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The conversion of the reinforced concrete post-war brownfield sites into greenfields: Green line buffer zone of Cyprus

Savaş Sonrası Betonarme Kahverengi Alanların Yeşil Alanlara Dönüştürülmesi: Kıbrıs'ın Yeşil Hat Tampon Bölgesi

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Abstract

Brownfield areas are hazardous areas that arise as a result of the disuse of industrial, commercial, and residential buildings, which pose an obstacle to planning and decision-making mechanisms for the regions in which they are located in terms of environment and energy, and are a global problem for settlements. In planning studies where sustainability principles are taken into account, both abandoned reinforced concrete structures and abandoned traditional structures that contribute to natural life should be considered together.
Brown field structures built with traditional and reinforced concrete materials can be seen in the green line region of the island of Cyprus. Converting abandoned building areas built from concrete material remaining in the unused buffer zone after the war on the island into green corridors is important to ensure sustainability.
In this context, the study was evaluated in line with the Wheeler Sustainability Principles, the weight of each marker was determined in line with the literature review and local expert reports, and a road map that could be used to transform brown areas into green areas was created. This study both contributes to the limited existing literature and reveals the effects of energy and environmental sustainability in abandoned areas.

Keywords: Brownfield, greenfield, renewable-energy, environment, green-line, Cyprus.

ÖZET

Kahverengi alanlar, endüstriyel, ticari ve konut yapılarının kullanılmaması sonucu ortaya çıkan, çevre ve enerji açısından bulundukları bölgeler için planlama ve karar alma mekanizmalarına engel teşkil eden, yerleşimler için küresel bir sorun olan tehlikeli alanlardır. Sürdürülebilirlik ilkelerinin dikkate alındığı planlama çalışmalarında hem terk edilmiş betonarme yapılar hem de doğal hayata katkı sağlayan terkedilmiş geleneksel yapılar birlikte düşünülmelidir.
Kıbrıs adasının yeşil hat bölgesinde geleneksel ve betonarme malzemelerle inşa edilen kahverengi alan yapıları görülmektedir. Adada savaş sonrasında kullanılmayan ara-bölge içerisinde kalan beton malzemeden inşa edilen terkedilmiş yapı alanlarının yeşil koridorlara dönüştürülmesi, sürdürülebilirliğin sağlanması için önemlidir.
Bu bağlamda çalışma Wheeler Sürdürülebilirlik İlkeleri doğrultusunda değerlendirilmiş, literatür taraması ve yerel uzman raporları doğrultusunda her bir işaretçinin ağırlığı belirlenmiş ve kahverengi alanların yeşil alanlara dönüştürülmesinde kullanılabilecek bir yol haritası oluşturulmuştur. Bu çalışma hem mevcut sınırlı literatüre katkı sağlamakta hem de terk edilmiş alanlarda enerji ve çevresel sürdürülebilirliğin etkilerini ortaya koymaktadır.

Anahtar Kelimeler: Kahverengi-Alan, Yeşil-Alan,, Yenilenebilir Enerji, Çevre, Yeşil Hat, Kıbrıs.

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Introduction

Brownfield areas negatively affect rural and urban living spaces and create a lot of pressure on living spaces in terms of decreasing environmental resources (Dubey & Narayanan, 2010). Therefore, it is revealed through literature research that globalization and modernization trends that started in the last century brought serious environmental disasters in settlements (Asilsoy et al., 2017; Yıldırım et al., 2020; Akansu & Karaman, 2023). At this point, the concept of brownfield emerges as an environmental disaster experienced in settlements during deindustrialization and suburbanization processes (Tang & Nathanail, 2012). Brownfields are defined by the US Environmental Protection Agency (1997) as "abandoned, idle, or underutilized industrial and commercial facilities where expansion or redevelopment is complicated by actual or perceived environmental pollution" (Alker et al., 2000). Additionally, brownfields in legislation may also reflect the approaches used by countries. European countries with higher population densities promote the efficiency of land recycling, while countries with lower population densities focus on cleaning (Oliver et al., 2005).

Accordingly, the increase in abandoned construction sites in recent years has damaged energy and environmental sustainability. There are many abandoned concrete structures on the Cyprus Green Line, which has been under UN control since 1974, negatively affecting the environment and human health. This study aims to evaluate the feasibility of transforming these areas into green corridors and analyze their effects on energy and environmental values.

Accordingly, the increase in abandoned construction sites in recent years has damaged energy and environmental sustainability. There are many abandoned concrete structures on the Cyprus Green Line, which has been under UN control since 1974, negatively affecting the environment and human health. This study aims to evaluate the feasibility of transforming these areas into green corridors and analyze their effects on energy and environmental values.

Abandoned buildings on the island of Cyprus emerge as a result of war, affect cities and rural settlements in terms of energy recovery, and reduce the quality of life by negatively affecting environmental parameters such as soil, air and water.

Research conducted in this context reveals that traditional structures provide the formation of habitats necessary for the protection of biological diversity (Francis, 2010). However, the damage that reinforced concrete structures, especially abandoned structures, cause to nature is indisputable. The materials used in these structures do not allow the protection of flora and fauna, on the contrary, they fill the land unnecessarily (Akansu & Gertik, 2018).

Former industrial areas appear as settlements with degraded ecological and natural areas and low livable limits. These areas can only be accepted into society if they are considered as a whole within the settlements. For this purpose, ecological sustainability can be achieved by using non-industrial areas together with the natural and architectural environment, climate characteristics, biodiversity (flora-fauna), topographic structure and natural resources. Ecological, cultural, social and economic resources of the areas to be restored are important factors in non-industrial regional area planning studies (Akansu & Gertik, 2018).

At this point, energy and environmental values are evaluated in terms of ecosystem life of living things and human health through Wheeler's Sustainability Principles (Wheeler, 1998). For this reason, Wheeler's Sustainability Principles will be used to measure the impact of brownfield conversion in the continuity of work. It is hoped that this study will contribute to the revitalization of these places and thus to the search for a solution to the political and ethnic conflict in Cyprus.

The research questions that will guide the study are:

How does the conversion of unused construction areas on the Cyprus Green Line into green corridors affect energy and environmental values?

What benefits and challenges does transforming abandoned spaces into green corridors present?

The methodology of the study includes the evaluation of environmental and energy indicators, as well as the socioeconomic analysis of the region. The expected results are the creation of a road map for the transformation of abandoned areas into green corridors and recommendations for the implementation of

public policies that promote sustainability in the region.

What makes Cyprus Green Line a worthy and important case to examine within the concept of a brownfield site is that the studies such as this one are promising in contributing to the revival of these sites and furthermore, to the resolution of the political and ethnic conflict that has been going on for more than 40 decades.

A critical evaluation has been put forward by discussing the benefits and drawbacks of converting unused concrete fields into completely green corridors on Cyprus Green Line which is designated as the study area. The potential environmental and energy impact of transforming and redesigning unused brownfield sites into greenfield sites has been discussed in this study

This study is an important contribution to the urban transformation and environmental sustainability literature. Its results are expected to be beneficial to local governments, environmental organizations, and society in general.

Theoretical framework of study

The method of the study was an important factor in the formation of the theoretical framework. In this context, brownfield-greenfield sites, ecological green corridors, and sustainability concepts are important for the theoretical aspect of this study.

The Brownfield concept is used as the opposite terminology of greenfield, which describes uncontaminated or undeveloped rural lands. These sites are dangerous areas that mostly result from the non-use of industrial, commercial, and residential buildings (Maczulak, 2009). They are identified as crucial areas which pose a threat to the sustainability of energy and the environment. Sustainable approaches evidenced the associated issues, problems, and potentials of brownfield sites and also helped all stakeholders to understand the importance of this issue (Beer & Higgins, 2000). It is important to transform these concrete, abandoned sites which became unused after the war, into green corridors to ensure the sustainability of the habitat and to provide them for the use of society.

The ecological green corridors, which are transformed from being reinforced concrete sites to a greenfield sites, contribute to protect the environment and providing quality living space for people. Furthermore, it helps to protect the habitats of the flora and fauna living in that region. New planning approaches such as; ecological corridors, green infrastructure and green roads, serve with a protective aim through directing urban development, controlling erosion and surface flows, reducing environmental pollutants, regulating microclimate, and providing habitats for wildlife (Yaman & Doygun, 2014).

Thus, while forming green corridors, implementation of suitable renewable energy resources (solar, wind, hydraulic, geothermal, biomass, and sea and ocean energy) has inevitable effects on the sustainability of a habitat's environmental values, its energy gains and human health.

Wheeler's Sustainability Principles are very crucial in guiding the applicability and development of sustainable environments and sustainable energy of areas that are left unused after a war. In line with these principles, the energy gains and environmental values are as follow:

1. It demonstrates its use for the protection of flora and fauna in ecosystems in compact and balanced land use. Brownfield sites represent areas with unused, abandoned buildings and their surroundings, and these sites are problematic in terms of utilisation of the land because they do not contain green spaces that would allow the development of ecosystem flora and fauna.
2. Vehicle use and easy access is a sustainability principle which demonstrates that driving a motorised personal vehicle would cause air pollution, thus supporting the use of bicycle, battery-powered vehicles or walking. The areas that are currently defined as brownfields and are closed for public use are problematic regions because they adversely affect sustainable energy and environmental value.
3. It supports rational use of resources, waste reduction, prevention of environmental pollution, minimised use of non-renewable energy resources and to support the use of renewable energy resources which protect the environment.
4. The restoration of natural systems lead to renewal and protection of open areas, valleys, canals, creeks, green corridors, topographic features of natural structure of the environment It supports the development of post-war from brownfield to green spaces.

5. It is an approach that supports the preservation of good housing and living environments, traditional building areas and natural building values. In the brownfield areas, good housing and living environments are replaced by waste sites and hampering the preservation of environmental values.
6. Healthy social ecology is a principle that aims to ensure social equality, meet the basic needs of people, create adequate jobs and conditions for social life. Sites that are closed to the public after a war, are problematic regions in terms of healthy social ecological values.
7. Sustainable economy is put forward through creating conditions in which future generations will not have difficulties to use resources, produce policies and distribute social welfare equally. Brownfield areas are also problematic in terms of healthy sustainable economic values.
8. Public participation is one of the principles which supports the public to have a say in the production of policies that will ensure equality, equal distribution of resources and welfare to all. Areas that are closed for public use are also problematic in terms of environmental sustainable values.
9. It supports the preservation of local culture and social values, agricultural production, natural resources and texture of local architecture. Brownfield settlements pose problems in development of local architectural texture, and the protection of local values and social values, natural resources and agricultural production.

Accordingly, the need for brownfield regions, which impact negatively on energy resources and environmental parameters, to be converted to green areas and the need for further studies in this field is put forward.

Methodology

The study method consists of revising the existing approaches in the literature to determine the context; the documentary analysis included reports prepared by public officials and experts within this field. Visual data was also employed which included maps and photographs. Maps were derived through satellite views secondary data on abandoned sites were derived through photographs taken by others and content analysis was applied.

Within the context of energy and environmental sustainability, the conceptual framework is formed through the use of renewable energy concepts proposed in Wheeler's Sustainability Principles and through concepts developed on brownfield sites as well as literature on the use of renewable energy in ecological green corridors.

Besides, the research was conducted in the last quarter of 2022 by reportage (questions and answers) to participants consisting of 50 experts (architects, engineers, urban planners, environmental scientists, non-society organizations). When preparing questions from participants within the framework of 9 principles published by wheller in 1998:

1. Compact, balanced land use
2. Vehicle use and easy Access
3. Rational use of resources, reducing waste, preventing environmental pollution
4. Restoration of natural systems
5. Good housing and living environment
6. Healthy social ecology.
7. Sustainable economy
8. Community involvement
9. Preservation of local culture and social values. Brownfield asked for opinions from the sample regions on energy and environmental values.

Moreover, to conduct an assessment of the current state of the region, the reports and publications prepared by city and regional planners, architects, engineers and individuals who have been actively working for many years in North Cyprus, have been analysed.

The life of ecosystem-living beings and human health data cross-assessment matrix was created from data derived from this study in accordance with Wheeler's Sustainability Principles in line with the study of energy and environmental values. The advantages and disadvantages of renewable energy resource utilisation and the conversion of the existing concrete structures into completely ecological green corridors were evaluated through this matrix.

Results and discussion

Island of Cyprus Green Line Formation, Development and Assessment of the Current Situation

Cyprus has been home to various civilizations such as Catholic, Archaic, Classical, Hellenistic, Roman, Byzantine, Arab Navy, Frankish, Lusignan, Genoese, Venetian, Ottoman, and British administrations. It is still an island where political, social, cultural, and architectural differences are being experienced. Cyprus was

under British rule during 1878-1960. After the establishment of the Republic of Cyprus, the Island was co-administered by Turkish and Greek Cypriots. However, due to political conflicts, it was divided into two regions in 1974. The line that divides the Island into two parts is called the Green Line. (Figure 1) The United Nation controlled Green Line occupies approximately %3 of the landmass of the Island of Cyprus (Grichting, 2010a). Frozen in a military status quo for the past 43 years, this strip of land swallows up abandoned settlements.

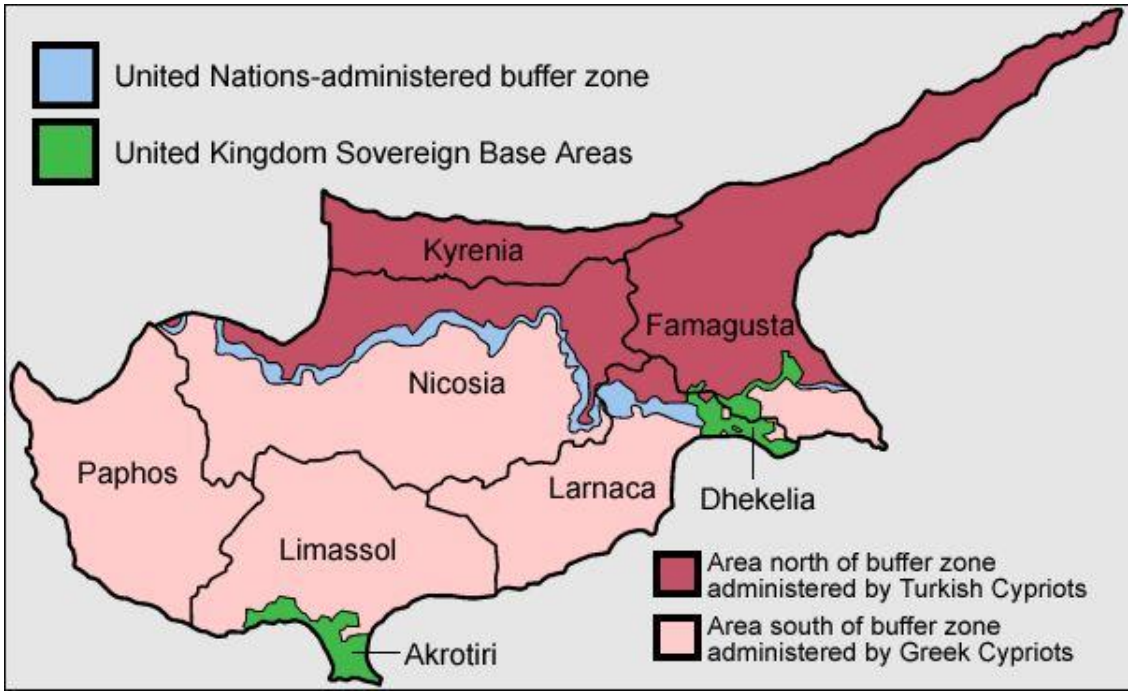

Figure 1. Cyprus Buffer Zone (Collet, 2023)

The present boundaries of the Green Line was determined in 1974 by the Cyprus Peace Operation. It is used to determine the region which separates the Turkish Republic of Northern Cyprus (de facto) and the Greek Cypriot Administration in Cyprus. It was first introduced in 1964 by Peter Young, commander of the United Nations "peacekeeping forces". General Young, who sent his forces to different parts of Nicosia, drew a line on the map with a green pencil. This line is then called the "Green Line" and determines the borders between the North and the South (Borowiec, 2000). Initially, the Green Line was under British control which later on was controlled by the military of the United Nations (Christofides, 2007). Assuming Nicosia as the center, the area that the line that divides through the East and the West regions, truly reflects Cyprus in terms of ecological values and landscape.

From the river deltas and sandy beaches of the East Coast (Famagusta-Varosha), it connects with the rocky shores of the West Coast (Kokkina Enclave), passing through wetlands, fertile plains, and hills, and following the crest of mountains, it stops in Troodos (Grichting, 2010a). Investigations into the unexpected flourishing of nature on the Green Line (flowers, birds, insects, and mammals) were undertaken by scientists from both Turkish and Greek Cypriot communities confirmed that the so-called 'Dead Zone' of Cyprus was in fact, a thriving landscape of biodiversity (Gucel et. al, 2008).

However, many structures are not used within the region that is known as the Buffer Zone which is under the United Nations administration. Although parts of these structures that are built with traditional materials help preserve and develop biological diversity, it is observed that there are problems in the areas constructed with reinforced concrete materials. These problematic constructions, which are referred to as brownfields, have a negative impact not only on people visually but also in terms of the sustainability of energy and the environment. The area of the Green Line is similar to other military buffer zones around the world as in the examples of the Korean Demilitarised Zone. This is because, due to its isolation, the Green Line became really green and it has become a haven of biodiversity (Grichting, 2010b).

Cyprus green line brownfield site study

Part of the areas within the borders of Cyprus Green Line consists of greenfield areas. Assuming Nicosia is the center, greenfield areas are mostly observed on the western part of the Island, from the hills of Lefka to the hills of Troodos Mountain. There are some greenfield areas to the east of Nicosia. This area extends to the village of Pyla, the British Sovereign Bases, and Varosha city known as the ghost city.

The investigation conducted for this study suggested that the density of the brownfield areas increases in Nicosia, the industrial areas of Lefka Cyprus Mine Corporation, and Varosha. In this respect, this study focuses on;

- Settlements in the Nicosia region,
- Varosha Region in the East of Nicosia, and
- Unused area of CMC in the West region of Nicosia.

Settlements in the Nicosia region

Besides traditional material and concrete buildings and commercial areas, one of the biggest airports of its time, Nicosia International Airport is also in The Green Line region in Nicosia. Historic Nicosia center is 5 km away from the abandoned airport, which constitutes one of its widest sections. (Figure 2)

Figure 2. Nicosia Green Line and Important Brownfield Areas (by Authors)

Nicosia International Airport was built in 1939 from reinforced concrete material and after 1947 it became the only international airport on the island (Milliyet Newspaper, 2014). Despite its active use during 1947-1974, it still causes a problem in terms of energy and environment as it occupies thousands of acres of land (Figure 3).

Figure 3. Present Day Nicosia International Airport Left Unused (Milliyet Newspaper, 2014)

Varosha region in the east of Nicosia

Varosha, one of the settlements of Famagusta once was a trade and tourism center. However, this situation has only been sustained for 15 years. From time to time, political and economic factors can create changes in cities and the Varosha region is one of the examples that experienced the change (Akansu & Duman, 2022). In other words, Varosha evidences the contradicting political desires and economic expectations and it is involved in negotiations for political reconciliation in Cyprus (Pyla & Phokaides, 2020). The situation is not very different in Varosha.

The settlement which is located within the borders of Famagusta city was left in the Green Line region after 1974 and is not being used ever since except for a couple of buildings (Figure 4)

Figure 4. Varosha brownfield settlement within the borders of Famagusta city (BY Authors)

Varosha was a very popular holiday destination until 1974, thus it harbors many touristic facilities and commercial buildings that became brownfield areas today. This area is observed as a problematic area in terms of energy and environmental destruction (Figure 5).

Figure 5. Varosha Brownfield's view (NTV, 2020)

Unused area of CMC in the west region of Nicosia

Besides the aforementioned settlements, part of Cyprus Mining Corporation (CMC) settlements passes through the Green Line. During the industrialization period, CMC was one of the first industrial examples located in Lefka which is on the west of Nicosia. This area is not only known to be an environmental problem for the Mediterranean but also it is among the areas that pose an environmental problem because it is unused. (Figure 6)

Figure 6. Brownfield settlement of CMC in Lefka (By Authors)

Part of Nicosia, CMC settlements, and Varosha are observed as brownfield areas after 1974 due to political reasons. As a result of studies conducted, it can be said that these settlements are problematic in terms of visual, energy and environmental sustainability.

Varosha, CMC settlement area in Lefka and part of Nicosia city are considered as after-war brownfield areas resulting from political reasons. It is observed that these unused settlements were concluded as problematic sites not only visually but also in terms of sustainability of energy and environment.

The Evaluation of Energy and Environment of Brownfield Site

The buildings in brownfield sites were built by reinforced concrete material, which was widely started to be used on the Island during the 1950s. Studies have shown that reinforced concrete structures, which are not in use today, increase carbon emission and adversely affect the living life in the environment by increasing greenhouse

effect and disrupt the balance of the ecosystem. In this respect, these buildings in the buffer zone were evaluated through Wheeler's Sustainability Principles in order to determine the current state of energy and environment. Also assessments and recommendations were also made on the ecosystem, life of living and human health on the presented table (Table 1).

Table 1.
Energy and Environment Evaluation of Wheeler's Sustainability Principles in Brownfield Assessment.

EVALUATION OF CYPRUS GREEN LINE AFTER WAR			
Wheeler's Sustainability Principles	**BROWNFIELD ASSESSMENT**		**Recommendation-Assessment** Ecosystem, Living-life and Human Health
	Energy	**Environment**	
1. Compact, balanced land use	Unused concrete materials increase the greenhouse effect and it does not allow the land to be used in order to provide an opportunity to use renewable energy sources.	Unused buildings, situated on these lands cause irregularity of green area formation which would have provided an opportunity for the development of flora and fauna.	**It is not possible to observe this principle in brownfield areas.** These areas pose a threat to ecosystem-living life and human health. Brownfield areas should be re-introduced to the usage of the society by taking into account the environmental and energy values.
2. Vehicle use and easy access	The fact that the region is closed to public access constitutes an obstacle in making decisions regarding the use of renewable energy sources.	It is observed that today, plants grow irregularly and unhealthily through buildings and transportation axes.	**It is not possible to observe this principle in brownfield areas.** Unhealthy development of flora and fauna led to the loss of pedestrian and vehicle axles. Visually, this impacts on human psychology negatively.
3. Wise use of the sources, reduction of wastes, prevention of environmental pollution	The region should be put into use in order to be able to propose nature protecting renewable energy resources.	The prevention of environmental pollution caused by unused structures in the region is possible through regional planning towards the utilisation of the area.	**It is not possible to observe this principle in brownfield areas.** In order to ensure human health and ecosystem diversity, the region should be freed from environmentally polluting brownfields, and planning efforts that support renewable energy resources should be put into practice.
4. The restoration of natural systems	Natural building areas that may be suitable for the use of renewable energy sources are not perceived.	Topographical features, open spaces, valleys, canals, creeks, and green corridors in the natural structure of the environment have disappeared.	**In brownfields, this principle irregularly develops in inside and outside of buildings.** Topographical features in the natural structure of the environment, open spaces, valleys, canals, creeks, and green corridors should be identified and a planning system which supports environmental and energy sustainability should be established.
5. Good housing and living environment	The use of renewable energy systems is important for the creation of good living spaces and environments.	The conversion of unused buildings into natural areas has a great importance for the local community.	**It is not possible to observe this principle in brownfield areas.** Green Line harbours unused buildings and is environmentally problematic for those living in the North and the South of this line.

6. Healthy social ecology.	-	People's negative feelings caused by abandoned and unused areas, adversely affect the formation of a healthy social life.	**It is not possible to observe this principle in brownfield areas.** In order to create healthy social areas and positive human psychology, the region should be cleansed from unused areas.
7. Sustainable economy	The required budget should be provided so that necessary renewable energy systems can be used in order to be able to maintain sustainability.	It is necessary to create conditions and develop policies in which future generations will not have difficulties to use resources.	**It is not possible to observe this principle in brownfield areas.** The programmes which provide necessary economic support to increase ecological diversity and healthier development of future generations, through the use of renewable energy, should be supported.
8. Community participation	Ensuring the equal distribution of renewable energy resources to be used in converting the abandoned areas for society use.	Necessity to get the opinion of experts and the public when decisions are made on abandoned areas and related environmental problems.	**It is not possible to observe this principle in brownfield areas.** To support planning decisions which would encourage public say on decisions that are related with human health and ecosystem.
9.Protection of the local culture and social values	-	Brownfield settlements adversely affect the necessary environmental development in the preservation of local culture and social values.	**It is not possible to observe this principle in brownfield areas.** To support planning activities on abandoned areas in terms of development of human health, and preservation of ecosystem, local culture and social values.

(Created as a table By Authors)

Within the context of this study, when Wheeler's Sustainability Principles are assessed, since the abandoned areas and the living areas around them are not used actively, the renovation of these areas will be possible only through large economic investments. However, by doing so, would also lead to the loss of biodiversity that currently exists around traditional abandoned structures. Evaluating the overall benefits it would provide, it is suggested as appropriate to form ecological green corridors which are thought to be beneficial for the settlement areas in North and South in the Green Line region and also to take action for planning on renewable energy sources.

Discussion

The study and the observations conducted reveal that it is necessary to carry out planning studies for the conversion of abandoned areas to green areas. In this study, the approach that supports the use of renewable energy sources in the process of converting the existing green areas into green corridors along with the abandoned areas has been put forward. In this respect, the advantages and disadvantages of the unused areas on the Green Line in Cyprus are determined as follows (Table:2).

As a result of the assessments and observations, it is concluded that there is a need to have planning activities towards transformation of abandoned sites into green areas. In this study, it is suggested that use of renewable energy resources is supported by transforming brownfield sites into greenfield sites and considering them as integrated with greenfield sites which exist both in the North and in the South. In this respect, the benefits and the drawbacks of the current situation in the unused areas that exist on the Green Line have been discussed in Table 2.

Table 2.
Benefits and Drawbacks of the Current Situation of the Green Line

Benefits	Drawbacks
The presence of both brownfield and greenfield areas on the Green Line border.	Brownfield areas' coverage has a negative impact on sustainability of energy and environment.
That the Green Line runs through both the sea and mountain slopes.	The dense existence of abandoned structures in areas with special importance.
The existence of natural habitat between the divided North and South Cyprus. Particularly observed in areas without any structures or in areas with only abandoned traditional structures.	Although reinforced concrete structures in the Green Line region are not used, along with the developing settlements outside the buffer zone, there is an increased greenhouse effect.
Excluding brownfield sites, observation of normal development of fauna and flora in greenfield areas where there is no settlement.	Brownfield areas poses an impediment against the normal development of flora and fauna.
Within the context of planning activities, greenfield sites can turn into green areas and proposes a potential renewable energy.	The need for some improvements in transforming the brownfield areas into green areas.

(Created as a table By Authors)

Furthermore; it has been demonstrated that the environmental values in the area are suitable for ecology, environmental sustainability, and the use of renewable resources. Harboring lands with different features at sea and mountain levels played an important factor when this argument was put forward. Another important detail is the fact that the areas outside the identified abandoned areas on the Green Line are greenfield areas, which are considered to be an important opportunity. The benefits and drawbacks of decontamination of the concrete area and its conversion to a completely green area are presented in Table 3.

Table 3.
Potential benefits and drawbacks of future transformation of brownfield areas to greenfield areas on the Green Line

Benefits	Drawbacks	Discussion		
Flora and fauna is expected to show a balanced development in terms of biological diversity in the coming years.	It is expected to take some time for the area to be purified from abandoned buildings and to be transformed into green areas, and for nature to adapt itself within a period of time.	By purifying the area from brownfields, the amount of oxygen will increase, the amount of carbon dioxide will decrease; thus the greenhouse effect will decrease accordingly.		
Studies will be made towards the usage of renewable energy resources by determining the natural resources of the area.	The fact that the unused buildings and the area are furnished with unrenewable energy that cannot be renewed.	The abandoned areas which are proposed to be transformed are suitable for positioning wind turbines and solar energy panels that can be used by both North and South Cyprus.	*Suggestion: Brownfield site sustainability*	*1.Restoration of natural System 2. Wise use of sources, reduction of wastes, prevention of environmental pollution*
An arrangement taking renewable energy resources into account, which would make it possible to transform abandoned areas into an area jointly used by both South and North settlements.	It will be insufficient to apply Wheeler's Sustainability Principles only on the abandoned buildings on the Green Line.	A large amount of financial support is needed to introduce regulations and planning which would encourage the use of renewable energy resources or to re-utilise abandoned areas within the region.		

(Created as a table By Authors)

According to the findings, it is argued that the abandoned buildings on the Green Line can be successfully re-used with a planning approach that would be developed in line with Wheeler's Sustainability Principles and keeping the whole Island of Cyprus in focus, and not only the Green Line region. This can be achieved by allocating a certain budget and joint action by two communities. When the current socio-political situation is considered it is suggested that it would be beneficial to plan the transformation of abandoned concrete areas into green areas which would allow the protection of biological diversity given the fact that;

- Majority of the Green Line is made up of greenfields
- The necessary conditions for renewable energy and
- It would be easily applicable under the control of the United Nations.

Suitable renewable energy sources for the region's conditions should be identified (i.e.: solar and wind energy) and used. Thus, the area which is currently problematic in terms of energy and environment will contribute to human health and living beings through the use of environmentally friendly renewable energy.

Conclusion

Brownfields are a global problem that poses an obstacle to planning and decision-making for the regions in which they are located in terms of environment and energy. A conceptual approach is needed to make this controllable and manageable. Restoration works that take sustainability principles into account lead to the destruction of biological diversity; Because in such planning studies, both abandoned reinforced concrete structures and abandoned traditional buildings that contribute to natural life need to work together.

However, the situation in Cyprus is that the Green Line (Settlements in the Nicosia region, Varosha Region in the East of Nicosia, and Unused area of CMC in the West region of Nicosia.) is closed to the public and has been under the administration of the United Nations since the post-war period. Therefore, it requires the development of different approaches. Thus, since there is no evidence of biodiversity in abandoned, reinforced concrete structures, they can be transformed into an ecological green corridor that includes green areas.

In this context, a planning approach is proposed that will provide the opportunity to create an ecological green corridor where solar and wind energy sources from renewable sources that may be especially suitable for Cyprus can be implemented. To ensure the applicability of the planning approach, firstly after the cleaning of the brownfield areas in the region.

Solar energy panels and wind roses are recommended to be installed in the region. In addition to this, designing pedestrian and bicycle axles in the revival of the area without users is another important suggestion.

Thus, it is expected to contribute to the protection of biodiversity as well as energy production by using renewable resources that can be used by both Northern and Southern Cyprus.

Accordingly, these benefits are expected to be achieved by transforming unused building areas into ecological green corridors;

- Cleaning the area from abandoned concrete structures that create environmental pollution,
- Reducing the greenhouse effect,
- Elimination of psychological pressure caused by visual impact,
- Emergence of lands suitable for the use of renewable energy resources.
- Cleaning the area that prevents the development of flora and fauna,
- There is an expectation that environmental and energy values will increase, biodiversity will increase, and positive effects will be provided to human health and living things.

In this study, the importance of using renewable energy and using ecological corridors for human health and the continuation of the ecosystem by benefiting from existing biological diversity and bringing lost ecological features to abandoned and reinforced areas is discussed. by cleaning them.

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