METU JFA 2018/1
(35:1) *89-109*

DOI: 10.4305/METU.JFA.2018.1.9

# APPROACHES TO CLIMATE CHANGE IN SPATIAL PLANNING AND DESIGN: INTERNATIONAL AND TURKISH EXPERIENCES

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**Alındı:** 25.07.2016; **Son Metin:** 15.12.2017

**Keywords:** Urban climate mapping; climate-sensitive planning and design; climate change.

## INTRODUCTION

Climate change falls into the theoretical and practical concerns of many disciplines ranging from natural to social sciences, engineering, urban planning, architecture and administrative sciences. In any country, climate adaptation and mitigation is a multi-level concern (Heinrichs et al., 2013). It requires simultaneous action mainly in two channels; both central and local administrations have critical roles in combating the climate change. While central administrations have a principal role to reduce emissions of carbon and other greenhouse gases; local authorities, as local decision-makers and providers of services, also have significant functions in reducing emissions at local level.

Spatial planning can be an effective tool both for national and local administrations in their emission reduction targets in a variety of spatial scales. Obviously, with regard to its spatial scale, the scope, content and form of the plan should vary in addressing the climate concerns. For instance, while a strategic spatial plan would define a larger framework for action at regional and metropolitan scales, an urban design scheme would describe building layout and codes for sun exposure, ventilation, shape and distribution of greenery, even the type of vegetation. It is important to take note that whatever the spatial scale is, planning for climate change should put emphasis on energy efficiency, green infrastructure and sensible use of resources.

A significant approach, in this regard, is the use of urban climate maps. These maps are products of a distinct scientific field named Urban Climatology, a field that provides knowledge about the meteorological conditions and requirements of a city, which should be paid attention in planning, urban design and architecture. There are worthwhile applications in different cities across the world, where local climatic knowledge is presented on urban climate maps (at varying spatial scales from city-region to neighborhood). These maps, as strong tools both in terms of their content

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and visual expressions, can guide urban planners in developing land-use decisions.

This study aims at understanding such efforts, that is, how local climatic conditions are included in plan-making, and what planning/design measures are developed. It should be noted that planning systems, and thus plan types and forms, can vary from one country to another. Therefore, the adoption of urban climate mapping studies can also show diversity with regard to the needs of different planning systems. The first part of the study elaborates different examples across the world where urban climate mapping studies are applied in plan-making. Despite these noteworthy implementations in various cities, in many other places the necessary linkages between this field and urban planning have not been established yet. The examples elaborated in this part reveal how urban climate maps can be operational in urban planning, and consequently help combatting the climate change. The second part examines the climate-related planning in Turkey. National framework plans for climate change, planning legislation, and spatial plan types were examined in order to see the extent the climate phenomenon is addressed in the Turkish planning system. Besides, in-depth interviews were conducted with experts in the Ministry of Environment and Urbanisation to understand the recent initiatives. To conclude, the study reflects on how these plan types can be improved in this respect.

## CLIMATE SENSITIVE SPATIAL PLANNING

### A Glance at the History of Climatic Concerns in Spatial Planning

Climatic concerns have always been considered in seeking the right location for settlement, and they have impacted on the settlement patterns. Turan (1975) mentions that from the hunting-gathering communities to more advanced agricultural societies, human beings always sought for the right micro-environment where they could stay comfortably away from physical disturbances. Different conditions led them to different solutions. He notes that evolution of the built environment is an outcome of a patient and sensible search of man throughout centuries (Turan, 1975, 233). The principles of healthy ventilation were recognized more than two thousand years ago by Vitruvius, which inspired later generations. A worthy example from modern times is the 1933 Charter of Athens by the International Congresses of Modern Architecture (CIAM). The Charter pays attention to developing key functions (inhabiting, working, and recreation) with the following necessities: adequate space, sun, and ventilation (Janković and Hebbert, 2012).

Studies on urban climatology started to grow in the 1920s, mainly in Europe, and this growth was followed by an expansion in the 1930s especially in Germany, Austria, France, and North America. Following a break in the Second World War, the studies continued to grow in the 1950s and early 1960s on a wider geographical basis (Oke 1979). From then onwards, urban climatology has been seen as a distinct field within the international scientific community of the World Meteorological Organisation. Jankovic and Hebbert (2012, 24) define it as a field which draws upon meteorology, physical geography, atmospheric physics and chemistry. Urban environment is the independent variable, which comprises the cultural and material circumstances that evolve over time. Urban climatology provides significant information to architects, urban planners, engineers and landscape designers for the improvement of quality of life in cities.

What we observe today is a widened perspective towards the climate phenomenon, which obviously includes the aim of healthy living, but goes beyond it: The ever-increasing concern for climate change has led theoreticians and practitioners in spatial policy and planning to take action for climate change mitigation and adaptation. The action-taking is two-fold: First is related to urban policy-making and governance of climate change, whereas the second is associated with plan-making and design. Obviously, these two fields are not mutually exclusive, but they are closely intertwined.

Being aware of the close interrelationship between policy/governance and spatial planning/design sides of climate change mitigation and adaptation, this study narrows its scope to the second; namely spatial plans which are produced through utilizing local climate knowledge besides the other necessary analyses related to an urban area. There is a growing consensus in the planning community that the form and functions of urban settlements can either reduce or increase the demand for energy, and can also influence how energy is produced, distributed, and used. Climatic concerns in urban planning and design can impact on the thermal performance of urban areas, help reduce energy consumption and dependency on fossil fuels, decrease emissions, provide energy and cost efficiency, and contribute to cleaner and more comfortable environments.

**Some Key Concepts in Urban Climatology**

Before elaborating the scope of urban climate mapping and its linkages to urban planning, it is important to clarify some terminology commonly used in the field of urban climatology. They are often referred in researches on climate change and urban planning, therefore, they should be well comprehended by planners for improving spatial plans with regard to climatic criteria. First is the concept of urban heat island. Cities are usually warmer than the country, which is explained through the concept of urban heat island. The heat island effect of a city is its relative warmth compared with pre-urban conditions (Oke, 1979). Every city has its own micro-climate different than that of the surrounding open space of its macro-region (Bonan, 2008; Golany, 1996). Moreover, within a city, different areas can have different temperatures related to topography, proximity to water elements, development density, amount of vegetated cover, and type of building materials. The central business district is warmer than its surrounding areas because of the intensity of activities and proximity and density of buildings. On the contrary, the peripheral areas would have lower temperatures compared to the city center (Golany, 1996). Besides the intensity, size, shape, orientation of buildings and streets, the characteristics of the surfaces (for instance, their albedo and heat capacity) also explain the temperature differences. Bonan (2008) reports that satellite measurements show several degree differences in surface temperature related to urban land use, with commercial-industrial areas having the warmest surfaces and parks having cooler temperatures (Carlson et al., 1981; Vukovich, 1983; Roth et al., 1989; Nichol, 1996; cited in Bonan, 2008). Numerous studies portray the importance of vegetated landscapes in ameliorating the urban heat island.

Other concepts are urban canopy layer and urban boundary layer, which are the two layers of the urban atmosphere. The urban canopy contains the air between the urban roughness elements (mainly buildings). Its climate is dominated by the nature of the surroundings (especially site materials and geometry) (Oke, 1979). Within the urban canopy layer, street canyons illustrate the effect of urban form on microclimates. The height of buildings and orientation of streets lead to complex shading patterns throughout the day that affect air and surface temperatures. Building height to street width is important in determining the catching of radiation within the canyon and warming (Nunez and Oke, 1976, 1977; Oke, 1987; Arnfield and Mills, 1994a,b; Eliasson, 1996; Arnfield and Grimmond, 1998; cited in Bonan 2008). Microclimatic conditions in the urban canopy layer can be impacted by a variety of factors, such as the geometry of the buildings, albedo of walls and roofs, vegetation and heat release mainly from vehicle traffic (Shashua-Bar et al., 2004).

The other layer, namely the urban boundary layer, directly situates above the first layer. It refers to that part of the planetary boundary layer (which is above the urban atmosphere) whose characteristics are impacted by the presence of an urban area (Oke, 1979). Obviously, as a distinct scientific field, urban climatology comprises a much larger content than these concepts. These basic terms are given here, as they are important concepts for comprehending the impact of spatial configuration on local climate.

## Urban Climate Mapping

### Urban Climate Maps and Their Use in Different Examples

Urban climate analysis and mapping is a significant tool that helps connecting a city's meteorological analysis to policy guidelines for planning. An urban climate map is an information and evaluation tool that presents urban climatic conditions on a two-dimensional spatial map which is understandable by city planners (Ren et al., 2013). It has two main components, namely, the urban climate analysis map (UC-AnMap) and urban climate planning recommendation map (UC-ReMap) (Ren et al, 2011). The former shows the structure of the local climate in relation to characteristic land use areas or climatopes (areas with the same urban climatological characteristics), while the latter puts forward policy recommendations (Hebbert, 2014). It is a city-scale map providing a holistic understanding of the climatic conditions of an urban area upon which further micro-scale studies should be conducted. It displays thermal and ventilation conditions (urban heat islands, cool areas, main wind circulation) to be used in spatial planning. Obviously, decisions at lower spatial scales require further detailed investigation, since the specific needs of the lower scale cannot be answered by these general maps (Burghard et al., 2010). Ren et al. (2013) report that the scale of urban climate maps normally vary from 1/100.000 to 1/5000, fitting to different urban planning scales ranging from region to city to neighborhood.

An UC-AnMap (the first component of the urban climate map) presents the results of the analysis of climatic conditions and variations. It relies on carefully collected and assembled meteorological data, planning, land use, topography and vegetation information. There are three analytical dimensions in these maps, namely, wind environment, thermal environment, and areas of air pollution. These three aspects together play an important role in understanding urban climatic conditions. Meanwhile, an UC-ReMap displays climatopes that present the sensitivity of areas affected by land use changes. These zones contain different information for planning. In other words, based on the UC-AnMap, an UC-ReMap presents the spatial evaluation of climatic conditions, and reveals climate-sensitive areas that need attention (Ren et al., 2011). Ren et al. (2011) note that as cities are subject to different planning systems and have different urban climatic problems, implementation of UC-ReMaps may require emphasizing different aspects.

Presently urban climate mapping is utilized to guide planning practices in more than 15 countries. Following the efforts in Germany that were intensified in the 1970s, these studies have been carried out in other European countries from the mid-1980s onwards, and in South American and Asian countries since the 1990s (Ren et al., 2011). Stuttgart (Germany) comes forefront as an important example, which has had long-established efforts in terms of urban climate analysis and linking it with urban planning. As a manufacturing town surrounded by hills, Stuttgart always suffered from air quality problems, thus, climate awareness in planning dates back to the second half of the 19th century. The municipal council in 1938 appointed a meteorologist to ensure the consideration of climatic factors in urban development. Following that, a specialist team was formed, which today works as the Urban Climatology Unit within the Office for Environmental Protection.

The city's most significant policy contribution is the *Klimaatlas* (Climate Atlas). The first Climate Atlas was prepared in 1987, and followed by a second one in 2008. The Atlas consists of maps at scales of 1/100,000 and 1/20,000, which show regional wind patterns, flows of cold air, air pollution concentrations, and other relevant information to be taken into account in city planning and project-making (Kazmierczak and Carter, 2010). It links meteorological analysis of the city's climatopes to planning. Climatopes are influenced by morphological factors and urban fabric. They include thermal load, ventilation and can also contain the air pollution aspect (Burghard et al, 2010).

The Climate Atlas of Stuttgart displays air flows and thermal exchanges (**Figure 1**). The Atlas identifies eleven climatopes, the climatic characteristics of which are explained in the legend of the Climate Atlas. The legend also includes cold air areas, air exchange, and areas with air pollution (**Figure 2**).

The Climate Atlas led to an UC-ReMap (**Figure 3** and **Figure 4**). In this map, open sites are categorized with respect to the significance of climatic conditions prevailing in these areas, and their vulnerabilities to intervention are described. Settled areas are categorized with respect to the functions and their relevance to climate. Their vulnerabilites are described in terms of climate/air pollution. High level of vulnerability obviously requires mitigation measures to relieve the climatic stress (Hebbert and Webb, 2012). Such information can guide urban plan-making, which will help reducing energy consumption, and relatedly, emissions and energy costs. It should be noted that for local development plans and individual design projects, a more detailed analysis of climatic conditions is required.

Arnhem (Netherlands) is another example where urban climate conditions are paid attention in spatial planning. Levels of climatic issues have been defined for different spatial scales as follows:

Urban heat island can be addressed at upper level plans, whereas thermal comfort and ventilation effects are impacted by building type/density and street orientation; that is, decisions at lower plans can impact on urban canopy and boundary levels. Similar to that of Stuttgart, the urban climate

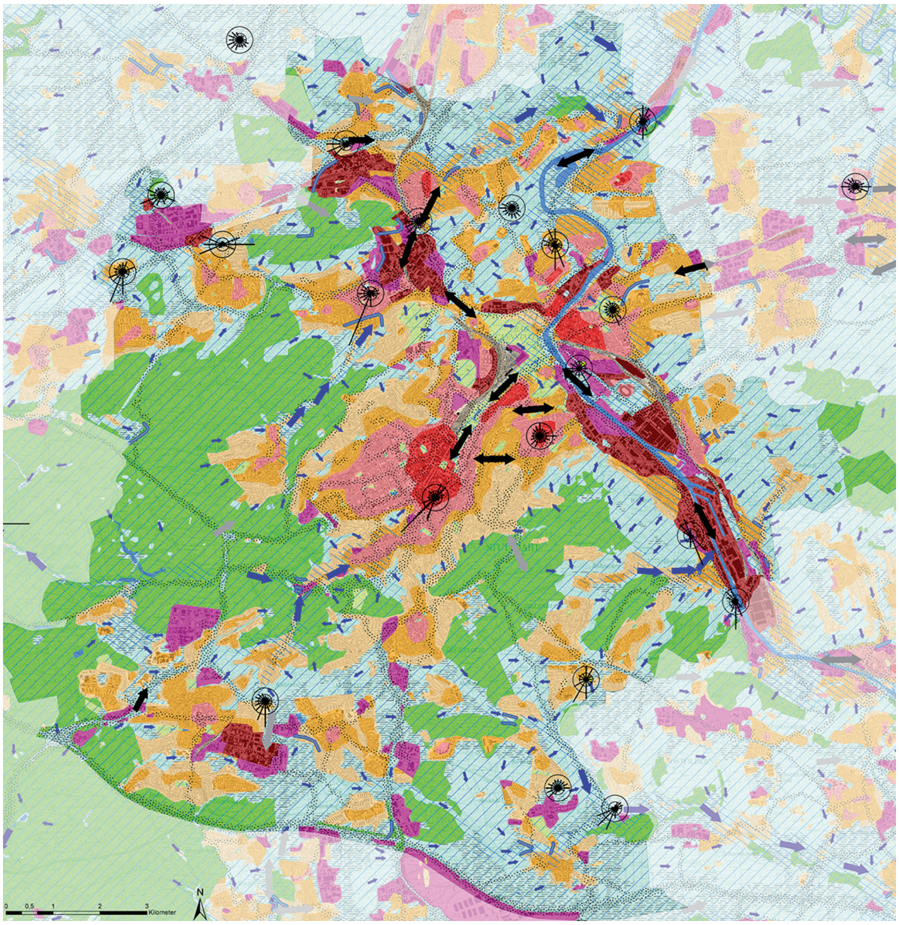

Figure 1. The Climate Analysis Map of Stuttgart 2008 (Verband Region Stuttgart, 2008).

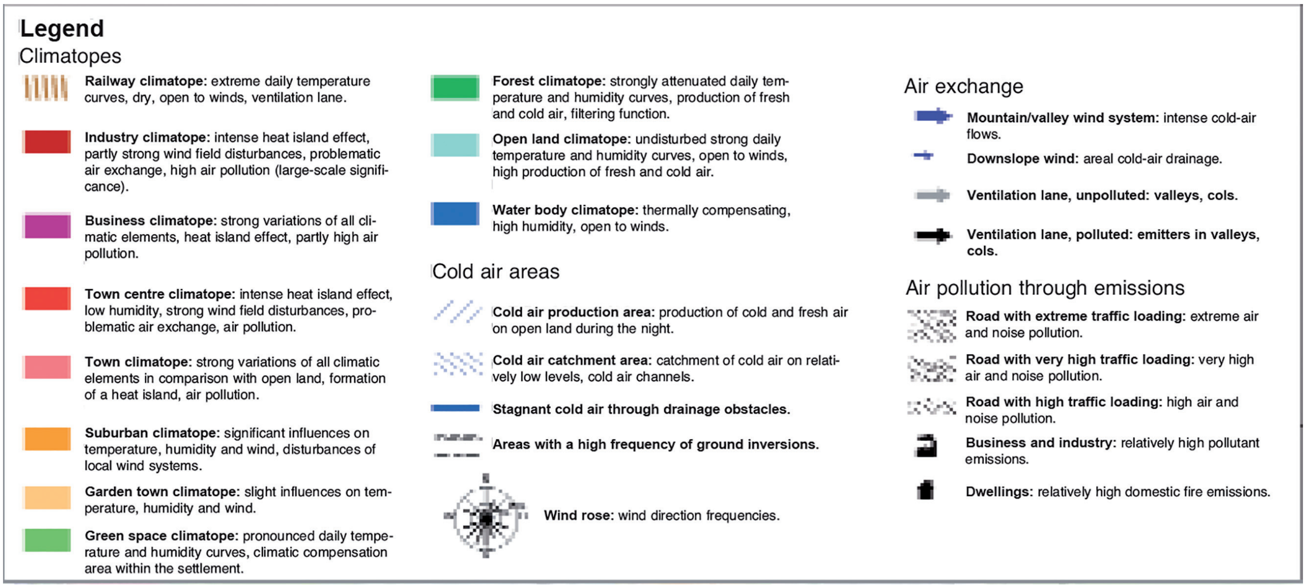


Figure 2. Legend of the climate analysis map (Verband Region Stuttgart, 2008).

analysis map of Arnhem displays where fresh, cold or mixed air conditions exist; which areas suffer from overheating; areas with high and low wind potentials ([http://www.future-cities.eu/uploads/media/The_Future_Cities_Guide_EN_02.pdf]). The map leads to planning recommendations such as

| Planning scale | Urban climate issue |
|---|---|
| 1/25 000 city: urban development, master plan | Heat island effects, ventilation and air paths |
| 1/5000 neighborhood: urban structures | Thermal comfort, air pollution |
| 1/2000 block: open space design | Thermal comfort |
| 1/500 single building: building design | Radiation and ventilation effects |

**Table 1.** Climatic issues in different planning scales (Based on Burghard et al., 2010)

preservation of fresh and cold air areas; keeping fresh and cold air streams open; reduction of heat stress in areas where there is overheating due to certain urban land-uses (for instance, inner city, industry, shopping mall).

In the case of Graz (Austria), a map of 33 climatopes was prepared on the basis of a dataset obtained through mobile measurements and thermal scanning flights. The map was drawn according to the parameters of building structure and the heat islands in view of local wind conditions. It shows features of different climatopes and includes recommendations from a climatic point of view, such as the number of stories, the orientation of buildings, and the restrictions on heating materials (Lazar and Podesser, 1999).

In Basil (Switzerland), a research project named *KlimaAnalyse der RegionBasel* was realized to analyze the regional climate of Basel, as a joint initiative of scientists, local authorities for air hygiene, and for urban/regional planning. The objective of the project was to produce climate analysis and planning recommendation maps in order to incorporate climate and air quality aspects in urban and regional planning. The project described three primary problem sections with regard to climatic requirements in the city, namely ventilation, air quality and thermal

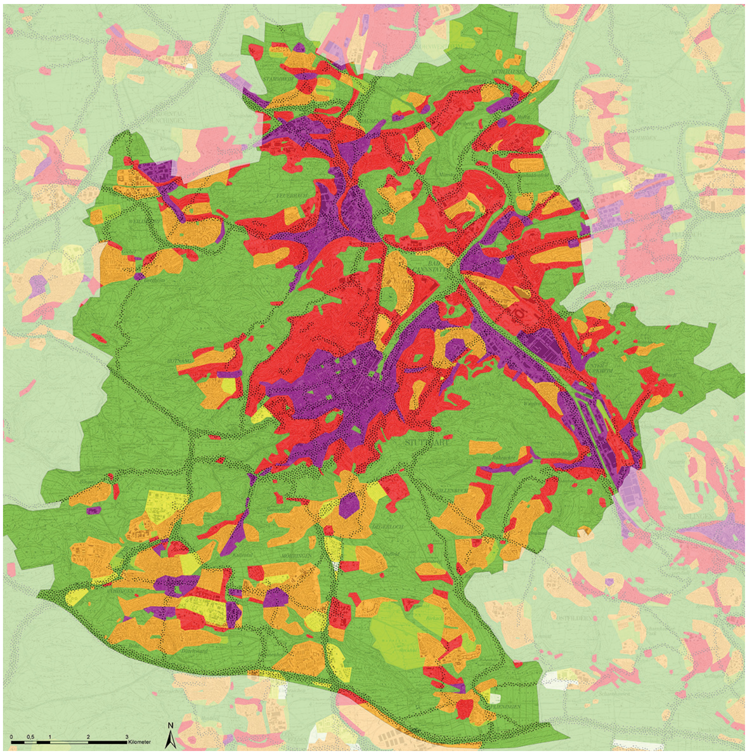

**Figure 3.** Map with recommendations for planning (Verband Region Stuttgart, 2008).

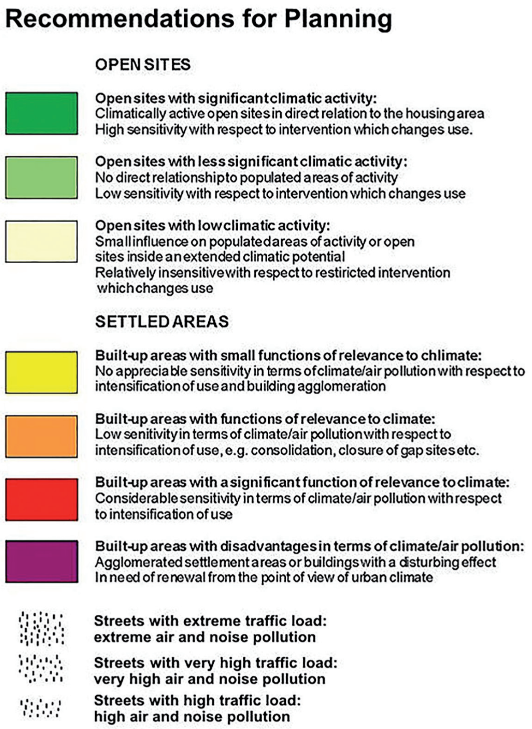


**Figure 4.** Legend of map with recommendations for planning (Verband Region Stuttgart, 2008).

situation. It then developed planning guidelines and measures for each of these sections (Scherer et al., 1999; Fehrenbach et al., 2001).

Implications of Climate for Plan-Making

To sum up, the local climate influences on the comfort conditions in a city, and in turn, the configuration of the built environment impacts on the local climate, in other words, there is a reciprocal relationship. The above examples reveal that the analysis of an urban setting from a climatic point of view provides important data for spatial planners. Urban planners and designers can consult to urban climate maps in order to better manage the urban form and land-uses at different spatial planning levels. In his widely cited work, Chandler (1976, 1-2) explains that there is a range of climate scales which should be given different weights at different spatial planning levels. At one end, there is the macro scale, i.e. regional climate, having a broad unity of climatic characteristics such as seasonal temperature and rainfall regimes. Within each regional climate, there exist mesoscale differentiations due to factors like local topography, proximity to water. Likewise, within each mesoscale, there are variations at micro scale over distances up to a few tens of meters stemming from factors such as vegetation, soil type and aspect. He notes that each spatial planning level requires the consideration of each of these climate scales with varying degrees. In other words, the climate scale that should be dominant in regional planning is the macro scale. For town planning, he defines the dominant climate scale to pay attention as the mesoscale. Finally for site selection and building design, the micro scale climate becomes the dominant scale.

Ren et al. (2011) describe four aspects to be taken into consideration by planners for an improved urban climate environment: albedo, vegetation, shading and ventilation. To attain these aspects (with respect to the climatic requirements of the city), they explain planning and design strategies for different spatial scales. These strategies cover many issues such as building codes, street design and orientation, parks and open spaces, even the building materials, which would address the quality of urban canopy and boundary layers.

Likewise, Erell (2008, cited in Webb 2016) explains the ways through which urban planning and design impact the urban climate and can help cities to mitigate and adapt to climate change. Because of the complexity of factors that impact the urban microclimate (such as geography, time of day, building materials, movement patterns), it is rarely possible to generalize results of interventions to all urban areas. Still, he emphasizes six main factors that are found under the responsibility of city planning departments that allow cities to better manage their urban climate. These are the level of urban density, street orientation, street aspect ratio, neighbourhood and building typology, size, type, and location of city parks, and building and paving materials (Erell, 2008, cited in Webb 2016, 2).

In another study, Katzschner (2008) also points that different urban planning levels address different climatic concerns. He states that at master plan level (at 1/25.000 scale, city level) the urban climate issues to be addressed are heat island effects and ventilation paths. At the urban fabric systems level (at 1/5000 scale, neighborhood level), the climate issue is air pollution. Following that at open space design level (at 1/2000 scale, block level), thermal comfort is addressed. Finally at single building level (at 1/500 scale, building design level), important climate issues are radiation and ventilation effects (Katzschner, 2008). The urban climate maps, which are developed at different spatial scales, can help taking these issues into account in plan-making. It should be noted that different planning systems might use different spatial scales for city, neighborhood, block and building levels. Therefore, as mentioned before, addressing urban climate issues might require certain adjustments in different planning systems. Ren et al. (2012) also note that in different countries the results of urban climate recommendation maps are translated into planning and design in different ways, depending on the planning systems.

## THE TURKISH PLANNING SYSTEM AND CLIMATE CHANGE

As mentioned before, as far as urban development and planning is concerned, climate change mitigation and adaptation requires multi-level governance, engagement in a variety of urban policy fields, and adoption of a climate-sensitive perspective in urban planning and design. All these channels –that is, governance of climate change, policy development, planning and design— are often intertwined and evolve together. Being aware of the interpenetration of these fields into each other, this study has narrowed its scope to the climate-sensitive planning and design.

To name some examples of national regulations for climate-sensitive planning, in Germany there is a nation-wide approach to promote UCMaps. In 1993, the German National Committee on Applied Urban Climatology published a national guideline named Environmental Meteorology Climate and Air Pollution Maps for Cities and Regions (VDI3787). The guideline explains key methods for developing urban climate maps, defines terms, symbols and representations used in these maps, and also provides recommendations for applying UCMaps in physical planning. With this national guideline, urban climate mapping was introduced in many other German cities (Ren et al., 2011).

Ren et al. (2011) point to Germany and Japan as the two leading countries in terms of urban climate analysis and application. In fact, literature demonstrates many other examples where urban climate mapping is applied, nevertheless, they mostly appear as individual attempts rather than being nationwide approaches. National-level regulation often comes into picture in the form of policy guidance that associates climate sensibility with spatial planning. For example, in Netherlands, the “Climate changes Spatial Planning” program was initiated for the period of 2004-2011 by a consortium which includes scientific institutes, ministries, NGOs and regional institutional bodies. The mission of the program is described as introducing climate change and climate variability as one of the guiding principles for spatial planning in the Netherlands. The program focuses on the themes of climate scenarios, mitigation, adaptation, integration and communication (available at [http://www.climatechangesspatialplanning.nl]). The program aimed at providing the government, private sector, and academia with a shared knowledge on the climate change and spatial use. Following that, in 2007, with the initiative of the national government, the Adaptation Program for Spatial Planning and Climate (ARK) was launched as a cooperative initiative of several ministries, provinces, municipalities, water boards, scientific communities and private sector. They formulated an adaptation strategy to climate-proof spatial planning in the Netherlands. The strategy looked for a flexible and robust spatial plan that could respond to foreseen and unforeseen changes. It focused on climate proofing location options, spatial planning and building design (Hendriks and Buntsma, 2009; European Climate Adaptation Platform webpage).

Another example is Austria. The Austrian Conference on Spatial Planning (ÖROK) is the highest-ranking spatial planning body in the country. It coordinates spatial development policy at the national level, including the publication of the Austrian Spatial Development Concept (ÖREK), which is prepared for ten-year periods. The decisions and publications by ÖROK are non-binding. In 2011, the Federal Ministry of Agriculture, Forestry, Environment and Water Management introduced the energy efficiency theme to ÖREK 2011. The Ministry, together with ÖROK, formed the ÖREK Partnership for Integrated Spatial and Energy Planning. The partners included representatives of the planning departments of the provincial governments, relevant institutions like League of Cities, other Ministries, the Austrian Energy Agency and others. The Partnership is based on the research project "PlanVision – Visions for an Energy-optimised Spatial Planning System", which was conducted by Institute of Spatial Planning, Environmental Planning and Land Rearrangement of the University of Natural Resources and Life Sciences in Vienna. It indicates spatial planning's scope of action to support climate protection and promote energy change. Following the activities and workshops of the partnership, the Final Report was released by the Standing Subcommittee of ÖROK in 2014, and the Integrated Spatial and Energy Planning Partnership was successfully finalized (Thalhammer and Stöglehner, Nd.).

Obviously there can be various other policy documents for climate change mitigation and adaptation in these countries; this study portrays the above attempts as some examples that focus on spatial planning. Following the international examples, this section addresses the use of local climate information in plan-making in Turkey. Regarding climate change mitigation and adaptation at local level, as in many countries, in Turkey, too, there is policy guidance at central level via national strategy documents and regulations, rather than applications of urban climate analysis presented in Section 2.3.1. The methods used in this study comprise a desk-based research, as well as in-depth interviews conducted with experts at the Ministry of Environment and Urbanisation. The findings are portrayed under two sections: First section portrays national framework plans and recent regulations related to climate, as these are formal documents that guide to local practices. The analysis was realized through a desk-based research and in-depth interviews with experts, with an aim to understand how the climate phenomenon is incorporated into these documents, and to see the extent they guide to local policy and planning for climate change. Second section elaborates spatial plan types in Turkey to understand the climate-related content of different plan types. Some recent plan examples were also examined to see how local climate provides input in plan-making.

**The Efforts to Combat Climate Change in Turkey: Framework Plans and Regulations**

Similar to other countries, Turkey, too, has taken measures towards climate change mitigation and adaptation. A major national level plan for combating the climate change is named Turkey's Climate Change Strategy (2010-2020). The document portrays short-medium-long term strategies for different sectors. As far as urban-level strategies are concerned, it emphasizes use of renewable energy and encouraging energy efficiency in buildings. With regard to the transportation sector, the document puts forward the objectives of increasing the shares of rail, marine and air transportation; improving pedestrian and bicycle-friendly urban environments; enhancing light-rail and metro systems. Meanwhile, it encourages efficient waste management in municipalities. Another plan is the Climate Change Action Plan (2011-2023), which puts concrete objectives with time-spans with respect to the sectors mentioned in the Climate Change Strategy. Both documents are policy frameworks that do not comprise direct guidelines for spatial plan-making and design; however, as general framework documents, they highlight priorities for urban action, which can be referred at spatial planning and design.

Another recent framework document, which was prepared by the Ministry of Environment and Urbanisation, is 2010-2023 Integrated Urban Development Strategy and Action Plan (*KENTGES* in its Turkish abbreviation). The works regarding *KENTGES* were started in 2007, developed during the Urbanization Council throughout 2009, and accepted in 2010. One of the ten commissions of the Urbanization Council was "Climate Change, Ecological Balance, Energy Efficiency and Urbanization". Final declaration of the Council includes statements for climate change mitigation and adaptation, too. It underlines improvement of energy efficiency and effectiveness in settlements and preparation of related plans and projects at settlement and building scales; reduction of GHGs and preparation of action plans for it; development of planning, design and architectural principles that are compatible with urban ecology and local climate (Kentleşme Şurası Sonuç Bildirgesi, 2009). These statements refer to planning, urban design and architecture; and establish clear links between these fields and climate change mitigation and adaptation. In line with these statements, *KENTGES* Plan includes objectives for climate change mitigation and adaptation.

Finally, HABITAT III National Report (2014), together with many other dimensions of urban development and planning, elaborates climate change. The report describes recent national policy documents and regulations in this respect, and underlines that one of the focal points to combat climate change is cities. This marks the significance of urban planning. The report argues that urban plans should be redefined in a way to cover climate change and environmental problems (Republic of Turkey, Ministry of Environment and Urbanisation, 2014, 21).

Besides these framework plans, there are significant regulations that can help increasing energy efficiency in cities: The Regulation on Energy Performance in Buildings (2008) obligates certain minimum criteria for energy efficiency in buildings (**1**). Municipalities provide construction and occupancy permits only if these criteria are satisfied. The Regulation for Efficient Use of Energy and Energy Resources (2011) defines responsibilities of various authorities including municipalities (**2**).

A recent related regulation (2014) is the Regulation for the Certification of Sustainable Green Buildings and Sustainable Settlements (**3**). Different from the other legislative attempts, this is the first initiative that includes a planning/design component for climate sensitive buildings and settlements. The regulation defines sustainable settlement as energy-efficient and nature-friendly. It should be noted that the regulation is not obligatory, that is, applying for a certificate of sustainable green building or sustainable settlement is optional. The regulation aims at providing a guidebook which includes criteria, performance indicators, and area sizes of sustainable settlements for the certification of sustainable green buildings

**1.** The title of the regulation in Turkish is "Binalarda Enerji Performansı Yönetmeliği".

**2.** The title of the regulation in Turkish is "Enerji ve Enerji Kaynaklarının Verimli Kullanılması Yönetmeliği".

**3.** The title of the regulation in Turkish is "Sürdürülebilir Yeşil Binalar ile Sürdürülebilir Yerleşmelerin Belgelendirilmesine Dair Yönetmelik".

and sustainable settlements. It has been explained by an expert from the Ministry that there are different certification systems being implemented across the world, and this regulation provides a certification system that pays attention to the needs and priorities of the Turkish context. The process of certification is as follows: building owners or representatives of settlements, after the preparation of necessary documents, apply to a certification institute (which is authorized by the Ministry). The institute evaluates the application with respect to the report that is prepared by certification experts. If the building or the settlement satisfies the criteria, it is awarded with a sustainability logo. The guidebook has not been prepared yet, so it is not known what planning/design criteria for sustainable buildings and settlements are to be included.

A final important document is the Directive on the Preparation and Evaluation of Urban Design Projects to be Approved by The Ministry (2015), where principles and criteria for urban design projects are explained (**4**). One of the objectives of the urban design projects is related to the use of local climate conditions. The objective mentions the decrease of energy and resource consumption; use of sustainable energy resources like wind, sun and rainwater; developing green system and landscape; and through that improving local climate. However, the directive does not include guidelines for planning and design for effective solar and wind access.

Compared to the concrete efforts at the central level, the local level efforts seem to be more limited. There are many attempts launched by municipalities, however, they are not performed in a systematic manner (Gedikli and Balaban, 2018). Most of them are policy initiatives in fields such as water and waste management, transportation, awareness-raising campaigns. Gaziantep Metropolitan Municipality is the first municipality that prepared a Climate Change Action Plan in the form of a policy document including related actions in 2011. Bursa Metropolitan Municipality also prepared a climate change action plan in 2015. Some Turkish cities involve in international climate or energy related networks like the Covenant of Mayors. As far as urban planning is concerned, establishment of the necessary links between urban climatology and planning, in the manner that is elaborated in the previous sections, is not observed. Certainly, analysis of climatic conditions is an important part of the analysis stage in plan-making in Turkey. Besides, particularly in the recent planning attempts, climate-related legend items are included in spatial plans. Nevertheless, local climate data do not have an influential role in deciding the spatial configuration of urban areas. In what follows, plan types in the Turkish planning system are elaborated with an emphasis on their climate-related scope.

**Spatial Plan Types**

The Turkish planning system comprises the following plan types.

- Regional plan determines the socio-economic and physical development potential of settlements, sectoral aims, distribution of employment and infrastructure. It is the duty of Regional Development Agencies (RDAs) to prepare these plans. RDAs submit the plans to the Ministry of Development.
- Strategic spatial plan has been introduced with the recent Regulation for Spatial Plan-Making (2014) (**5**). It is an upper level plan, interconnecting national development policies and regional development strategies at spatial level. Besides, it determines spatial

**4.** The title of the directive in Turkish is "Kentsel Tasarım Projelerinin Hazırlanmasına ve Değerlendirilmesine Ilişkin Yönerge".

**5.** The title of the regulation in Turkish is "Mekansal Planlar Yapım Yönetmeliği".

6. The term Territorial Development Plan is used as the English correspondence of "Çevre Düzeni Planı".

strategies for preservation and improvement of natural, historical and cultural assets, development of settlements, transportation systems, social and technical infrastructure. It is prepared for the entire country or regions. It is the duty of the Ministry of Environment and Urbanisation to prepare these plans.

- Territorial Development Plan is an upper level plan that shows basic geographic areas, determine land-use decisions in accordance with strategic spatial plans (if they exist) (**6**). It is prepared at regional, water basin or provincial levels. It is the duty of the Ministry of Environment and Urbanisation to prepare these plans.
- Urban development plan is a lower scale plan that shows urban land-uses, population densities, building densities, development directions and principles, urban social and technical infrastructures, and transportation decisions. It guides to the preparation of implementation plans. These plans are prepared or get prepared by municipalities.
- Implementation plan is a lower scale plan that shows detailed coding for land-uses. They are prepared or get prepared by municipalities.
- Urban design project has been defined for the first time in the recent Regulation for Spatial Plan-Making, although it has always existed in practice. It organizes building layout, open space design, and vehicular and pedestrian movement; shows interrelations between buildings, street pattern, open and green areas; includes image, meaning and identity features (Mekansal Planlar Yapım Yönetmeliği, 2014).

**Climate-Related Content of Plan Types**

Impacted by the contemporary debate over climate change, a significant factor in regional plans is the energy sector. All of the recent regional plans, with a concern for sustainable development, highlight energy efficiency and use of renewable energy. While some plans include spatial development schemes (as conceptual diagrams showing major decisions), others do not comprise such schemes. The conceptual spatial schemes are drawn in a schematic way, therefore they should be comprehended together with the written part of regional plans. These spatial diagrams can include renewable energy potential, if it is available in the region (see for example, Regional Plans for Hatay-Kahramanmaraş-Osmaniye NUTS II Region).

As far as the consideration of climate (or climate change) of strategic spatial plans is concerned, the Regulation on Spatial Plan-Making states that this plan aims at disaster mitigation and sustainable use of resources (besides its other aims). During the data collection stage, it is essential to collect data about areas which are threatened by the risk of climate change.

According to the Development Law, territorial development plans are made in conformity with the National Development Plan and Regional Plans, and contain land-use decisions such as housing, industry, agriculture, tourism, transportation (Ersoy, 2011). The Environmental Law emphasizes the sustainable development principle and the conservation-use balance. It says that territorial development plans are prepared with the aim of preventing environmental pollution that may occur while meeting the accommodation, workplace, recreation, transportation needs of urban and rural populations.

Urban development plans and implementation plans identify precise locations and forms, area needed for different land-uses, and overall distribution of physical and social infrastructure and transportation (Ersoy, 2011). Technically speaking, local climate conditions can be considered in plan-making to maximize passive gains from solar energy and ventilation, as well as to address the urban heat island and aspects of urban climate (as discussed in Section 2.2.). However, this is not an obligation in the preparation of these plans, and it is not common to see such concerns in them. Local climate conditions are generally given attention in decisions for agricultural areas; that is, most plans include proposals about the crop types which are compatible with the local climate. Evans and de Schiller (1996) note to similar attitudes in other planning systems. They mention that in many planning studies, information regarding climate and microclimate is mainly descriptive without explaining the way in which climate variations at the urban and regional scale require specific responses in the development of town plans or projects for urban development at the more detailed scale. Consequently, most building and urban design projects do not consider the subtle impact of small-scale climate variations at the urban and regional scale. Projects do not respond to existing microclimatic variations and attempt to make beneficial changes to the urban thermal environment. As a result, many design decisions create undesirable effects in the spaces around buildings or at the scale of the urban thermal environment (Evans and de Schiller, 1996).

**Legend Items Used in Plans**

Legend items indicate the planning lexicon used in different plan types, in other words, they give information about the content of spatial plans. The annexes of the Regulation for Spatial Plan-Making prescribe legend items to be used in different plan types, that is, how land-uses are shown at different planning scales. Examining the legend items mentioned in these annexes for the above plan types, this study assumes items that indicate (renewable) energy sites and areas under disaster risks as climate-related items. Besides, those for nature conservation are also presumed as climate-related, considering the role of green areas in combatting the climate change. It should be noted that this content (indicated with the mentioned legend items) does not reflect the output of an urban climate analysis as elaborated in previous sections, still, they can be assumed as climate-related content of plans since they involve energy, natural disaster risks, and conservation and improvement of green spaces.

Among the annexes for legend items, one of them shows common legend items for all planning scales. This annex comprises a wide variety of items for nature conservation areas. One item is specifically for Areas of sustainable conservation and restrained use. There are many other items for conservation of natural areas (including ecologically sensitive areas, flora, fauna, water basins, wetlands). Under these common legend items, the energy-related one is energy generation area without differentiating the type of energy (renewable or non-renewable).

Other annexes of the Regulation for Spatial Plan-Making define specific legend items for each plan type. Climate-related items for strategic spatial planning include areas prone to natural disaster risks and areas not suitable for settlement, important conservation areas, and sensitive ecological systems. As far as energy is concerned, there is an item named energy generation areas, and the annex states that the type of energy is to be indicated on the plan. For this scale, no other climate or energy-related issues are indicated as legend items.

For territorial plans, the annexes do not identify any items for climate-related land-uses other than the common items described before. Having examined some examples of territorial plans prepared in recent years, it is seen that some plans show sites for renewable energy production (if available). However, other than showing sites for renewable energy production, these plans do not reflect other land use decisions related to local climate analysis, as in the examples portrayed in the previous sections.

As far as settlement scale planning is concerned, legend items for this plan level include areas where construction is prohibited, areas prone to disasters and areas prone to floods. For energy generation areas, the annexes describe several categories, but do not differentiate between renewable and nonrenewable energy types. There is one item named turbine area.

The legend items for implementation plans, besides the common items mentioned above, include underground water conservation areas, and geothermal resources conservation areas. Likewise the above plan types, there are items for areas where construction is prohibited, areas prone to disasters. In line with the global discourses and practices about sustainable cities, there are some new items introduced for this scale such as bicycle road, bicycle parking area, and pedestrian road and area. Different from the above plans, this is the only scale where there is an item that specifically mentions renewable energy generation areas. Some recent lower level plans, within plan notes, identify the Regulation of Energy Performance of Buildings (2008) as a framework document to be obeyed. Many municipalities started revising their urban development regulations in a way to comply with the recent regulations on the energy performance and energy efficiency of buildings.

To sum up, at upper scale plans (1/100.000, 1/50.000), the climate-related land use decisions mostly focus on nature conservation sites, and sites for renewable energy plants, but they do not reflect land-use decisions that depend on macro level climate analysis of wind and sun conditions. Meanwhile, for lower scale plans (1/5000, 1/1000), key urban climatology terminology, their relation to thermal comfort in urban areas, principles for benefiting from solar or wind energy through site planning and design, creation of fresh air corridors in the built-up areas, etc. are not identified in the planning lexicon of policy documents and regulations. Obviously, it is technically possible for planners to consider these issues in planning and urban design; nevertheless, the absence of guidance in planning regulations leaves this consideration to the preference of planner. Their presence in regulations or guideline documents prepared by related public organizations would direct planners better in this regard and strengthen the climate sensitive content of plans.

## CONCLUSION

Planning and design can be effective tools for climate change mitigation and adaptation. There is a distinct field of urban climatology, which provides significant information to architects, urban planners, engineers and landscape designers for the improvement of quality of life in cities. The representation of thermal and ventilation conditions in urban areas prepare a basis for plan-making. The examples portrayed in the study reveal how urban climate maps can guide to spatial planning. Although some places managed to provide the linkages between urban climatology and spatial planning, Eliasson (2000) notes that even in places, where environmental concerns are the subject of public debate and where urban planners are interested in climatic aspects of design, climatology has little impact on the planning process. As also discussed in this paper, apart from local level implementations, nationwide approaches in this respect are not very common.

With the debate over climate change in the last decades, Turkey has taken important steps in terms of climate change mitigation and adaptation. Besides the National Climate Change Strategy and Action Plans, a significant document is the 2010-2023 Integrated Urban Development Strategy and Action Plan, which was prepared in order to plan country's physical space through an integrated approach. This plan includes objectives for climate change mitigation and adaptation. Likewise, Turkey HABITAT III National Report underlines the necessity to redefine urban plans to cover climate change. However, these attempts have not yet resulted in a planning approach where clear links between urban planning and climate information are established.

Meanwhile, the climate-related content of plans seems to be limited to indicate sites for energy/renewable energy generation. Being sensitive to local climate in plan-making is not only related to use of renewable energy types, but goes beyond, and includes principles for site planning and design to better make use of local climate conditions. Even for already built-up areas there can be solutions to relieve the heat island effects. Relying on the relevant literature and practical cases elaborated, this study infers the following conclusions and policy implications for climate-sensitive planning and design:

- Climate-sensitive planning and design addresses the heat island effects, ventilation effects, quality of urban canopy and boundary levels in order to provide a comfortable and healthy urban climate environment. Besides many other parameters, local climate conditions are paid attention, too, in determining urban density(ies), building typology and codes, street orientation and design, types and locations of parks and open spaces, even the building and paving materials.
- It is not limited to site selection for renewable energy generation, inhabitable areas (due to natural disaster risks) and open space conservation and improvement. Climate-sensitive planning and design principles obviously include them, but go beyond. The planning lexicon of policy documents and regulations should be enhanced to improve those principles, which could improve the climate-related content of plans and design schemes.
- Displaying thermal and ventilation conditions, urban climate maps are known to be useful tools in guiding planning and design. They provide different level of climate information for different spatial scales. Going down to lower spatial scale, more detailed climate analysis is needed. Embracing the use of such schemes can help improving the climate-sensitive content of planning and design.
- As noted by Ren et al. (2011), cities are subject to different planning systems and have different urban climatic problems, thus developing

principles or schemes might require emphasizing different aspects. Therefore, while adapting such principles and schemes in the Turkish context, country and local level needs and priorities should be taken into consideration.

- Lastly, localities should also have flexibilities to further enhance these principles when it is needed to respond to their local-specific priorities.

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**Alındı:** 25.07.2016; **Son Metin:** 15.12.2017

**Anahtar Sözcükler:** Kentsel iklim haritalaması; iklime duyarlı planlama ve tasarım; iklim değişikliği.

## MEKANSAL PLANLAMA VE TASARIMDA İKLİM DEĞİŞİKLİĞİNE YÖNELİK YAKLAŞIMLAR: ULUSLARARASI DENEYİMLER VE TÜRKİYE ÖRNEĞİ

İklim değişikliği doğa bilimlerinden sosyal bilimlere, mühendislik bilimlerinden şehir planlama, mimarlık ve idari bilimlere uzanan pek çok disiplinin kuramsal ve uygulama alanlarına düşen bir olgudur. Mekansal planlama iklim değişikliğiyle mücadele ve uyum konusunda etkili bir araç olabilir. Elbette ki, planın hazırlandığı mekansal ölçekle ilişkili biçimde, planın iklim konusunu ele alışındaki kapsam, içerik ve form değişecektir. Örneğin, bir stratejik mekansal plan iklime duyarlılık konusunda bölgesel ve kentsel ölçekte daha geniş bir eylem çerçevesi tanımlarken; bir kentsel tasarım projesi günışığından ve havalanmadan yararlanmak için binanın konumlanması ve yapı nizamını, yeşil alanların biçimini ve dağılımını, hatta bitki türünü bile tanımlayabilir. Burada önemli olan, mekansal ölçeği ne olursa olsun, iklim değişikliğiyle mücadele ve uyum konusuna yönelik olarak planlamada, enerji verimliliği, yeşil altyapı ve kaynakların akılcı kullanımı konularına vurgu yapmanın gerekli olduğudur. Bu açından dikkate değer bir yaklaşım, mekansal planlama için önemli yol göstericiler olan kentsel iklim haritalarıdır. Bu makalede, yerel iklim koşullarının plan yapımında ne şekilde dikkate alındığını kavramak için, öncelikle söz konusu yaklaşımın çeşitli dünya örneklerindeki uygulamaları incelenmektedir. İkinci bölümde ise Türkiye'deki uygulamalar ele alınmaktadır: Bu bölümde Türk planlama sistemindeki plan türleri incelenerek, bu planların iklime ilişkin yaklaşımları ve içerikleri değerlendirilmektedir. Sonuç bölümünde ise, iklime duyarlı mekansal planlama konusunda bir değerlendirme yapılmakta ve Türkiye'deki plan türlerinin bu açıdan nasıl geliştirilebileceği konusu tartışılmaktadır.

**APPROACHES TOWARDS CLIMATE AND CLIMATE CHANGE IN SPATIAL PLANNING AND DESIGN: INTERNATIONAL AND TURKISH EXPERIENCES**

Climate change falls into theoretical and practical concerns of many disciplines ranging from natural to social sciences, engineering, urban planning, architecture and administrative sciences. Spatial planning can be an effective tool for climate mitigation and adaptation. Obviously, with regard to its spatial scale, the scope, content and form of the plan would vary in handling the phenomenon. For instance, while a strategic spatial plan would define a larger framework for climate sensitive action at regional and urban scales, an urban design scheme would describe building layout and codes for sun exposure, ventilation, shape and distribution of greenery, even the type of vegetation. It is important to take note that whatever the spatial scale is, planning for climate change should put an emphasis on energy efficiency, green infrastructure and sensible use of resources. A noteworthy approach in this regard is the use of urban climate maps that consist of significant guidelines for spatial planning. With the aim of understanding how local climatic conditions are paid attention in plan-making, the study first of all investigates this approach in different examples across the world. The second part, meanwhile, portrays the Turkish case. It elaborates the plan types in the Turkish planning system, and evaluates the climate-related perspective and content of these plan types. The study concludes with an evaluation of climate sensitive spatial planning, and reflects on how the plan types in Turkey can be improved in this respect.

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