

7 Planning Urban Green and Open Spaces as a Contribution to Sustainable and Livable Cities

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Scientific studies predict a global temperature rise between 1.1 and 6.4°C and an increase of extreme weather events due to climate change (IPCC 2007, p. 45). This will have serious consequences for inhabitants of cities (e.g. formation of heat islands). Significant, negative impacts on health and quality of life are expected for city inhabitants. In terms of climate change mitigation and adaptation to its possibly negative consequences in an urban environment, green and open spaces are particularly important. The ecosystem services provided by green and open spaces can, for example, reduce the predicted impacts on health and life quality.

“Urban greening has been proposed as one approach to mitigate the human health consequences of increased temperatures resulting from climate change.”

(Bowler 2010, p. 147)

However, many urbanites are not aware of the positive effects resulting from biotic and abiotic processes in green and open spaces since these are not easily discernible. In order to arouse the interest and openness of urban inhabitants and sectoral planners, ecosystem services are presented more thoroughly in the following section IV 7.1. Worldwide, full understanding and appreciation of these “free services” is still in an early stage. A legal basis is needed to ensure legally binding regulations of green and open spaces in order to protect ecosystem services and their benefits (see IV 7.2).

7.1 Urban Ecosystem Services

Ecosystem services are defined by the Millennium Ecosystem Assessment (2005, V) as “the benefits people obtain from ecosystems”—these are divided into four categories of services:

- Provisioning Services (e.g. of food, fresh water, and other goods).
- Regulating Services (e.g. of climate, water and pollination),
- Supporting Services (e.g. soil formation and nutrient cycling), and
- Cultural Services (e.g. educational, aesthetic, cultural heritage values and recreation).

In urban areas these ecosystem services are mainly provided by public, semi-public, and private green and open spaces. In this context the overlap of ecosystem services has to be emphasized: in most cases, several ecosystem services can be carried out by the same area. This multifunctionality of urban green and open spaces underlines their essential importance.

7.1.1 Provisioning Services

Supply of food

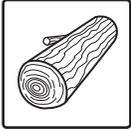


Urban ecosystems can supply urban populations with supplementary plant and animal food products. Beyond common place agricultural and horticultural cultivation as well as small-scale animal husbandry, food supply can also encompass novel cultivation and production types, e.g. urban aquaculture, hydroponic cultivation systems, and even vertical farming. For such purposes, housing block and neighborhood levels can re-use water and nutrient resources from sewage. Not only would this utilize nutrients contained in, and thus purify, sewage, but it would also regionalize energy and material cycles. Novel agricultural cultivation methods feature a high degree of intensification and mechanization and therefore they possess a rather “artificial” character. However, they are composed of the natural abiotic and biotic processes which are the basis of the ecosystem services and which create a new source of food supply at an urban local level.

Benefits to humans:

- Contribution to food security through increased self-supply and creation of additional income through sales revenue;
- Potential tourism and cultural significance through the preservation and marketing of regional specialties;
- Contribution to climate change mitigation by shortening the length and decreasing the number of transport routes.

Supply of raw material

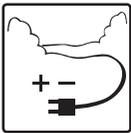


Urban ecosystems can supply renewable raw materials (as well as basic material for medicine) from plant and animal products, creating urban raw material production at a local level.

Benefits to humans:

- Supply of materials for consumer goods;
- Increasing self-supply and creation of additional income through sales revenue;
- Medical supply through medicinal plant and animal substances;
- Contribution to climate change mitigation by shortening the length and decreasing the number of transport routes.

Supply of energy



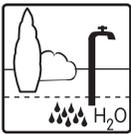
Urban ecosystems can supply urban inhabitants with a source of renewable energy from biogas plants through which organic waste of households is recycled. In the face of steadily growing agglomerations, urban production of renewable energy is becoming more and more important.

The energy production of urban biogas plants with 24-hour operation can make a significant contribution to the basic energy needs of urban inhabitants. The overarching energy goal is to produce the maximum amount of energy directly where it is needed—within the urban space at a local level.

Benefits to humans:

- Increasing self-supply of renewable energy,
- Contribution to climate change mitigation by reducing fossil energy use.

Supply of water



The groundwater recharge functions of infiltration, filtering, and buffering, as well as the decomposition of waste products by soil organisms, play an important role in the sustainable supply of water for urban populations. Unsealed soil surfaces and non-contaminated soils are necessary prerequisites for the supply of soil-based ecosystem services.

Benefits to humans:

- Security of drinking and process water supply for private households, trade, and industry;
- Irrigation of urban vegetation.

Urban Form

In terms of mitigation and adaptation to climate change and its potential negative impacts on the urban environment, green and open spaces are particularly important. The ecosystem services provided by green and open spaces can reduce for example, the expected impacts on health and life quality.

Urban Resources

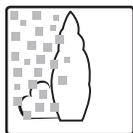
Urban Technology

Urban Governance

The benefits of urban green spaces are particularly important for groups which are socially disadvantaged.

7.1.2 Regulating Services

Air purification

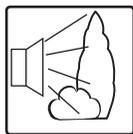


By filtering out particles and pollutants, urban vegetation can (alongside technical measures) significantly improve urban air quality.

Benefits to humans:

- Improved urban air quality: lower pollution load and improvement of health (e.g. protection against respiratory diseases).

Noise reduction

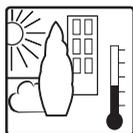


Beyond a, rather low, physical noise reduction, vegetation's optical shielding of the noise source creates a psychological reduction of noise perception. Larger green and open spaces create further noise reductions by increasing the distance between noise sources.

Benefits to humans:

- Reduction of noise exposure: protection against hearing impairment and noise-induced stress;
- Psychological relief through decreased perception of noise levels
- Increased real estate value.

Regulation of the urban climate

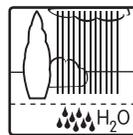


Urban green and open spaces help reduce intra-urban daytime temperature peaks through transpiration of vegetation and evaporation from moist soil, as well as by casting shadows. These services require sufficient water availability, which is why drought-tolerant (generally local) plant species should be used, especially in semi-arid areas. The cooling effect can be felt not only within green and open spaces but also, depending on local conditions, within neighboring housing. The provision of nocturnal cooling has a significant importance for health issues. Night temperatures above 20°C have a negative impact on human well-being and increase health risks when persisting for the longer term. An adequate amount of green and open spaces, without extensive tree canopies, is necessary if reduction of intra-urban night temperatures is to be achieved by nocturnal radiative cooling.

Benefits to humans:

- Local reduction of temperature peaks (urban heat island) within green and open spaces as well as in neighboring housing;
- Energy saving (e.g. reduced demand for air conditioning);
- Cooling of night temperatures through radiative cooling of open areas
- Alleviation of extreme events (periods of severe drought and heat).

Retention and storage of rain water

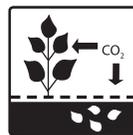


The storage capacity of ecosystems retains precipitation in both soil and vegetation. Reducing surface runoff can help avoid the detrimental effects of erosion, allowing more water to be stored in the soil. In turn, soil stored water available for native vegetation reduces the need for irrigation during drier periods.

Benefits to humans:

- Mitigation of extreme events (heavy rainfall, floods);
- Erosion protection through reduction of surface run-off;
- Storage of water (for vegetation, reduction of irrigation demand).

Carbon binding



Atmospheric carbon can be bound in the soil layer as well as in both above- and belowground plant components. However, water availability is a limiting factor, meaning that semi-arid climates have lower carbon binding in comparison to moderate climates. Carbon binding as an additional positive side effect of urban open spaces should be implemented through local, drought-tolerant vegetation.

Benefit to humans:

- Small-scale contribution to climate mitigation.

7.1.3 Cultural Services

Supply of local areas for recreation



A suitable quantity and quality of public green and open spaces provide urban inhabitants with places for recreation and relaxation which are close to their homes.

Benefits to humans:

- Contribution to local recreation opportunities;
- Increased real estate value of neighboring housing;
- Additional attractiveness for tourism.

Supply of green spaces for culture and education



Public green and open spaces can make a broad and diverse contribution to education and the mediation of cultural values through guided tours, educational trails, environmental education facilities, and so forth. They also offer individuals space for personal and religious reflection.

Benefits to humans:

- Enabling the experience of nature;
- Aesthetic enjoyment, inspiration for artistic services, cultural-historical importance;
- Importance for religious contemplation and spirituality;
- Environmental education: the acquisition of home and natural-historical knowledge, as well an understanding of environmental science;
- Enabling of identity-generating experiences, support of personal development;
- Space for creative and sports activities;
- Inspiration for orienting science towards natural models (e.g. bionics)
- Places for ethical and religious inspiration;
- Additional attractiveness for tourism;
- Increased real estate value of neighboring housing.

7.1.4 Supporting Services

Maintenance of the capacity of urban ecosystems



Maintenance of abiotic and biotic processes is an essential basis for all ecosystem services. This is especially important given the way basic ecosystem services will be altered by climate change with potential negative impacts on human well-being.

“Drivers of global environmental change (e.g. land-use change or climate change) can directly pose health risks or impair ecosystem services that subsequently influence health.”

(Myers and Patz 2007, p. 227)

Preservation of ecosystems as fundamental for humans:

- Preservation of biodiversity
- Habitat supply
- Biological pest control
- Soil development
- Reproduction of all living organisms within an ecosystem
- Self-regulating, self-sustaining services

7.1.5 Environmental Justice—Opportunities by Urban Green and Open Spaces

Green and open spaces can help minimize health risks in the urban environment (e.g. air pollutants, noise, heat and aridity/drought). They also have great potential for increasing psychological, physiological and social well-being. These contributions translate into reduced healthcare costs. Health related benefits of urban green spaces are particularly important for socially disadvantaged groups. Low income and low social status inhabitants often lack the means to improve their immediate quality of life (e.g. by energy-intensive cooling of the flat or by leaving the city during thermal inversion). Moreover, socially disadvantaged urban populations tend to have substandard access to green and open spaces, negatively affecting their quality of life. Both aspects, health and social situation, are discussed under the topic of environmental justice.

With this in mind, the services of urban ecosystems take on an increasing importance for the life quality of urban inhabitants, from well-being to health. In particular, the circumstances of socially disadvantaged groups can be improved by supplying access to a minimum of 7m² per capita of public green and open spaces. Both the creation and protection of urban green and open spaces are crucial if the positive social and health impacts of ecosystem services are to be preserved.

7.2 Binding Designation of Environmental and Nature Conservation Concerns as a Contribution to Sustainable Cities

The planning of sustainable cities should include measures for mitigation of and adaptation to climate change in order to prevent further rising of global temperatures, as well as to preserve and possibly improve quality of life. Beyond measures in the construction and transport sector, urban green and open spaces are essential for the quality of life of city inhabitants and for the preservation of natural resources (see chapter IV 7.1).

“As the cities will determine the fate of the remaining biodiversity of our planet, there is a strong view that the battle for life on Earth will be won or lost in the cities.”

(Djoghla 2007, p. 4)

Sustainable urban planning must incorporate laws which ensure: the existence and maintenance of a sufficient amount of green and open spaces;

and, associated with that, the consideration of environmental and nature conservation concerns in the planning process.

7.2.1 Preconditions for the Efficacy of Environmental Law

There are a multitude of legal agreements for the protection and maintenance of the environment at the international level. However, it is national implementation which permits the legal protection of environmen-

tal concerns in federal, regional, and municipal planning. Additionally, the inclusion of environmental concerns in the laws of functional departments whose activities impact the environment (e.g. construction and transport laws) is also of vital importance. Moreover, regulations must be sufficiently detailed and precise in order to ensure all necessary legal protection of environmental and nature conservation concerns are incorporated in planning processes.

In many emerging and developing countries in the MENA region, including in Iran, such precision is largely missing: the legal basis for environmental protection lacks sufficient regulatory depth. The following sections draw from the German Federal Building Code (BauGB § 9) in creating suggestions for improving environmental consideration in Iran's regulatory structure.

7.2.2 Inclusion of Environmental Concerns in the German Federal Building Code

German urban land-use planning, subject to the Federal Building Code (BauGB), serves as an example of sustainable urban development. The goal of the code is to create a livable urban environment while protecting and developing local natural resources (BauGB § 1). The Federal Building Code precisely regulates land-use planning to ensure the provision of green and open spaces to meet environmental concerns and as an essential part of healthy, livable urban environments. Section 9 of the Code allows for explicit, legally binding regulations which require green and open spaces to be incorporated in land-use plans.

7.2.3 Possibilities for Planting and Maintaining Green and Open Spaces in a Legally Binding Land-use Plan

Regulations for planting and maintaining green and open spaces serve to increase the amount of greenery in the urban fabric, help with the formation of the townscape, structure and shield building areas, as well as form the transitions between settlements and rural areas. Local climate concerns, like the ecosystem service of fresh air, can also justify regulations for planting and maintenance. They can also be designated as part of building facilities, providing a legal basis for façade and rooftop greenings as well as the greening of noise protection embankments.

The Federal Building Code even specifies the maintenance of smaller waters (where the water laws do not apply)—e.g. when they are relevant

- Planting of particular tree and shrub species (plant lists),
- Density of greenery (number of plants per m²),
- Minimum standards (size, trunk diameter, quality),
- Defining the ratio of different species (as well as seed mix).

Such legally based protection and development of urban green and open spaces is illustrated with example applications in Chapter VI 7.

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for the urban and landscape scenery, but also when they are necessary for climate protection.

Binding regulations for the planting and maintenance of public and private green areas include written descriptions and concrete identification in a map. This allows precise quantitative and qualitative requirements which may include the following instructions: