İnsan ve Toplum Bilimleri Araştırmaları Dergisi
Journal of the Human and Social Science Researches
[2147-1185]
12 th Years

2023, 12 (3), 1310-1330 | Research Article

Practices in Natural History and Science Museums in Türkiye for the Combat with Environmental Challenges in the Center of Climate Change

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Abstract

In this article, environmental and climate practices in science and natural history museums in Türkiye are presented and discussed. While environmental and climate problems are global issues, they have local roots. As environmental issues are related to human activities and museums play a societal role, it is important to examine practices and approaches of museums in relation to the environment. Operations and practices of natural history and science museums in Türkiye, including educational activities, are important elements in communicating the risks of vulnerable environmental issue. This study outlines the environmental practices of the science and natural history museums of Türkiye which are commonly accepted as reliable providers of information to engage with audiences for action towards environmental challenges. Documentary research was conducted for the study. When the environmental practices and approaches are reviewed, it is seen that natural history museums function basically as research areas. Still, they have public education roles and organize educational activities about natural history, biodiversity and environment. While public education is one of the roles of natural history museums besides their conventional functions like collecting, conserving, researching and exhibiting, science centers are institutions dedicated to public education. Since science centers are mostly supported by municipalities, it can be said that they operate in a more sustainable and holistic way. Also, it is seen that their environmental reach-out programs offer a wider range. Based on data, we claim that collaboration with municipalities has an effect on the environmental activities and perspectives of museums. Also, climate-context works encourage museum community to make interdisciplinary works across the world. By presenting the current environmental and climate practices in natural history and science museums in Türkiye, it is aimed that the article can provide collaboration among institutions and advance the discussions among museums in the context of environment and climate.

Keywords: Climate Change, Environmental Issues, Natural History Museum, Science Museum, Science Center, Museum-Municipality Collaborations, Museums in Türkiye

Sivrikaya, G. & Güneröz, C. (2023). Practices in Natural History and Science Museums in Türkiye for the Combat with Environmental Challenges in the Center of Climate Change . Journal of the Human and Social Science Researches , 12 (3) , 1310-1330 . https://doi.org/10.15869/itobiad.1278607

Date of Submission	06.04.2023
Date of Acceptance	08.09.2023
Date of Publication	30.09.2023

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İnsan ve Toplum Bilimleri Araştırmaları Dergisi
Journal of the Human and Social Science Researches
[2147-1185]
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2023, 12 (3), 1310-1330 | Araştırma Makalesi

İklim Değişikliği Odağındaki Çevresel Sorunlarla Mücadelede Türkiye'de Bulunan Doğa Tarihi ve Bilim Müzelerinin Uygulamaları

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Öz

Bu makalede, Türkiye'de bulunan bilim ve doğa tarihi müzelerinde çevre ve iklimle ilgili yapılan çalışmalar sunulup tartışılmaktadır. Çevre ve iklim sorunları küresel meseleler olmakla birlikte, bu sorunların yerel yaşantıyla ve beşeri faaliyetlerle ilişkili kaynakları vardır. Müzelerin toplumu yönlendiren rolü göz önüne alındığında, müzelerin çevre ile ilgili uygulama ve yaklaşımlarını incelemek önem kazanmaktadır. Eğitim faaliyetleri de dahil olmak üzere, Türkiye'deki doğa tarihi ve bilim müzelerinin faaliyetleri çevre sorunlarına ilişkin risklerin gündeme gelmesinde önemli unsurlardır. Dolayısıyla bu çalışmada Türkiye'deki bilim ve doğa tarihi müzelerinin çevreye ilişkin faaliyetlerinin ortaya konması amaçlanmaktadır. Belirtilen amaç doğrultusunda doküman incelemesi yapılmıştır. Müzelerin uygulama ve yaklaşımları incelendiğinde, doğa tarihi müzelerinin temel olarak araştırma alanı işlevi gördüğü görülmektedir. Bununla birlikte toplum eğitimine yönelik çalışmalar yaptıkları; doğal tarih, biyoçeşitlilik ve çevre hakkında eğitim faaliyetleri düzenledikleri görülmektedir. Doğa tarihi müzelerinin asıl olarak toplama, koruma, araştırma ve sergileme işlevlerini yerine getirdikleri, eğitim işlevini belirtilen işlevlerin yanı sıra gerçekleştirdikleri görülmektedir. Diğer yandan bilim merkezlerinin çoğunlukla eğitim ve toplumsal işlev rolüne yönelik çalışmalar yaptığı gözlemlenmektedir. Böyle bir zeminde, bilim merkezleri çoğunlukla belediyeler tarafından desteklendiği için çevreye ilişkin çalışmalarının daha bütünsel ve sürdürülebilir şekilde çalıştığı görülmektedir. Ayrıca, topluma yönelik çevre programlarının daha geniş bir yelpaze sunduğu izlenmektedir. Bu makalede, doküman incelemelerine dayanarak, müzelerin belediyelerle yaptığı işbirliğinin müzelerin çevreye ilişkin faaliyetlerine ve bakış açılarına etkisi olduğu öne sürülmektedir. Ayrıca dünya ölçeğinde bakıldığında, iklim bağlamında yapılan çalışmaların, müze camiasını disiplinler arası çalışmalar yapmaya yönlendirdiği gözlemlenmektedir. Türkiye'deki doğa tarihi ve bilim müzelerindeki güncel çevre ve iklim uygulamalarını ortaya koyan bu makale ile çevre ve iklim problemlerine yönelik kurumlar arası işbirliğinin sağlanması ve müzeler arası tartışmaların genişletilmesi amaçlanmaktadır.

Anahtar Kelimeler: İklim Değişikliği, Çevresel Problemler, Doğa Tarihi Müzesi, Bilim Müzesi, Bilim Merkezi, Müze-Belediye İşbirliği, Türkiye'deki Müzeler

Sivrikaya, G. & Güneröz, C. (2023). İklim Değişikliği Odağındaki Çevresel Sorunlarla Mücadelede Türkiye'de Bulunan Doğa Tarihi ve Bilim Müzelerinin Uygulamaları . İnsan ve Toplum Bilimleri Araştırmaları Dergisi , 12 (3) , 1310-1330 . https://doi.org/10.15869/itobiad.1278607

Geliş Tarihi	06.04.2023
Kabul Tarihi	08.09.2023
Yayın Tarihi	30.09.2023

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Introduction to Environmental Issues and Museums

Environmental issues are problems or concerns one can relate to the environment, including the elements such as natural resources, living organisms, and the courses that add up to them such as climate change, pollution, loss of biodiversity, deforestation, as well as overconsumption of natural resources. These can have significant impacts on the planet and the people living on it. A healthy environment is necessary for the survival and prosperity of people, as well as for the preservation of the planet's biodiversity.

When international political actions are considered, the Stockholm Conference is the first international conference of United Nations in terms of environment, which was held in 1972. At the conference educational, informational, social and cultural aspects of environmental problems were on the agenda. In its action plan, the conference recommended (*Recommendation 96/1*) that UNESCO should take steps necessary to educate about the environment both in school and informal learning environments. With this, the public at all ages was instructed to manage the environment more carefully (United Nations, 1973). While public awareness was always an important aspect for the conferences, McGhie (2020) highlights that the Paris Agreement, which was recognized in 2015, is important for climate action addressing museums as key actors, which legitimates the societal role of the museums. Additionally, researchers have identified climate change as one of the most significant threats to society, including its posing considerable risks on cultural heritage, which increases the responsibility of museums (García, 2019; Jigyasu, 2019). It is also emphasized that the mutually positive interaction between Sustainable Development Goals, which is a call adopted by United Nations for prosperity, and by museums. Moreover, he underlines that UNESCO's 'Recommendation concerning the protection and promotion of museums and collections, their diversity and their role in society' describes climate change as a threat although it hadn't been particularly mentioned in the Recommendation before. It has been pointed out in Parker et al. (2019)'s study examining climate change communication in a museum context, uncertainties remain among the public-at-large about the scientific facts, causes and effects of climate change and the impact of human actions. Thus, museums both serve a function for public awareness to remove the uncertainty and have an active role to sustain themselves due to climate change.

At this point, it is appropriate to acknowledge the transformation in museums' relationship with society. In her work, Hooper Greenhill (1992, p. 26) emphasizes that paradigm shifts have occurred in the field of museology much like many other social institutions. Among these changes is the transition from a 'collection-oriented' museology approach to 'visitor-centered' strategies (Reussner, 2003, p. 97, Sandell & Janes, 2007, p. 14; Ross, 2004 p. 85; McCall & Gray, 2014, p. 33, Spalding, 2002, p. 114). Concepts such as the 'responsive museum' (Lang, Reeve & Woolard, 2006, as cited in Stuedahl, 2015), the 'inclusive museum' (Black 2005, as cited in Stuedahl, 2015), and the 'participatory museum' (Simon, 2010, as cited in Stuedahl, 2015) support the shift of focus within museums from the collection to the role of the public in societal development, communication, education, and the inclusion of communities (Stuedahl, 2015, p. 31).

Hooper Greenhill envisions the museum of the future 'as a process or an experience' rather than a mere building, and seeks for the museum to move 'as a set of processes

into the spaces, the concerns and the ambitions of communities' (2000, p. 152-153). Additionally, museums 'can impact positively on the lives of disadvantaged or marginalized individuals, act as a catalyst of social regeneration and as a vehicle for empowerment with specific communities and also contribute towards the creation of more equitable societies as cultural institutions' (Sandell, 2002, p. 4). These cultural institutions can fulfil their social duties and responsibilities by encouraging and supporting their employees, visitors and the public-at-large in evidence-based and informed discussion on environmental challenges confronting societies today. There is an increased focus on their role as "meeting places" and arenas for civic engagement and community involvement on societal issues (Bikovska & Liew, 2022; Johnston & Liew, 2020). That is why museums can capitalize on the cultural shift occurring in which people demand museums to recognize and value the general common sense of local communities in regards to natural issues, climate change and etc., rather than just serving as authorities that provide content to their community. Increasingly, museums and science centers have also become key agents in the representation, speculation and simulation of possible futures, from the utopian to the dystopic. Salazar (2011, p. 130) states that there is significant potential for the museum sector to develop programming that communicates the human dimensions of climate change, while not only expressing basic scientific facts.

Sutton (2020, pp. 620-627) comments on climate practices and approaches in museums. The practices every museum should consider are as follows: Sustainable building design, sustainable-story-materials collection through different disciplines, energy-efficient collection and conservation care with display practices, exhibitions and public programs encouraging audiences to act, and visitor operations like waste management and public transportation. Here, sustainable building design operations and some examples around the world are substantial practices. For the sustainable design of buildings, some green building certificate systems exist like LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment's Environmental Assessment Method), and DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen [German Sustainable Building Council]). In these programs, through criteria requirements, buildings can be certificated according to their environmentally friendly decisions.

Besides, defending and corroborating the resilience of the museums against natural disasters; empowering and educating the communities against environmental issues are additional steps for the museums. Designing exhibitions and planning educational practices for the society are basic methods, as museums are key sites for formal and informal education for technology, sciences, arts, humanities and many more popular topics such as migration, economic crisis, the pandemic, biodiversity and climate change (Kristinsdóttir, 2016). Particularly, the environmental issues are the up-to-the minute topics for the museums in order to catch the society through education of late years. While some museums have been designed based on environmentally friendly criteria from the beginning, others have increased their public activities concerning climate change.

In this article, we show the environmental practices of science and natural history museums in Türkiye. Based on the picture in Türkiye, we have two claims in this article. Firstly, we claim that collaboration with municipalities and developing policies about

climate change are essential parts of sustainable actions of science and natural history museums in Türkiye. While science centers are supported by the municipalities and natural history museums are mainly research centers, science centers have more emphasis on climate change. We think that it is because municipalities are expected to be more responsive to current issues and science centers that they support are channels to show it. Our second claim is that climate change has an impact on the museum community in ways like interdisciplinary and climate-context work, which may be a shift point in museum area After discussing our claims depending on practices in Türkiye and the literature, we have some suggestions for science and natural history museums in Türkiye to support their societal roles in a holistic way.

Museums in Türkiye and Environmental Issues: Natural History and Science Museums

The first Natural History Museum in Türkiye was established in İstanbul in 1839 at Mekteb-i Tıbbiye-i Şahane. This collection contained a large number of specimens brought from Europe. The herbarium of the Medical School was established in 1844, when the German pharmacist Friedrich Wilhelm Noë (1798-1858) was put in charge of the school's Botanical Garden. In the Republican Era, the institute of Mineral Research and Exploration (MTA) established the first natural history museum of Türkiye in 1968. MTA Natural History Museum collections contain paleoanthropological, mineralogical, petrographic and prehistoric archeology and fauna-flora of Türkiye. Ege University Faculty of Science operated a natural history museum in 1967 in İzmir. As a scientific and educational institution that covers all phases of earth sciences, it focused on promoting materials at home and abroad. The institute also opened an energy park in the same museum campus. In Erzincan city, Ali Demirsoy Natural History Museum was established in 2006 (Dilli, 2015). It is seen that natural history and environmental issues are generally handled by natural history museums opened within universities. The latest natural history museum of Türkiye, which was created by the restoration of Kavaklı Greek Church building opened in 2016 in the city of Burdur.

Many of the pioneer examples of natural history museums design environmental education activities for different segments of society. The aim of these museums is helping to develop the knowledge, skills, attitudes, and values that are necessary for responsible environmental stewardship.

The MTA Natural History Museum has a very rich collection in parallel with its researcher identity as the general directorate of mineral research and exploration. Animal and plant species, fossils, mineral samples and rocks from Türkiye and various parts of the world are exhibited in the museum. All kinds of energy sources are presented in the Energy Park as well under the same body of the campus (Türkiye Kültür Portalı n.d.). The education department was opened in 2012 in order to make the educational role more efficient to promote environmental awareness and understanding in Türkiye through national curriculum. The museum has an education room for children (Maden Tetkik Arama n.d.a). In the education department, children have the opportunity to study the selected samples such as minerals, rocks, and plant and animal fossils in hands-on activities. In addition to learning by touching the samples, the learning process is enriched by other educational materials prepared for different age groups. The museum also has a planetarium room and shows documentaries about the environment including issues like climate crises, which can be seen on the globe in the

room. Moreover, the ground floor of the museum is designed for visually impaired people. The displays have touchable and audible elements and the labels are written in the Braille alphabet as well. Also, museum guides are trained in order to guide visually impaired people. On this floor, there are fossils and mounted animals, footprints of man, which is one of the masterpieces of the museum, prehistoric stone tools and old mining equipment. The museum has also designed a "museum at the classroom" program which includes pre-museum information by the museum staff through museum and school collaboration. The museum takes part in EU and TÜBİTAK (Scientific and Technological Research Council of Türkiye) projects, and has partnerships with universities in Türkiye. Due to the researcher identity of the museum, some national and international research projects are also conducted there. For example, Paleogene Fossils, Stratigraphy and Paleogeography of Türkiye, Archaeogemology of the Ancient Gemstones, Development and Application of Energy Technologies, Historical Development of Mining in Anatolia, Gemstone Potential of Türkiye and Museum Preliminary Studies are conducted by the museum (Maden Tetkik Arama n.d.b). The projects also play an educational role as numerous activities for secondary and high school students are conducted by the museum. The MTA Natural History Museum has prepared a teaching kit for preschool students and teachers, as well as informational and artistic books about dinosaurs, elephants and energy sources that visitors can obtain.

A university-centered natural history museum, *The Natural History Museum of Ege University* is associated with the Natural History Research Center whose board consists of the faculty members. The exhibition consists of 400 items. Exhibiting items are classified as paleontology, rocks and minerals, birds, fauna of Türkiye, general zoology, osteology and evolution. The museum can basically be seen as an institute for university students and researchers. Still, primary and secondary school students often visit the museum for educational purposes as a supplementary activity for the school curriculum of science. Besides the environmental conferences and film shows are organized; on-site educational practices which aim to teach the complex and interconnected systems of the natural world, as well as the impacts that humans have on it are operated by the university members for the public (Ege Üniversitesi Tabiat Tarihi Uygulama ve Araştırma Merkezi, n.d.).

Ali Demirsoy Natural History Museum is located on the campus of Hacı Ali Akın Multi-Program High School in the Kemaliye district of Erzincan Province. The collection of the museum was primarily created by the project, 'Investigation of Kemaliye and Its Surroundings in Terms of Biodiversity', which included 48 scientists from 10 different universities. The collection includes natural history specimens, including various minerals and rocks, single-cell organisms (shown under microscope), some invertebrates, herbarium and insects on panels, fishes in alcohol, amphibians in alcohol, venomous snakes and other reptiles in formaldehyde and alcohol, birds in formaldehyde and alcohol and examples of mounted mammalians such as bears, wolves, wildcats, martens, mountain goats, badgers, squirrels, rodents, etc. Also, it should be added that the museum is supported by The Scientific and Technological Research Council of Türkiye and is a partner of several European Union research projects (Doğa Müzesi n.d.a). Thus, the museum partially functions as a research center. Besides its collection and research function, the museum emphasizes the educational role of museums for the public. Primary and secondary school students visit the

museum in the context of science and environmental education and the museum develops learning activities through its collection. The museum enables student groups to investigate nature by touch and observe using scientific devices. Museum helps to engage university students of region and local communities in local environmental issues like science in agriculture, biodiversity of Erzincan and etc., and encourages them to take action to protect and preserve the natural environment of the city. (Doğa Müzesi n.d.b, Doğa Müzesi n.d.c).

The Burdur Natural History Museum contains rock samples and fossils of animals that roamed the region over 2 million years ago. The museum is often visited by groups for educational purposes for Life Sciences and Science class curriculum (Burdur Valiliği n.d.; Kültür Portalı n.d.).

Table 1. List of Main Natural History Museums and Their Approach for Environmental Issues through Education and Public Programs

Museum	Environmental Issue	Educational Practice through the Collection	Supporter Institutions or Organizations
MTA Natural History Museum (Ankara)	Natural history Biodiversity Flora and Fauna of Türkiye Mining	Hands-on activities Museum at the classroom pre-museum activity Scientific guided tours Thematic workshops Conferences	The Institute of Mineral Research and Exploration
Ege University Faculty of Science (İzmir)	Natural history Biodiversity Flora and Fauna of Türkiye	Scientific guided tours Thematic workshops Conferences	Ege University
Ali Demirsoy Natural History Museum (Erzincan)	Natural history Biodiversity Flora and Fauna of Türkiye	Scientific guided tours Thematic workshops Conferences	TÜBİTAK
The Burdur Natural History Museum (Burdur)	Natural history Biodiversity	Scientific guided tours Thematic workshops Conferences	The Ministry of Culture and Tourism

Science centers also carry out certain environmental practices specific to the local context. The ones with such specific practices are Bursa Science and Technology Center (2014), Konya Science Center and Tropical Butterfly Garden (2014), Kocaeli Science Center (2015), İstanbul Sancaktepe Science Center (2014), İstanbul Sultanbeyli Science Center (2019), Eskişehir Science and Experiment Center (2012), and Şanlıurfa STEM Center (2015).

The Bursa Science and Technology Center is a project of Bursa Metropolitan Municipality to increase children's interest in science and to contribute to the skilled labor force of Türkiye. The center contains 135 different settings and a planetarium. The center also organizes science shows, workshops for school and family groups, night events and festivals (Bursa Bilim ve Teknoloji Merkezi n.d.). The center plays an active role in the public events of the municipality, as well as environmental events. For example, it is one of the partners of events conducted by the municipality, for example World

Environment Day (Türkiye Sağlıklı Kentler Birliği 2018). Another one is municipality-science center and industry partnership. In an event with the families of an industrial firm, the families were informed about how to cultivate previously uncultivated land, as well as how to make use of seed bombs. Moreover, families have seen a documentary about global warming and climate crises at the planetarium of the center (Türkiye Sağlıklı Kentler Birliği, 2019). In addition to industry partnerships, the center takes part in UN projects. During a UN project called 'Green Energy-Clean Energy', the center reached out to hundreds of underprivileged elementary school students. The project included topics like climate change, energy saving and renewable energy. Workshops, science shows and planetarium shows were organized for the duration of the project (Bursa Bilim ve Teknoloji Merkezi, 2018). Thus, with its different activities and projects, the Center aims to create a more environmentally literate and responsible society, which is essential for the protection and preservation of the natural world and the sustainability of the planet.

The Konya Science Center was planned as a large complex consisting of walking trails, green areas, open air exhibitions, conference rooms, laboratories, a library, an observation tower and a planetarium in addition to the confined space that includes its main exhibitions. It is the first and only science center to achieve a LEED Gold NC label in Türkiye, meaning it is a model to other institutions, as well as the public with its environmental responsibility in the center's operation. To follow the same track, some of the green features of the center will now be outlined. In Türkiye, the most popular certificate system is LEED (Green Building Information Gateway, n.d.). Museums that have been certified by LEED are the Konya Science Center and the Butterfly Garden and Insect Museum, Konya. Also, it should be mentioned that Sakıp Sabancı Museum, İstanbul, is in the certification process. When certification systems are reviewed, some may see that the buildings are not green. On the contrary, the building and the environment should be considered together as an ecosystem which encourages the public to participate in sustainable practices. Therefore, creating consciousness of the site in terms of climate, flora and fauna, energy sources, material sources, and transportation system is of high importance. Moreover, collection conservation and display practices should also be organized sustainably and efficiently. Thus, the features of the site, museological activities and other operations need a coherent organization and a holistic approach for a long-term sustainability.

Konya Science Center was constructed near public transport on the way of the airport, the high-speed train station, and urban public transportation roads, so it provides easy access for both domestic and foreign audiences. As the site of the Konya Science Center is located on an organized industrial site, a conscious decision was made to use green areas (Erdoğan, 2015; Yanar, 2017). Also, the architecture of the center was designed in consideration of the heat-island effect, so sun-reflecting materials were used for the siding of the center. What is more, the center has a rainwater harvesting system. However, the center does not have management and quality control mechanisms for rainwater (The U.S. Green Building Council, n.d.; Yanar, 2017). Having solar panels and a wind power plant decreases the energy consumption of the center significantly (Erdoğan, 2015). Thus, the Konya Science Center can be seen as an inspiration for widespread audiences, as well as for other institutions in terms of its environmentally-conscious design. To add to its ecologically mindful organization, the Konya Science Center also has two main exhibitions focusing on the environment: (1) Energy Sources

and (2) Anatolia's Flora and Fauna. After some thorough paleontological research that found fossils around Konya, the 'Fossil-Rock-Mineral' exhibition was also designed for the center (Erdoğan, 2015; Konya Bilim Merkezi, n.d.b). Moreover, the center has enjoyed some partnerships with the municipality for events regarding the environment like Zero Waste Day, Sustainable Design Hackathon, and Camping in Nature (Konya Büyükşehir Belediyesi, 2021). Besides its environmental exhibitions and events, a planetarium show about climate change has also been presented at the center.

The Kocaeli Science Center is called an industrial transformation project. The building of the center belonged to a paper mill which was founded in 1934. After restoring the building, it was turned into two museums, which are the Kocaeli Science Center and the Seka Paper Museum (Kocaeli Bilim Merkezi, n.d.a). The exhibitions of the center are primarily based on the field of Physics. Still, the center has many different activities and one of them is 'The Underwater Voyage' which is for primary and elementary school students. In the course of this activity, children discover marine species using technical devices and they are informed about marine pollution (Kocaeli Bilim Merkezi, n.d.b). The center is part of the 'Greenhouse Gas Inventory and Climate Change Initiative' project whose parties are the Kocaeli Metropolitan Municipality and the Ministry of Education, and they are responsible for training teachers in robotics and coding in the context of climate change (TÜBİTAK Bilim Merkezleri, 2018).

The Sancaktepe Science Center is an institution which was founded by the district municipality. The aim of the center is to dispense scientific and technological knowledge among the public (Sancaktepe Bilim Deney Merkezi, n.d.a). The center has two focuses in regards to energy, which are the use wind power and energy efficiency as it owns an area where visitors can compare the energy consumption of different kinds of lightbulbs (Sancaktepe Bilim Deney Merkezi, n.d.b; n.d.c). The context of these settings are not directly related to environmental issues. A regular event of the center in regards to climate change is a planetarium show. Also, the center has a project, named 'Climate Change and Antarctica', focusing on a conversation with a scientist and the public (Sancaktepe Bilim Deney Merkezi, n.d.d).

The Sultanbeyli Science Center is a project of the Sultanbeyli District Municipality and the İstanbul Development Agency. The center mostly has exhibitions explaining physical phenomena and nature laws. However, the center has other events including arts and crafts workshops. One of the workshops of the center is about botany (Sultanbeyli Gençlik Eğitim Merkezleri, n.d.). It is seen that the center has also played a role in an environmental festival where the climate crisis was specifically emphasized by the mayor of the district municipality (Sultanbeyli Belediyesi, 2021).

The Eskişehir Science Experiment Center is founded by the Eskişehir Metropolitan Municipality. The settings of the exhibitions are based on different disciplines, for example chemistry, physics, engineering, and paleontology. When the center is reviewed in terms of environmental practice, renewable energy has an important section in the center (Eskişehir Bilim Deney Merkezi, n.d.). Also, supplementary materials for teachers are presented on the website as open source. For climate practices, a conversation with a scientist series were organized regularly. During these conversations, global warming and climate change, their effects on life, future scenarios regarding these issues and possible solution recommendations are mentioned and discussed.

The Şanlıurfa STEM Center has a special place in terms of environmental activities. What makes it special is its regional support program, the Southeastern Anatolia Region Project (GAP). GAP, started in 1989, is a sustainable development plan including nine provinces located in the Euphrates-Tigris Basin and the upper Mesopotamia plains. The region is approached holistically, in the sense that environmental issues are also covered in the project (GAP, n.d.). Thus, it is inevitable that the science center is not indifferent to the environmental issues. The center organizes the GAP Green Innovation Project Competition for middle schools, high schools and universities in partnership of other government agencies including the GAP team (Şanlıurfa STEM ve Bilim Merkezi, n.d.a).

Table 2. List of Main Science Centers and Their Approach for Environmental Issues through Education and Public Programs

Science Center	Focused Environmental Issue	Educational Practice through the Collection	Supporter Institutions or Organizations
The Bursa Science and Technology Center	Energy Biodiversity Sustainability Climate Crisis	Scientific guided tours Science shows Workshops for school and family groups Night events and festivals Conferences	Bursa Metropolitan Municipality
The Konya Science Center	Universe Planet Earth Biodiversity Life Laboratory Robotics and the Future Sustainability Climate Crisis Global Warming	Scientific guided tours Conferences Workshops for school and family groups Night events and festivals Science camps	Konya Metropolitan Municipality, Konya Chamber of Industry, Konya Organized Industrial Zone, Selcuk University, Provincial Directorate of National Education, Provincial Directorate of Culture and Tourism, Konya Chamber of Commerce, Konya Commodity Exchange Konya Water and Sewerage Administration, TÜBİTAK
The Kocaeli Science Center	Physics Greenhouse Robotics Coding Climate Crisis	Scientific guided tours Conferences Workshops for school and family groups Night events and festivals Science camps	Kocaeli Metropolitan Municipality, TÜBİTAK
The Sancaktepe Science Center	Energy Biodiversity Climate Crisis	Scientific guided tours Thematic workshops Science shows	Sancaktepe District Municipality
The Sultanbeyli Science Center	Physical Phenomena and Laws Botany Climate Crisis	Scientific guided tours Environmental festival Thematic workshops	Sultanbeyli District Municipality, İstanbul Development Agency
The Eskişehir Science Experiment Center	Chemistry Physics Engineering Paleontology Renewable Energy Global Warming Climate change	Scientific guided tours Conversation with a Scientist Series Thematic workshops	Eskişehir District Municipality, Bursa Eskişehir Bilecik Development Agency, Anadolu University, and support of some brands
The Şanlıurfa STEM Center	Green Innovation Enery Agriculture	Scientific guided tours GAP Green Innovation Project Competition Thematic workshops	EU (via ERASMUS+ Project), Provincial Directorate of National Education, The Ministry of Industry and Technology, Şanlıurfa R&D,

Governship of Şanlıurfa, Harran University, Harran Continuing Education Center, Association of Genç STEM

These centers also collaborate with city planners, architects, artists, scientists, and policy makers to create scenarios, bring them to life via design charrettes and exhibits, and invite the public to use these designs to help envision the future they want to build for their community. Therefore, they are considered as the future projections of environmental studies in Türkiye.

One of the environmentally-sensitive museum opened in İstanbul in 2022 under the name of *Museum Gazhane*. Museum was opened as a climate museum but the building was built in 1892 as an industrial facility that produces gas from coal as fossil fuel. However, it has been transformed into a climate museum in order to avoid all agendas in Türkiye (Museum Gazhane, 2022). The climate museum is a good example of post-disciplinary approach of climate-contexted museums. The museum does not define itself as a science or technology center, on the contrary it is called as a "creative space". The activities of the museum varies from art classes including different disciplines like drama, dance and sculpture to artistic events like concerts and movies. Moreover, the creative space was also a part of 17th İstanbul Biennale. Besides its scientific, technological and artistic approach, the museum hosts speakers from disciplines like communication or psychology. In addition to Museum Gazhane, the latest natural history museum opened in Türkiye is Hacettepe University Biodiversity Museum (Biyosfer Müze). The museum, which opened its doors to visitors on May 22, 2023, on World Biodiversity Day, promises to be a new meeting point with the community through its extensive collection and a scientific illustration exhibition organized in collaboration with the Graphic Design Department shortly after its opening.

Discussion

Natural history museums and science centers in Türkiye take environmental and climate issues seriously, and intend on serving as providers of environmental education. First of all, natural history museums in Türkiye are directly connected to research centers and their academic staff. Therefore, their main museological activities are collecting, conserving, researching, exhibiting and interpreting objects. Moreover, they aim to spread knowledge about natural history, biodiversity and the environment within their public education activities. Thus, building on previous writings, natural history museums in Türkiye conduct activities directly related to the climate crisis. At this point, the perspectival difference between natural history museums and science museums can also be mentioned by referring to Rader and Cain's (2008) example of the Boston Science Museum. It is said in their work that the Boston Natural History Museum changed its name to the Boston Science Museum, with the aim to make the museum be based on living materials, rather than the dead ones (Rader & Cain, 2008 p. 156). Here, the history of natural history museums in the US can be matched with today's natural history museums in Türkiye. Natural history museums in Türkiye are not disposed to current issues as much as science centers are, as natural history museums are involved in activities like creating and maintaining inventories and training students which can be considered as the conventional roles of natural history museums.

On the other hand, science centers in Türkiye work more like public education areas. Friedman (2010) indicates that they generally do not have collections and their primary function is focused more on public education, when compared to earlier forms of science museums, which makes the museum's public activities more comprehensive. When science center practices in Türkiye are reviewed, it reflects the same situation. They organize environmental events about seed bombs, planting, marine pollution, waste management, and at the same time present ideas about climate issues. Also, all science centers in Türkiye have been founded mainly on municipality support. Moreover, the websites of them are situated as a sub-directory of municipality' official websites, which may also explain the public communication function of science centers in Türkiye. At this point, we claim that science centers are inherently part of environmental or climate practices because municipalities share their responsibility in relation to sustainability issues.

If climate practices and approaches in natural history and science museums in Türkiye are examined using Sutton's (2020, pp. 620-627) perspective on climate practices in museums, we also argue that sustainable building designs (Konya Science Center), exhibitions and public programs (all-natural history and science museums mentioned in the article), and visitor operations (Konya Science Center) reflect environmental and climate practices. On the other hand, collecting different sustainable-story-materials through different disciplines, which will be discussed in the following lines, and energy-efficient collection and conservation care with display practices have not been considered carefully enough in the literature.

When science centers' other environmental practices are surveyed, it can be observed that their exhibitions generally focus on the biodiversity of the district, energy sources, energy consumption and renewable energy. Climate practices are focused on planetarium shows, various projects, and science talks. İKSV [İstanbul Foundation for Culture and Arts] 2021, June) shares that terminology in regards to climate and ecological practices has been transformed into the terms 'climate crisis'/ 'ecological crisis', which highlights the need to take urgent action. When practices in Türkiye science and natural history museums are reviewed in terms of terminology, while 'climate crisis' is rarely used, 'global warming' and 'climate change' are commonly seen during out-reach activities. However, it should be said that while the climate crisis is a global issue, deforestation, decreasing water sources, air, sea and soil pollution and waste issues are just other faces of environmental problems in Türkiye, which have become more observable in recent years. For example, sea snots in the Sea of Marmara and the drought of the Salt Lake area are just two examples among many. Therefore, while importantly apparent environmental problems are increasing in Türkiye, science and natural history museums focused on events related to 'global warming' or 'climate crisis' to catch current global issues and its relationship with the local environmental problems.

Karaman (2021), in his interview with scientists from Türkiye, indicates two reasons for environmental problems in Türkiye: lack of environmental education and citizens not knowing their own power. Thus, all environmental and climate practices in science and natural history museums are able to have some kind of noteworthy impact. When analyzing the bulk of environmental and climate practice matters, the value of a holistic approach should also be highlighted. In Türkiye, the Konya Science Center can be called

as a symbol of an integrated approach. With the building and its environmentally oriented design and operations, the Konya Science Center was intended to be organized sustainably. Here, its support from trade areas like the Konya Chamber of Industry, the Konya Organized Industrial Zone, the Konya Chamber of Commerce and the Konya Commodity Exchange can also be seen as practices focused on sustainability. Moreover, the Şanlıurfa STEM Center should also be highlighted because of its partnership with several governmental institutions for its region-specific decision-making activities, which enables the region to develop a more sustainable atmosphere in terms of practical issues and environmental awareness.

While environmental and climate practices are important, the personal and societal levels should also be given attention. In 2002, the ASTC (Association of Science-Technology Centers) and ECSITE (The European Network of Science Centers and Museums) carried out an analysis of the impact of science museums on their local community of interests. When focusing on the research dimension, the impact of science museums was classified into four categories: personal, societal, political and economic. The results of the study showed that the major impact (87%) of science museums lies in the personal category (science learning, changed attitudes towards science, social experience, career directions formed, increased professional expertise, and personal enjoyment). Personal impact is followed by societal impact whose proportion is 9%. Thus, while the educational role of science museums was saturated to some degree, the societal role of museums remained in the background (ECSITE, 2002). From then until now, we observe that recent museological approaches and practices emphasize the societal dimension of museums due to today's issues including environmental issues and the climate crisis. For example, the ASTC and the ECSITE, aim not only to enhance scientific literacy, but also to highlight the climate crisis and to emphasize equity and social justice for essential values (ASTC, n.d.; ECSITE, n.d.). Here, it should be emphasized that social justice and the climate crisis are connected topics because climate change impacts people with a low-social status disproportionally. Thus, societal role of science and natural history museums highlights the importance of collaboration with municipalities and developing policies about climate change. Turkish branch of Museums for Future states that if the museums in Türkiye, which are tasked with protecting and transferring the cultural heritage, do not take a role in the fight against the climate crisis, there will be no legacy for them to transfer to the future. That's why Museum for Future Türkiye supports climate strikes, informs the Turkish society about the national and global effects of the climate crisis, pioneers in transforming institutions and provides information about the role of museums on environmental issues to all decision makers in Türkiye (Museum for Future Türkiye, 2022).

According to Pedretti and Iannini (2020, p. 63), two critical features of emerging science museums are to work collaboratively with other disciplines and to aim for social change. Moreover, it is possible to say that the borders between museum types and the disciplines can be bent and museums can be encouraged to collaborate together to keep up to date. Fehlhammer and Fuessl (2000, p. 520) present a similar idea, namely *transmusealisation*. Beyond transmusealisation, which means the mixing of the primary collection with collections in other types of museums. For example, a science museum can host an art collection and therefore contextual museums have emerged. As previously mentioned, climate museums are one of the distinct examples of mixing museum orientations. In the Bremerhaven Declaration, it is stated that 'Climate change

requires radical creativity and radical collaboration', so experts from science, arts and humanities and communities can collaborate for climate action under the same roof (Klimahaus Bremerhaven, n.d.). Museum Gazhane in İstanbul is an example of a collaborative attitude. Their 'creative space' opens its doors to any activities encourages society through science, technology, arts and humanities, which represents their post-disciplinary approach. This brings us to our second claim that museums, which were basically founded to put in order the things of the chaotic world of the cabinets, undergo a transformation depending on societal crises of our age, which lead them to create social and environmental contexts including different ranges of collections and approaches. In a similar vein, while McKenzie (2020, pp. 676-679) shares the principles of Climate Museum UK, she postulates that the climate crisis is not separated from other issues and it is also a systemic judiciary issue, which reflects social and environmental context-based approach of museum area.

At this point, environmental and climate practices oriented towards the public among the science and natural history museums of Türkiye are generally based on school group activities. Also, some projects like 'Green Energy-Clean Energy', organized by the Bursa Science and Technology Center, can be seen as an example of intending to reach out to underprivileged schools. While acknowledging such outreach projects, environmental education in the museums of Türkiye can also be considered within a community-centered context. In this context, the implementation of environmental and climate education should be locally relevant and culturally appropriate.

Conclusion

Based on our discussion, we have five suggestions for natural history and science museums in Türkiye. We suggest that natural history and science museums in Türkiye should have some regulations for their policies and physical environment. In line with those regulations, their exhibitional approach, educational activities and evaluation processes can be enhanced.

- Policy regulations: A climate change preparedness should be enacted by the government. While museum regulations mention natural disasters as safety issues (Vakıflar Genel Müdürlüğü [General Directorate for Foundations], n.d.), legal regulations should be updated in terms of climate change and its social context in order to make these actions more sustainable in the long term. The plan should outline the actions that the museum will take in order to protect its collections, facilities, and staff in the case of extreme weather events or other climate-related disasters. During policy regulations, government, professional museum organizations and municipalities should pioneer together.
- Regulations for physical environment: Using sustainable materials in construction and exhibit design, as well as choosing materials that are less damaging to the environment during production and disposal can be important steps to make museums sustainable. Also, energy-efficient systems like energy-efficient lighting and water conservation systems can help to reduce the museums' carbon footprint and lower its energy costs. Moreover, transportation to the museums should be considered and museums should have collaborative relationships with municipalities.

- Exhibitional approach: An interdisciplinary approach can also be implemented in science and natural history museums in terms of environmental and climate practices. Especially, artists working on environmental issues and traditional approaches to environmental sustainability can enrich science and natural history museums' work in Türkiye. In this way, the societal dimension and an interdisciplinary approach can be implemented in locally relevant and culturally appropriate ways.
- Educational activities: Natural history and science museums in Türkiye can work with local organizations and communities, which empowers their educational activities with its societal emphasis. This can be more effective to reach out vulnerable groups.
- Evaluation processes: Museums should continuously monitor and assess their vulnerability to the impacts of climate change and adjust their preparedness plans accordingly. This process provides natural history and science museums in Türkiye to demonstrate their accountability.

Our suggestions for natural history and science museums in Türkiye are aimed to benefit from their full potential as strong partners in Türkiye's sustainable, fair and green change.

Sonuç

Araştırma sonuçlarına dayanarak yaptığımız tartışmalardan yola çıkarak Türkiye'deki doğa tarihi ve bilim müzeleri için bazı önerilerimiz bulunmaktadır. Öncelikle bu tür müzelerin fiziksel çevreleri de dahil olmak üzere bazı yasal düzenlemelerinin olması uygun görülmektedir. Yapılan düzenlemelerle ilişkili olarak sergi yaklaşımlarının, eğitim etkinliklerinin ve değerlendirme süreçlerinin geliştirilebileceği düşünülmektedir.

- Yasal düzenlemeler: Müze yönetmelikleri doğal afetleri güvenlik sorunu olarak ele alırken (Vakıflar Genel Müdürlüğü, t.y.), bu eylemlerin daha sürdürülebilir olması için yasal düzenlemelerin iklim değişikliği ve sosyal bağlamı açısından güncellenmesi gerekmektedir. Plan, doğal afetler veya iklimle ilgili diğer felaketler durumunda müzelerin koleksiyonlarını, kurumlarını ve personellerini korumak için alacağı eylemleri özetlemelidir. Politika düzenlemeleri sırasında, profesyonel müze kuruluşları ve belediyelerle de iş birliği yapılmalıdır.
- Fiziksel çevreye ilişkin düzenlemeler: Müzenin yapımı ve sergileme tasarımında sürdürülebilir malzemelerin kullanılması, üretim ve imha sırasında çevreye daha az zarar veren malzemelerin seçilmesi müzelerin sürdürülebilir olması için önemli adımlar olabilir. Ayrıca, enerji tasarruflu aydınlatma ve su koruma sistemleri gibi enerji tasarruflu sistemler, müzelerin karbon ayak izini azaltmaya ve enerji maliyetlerini düşürmeye yardımcı olabilir. Ayrıca ziyaretçilerin müzelere ulaşımı göz önünde bulundurulmalı ve müzeler belediyelerle iş birliğine dayalı ilişkiler içinde olmalıdır.
- Sergileme yaklaşımı: Bilim ve doğa tarihi müzelerinde çevre ve iklim uygulamaları açısından disiplinler arası bir yaklaşım da uygulanabilir. Özellikle bölgeye özgü geleneksel uygulamalar ile çevresel sürdürülebilirliğe yönelik çalışan sanatçılar Türkiye'deki bilim ve doğa tarihi müzelerinin çalışmalarını zenginleştirebilir. Disiplinler arası yaklaşım ve müzenin sosyal

bağlamı sayesinde müze uygulamaları kültürel ve yerel unsurları anlamlı bir şekilde sahiplenebilir.

- Eğitim etkinlikleri: Türkiye'deki doğa tarihi ve bilim müzeleri, eğitim faaliyetlerini toplumsal vurgu ile güçlendiren yerel kuruluşlar ve topluluklarla çalışabilir. Bu yaklaşım, kırılgan gruplara ulaşmak için daha etkili olabilir.
- Değerlendirme süreçleri: Müzeler, iklim değişikliğinin etkilerine karşı hassasiyetlerini sürekli olarak izleyip değerlendirmeli ve hazırlık planlarını buna göre düzenlemelidir. Bu süreç, Türkiye'deki doğa tarihi ve bilim müzelerinin toplumsal sorumluluklarını ve hesap verebilirliklerini göstermelerini sağlar.

Türkiye'deki doğa tarihi ve bilim müzelerine yönelik sunduğumuz öneriler, Türkiye'nin sürdürülebilir, adil ve yeşil değişiminin güçlü ortakları olarak potansiyellerinden tam olarak yararlanmalarını amaçlamaktadır.

Peer-Review	Double anonymized - Two External
Ethical Statement	* This article is the revised and developed version of the unpublished conference presentation entitled "What about Environmental Issues? Approaches of Turkish Museums" orally delivered at the CIMUSET Tehran 2021: Museums & Environmental Concerns – New Insights Symposium. * It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.
Plagiarism Checks	Yes - Ithenticate
Conflicts of Interest	The author(s) has no conflict of interest to declare.
Complaints	itobiad@itobiad.com
Grant Support	The author(s) acknowledge that they received no external funding in support of this research.
Author Contributions	Design of Study: 1. Author (%30), 2. Author (%70) Data Acquisition: 1. Author (%50), 2. Author (%50) Data Analysis: 1. Author (%50), 2. Author (%50) Writing up: 1. Author (%70), 2. Author (%30) Submission and Revision: 1. Author (%70), 2. Author (%30)

Değerlendirme	İki Dış Hakem / Çift Taraflı Körleme
Etik Beyan	* Bu makale, CIMUSET Tehran 2021: Museums & Environmental Concerns – New Insights Symposium'da sözlü olarak sunulan ancak tam metni yayımlanmayan "What about Environmental Issues? Approaches of Turkish Museums" adlı tebliğin içeriği çoğunlukla değiştirilerek ve geliştirilerek üretilmiş hâlidir. *Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur.
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Çıkar Çatışması	Çıkar çatışması beyan edilmemiştir.
Finansman	Bu araştırmayı desteklemek için dış fon kullanılmamıştır.
Yazar Katkıları	Çalışmanın Tasarlanması: 1. Yazar (%30), 2. Yazar (%70) Veri Toplanması: 1. Yazar (%50), 2. Yazar (%50) Veri Analizi: 1. Yazar (%50), 2. Yazar (%50) Makalenin Yazımı: 1. Yazar (%70), 2. Yazar (%30) Makale Gönderimi ve Revizyonu: 1. Yazar (%70), 2. Yazar (%30)

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