International Journal of Environmental Trends (IJENT)
http://dergipark.gov.tr/ijent
International Journal of Environmental Trends (IJENT)
2019: 3 (1),31-38
ISSN: 2602-4160
Turkish JournalPark ACADEMIC

Review Article

A review on Urbanization, Pollution and Biodiversity in İzmir

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Received
05 November 2018

Accepted
14 April 2019

Keywords
İzmir
Ecology
Biodiversity
Urbanization
Pollution

Abstract

Izmir is a town with rich habitats in biodiversity as urbanization is rapidly increasing. In this study, the studies on ecology of Izmir have been compiled and important natural areas are mentioned. Urbanization and pollution have also been noted.

The purpose of this study is; the bringing together of scientific data on urbanization, pollution and ecology of Izmir and the constituting a basis for evaluating the factors that threaten the ecological situation and environmental health which are not taken into consideration in the projects planned or the projects to be carried out.

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INTRODUCTION

Although urbanization is an increase in the number of cities and population, it is a process that changes the attitudes and behaviors and social structure of people emerging with some technological, economic, social and political phenomena. As cities include different ethnic groups, cultures, social strata and occupational groups, the relations at individual and group levels differ in cities. The resulting individualization is the source of intergenerational conflict arising from value differences. In the context of urbanization in Turkey, while Izmir, Ankara and Istanbul are metropolitanizing, medium-sized cities have also migration [1]. Cities have an urgent need for green spaces because the exponential growth of the population in third-world countries that have no green spaces in their cities can lead to physical, social, physiological, psychological and environmental hazards. In recent years, the Ministry of Forestry has established forests in cities. In addition, existing forests are divided into infrastructure, industry, firewood, recreation areas such as mining, education campuses, waste storage, growing cities, tourism, electricity and transportation provider [2].

The Environmental Protection Agency (EPA) defines pollutants as "priority pollutants", which may be waterborne, organic or inorganic. Priority pollutants are selected based on mutagenic, embryo development disrupting or acute poison effects [3]. An increase in the incidence of psychotic disorders and other health problems can be observed with environmental pollution [4]. Mining activities, agriculture, waste storage, industrial and urban wastewater, natural geogenic oscillations are mainly responsible for global pollution of waters [5].

The world is not an unlimited area for human activities, ecosystems must be known and protected to prevent environmental problems. The measures taken for the protection of wildlife are more efficient and more economical than the correction process after environmental problems [6]. Humanity and wildlife problems are caused by the negative impact of human behavior on the wildlife and habitats, the negative impact of wildlife on some stakeholders, some people's wildlife-oriented behaviors causing negative interactions with other people and also often conflicts of worth. Therefore, humanity - wildlife problem contains human - wildlife interaction, human - human interaction or both. [7].

Today, Izmir is a popular city because of being a tourism center, migration of people from Anatolia to the coastal areas, preference of people a quieter life against the complex life of Istanbul, searching new areas for construction sector and advertisements by various mass media such as social media, television and radio. In this study, the biodiversity of Izmir (including microbiota, fauna and flora), urbanization and environmental pollution are reviewed for creating a general perspective in a holistic approach.

GEOGRAPHICAL STATUS OF IZMIR

The city of Izmir was founded at the end of the bay that took its name from it, and it has developed since ancient times and has become the most important settlement of the Aegean Region. Originally settled on the eastern edge of the bay, the city later expanded to the alluvial plain between the Kadifekale Foothills and the Meles Delta. The port city (Pales Smyrna) was abandoned when the alluvial layer was formed. Thanks to its large water resources, the city has rich agricultural lands and it is estimated that the population is rapidly rising. In the 4th century BC, a castle was built by Alexander the Great on the Pagos Mountain (Kadifekale). By the protection of the fortress, trade developed and new settlement areas were opened towards the mountain [8].

The end of Izmir Bay are connected to the Gediz, Küçük Menderes and Büyük Menderes valley channels with roads of created by nature. This geographic location creates a large ard zone. The city is surrounded by mountains overlooking the bay. Manisa Mountain in the northeast, Mount Yamanlar in the north, Mount Nif in the east, Kizildag in the south, and Karaburun Peninsula in the west, which limits the first region of Izmir Bay. Between these mountains, Belkahve pass (260 m.), Sabuncubeli (700 m.) which is on the Sipil Mountain, the Menemen (Emiralem) strait which the

railway passes through, such as the low passes connects the city around to the surroundings. In addition, a low passage of 130 m. follows the valley of Meles and connects to Cumaovası and Torbalı plain [8].

The boundaries of the province of Izmir are between 37° 45' and 39°15′ N latitudes and 26° 15′ and 28° 20′ E longitudes. The length of the province in the north-south direction is approximately 200 km and the width in the east-west direction is 180 km. Its surface area is 12.012 km2 [9].

The city of Izmir, is located in the west of Turkey and is the third largest metropolitan city of the country. The city is under the risk of natural disasters as earthquake, flood, landslide and rock falls. Due to the tectonic regime in Western Anatolia, there are many fault lines in the immediate vicinity that threaten the city. There is a fault line known as Izmir fault along the metropolitan area [10].

URBANIZATION

Traffic problems occur with increasing urbanization and population in Izmir. As a solution to the traffic problem, solutions such as the development of pedestrian and bicycle paths, the development and expansion of alternative roads, the increase of vehicle parks, the development of public transportation, the establishment of different centers in the city, the arrangement of roads according to the new houses, the creation of intelligent traffic systems are presented [11]. While these suggestions were made, the city of Barcelona was taken as an example but the differences between Izmir and Barcelona were not taken into consideration. Barcelona has its own political and geographical conditions. Main road systems which have an important place in road transportation depend on geographical conditions, natural boundaries, population density and topological effects [12]. The related article does not mention the differences caused by these effects.

By the Metropolitan Law No. 6360, the villages became a neighborhood of the city. Service access became more difficult with centralization. There is a need for developments that protect the traditional texture and life of rural areas, preserving the nature and socio-cultural characteristics of rural areas, improving the working and living areas of rural people and preserving the architectural textures [13]. Risks in urbanization are increased vehicles and motorways in short term, loss of property owners, loss of green areas, loss of agricultural areas, negative impact of bay, fishery and wetlands, an area open to disasters, increase in density, loss of rural gardens and picnic areas. Besides that long term the risks are air pollution from traffic and problems, gentrification, soil pollution - so the formation of urban heat island, environmental issues, rather than local food imported food consumption, degradation of land and marine ecosystems, increasing contamination of air - land - surface and underground water resources, a depressed society that is closed to the inside [14]. While accessibility is increased by the construction of new roads in the cities, the housing prices are increasing, however, there are negative effects such as traffic density and noise pollution [15].

Urban transformation refers to the strategies and actions developed by the integrated approach with a comprehensive consideration of the economic, social, physical and environmental conditions of the urban space that has been degraded. Unhealthy built-up areas, squatter areas, collapse zones caused by disasters and wars, settlements with risk of natural disaster, business areas that lose economic vitality, urban structures and areas that need protection are the areas of application of urban transformation projects. The reason of urban transformation in Izmir is that it is a region that can be exposed to a disaster or it is the cleaning of the unhealthy living areas [16].

While urbanization and population plans are made in Izmir, the carrying capacity of water resources is not taken into consideration [17]. Nevertheless, Izmir is rapidly becoming a metropolitan and losing its natural characteristics. For example, in the town of Çiğli, which hosts the Gediz Delta, the coastal areas have been destroyed due to the building, agriculture and forestation that were created against the ecosystem and began to lose their natural characteristics [18]. When the 1980 and 2010 maps of Gediz Delta were compared, coastal wetlands were exposed to significant pressures and threats [19]. The importance of wetlands for a sustainable urban life should be understood and any irreversible mistakes should be avoided.

POLLUTION

Dust and sulfur dioxide which cause air pollution in Izmir are among the causes of asthma [20]. It has been revealed that the pollutant sources located outside the Izmir metropolitan area have significant risks for urban air quality. The results show that industry, which is the most pollutant sector, contribute to total SO_2, Particulate matter (PM), NO_x and CO emissions of 91%, 41%, 90% and 70%, respectively [21]. Izmir Bay contains high concentrations of nutrients throughout the year. Densities in the inner and middle parts of the bay are more than the Aegean Sea exterior. A negative trend was observed in the outer parts of the bay for phosphorus and nitrate, whereas for the nitrate there was a negative trend in the middle and inner parts of the bay. The ciliates found in different parts of the Izmir Bay showed a positive trend. Contamination outside the bay is important, but there is a high eutrophication inside the interior and may extend to the outside. The wastewater treatment plant established at the beginning of the 2000s is sufficient to purify nitrogen while it is insufficient to purify the phosphate. The amount of nutrients on the surface is relatively high at the mouth of the Gediz River. The heavy metal concentration in Izmir Bay is higher than the Aegean Sea and the Mediterranean Sea. The Gediz River is the main anthropogenic source polluting the Izmir Bay due to poorly treated wastes. Petroleum hydrocarbon wastes, which are the other anthropogenic pollution source, are located in the bay due to sea traffic and industrial activities. The average amount of Hg and Cd in fish Aegean Sea and the Mediterranean are more likely than not to let the dirty parts. Mussels and fish in the Bay of Izmir may be the biological indicator of polycyclic aromatic hydrocarbons and heavy metals. The most common trace metals Hg, Cd, Pb, Cr, Cu and Zn are the leading organic pollutant chlorinated organic pesticides and petroleum hydrocarbons. The burden of accumulated impurities from the environment for 50-60 years in the Bay of Izmir has disturbed the ecosystem quality of Izmir Bay [22].

Chlorinated organic pesticides and polychlorinated biphenyls are persistent organic compounds that disrupt the health of humans and ecosystems by causing environmental pollution. The chlorinated organic pesticide in the sample of 18 sediments taken along the Izmir Bay ranged from 0.12 ng/g to 11.35 ng/g, while polychlorinated biphenyls ranged from 0.22 ng/g to 43.53 ng/g. The highest total amount of chlorinated organic pesticides was found inside the bay and in the mouth of the Gediz River and the total polychlorine biphenyl was found in the bay [23].

According to the Gediz Basin Pollution Prevention Action Plan of the Turkish Republic Ministry of Environment and Urbanization General Directorate of Environmental Management, by the regulation on Surface Water Quality Management in accordance with the quality criteria and classes, Gediz Basin Water Quality is II. class according to general conditions, IV. class according to oxygen parameters, IV. class according to nutrient parameters, III. class according to trace elements, II. class according to bacteriological parameters. This action plan by the ministry in the short, medium and long-term measures to be taken have been identified [24].

ECOLOGY AND BIODIVERSITY

A microbial ecosystem includes cyanobacteria, green algae, diatoms, ciliates, bacteria, archaea and viruses in salt marches [25]. The strains belonging to the families of Gammoproteabacteria, Firmucutes, Actinobacteria and Halomonadaceae, Vibrionaceae, Bacillaceae, Micrococcaceae, Enterobacteriaceae were isolated from the salts in Gediz Delta which contain Çamaltı Salt Marsh [26]. The Gediz Delta and the Izmir Bay create a suitable environment for the accumulation and attachment of Dinoflagellate cysts. 36 Dinoflagellate species were identified including *Dubridunum caperatum*, *Gymnodinium cf. nolleri*, *Lingulodinium machaerophorum*, *Polykrikos kofoidii*, *Quinquecuspis concreta*. Potential toxic cysts types observed as *Alexandrium* genus. They should be monitored for commercial fishing and public health. The sediments of the bay of Izmir are rich in Dinoflagellate cyst and are suitable for the investigation of the ecology and biogeography of the cyst-forming Dinoflagellates [27]. *Artemia spp*. which is known as salt marsh shrimp is also important part of ecosystem [28]. 47 ring

worm species have been identified in the study conducted between February 1998 and May 1999, in 16 station which temperatures were between 8 ºC and 31 ºC, dissolved oxygen measurements were between 0 mg/L and 14 mg/L, pH values were between 7 and 9.93, salinities were between % 0,056 and % 3,88 [29]. The algal flora of Çamaltı Saltworks was given in December 2017 as Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae, Monocots and a total of 29 taxa were determined [30].

In the mid-winter water bird counts of 2015, 64579 individuals were counted under 59 species in Gediz Delta. 6277 individuals were counted under 20 species in Izmir Bay [31]. Reproduction, wintering, population size, distribution and seasonal changes of the coastal birds (plovers) in Gediz delta were examined and 38 different species were observed [32].

In a study which crustacean diversity is researched, 81 species and 2179 individual were identified from Aegean Sea. 29 species and 271 individual were collected from Dikili, 23 species and 268 individuals were collected from Şakran in Aliağa, 26 species and 218 individuals were collected from Foça, 244 individuals and 30 species were collected from Alaçatı [33]. 17 Amphipod species were identified from 9 stations along the Aegean Sea coast of Cesme Peninsula [34].

Myxomycetes are multi-nucleus, organisms that do not have cell walls, which can produce single or multiple sporophores. 16 genus of myxomycetes including *Arcyria* genus were found in around of Kemalpaşa in Izmir [35].

Key biodiversity areas (KBAs) where biodiversity is protected on a global or local scale. Doga Dernegi, which is non-governmental organization for the protection of key biodiversity areas in Turkey takes an active role. Alacati Peninsula, Boz Mountains, Dilek Peninsula, Foca Peninsula, Gediz Delta, Karaburun Peninsula, Nif Mountain, Spil Mountain and Yamanlar Mountain are the KBAs in Izmir. Estimated carrying capacity for *Lynx lynx*, which is known as the Anatolian lynx, is 17 pairs in the Boz Mountains, 1 pairs in the Dilek Peninsula, 2 pairs in the Nif Mountain, 2 pairs in the Spil Mountain. Estimated carrying capacity for *Hyaena hyaena* is 4 pairs in Alaçatı Peninsula, 1 pairs for Foça Peninsula and 3 pairs for Yamanlar Mountain. Estimated carrying capacity for *Felis chaus* is 6 pairs in Gediz Delta. Estimated carrying capacity for *Caracal caracal* is 12 pairs in Karaburun Peninsula [36].

RESULT AND DISCUSSION

Due to the rapidly growing population, urbanization and pollution caused by humans, Izmir's ecosystem is in danger. Since people are also part of the ecosystem, the negative impacts will affect health of them. For example, changes in the physical parameters of Izmir Bay, such as temperature, pH, decrease of water flow, overgrowth or decrease of some species, can cause chain problems in ecosystem which may affect human health negatively by causing the reproduction of toxins or spreading disease factors. Besides that, pollutant factors may interfere with food, drinking water or air and adversely affect public health.

Unplanned structures which are rapidly constructed in Izmir and distorted urbanization which will be triggered by projects such as the gulf transition project where the effects of the environment are not considered with a holistic approach; threatens nature, the environment and human health. If necessary measures are not taken in the near future, irreversible environmental destruction can be caused.

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