosaic of three types of land: i) valuable habitats and scenic landscapes under conservation orders, ii) protected forests, and iii) urban areas including suburban developments. In the municipalities that were encompassed by the plan; Lyngby-Taarbæk, Rudersdal and Furesø; only very small areas remain available for urban development.

5: The Fingerplan and ecological corridors

Although ecological considerations have only indirectly been included in the anthropocentric concept behind the Fingerplan, the design of a hierarchically ordered system of recreational areas, providing space for sustainable populations of wildlife in recreational islands connected by ecological corridors, is certainly a consequence of the plan. Especially since the 1980s, ecological dispersal considerations have also been part of the agenda for physical planning in densely populated areas, as a more long-sighted aspect of nature conservation. Thus an evaluation of the Fingerplan from a landscape-ecological point of view is of fundamental importance for the evaluation of the long-term sustainability of the Fingerplan concept.

Leaving aside the classical planning concept of greenbelts being established in the urban periphery for recreational reasons, ecological corridors have been presented in a physical planning perspective roughly according to three different traditions:

- a *greenway* tradition, mainly based on an American landscape-architectural tradition dating back to the beginning of the 20th century (Lewis 1964, McHarg 1969)
- a *nature conservation* tradition based on modern Island Theory and Metapopulation Theory and their implementation in conservation planning (Forman & Godron 1986, MacArthur & Wilson 1967, Opdam et al 2002)
- a *landscape stabilisation* tradition with roots in geo-ecologically oriented landscape planning, especially in eastern Europe (Mander et al 1988, Miklos 1986)

In the 1930s and 1950s the greenway tradition was adopted in Copenhagen urban planning and in the regional planning of Greater Copenhagen in the early 1970s - in accordance with the Fingerplan concept, focusing on the landscape connections within the wedges between the fingers. Danish implementation of ecological dispersal corridors in regional planning was launched in many Danish regions during the 1980s. The dispersal corridors of the Greater Copenhagen Regional Plan was one of the first and most advanced in this respect, however it had little noticeable relation to the Fingerplan concept (Brandt 1995).



Figure 11a,b. The southern part of Søllerød nature park (south of "Gammel Holte"; Fig 5) has not changed much during the 40 years between the two photos. It certainly was not meant to! The strict landscape protection measures imposed to the area should protect it against urban sprawl. The most prominent change is the change of the fields in rotation of 1966 and the fallow land and pastures of 2007. A clear indication of the disappearance of active farmers from the Copenhagen fringe. Courtesy Ruderød Museum (11a)

The imprint of the Finger plan 1947-2006

The Fingerplan pattern was easier to implement in the flat homogeneous open landscape of the western fringe, where no distinctive deep structure elements such as forests or lakes were present, and only few small sites were protected through conservation orders. Between the Køge Finger and the Frederikssund Finger (Figure 3), it made good sense to develop the three urban fingers and the two green wedges between them. During the post war period, the contours of the green wedges to the west began to be shaped in the planning process and in the urbanisation on the ground: 1) The Hjortespring wedge, 2) The Vestskoven Wedge, and 3) The Vallensbæk Wedge (Figure 3).

Despite being common offspring of the Fingerplan, the three wedges have developed very differently. The Hjortespring wedge was successively diminished through un-coordinated planning at the municipal level, and it was narrowly saved from almost complete obliteration, by the four local municipalities agreeing upon a comprehensive plan to safeguard what remained (Anon. 1994).

The Vestskoven wedge was effectively safeguarded by leaving the entire planning to the State Forest District, and by imposing the very strict and effective Forest Protection Act on the area.

The Vallensbæk Wedge was effectively demarcated by two motorways, but the four municipalities followed four different agendas in terms of which functions were allocated to their share of the wedge. Rodovre municipality is still considering the future land use, Brøndby Municipality planted forest and allocated numerous allotment gardens, Vallensbæk located golf courses; but kept the village with its surrounding open fields in memory of former rural times; and Ishøj municipality created a comprehensive landscape park with a village-fields-forest pattern resembling old centre-periphery Danish rurality. A unifying plan for the Vallensbæk wedge was not formulated until 1996 (Anon. 1996).

Hence, whereas the built-up parts of the Fingerplan pattern were more or less in place in the urban structure in the late 1960s, it took more than 20 years to plan and develop the landscapes in the wedges.

The reclaimed landscapes

Two important landscape changes occurred outside the wedges which were of major importance to the Copenhagen green space. The first was the reclamation of the shallow sea between the island of Amager and southern Copenhagen (Vestamager), which took place during World War II. The reclaimed area developed into a valuable nature area under military jurisdiction, and was opened to the public in the mid 1980's. The second was the creation of a beach park off the south coast. Both areas fitted well into the Fingerplan pattern as they were along the band-shaped cities. Both projects involved public money and represented highly centralised planning.



Figure 12 a,b,c. Three steps in the development of the landscape of the urban parts of Søllerød – southeast of ‘Høje Sandbjerg’ (Fig 5). The 1937 landscape is typical for the rolling terrain with hedgerows and woodlots of the northern fringe of Copenhagen. At this time, settlement was virtually absent. The 1955 scenery represents a highly dynamic phase with the building of multi-storey apartment houses and other urban sprawl consisting of single family houses, summer houses and allotment gardens. The 2007 view comprises a complete transformed landscape: large single family houses occupy most of the area, with real estate prices in the top end of greater Copenhagen. Courtesy Ruedersdal Museum (12a,b).

6 : Achievement of landscape stabilisation in the Fingerplan

Basically, the prioritising of the Fingerplan to an anthropogenic network of transport and communication at all spatial levels gives problems for the connectivity, and thus the functionality, of a heterolevel structure of ecological networks (Swaffield and Primdahl 2006). However, the ecotone structure can also be enhanced and supported by the anthropogenically oriented Fingerplan model and, seen from an ecological point of view, it can be postulated that this ‘ecological’ ecotone functionality has been implemented in the development of the Fingerplan, even where it was not fully integrated in the Fingerplan concept.

Interestingly, the design of a new green belt west of Copenhagen (see Figure 10 and below), which partly contradicts the Fingerplan pattern, may also conceptually be understood as a achievement of a Nature Fingerplan; at least partially linking the extensive forests of northern Zealand with the Mid-Zeeland forests. However, such a plan goes beyond the regional planning level, since the core natural areas to be linked are located in different regions.

The strongest human-nature related ecotones in the Copenhagen area are represented by the coastal zones. It is interesting that although the coastal ecotone plays a reduced role in the original Fingerplan – with no finger along the coast north of Copenhagen, and no compensatory areas outside the finger along the southern coast – the ecotone character of these coastal zones, both for nature and for recreational purposes, featured in both the original ideas of the Fingerplan and in its implementation: in reality in the form of social battles on the design of these ecotones (and the degree of built-up areas in the coastal zone), which were often blurred in the planning documents.

Three successes

Among the six major green space regions of the Copenhagen urban fringe, three stand as conspicuous successes, in terms of safeguarding areas from urban development, and providing the population with easily accessible recreational areas. The three areas represent the 1936 green network plan, the Fingerplan, and the reclamation initiatives respectively. For detailed presentation, consult the boxes.

LANDSCAPES OF TRANSFORMATION – OLD STRUCTURES AND NEW FUNCTIONS.

It should be evident that the landscapes of the Copenhagen urban fringe have been subjected to comprehensive transformation during the last 70 to 100 years. It is also clear that the landscapes of the different regions have followed unique paths of development. Despite the unifying vision of the Green Network Plan and the Fingerplan, and the successful attempts to use the plans as guiding principles, there are strong differences in the strategies for the protection and enhancement of the green-space reserved for recreational purposes. It is



Figure 13a,b,c: The almost treeless, fertile plains of western Copenhagen are neatly represented by the two aerial views of the villages Risby and Hørsholm in the early 1950's. The overwhelming transformation of this landscape is depicted on the 2005 view of the Vestakoren green wedge between the Frederikssund finger (right) and Roskilde finger (left). Courtesy: Royal Danish Library (13 a,b) Forest and Nature Agency (13c)

safe to say that the plans ensured the structural prerequisites for the functional development of recreation, habitat enhancement and ecosystem services now provided by the green space. Although the plans gave little advice about the contents and functions of the green structures, the planners were foresighted enough to create structural frames that the following generations could fill. Carbon sequestration, biodiversity, air and water quality was not on the agenda in the 1940s, but the green space created the opportunity to plan and manage the areas following a moving target. Bredsdorff, Forchhammer and their teams should be credited for this.

THE OUTER FRINGE OF THE CONTEMPORARY URBAN-RURAL FRONTLINE

Whereas the inner green wedges gradually developed from farmland into variously park land, sports fields, allotment gardens or forest, parts of the outer Copenhagen fringe are dominated by agricultural land use, with the exception of the forested part of the northern fringe. These agricultural landscapes were not paid any particular attention in the Fingerplan or the regional planning from the late 1970s and onwards. The main concern has been to control urban development and, from the 1980s, also nature conservation and the provision of ecosystem services, such as drinking water. Apart from objectives linked to the dispersal of species and protection of water resources, no particular policies or planning practices have dealt with the agricultural landscape of the greater Copenhagen region. From repeated studies (1984, 1994 and 2004) of changes in different parts of this outer fringe, it has been found that the planning system has been working relatively well when it comes to concentrating most of the urban growth in the fingers, including the extensions of the fingers (Primdahl *et al.* 2006). Furthermore, the studies have shown that the planning system has been unable to prevent significant functional changes of the agricultural landscapes; from production landscapes primarily owned by full time farmers, to consumption landscapes, owned by part time and hobby farmers (See Box 6).

These developments are driven by changing urbanisation processes and urban-rural relationships (Antrop 2004), which are only superficially affected by planning and other policy interventions. However, planning still has a role to play in guiding change in the urban fringe landscapes of Greater Copenhagen – but today traditional planning practice, based on guiding urban growth, is not adequate to cope with undesired changes such as the evolution of rural business areas. One of the major problems in the current system is that the rural areas are generally governed by regulatory measures which are the same all over the country but which are not restrictive enough to prevent a diffuse type of urbanisation of the fringe.

INTO THE FUTURE – THE NEW REGIONAL PLANS FOR THE GREATER COPENHAGEN GREEN SPACE.

A new regional plan (Anon. 2005) has just been approved for the Copenhagen region. The plan will, for the next five to ten years, constitute the framework for municipal planning. The current plan builds on the Fingerplan principle, although it is now supplemented by a green belt and extensions of the wedges. The green belt can be seen as a realisation of the principles given in Figure 9. Within the belt and wedges there will be restrictive control of urban development – it will be contained by concentrating on the suburban areas, abandoned industrial sites and a few remaining sites zoned for development.

In the proposed plan, new fringe landscapes will be included in the outer wedges and the green belt. The positive part of this new plan is that it will connect existing forests and natural areas through a green ring running from the forest and lake areas in the north through the Vestskoven area in the west and will end at the coastal areas at Koge Bugt in the south. It will maintain the close contact between residential areas and green space, which was an important component of the original Fingerplan.

There are drawbacks because all construction of sports fields and traffic lanes will be located in the green ring. Mosaic agricultural landscapes will be replaced by enclosed sport fields alternating with forests and relatively dense patterns of roads, bike paths and other constructions (see Figure 11 for an example of the detailed plans for a section of the new green belt). In addition, the process of eroding the agricultural structures and functions will accelerate, especially when it comes to the small pockets of agricultural land which will be left trapped between the ring to west and the urban areas in the fingers.

6: Farming and landscape management in the green space and the urban fringe

Many cities are surrounded by fertile farmland simply because, historically, the agricultural economy was important for the growth of the city. This is no longer the case: globally and locally the economy is driven from the city and its urban network. However, this does not mean that farming and agricultural landscapes are without functions from an urban perspective.

Open landscapes with wide views, which require farming (or intensive park management), are appreciated by residents as well as visitors, and such landscapes are also a rural characteristic which, juxtaposed with urban and suburban landscapes, defines urban borders and gives identity to the individual city or urban district. In addition, diversity of crops (in time and space) and grazing livestock also add to the aesthetic values of rural landscapes and together with farm shops, opportunities for horse riding, and other activities associated with farms, add to the recreational value of urban fringe areas. Agriculture gradually vanished from the green spaces in the Copenhagen finger wedges during the 1960s and 1970s. In most places the farmland was purchased by the state forestry service or the municipality and converted in parkland, forest, sports fields and allotments gardens. In only a few places in the wedges, community farms have been established, usually by the municipality, and a few privately organised "grazing societies" are keeping livestock herds and maintaining pastures and semi-natural habitats.

In the urban fringe areas further to the west and south of Copenhagen, the planning system has controlled urban development, and clear urban-rural borders have been a high priority in most post war plans, including the most recent ones. However, the planning system has not been able to prevent urban functions invading the agricultural landscapes. In three studies of urban-fringe landscapes at varying distances from the centre of Copenhagen, and bordering townships of various sizes (Primdahl et al 2006), it was found that in two areas about 20 km to the west (Ganløse) and south-west (Tune) the following development patterns occurred from 1984 to 2004:

- full time farmers have almost disappeared, whereas hobby farmers have increased in numbers and in their share of the farmland
- agricultural production has been extensified – land in rotation has been converted to grassland, and the 'productive' livestock has been significantly reduced whereas 'hobby' livestock (sheep and horses) has to some extent increased
- building activity and the number of farms with non-farm enterprises are growing – the areas are slowly turning into urban-rural fringe versions of industrial parks.

The landscape structure is also changing, although more slowly than the functional changes – new forests, thickets and hedgerows are slowly closing up the landscape and the uncultivated share of the landscape is growing: the biodiversity is increasing and crop and livestock diversity is in decline.



Figure 14. Aerial view across the Koge Finger with its mixed residential and industrial areas lined with traffic corridors. The Koge finger follows the original idea of the Finger plan in many respects – including the smaller green corridors separating the finger's urban areas. In the background the barrier islands of the reclaimed Koge Bugt Beach Park is visible. Courtesy Forest and Nature Agency



Figure 15. Aerial view of the protected open landscape separation: the suburbs Farum (left) and Bistrup (right), respecting the basic idea of the 1936 Green Structure Plan. Lake Furesø in the foreground, the largest freshwater body of greater Copenhagen (see Fig 2). Courtesy Forest and Nature Agency

As mentioned above, the landscape function is already changing from agricultural production to hobby farming, and a mixture of functions related to housing, non-agricultural businesses, recreation and small-scale farming. The consequence of such developments is that the urban and rural entities will disappear – instead a new sort of landscape which Gulick (2001) refers to as “rurban landscapes” will emerge. The latest development in Copenhagen planning has proven the strength of the Fingerplan metaphor. The Ministry of Environment proposed a revised Fingerplan for greater Copenhagen in early 2007, which rests on the traditions of the 1947 plan.

CONCLUSIONS AND PERSPECTIVES

There is as much myth as reality in the reputation of the Fingerplan, which many tend to perceive as a plan for green structures and countryside preservation. The Fingerplan is often saluted for its foresightedness. It is certainly true that the plan represents a sincere vision, and it is evident that its main structure has been followed as a guiding principle since the World War II. However, the plan contains indefensible ideas (such as the establishment of 15 airports to provide local, airborne commuter services) and it has been violated in a number of cases. It did not foresee the explosion in the urban population, and it said little about the future of the countryside between the urban fingers; and nothing about the countryside outside the plan area. The Fingerplan worked well in guiding urban development in the sparsely developed landscapes west of Copenhagen, but it had little effect to the north, where the landscape pattern was not in fact suited to the concept of urban fingers.

The protection of green space was most efficient and best managed where central authorities were given responsibility, and where these spaces coincided with natural and man made deep structures, such as lakes and old forests (Swaffield and Primdahl 2006); in contrast to the green space where the development was delegated to the municipal level and where new landscape patterns had to be established. The greatest successes comprise the protection of the most valuable landscapes north of Copenhagen, the rapid and firmly directed development of Vestskoven, and the reclamation of the coast in Køge Bugt Beach Park. The mutilated Hjortspring wedge is an outstanding failure as is, to a lesser extent, the Vallengsbæk wedge with its highly differentiated land use. All green space suffers from a lack of rural identity. Farming has almost vanished from around the Copenhagen green space, and with this loss the city has lost its historical connection to its rural hinterland. The new green belt may well be aggravating this development; which may be seen as a parallel to dismantling Copenhagen's harbour facilities: uprooting it from its commercial maritime origins (its name means literally "the merchants' harbour").

The new landscapes that are emerging may be broadly characterised as the establishment of contemporary recreational landscapes of forests, pastoral commons and gardens, with scattered remains of cropland. Landscape functionality has been transformed accordingly. Recreation is by any count the prime function, followed by the provision of wildlife habitats, supplying ecosystem services, housing and to a very limited extent, production.

The future of green space in the rapidly growing urban conglomerate is currently being decided in the outer urban fringe of Copenhagen. It is not certain whether the development will result in a renewed or revised Fingerplan, or if it will mean the end of a metaphor: the city without a city the 'Zwischenstadt of Copenhagen' (Sieveerts 2003).

Compared to other cities, especially in southern Europe, the contemporary development of the Greater Copenhagen areas has been characterised by urban sprawl (EEA, 2006) with a clear risk of infilling the remaining green spaces in periods when urban planning is given low priority (Caspersen *et al.* 2006). In a comparative study of land cover in the above mentioned urban areas in Europe, Caspersen and Holmes (2006) could not identify a higher preponderance of rural or green areas in cities with a fingerplan structure. However, a notable majority of the population in Stockholm (97%), Helsinki (91%) and Copenhagen (80%) lives within a distance of less than 1,000 m. from green areas, with the other cities at a lower level: Randstad 74%, Barcelona 70%, Hamburg (which, however, also has a fingerplan structure) 68%, Antwerp 63% and Milan 47%.

Whether the Fingerplan will be able to keep its symbolic power is uncertain. In any case it has certainly had its impacts on Greater Copenhagen – and mostly for the good.

a passage from an editorial from one of the large Danish morning papers from 1966. It was written by the Chief Editor Hakon Stephensen who took lead in a campaign for planting trees in the future forests. The newspaper spawned a fund-raising campaign for buying trees:

Danish: "Forældre, plant et træ for hvert af Deres børn. De vil en dag virkelig opleve den nye skov, og børnebørnene vil sende Dem en taknemlig tanke. De vil sige: Denne skov plantede vores bedsteforældre. De var alligevel ikke så snæversynede som man påstår".

English: - "Parents, plant a tree for each of your children. They will eventually experience the new forest, and your grandchildren will send you a grateful thought. They will say: Our grandparents planted this forest. They were after all not that narrowminded, as asserted".

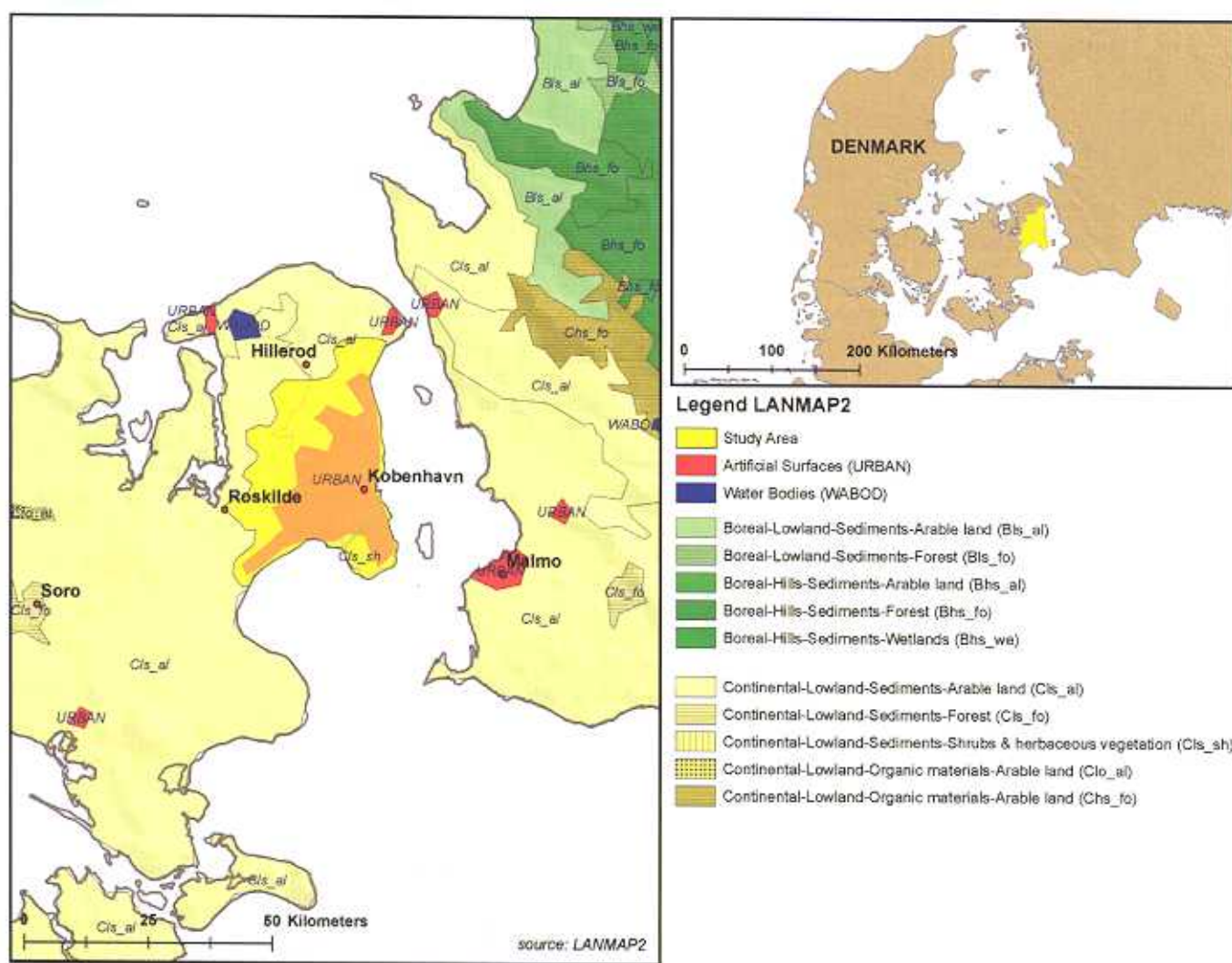
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7 : European landscape characterization of the Finger plan of Copenhagen

In 1947 Peter Bredsdorff and Sten Eiler Rasmussen presented a new vision for the urban development of greater Copenhagen. The front page of the plan visualized the future urban areas as a hand with fingers as outskirts. The plan was logically nicknamed "The Finger Plan". For 60 years, the Finger Plan has guided the urban development, infrastructure and green space in Copenhagen, and the impact is clearly visible in the contemporary landscape. The study area is indicated in the above figure with the yellow lines and within this area the fingers of the urban agglomeration of Copenhagen are clearly visible. In a European dimension this area is dominated by the landscape type Urban agglomeration (Urban), which is in this case the capital city Copenhagen. The other main landscape type is Continental lowland dominated by sediments and arable land (Cls_al). A minor landscape type is a more natural landscape type Continental lowland dominated by sediments and shrubs and herbaceous vegetation (Cls_sh), with only 4% of the study area. Changes from production farming (full time farmers) towards consumption farming (part-time/hobby farmers) will clearly affect the landscape character – an aspect that deserves further attention in the development of a European typology.

This Box has been produced by C.A. Mächer, D.M. Wascher and P. Dziamski.



8 : High Nature Value map

Agriculture in Denmark is generally intensive; HNV farmland is scattered and consists mostly of small parcels of extensively used permanent pastures located along the river courses. In particular, the analysed site includes the entire urban area of Copenhagen; therefore it contains hardly any HNV farmland.

This box is a joint product of JRC/EEA.



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