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The Impact of Sustainable Architecture on the Design of Fire Lookout Towers

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Abstract

Türkiye is considered the most successful country among the Mediterranean neighbors regarding wildfire management efforts. This success has been achieved through the enhancement of early intervention capacity, the development of surveillance systems, and the effective utilization of both ground and aerial firefighting vehicles. These efforts are continuously supported by improvement initiatives aligned with current technological advancements and innovations to ensure the sustainability of rapid and effective response to wildfires. Increasing concerns about climate change, environmental protection, and forest sustainability have also emphasized integrating sustainable approaches into architectural design. This article examines the impact of sustainable architecture on the design of fire lookout towers. While these structures have historically played a critical role in the early detection and response to forest fires, they are now being re-evaluated regarding environmental compatibility and resource efficiency. The study explores key sustainability aspects, including using locally sourced and renewable materials, energy efficiency measures, water management systems, and integration with the natural environment. Findings derived from case analyses indicate that although sustainable design may entail higher initial costs, it significantly reduces environmental impact and enhances compatibility with forest ecosystems over the long term. The article emphasizes the balance between sustainability and functionality, offering practical recommendations for architects, forest managers, and policymakers.

Keywords: Environmental Compatibility; Sustainable Architecture; Design; Fire Lookout Tower

1. Introduction

Forest fires are natural disasters that are mainly caused by human activities and cause significant damage to ecosystems. These fires threaten biodiversity and cause environmental disasters by polluting the air. Post-fire effects such as erosion, contamination of water sources, and habitat loss lead to long-term ecological problems [1]. Moreover, with the impact of global climate change, the frequency and intensity of forest fires are predicted to increase further [2-4]. Combating forest fires is of great importance in preserving the environmental balance and sustaining biodiversity. Therefore, adequate measures must be taken before, during, and after a fire. One of these measures is the use of fire observation towers (FOT), which are strategically important for early intervention in forest fires [5].

Fire observation towers are built strategically to detect fires early and enable rapid intervention. Built in areas with wide visibility to scan a large area, these towers play a critical role in controlling fires before they spread by contributing to the early detection of possible fires and quickly notifying the necessary units [6-8]. The effectiveness of the towers is measured through visibility analyses conducted on past (current) structures, allowing for an assessment of their success in responding to fires. Such analyses provide critical information for optimizing firefighting strategies and responding more effectively to emergencies [9, 10]. With this analysis, fire detection capacity can be evaluated, deficiencies can be

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identified, and the locations of existing towers can be reviewed to determine new areas where they are needed. Thus, a stronger and faster line of defense against fires can be established, minimizing the adverse effects of fires [11, 12].

However, these structures should be evaluated not only for their technical performance but also for their environmental impact. Historically, these structures were mostly built with functionality in mind, but today they are being reevaluated within the framework of sustainability principles [13]. In this context, the concept of sustainable architecture, which advocates integrating environmentally friendly principles into building design, offers a new perspective on the design and construction of fire observation towers and necessitates that these structures be re-examined within the scope of sustainable architecture. This article will evaluate how sustainable architecture principles can be used in the design of fire observation towers and how sustainability can be integrated into fire observation towers in terms of design and ecological impacts.

1.1. Fire Lookout Towers: Definition, Function, and Historical Development

The primary function of fire lookout towers is to detect signs of fire at an early stage, enabling rapid response. Personnel stationed in these towers continuously provide information about the fire's location, direction, and spread, guiding ground crews and coordinating the efforts of teams attempting to reach the fire. This ensures effective communication and coordination during a fire, allowing the response process to be carried out more effectively [14].

These structures, whose first examples consisted of simple wooden platforms, began to be built with stronger materials such as steel and concrete over time to increase their resistance to fires. In particular, the “Big Burn” fire that occurred in the United States in 1910 brought the need to strengthen the fire observation infrastructure to the agenda. In this context, steel towers became widespread. The towers were developed to provide fire lookout personnel with a high field of view and accommodation and communication facilities. Approaches to fire lookout towers vary globally depending on countries' geographical features, climatic conditions, and forest management policies. For example, the National Forest Service operates an intensive surveillance network in the United States, particularly in states such as California and Colorado, which are highly exposed to forest fires. Similarly, in European countries such as Spain and Portugal, where the risk of fire is high, a comprehensive network of fire observation towers has been established to strengthen early warning and response systems.

In Türkiye, forest fires are a significant concern, particularly in the Mediterranean and Aegean regions [15-17]. In this context, the history of fire observation towers dates back to 1946, and these structures have been widely adopted as a preventive strategy against forest fires. Over time, with increasing height and the impact of developing technology, fire observation towers have become a critical structure in the protection of forest areas, creating an extensive network of fire towers spread across our forests. Thus, Türkiye has strengthened its efforts to protect its nature and combat fires [18]. In 1983, as part of the work carried out in collaboration between the General Directorate of Forestry and Istanbul University, areas visible and invisible from the towers were determined; based on this information, new tower locations were proposed, and some existing towers were removed. Ensuring that fire-prone areas are visible from at least two different towers, various elements such as hazardous areas, picnic areas, power transmission lines, agricultural lands, and settlements were processed and analyzed in other layers. This process was an essential step in terms of the strategic positioning of the towers (Figure 1).

Figure 1 2000 m. Beştepe Fire Tower, Mersin, Dominating the Height and Surroundings

With the advancement of technology today, Geographic Information Systems (GIS) offer practical and innovative solutions in various fields, making a significant contribution to decision-making processes [19-25], and are also used as an effective decision support tool in the planning of fire observation towers. GIS provides high accuracy and efficiency in analyzing the viewing areas of existing towers, identifying fire-prone areas, and suggesting new tower locations. Furthermore, through this system, different layers such as settlements, power lines, and recreation areas at risk can be evaluated multidimensionally, enabling comprehensive solutions in fire management. Furthermore, semi-automatic and automatic tower location determinations are made using mathematical modeling methods that help identify the most suitable observation points by analyzing specific parameters and data, thereby enabling more effective management of fire risks [26, 27].

Forest fire towers in Türkiye and worldwide continue to exist as concrete examples of ongoing efforts to protect against the destructive effects of fires.

The Adana Balcalı Automatic Fire Surveillance Tower System alone detected and tracked 11 potentially dangerous forest fires in 2023, significantly in the dispatch and management of the nearest first response teams (Figure 2).

Figure 2 Adana Balcalı Automatic Fire Monitoring Tower System, [28]

However, with increasing environmental concerns and technological developments over time, the design concept of these structures has also evolved; with the proliferation of satellite imagery, uncrewed aerial vehicles, and automatic camera systems, some traditional towers have partially lost their surveillance functions. As shown in Figure 2, the lifespans of these towers have been extended and waste generation reduced by repurposing them for different purposes, such as tourism or research [29].

Figure 3 Re-evaluated Fire Watch Towers, [30].

1.2. Sustainable Architecture

To combat numerous problems such as the disruption of ecological balance, global warming, water crisis, and depletion of energy resources, it is necessary to focus on sustainable resources and environmentally friendly solutions. As in every field, it is essential to move forward with sustainable solutions in architecture. With climate change and environmental degradation being the most pressing environmental issues on a global scale today, sustainable architectural solutions are coming to the fore, offering an essential path to a more resilient and environmentally friendly future.

Sustainable architecture is an approach that aims to minimize the environmental impact of the design and construction processes of buildings, promote the efficient use of energy and resources, and improve the quality of life for users. The sustainable architecture approach prioritizes both increasing energy efficiency and protecting natural resources. Green buildings are constructed with innovative designs emphasizing renewable energy systems, recyclable materials, and natural lighting. Strategies such as rainwater harvesting systems, innovative building technologies, and sustainable landscaping are also preferred to minimize environmental impacts. Green building design is a holistic approach that aims to make a positive contribution not only to the environment but also to the people living in the building.

Since the 1950s, the urbanization process in Türkiye has primarily been shaped by land speculation and speculative construction; this situation has led to the emergence of unhealthy urban agglomerations due to the effects of unplanned and rapid urbanization. This type of construction has led to forming an urban fabric far from sustainable principles, putting pressure on natural resources and bringing various environmental problems with it. Notably, the shift towards renewable energy sources has been limited in this process, and awareness of sustainability has not developed sufficiently in either society or the construction sector. On the other hand, while aesthetic, nature-sensitive, and sustainability principles are clearly evident in Türkiye's traditional building approach, the importance of these principles is also increasing in new construction processes today.

Considering the city's frequent fires, which caused significant economic hardship for its residents and devastated the town, the Beyazıt Meteorological and Fire Watchtower was built in 1749 to monitor fires in Istanbul. Constructed of wood, it eventually reached a height of 118 meters. In addition to fire surveillance, it served as a functional structure that informed the public about the next day's weather conditions through different colored lights (blue for clear skies, green for rain, yellow for fog, red for snow). The Beyazıt Meteorology and Fire Watchtower, which serves as a functional structure, attracts historical and functional attention in traditional and sustainable architecture (Figure 4).

Figure 4 Beyazıt Meteorologie and Fire Watch Towers

In today's new construction process, bioclimatic design elements such as passive and active solar heating systems, especially in small-scale housing, reflect a positive trend towards sustainability. Furthermore, the growing interest in local and ecological materials also supports social awareness towards creating healthy living environments. However, the insufficient effectiveness of environmental management systems leads to neglecting fundamental sustainability criteria in building production, such as waste management, indoor air quality, and energy efficiency. Therefore, policymakers and industry stakeholders must adopt holistic and determined approaches to promote sustainable architectural practices.

In this context, prominent examples of sustainable architecture in Türkiye and worldwide showcase successful applications of environmentally compatible construction and concretely demonstrate how sustainability principles are reflected in architecture. The self-sufficient 'Pixel Building' (Melbourne) maximizes daylight with its colored panels, provides energy and water efficiency through waste and rainwater management systems and vertical wind turbines; The world's most sustainable office building, 'The Edge' (Amsterdam), equipped with energy efficiency, smart building technologies, solar panels, rainwater harvesting systems, and user-focused flexible workspaces; The Crystal exhibition center (London), which minimizes carbon emissions, reduces energy consumption, and uses natural resources efficiently thanks to smart building technologies, low energy consumption, and the use of environmentally friendly materials; 'Villa Welpeloo' (Enschede), designed with recycled materials; 'Liuzhou Forest City' (Guangxi), a forest city designed with a sustainable architectural approach to allow 30,000 people to live in harmony with nature, using 40,000 trees and 1 million plants; 'Vakko Fashion Center & Power Media Center' (Istanbul) and 'Maslak No.1 Office Building' (Istanbul), which feature smart building management systems that maximize natural lighting and minimize energy consumption; 'TEGET Office Building' (Izmir), which stands out with its passive climate control features and green roof; 'Yalıkavak Marina' (Bodrum), which incorporates technologies that save water and improve energy efficiency in its design, are just some of the many examples of sustainable architecture in Türkiye and around the world.

Additionally, the Bosco Verticale (Vertical Forest) project, considered a milestone in green urbanism and sustainable architecture, was designed to achieve aesthetic and functional harmony with nature, utilizing 900 trees, 5,000 shrubs, and approximately 11,000 perennial plants placed at different heights according to their light-capturing capacity. In this structure, plants provide visual richness and offer numerous environmental and ecological benefits. Green facade applications create a microclimate between the interior and exterior environments through shading and natural insulation, helping protect against extreme temperatures while significantly reducing energy consumption and urban noise. Furthermore, the irrigation needs are met by an integrated system that recycles gray water obtained from the building occupants' consumption, setting an example for sustainable water management (Figure 5).

Figure 5 Bosco Verticale (Milano)

1.2.1. Evaluation of Fire Lookout Towers within the Scope of Sustainable Architecture

Fire lookout towers have long been recognized as a fundamental element of forest management and safety. Historically, these structures were built primarily with functionality in mind [31], and sustainable architectural principles were largely neglected (Figure 6).

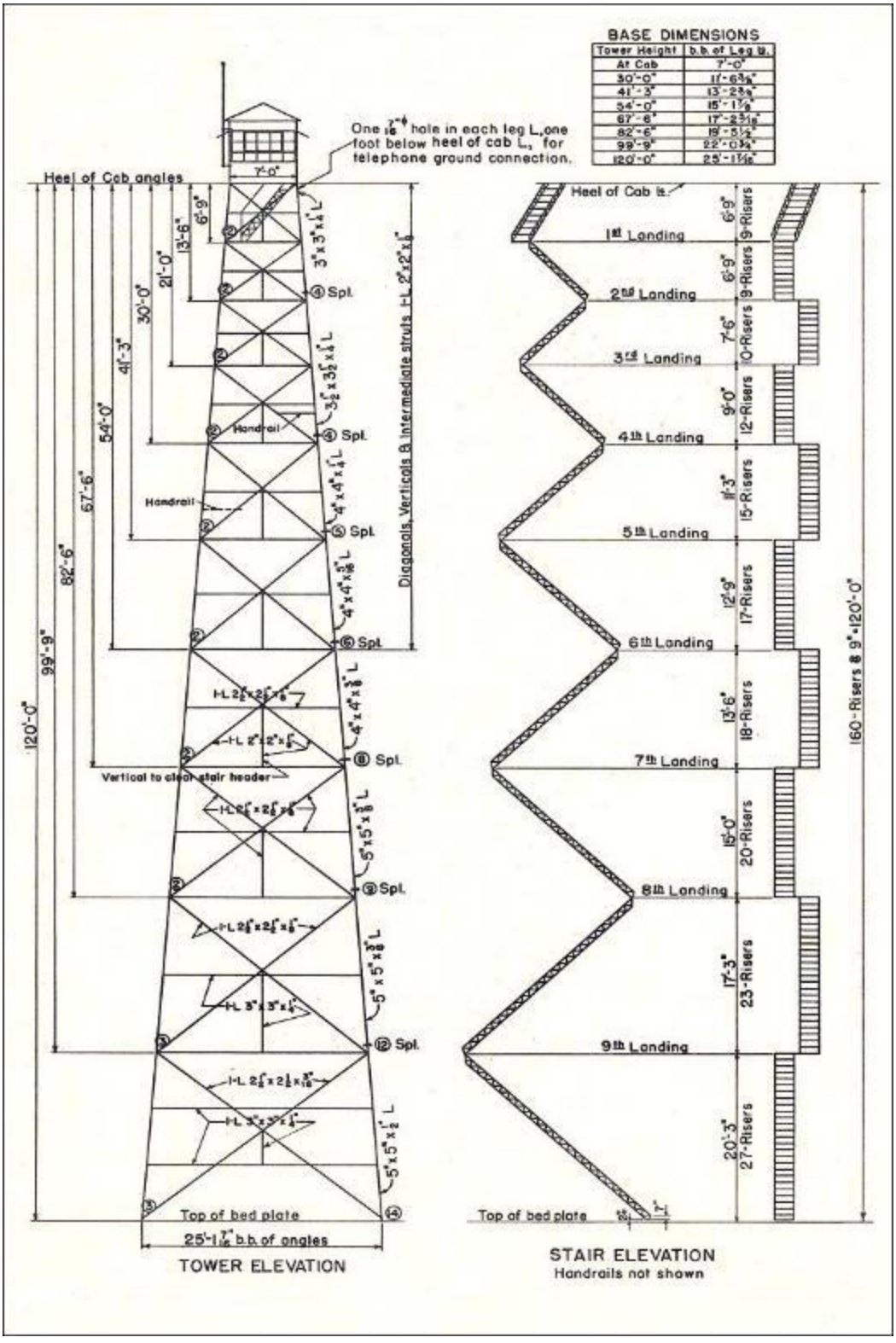

Figure 6 Example of a Traditional Fire Tower Design

However, increasing environmental awareness today necessitates that environmentally friendly design principles be considered alongside the functionality of these structures [12]. Using local, renewable, or recycled materials can significantly reduce the carbon footprint of structures. Wood material obtained from managed forests stands out as an environmentally friendly option. In addition, alternative sustainable materials such as bamboo, which has rapid growth properties, can also be considered for specific structural and design elements. Integrating solar panels to provide energy for basic equipment such as communication systems and lighting in towers reduces dependence on non-renewable energy sources and contributes to the structure's sustainability. Furthermore, energy-efficient LED lighting systems minimize energy consumption during nighttime use. Integrating rainwater harvesting systems into tower design is particularly important for water supply during droughts. These systems can operate effectively through gutters and storage tanks. Vertical gardens integrated into the tower's exterior facilitate the building's integration with the environment, improving air quality and supporting local biodiversity [10]. The façade design, featuring large windows and natural ventilation, provides natural coolness in summer, while insulated walls and openings planned to take advantage of sunlight offer passive heating in winter, reducing energy requirements. Considering the variability of forest dynamics, the modular design of the towers minimizes environmental impact by allowing them to be dismantled, transported, or relocated. Furthermore, the use of less intrusive foundation systems, such as screw piles, compared to traditional methods, minimizes damage to the forest floor and ecosystem during the construction process [32].

To achieve a balanced approach to functionality and sustainability, the design of fire observation towers must prioritize harmony with nature. These structures should be conceived not merely as elements within the forest, but as an integral part of the forest ecosystem. Blending modern architectural principles with traditional knowledge specific to the forest ecosystem and the experiences of local communities strengthens an environmentally conscious and sustainable design approach. Aesthetic elements, alongside functionality, are considered an important complementary factor in the design of fire lookout towers. These structures serve technical purposes and are seen as a symbolic expression of environmental awareness, sustainability, and nature conservation. Forms inspired by nature, natural color tones, and fluid architectural lines allow the structure to blend in with its surroundings, offering users a calm and harmonious spatial experience.

Figure 7 Modern Fire Tower Design Example (2D)

Sustainable architecture is not limited to selecting environmentally friendly materials and energy efficiency, but aims to redefine the relationship between humans and nature. With their vertical rise, fire lookout towers symbolically reflect the delicate balance between humans and nature and draw attention to the importance of this relationship through sustainable design. A frequently overlooked issue in forest structures is the impact of buildings on local fauna. Therefore, sustainable designs should not only be passive observation points but also offer active solutions that consider the interaction between humans and wildlife. For example, special glass surfaces that prevent bird collisions and wildlife corridors that allow small animals to pass through are critical in minimizing ecological impact. Sustainability is also

related to the longevity of structures and the ease of maintenance. The materials must integrate with the natural environment over time and adapt to weather conditions. For example, copper material forms a green patina over time (a green-colored layer that forms on the copper surface over time due to corrosion due to the effects of the air), allowing the structure to be in aesthetic harmony with its surroundings. In addition, the tower design should facilitate maintenance processes and support the structure's safety and functionality for many years [33].

Walkways, stairs, and viewing platforms in fire observation towers should be constructed from durable, non-slip materials, and safety rails should be rust-resistant and sturdy. Beyond their primary function, these structures can also serve as areas for providing environmental education to visitors. Interactive information screens powered by sustainable energy sources can be used to inform visitors about forest conservation awareness, the role of fires in ecosystems, and the importance of sustainable architecture. Thus, the towers go beyond their surveillance function and also make a valuable contribution to environmental education.

Even if they are built with the best design practices, some towers may need to be relocated or decommissioned over time. Therefore, sustainable designs should aim to minimize the structure's environmental impact at the end of its useful life. In this context, a future-oriented design approach is an important component of sustainability. Climate change and transformations in forest ecosystems necessitate that these structures be designed flexibly to adapt to changing conditions. Flexible systems, such as adjustable observation platforms and modular components, enable towers to adapt to different needs in the coming years.

Technological developments offer significant opportunities to enhance the functionality of fire observation towers. In particular, systems equipped with artificial intelligence-supported sensors enable the creation of more accurate early warning mechanisms by detecting variables such as humidity, temperature, and smoke density. Sharing this data with forest management teams shortens response times and contributes to reducing the damage that fires can cause [34]. In this context, the Sarıyer Forest Observation Tower, which enables 24/7, 360-degree monitoring from the Fire Coordination Center via internet-connected thermal cameras to monitor forest fires in the north of our country, has increased forest visibility by 9% with its 32-meter height (Figure 8). In addition, the tower, which has been given a historical appearance with natural cladding materials, functions as a structure that informs the public about the forest organization's work with bird's-eye views by hosting social events, nature education programs, and press conferences with its structure suitable for disabled access, as well as communicating weather information with colored lights.

Figure 8 Sarıyer Forest Watchtower

Sustainable architecture is an approach that encourages the use of materials with low environmental impact. Specifically for fire watchtowers, the preference for locally sourced, renewable, or recycled materials is important in reducing the ecological footprint of structures. Integrating systems such as solar panels into tower design to increase

energy efficiency not only reduces environmental impact but also allows the structure to independently meet its energy needs in remote areas. Sustainable architecture also involves thoughtful site planning. Strategically positioning towers in a way that does not harm local ecosystems is critical for the protection of wildlife habitats and the continuity of biodiversity [35]. This approach also takes climatic conditions into account. In fire-prone forested areas, structures built with environmentally resilient, fire-resistant materials that allow for rapid evacuation should be designed as a priority. Furthermore, sustainable designs that encourage community participation increase the social acceptance of structures by incorporating the needs and views of local people into the process. Sustainability is also related to durability and ease of maintenance. Long-lasting and low-maintenance materials reduce resource consumption and increase economic efficiency. The environmental and visual harmony of structures with the natural landscape is important in terms of architectural-nature integrity.

Applying sustainable architectural principles in the design of fire lookout towers not only produces functional structures but also ensures that these structures make positive contributions to the natural and social environment. Material selection, ecological sensitivity, preservation of biological diversity, community participation, and long-term livability are fundamental criteria in this context [36]. Sustainable architecture offers a planning approach that also includes the integration of smart technologies. Through advanced sensor systems and monitoring technologies, fire lookout towers can analyze indicators such as smoke and heat increase; thus, potential fires can be detected at an early stage, enabling rapid intervention [37]. This early intervention process facilitates the control of fires, protecting both human life and natural resources. Furthermore, considering the declining freshwater resources, rainwater harvesting systems are important to sustainability. These systems allow the collected water to be used for irrigation, cleaning, and other daily needs, thus contributing to the conservation of natural water resources [38]. Sustainable architecture also involves minimizing waste production and integrating recycling systems. Sustainable architecture also involves minimizing waste production and integrating recycling systems. The construction of fire observation towers with low waste and their support through waste management plans should be evaluated within this framework. At the same time, this approach also emphasizes social inclusivity; designing towers to be accessible to everyone promotes social equality and increases participation in fire management. Educational functions are also part of sustainable architecture. Environmental awareness can be increased by providing information about local flora and fauna and fire prevention methods through information boards or interactive screens located in the towers. Integrating the traditional knowledge of local communities regarding fire management into the design increases the structures' sustainability and effectiveness [39]. Sustainable architecture encompasses not only the initial design phase but also the post-use life of the structure. Designing fire lookout towers to be resilient and planning them with strategies suitable for post-disaster reconstruction supports regional sustainability.

2. Discussion and Conclusion

Fire observation towers have played an important role in the early detection and rapid response to forest fires from the past to the present. However, today they have become structures that must be evaluated for their technical functionality and environmental and social impacts. The study reveals that integrating sustainable architectural principles into tower designs offers significant ecological and economic benefits. In particular, using local and renewable materials reduces the carbon footprint of the towers, while integrating energy-efficient systems lowers operating costs in the long term. This shows that although sustainable design may be costly in the initial stages, it is more advantageous in the long term, both environmentally and economically.

Sustainability is not limited to material selection and energy efficiency; it also encompasses social and cultural dimensions. The towers' additional functions, such as environmental education, developing nature awareness, and ecotourism, increase the community's participation and awareness in firefighting. In this context, fire observation towers should be considered as surveillance structures and multifunctional structures aligned with sustainable development goals. Furthermore, innovative systems equipped with modern technologies enable the early detection of fire risks and save time in disaster management.

International examples shed light on different design approaches that could be implemented in Türkiye. The proliferation of sustainable tower designs in countries with high fire risk, such as the US, Spain, and Portugal, is instructive in terms of both forest management and architectural design. In the face of increasing fire risks, it is critically important for Türkiye to develop tower models compatible with its own geographical and climatic conditions and sustainable architectural principles.

In conclusion, designing fire observation towers in accordance with sustainable architectural principles is possible through a holistic approach encompassing many components, such as reducing environmental impacts, technological integration, efficient use of resources, community participation, accessibility, education, cultural sensitivity, and post-

disaster recovery [40]. Applying these principles will provide effective tools for fighting fires and contribute to the overall well-being of natural and social systems, strengthening an architectural approach compatible with natural ecosystems. Future studies focusing on design models that integrate the functionality of towers with ecological, economic, and socio-cultural dimensions will be instructive for sustainable fire management.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they no conflict of interest. The none of the authors have any competing interests in the manuscript.

References

[1] Küçükosmanoğlu, A. (1994). Forest Fires and Fire Seasons in Our Country, Journal of the Faculty of Forestry Istanbul University, 44(1-2):121-128.

[2] Cantürk, U., Koç, İ., Özel, H. B., & Şevik, H. (2024). Possible changes of Pinus nigra distribution regions in Türkiye with the impacts of global climate change. BioResources, 19(3), 6190-6214

[3] Ertürk, N., Arıcak, B., Yiğit, N., & Sevik, H. (2024). Potential changes in the suitable distribution areas of fagus orientalis lipsky in kastamonu due to global climate change. Forestist, 74(2), 159-165.

[4] Canturk, U., Koç, İ., Erdem, R., Ozturk Pulatoglu, A., Donmez, S., Ozkazanc, N. K., ... & Ozel, H. B. (2025). Climate-Driven Shifts in Wild Cherry (Prunus avium L.) Habitats in Türkiye: A Multi-Model Projection for Conservation Planning. Forests, 16(9), 1484.

[5] Mol, T. (1993). Orman Yangınları. Journal of the Faculty of Forestry Istanbul University (JFFIU), 43(3-4):69-78.

[6] Anonim, (1995). Communiqué No. 285: Application Principles for Preventing and Extinguishing Forest Fires, p 64, Ankara.

[7] Bilici E (2009). A Research on the Integration Planning and Implementation of Forest Fire Roads and Lanes and Forest Road Networks (Gallipoli National Park Example). Journal of the Faculty of Forestry Istanbul University,| İstanbul Üniversitesi Orman Fakültesi Dergisi, 59(2):85-102.

[8] Küçük, Ö., Topaloğlu, Ö., Altunel, A. O. ve Çetin, M. (2017). Visibility Analysis of Fire Look Out Towers in the Boyabat State Forest Enterprise in Turkey, Environmental Monitoring and Assessment, 189(329):2-18.

[9] Martell, D. L. (2007). Forest Fire Management, In Handbook of Operations Research in Natural Resources (pp. 489-509). Springer, Boston, MA.

[10] Akay, A. E., Sivrikaya, F., Yenilmez, N. ve Taylan, H. (2011). Evaluation of Fire Watchtower Locations with Visibility Analysis in GIS Environment, Ulusal Akdeniz Orman ve Çevre Sempozyumu, 24-26.

[11] Varol, T., Özel, H. B. ve Macaroğlu, K. (2010). Possibilities of Using Network Analysis in Forest Fires (Yenihan Forest Management Directorate Case Study), III. Ulusal Karadeniz Ormancılık Kongresi, 20-22.

[12] Kudu, M. U. ve Buğday, E. (2019). Evaluation of the Suitability of Fire Lookout Tower Locations (Ilgaz Forest Management Directorate Sample), Journal of Bartin Faculty of Forestry, 21(2):550- 559.

[13] Ayaşlıgil, T. (2007). Recreational Use of Urban Forests and Its Analysis in the Example of Istanbul Province, YTÜ Mim. Fak. Dergisi, 2(4):1- 24.

[14] Bereket, H. (2019). Spatial Analysis of Fire Lookout Towers: The Case of Isparta Regional Directorate of Forestry (Master's Thesis), Institute of Graduate Education.

[15] Ertugrul, M., Ozel, H. B., Varol, T., Cetin, M., & Sevik, H. (2019). Investigation of the relationship between burned areas and climate factors in large forest fires in the Çanakkale region. Environmental monitoring and assessment, 191(12), 737.

[16] Dogan, S., Kilicoglu, C., Akinci, H., Sevik, H., & Cetin, M. (2023). Determining the suitable settlement areas in Alanya with GIS-based site selection analyses. Environmental science and pollution research, 30(11), 29180-29189.

[17] Dogan, S., Kilicoglu, C., Akinci, H., Sevik, H., Cetin, M., & Kocan, N. (2024). Comprehensive risk assessment for identifying suitable residential zones in Manavgat, Mediterranean Region. Evaluation and program planning, 106, 102465.

[18] Çanakçıoğlu, H. (1993). Orman Koruma. İstanbul Üniversitesi Orman Fakültesi Yayınları, Yayın No. 3624/411, 632 s., İstanbul.

[19] Çoban, H. O. (2004). Bilgisayar Destekli Konusal Orman Haritalarının Üretilmesi, SDU Orman Fakültesi Dergisi, 1(2):83-96.

[20] Çoban, H. O., Eker, M. ve Nevzat, A. (2009). Assessment of Forest Storage Locations in Wood Supply Chain, 42th International Symposium on Forestry Mechanization (FORMEC-2009), Czech Republic, 1(1):38-43.

[21] Çoban, H. O. ve Eker, M. (2009). Post-Fire Harvest and Transport Planning Model, 1st Forest Fire Fighting Symposium, 07-10 January, Antalya, 395- 402.

[22] Çoban, H. O. (2011). Calculation of Averages Kidding Distance on Sloping Terrain with GIS Tools, SDU Orman Fakültesi Dergisi, 12(2):98-103.

[23] Cobanoglu, H., Canturk, U., Koç, İ., Kulaç, Ş., & Sevik, H. (2023). Climate change effect on potential distribution of Anatolian chestnut (Castanea sativa mill.) in the upcoming century in Türkiye. Forestist, 73(3), 247-256.

[24] Zeren Cetin, I., Ozel, H. B., Varol, T., Canturk, U., & Sevik, H. (2025). Climate change impacts on Taxus baccata distribution and conservation. Journal of Forestry Research, 36(1), 95.

[25] Isinkaralar, O., Isinkaralar, K., & Sevik, H. (2025). Health for the future: spatiotemporal CA-MC modeling and spatial pattern prediction via dendrochronological approach for nickel and lead deposition. Air Quality, Atmosphere & Health, 18(4), 1087-1099.

[26] Bao, A., Xiao, N., Lai, Z., Zhang, H. ve Kim, C. (2014). Optimizing Watch to Werlocations for Forest Fire Monitoring Using Location Models, Fire Safety Journal, 71, 100-109.

[27] Shi, X. Ve Xue, B. (2016). Deriving a Minimum Set of View Points for Maximum Coverage over any Given Digital Elevation Model Data, International Journal of Digital Earth, 9(12),1153-1167.

[28] URL-1. https://sosyalup.net/ormanin-gozleri-projesinde-yangin-gozetleme-kule-sayisi-5-oldu/?utm, (29.08.2025).

[29] Topaloğlu, M.Ö. (2013). Mapping of Fire Hazard According to Topographic Features and Combustible Material in Boyabat Forest Management Directorate and Mapping of Fire Hazard and Visibility Analysis of Fire Watchtowers, (Master's Thesis, Kastamonu University, Institute of Science).

[30] URL-2. https://www.aa.com.tr/tr/gundem/yangin-gozetleme-kulesi-personeli-gozunu-ormanlardan-ayirmiyor-/2606170, (29.08.2025).

[31] URL-3. https://minnesotafiretower.blogspot.com/2018/04/tower-plans-of-usfs-region6.html, (29.08.2025).

[32] Başar, M., Tosunoğlu, Ş. ve Kılıçaslan, Y. (2009). Efficiency Analysis of Forest Revolving Fund Enterprises in Turkey: Problems, Solutions and Policy Recommendations, TUBITAK, Project No:107K552, Ankara.

[33] Birben, Ü., Ünal, H. E. ve Karaca, A. (2018). Examining Social Perception Regarding Forest Resources (Çankırı City Center Example). Turkish Journal of Forestry, 19(1):76-82.

[34] Çelik, İ. (2020). Mobile Fire Watchtower, International Marmara Science and Social Sciences Congress.

[35] Tarım, S. (2000). Eskisehir Kalabak forests woody plants and their usage values (Master's thesis, Anadolu University (Türkiye)).

[36] Jones, J. (2020). A New Wilderness Lookout: Reimagining The Fire Lookout For Ecological Stewardship and Community Engagement, 1- 145.

[37] Demirarslan, D. (2023). Sustainable Approaches in Interior Architecture and the Environment, İKSAD Publishing, 1-236.

[38] Özmehmet, Ö. G. E. (2007). A Critical Look at the Understanding of Sustainable Architecture in Europe and Turkey, Yaşar University E-Journal, 2(7):809-826.

[39] Yalçınkaya, Ş. ve Karadeniz, İ. (2022). The Role of Waste Materials in Sustainable Architectural Design, Journal of Architectural Sciences and Applications, 7(2):750-762. https://doi.org/10.30785/mbud.1168291.

[40] Oktay, D., Gürçınar, Y., Çerçi, S. ve Mansuri, M. E. (2011). Ecology and Architecture, Southern Architecture Magazine, 1- 99.