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Role of green belt in reducing city pollutants.

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ABSTRACT

The article discusses the role of green belts in reducing pollutants in cities. A green belt is a strip of land surrounding a city or industrial area that is designed to reduce air pollution by intercepting pollutants before they can spread further. Green belts are important in reducing air pollution, improving air quality, and promoting a healthy environment. The design and management of green belts, including selecting plant species, planting patterns, and maintenance practices. It emphasizes the importance of choosing plants that are tolerant of air pollution and can effectively absorb pollutants. The importance of meteorological conditions in regulating the transport and dispersion of pollutants in the atmosphere. It needs for a comprehensive approach to air pollution control, including the use of green belts, emission reduction technologies, and pollution monitoring systems. Overall, the importance of green belts in reducing air pollution and promoting a healthy environment. It needs for a comprehensive approach to air pollution control and the importance of choosing the right plant species and design for effective pollution reduction.

***Keywords*:** Green Belt, Landscape, Air Quality.

INTRODUCTION

Most parts of the world suffer from dust storms, desertification phenomena and excessive increase in air pollutants with high toxicity to humans and animals, and the increase of urban areas at the expense of vegetation cover in an uncontrolled manner in large cities has resulted in a significant imbalance in the environmental balance[1], which led to extreme temperatures and the rate of rainfall, which increased the severity of climate phenomena, especially in recent years, influenced by the global warming phenomenon and the atmosphere's increased concentration of greenhouse gases, particularly carbon dioxide and dust[2], the increase in the population, the expansion of cities, the unprecedented increase in the number of cars, modes of transport, factories and the increasing need for energy production in all its forms led directly and indirectly to the release of millions of tons of pollutants and harmful gases into the air every day, and the increase in the percentage of carbon dioxide in the atmosphere contributed to As a result of global warming, drylands expanded at the expense of wetlands, and this led to an increase in the frequency of dust storms over the past years [3]. It has become clear the seriousness of the environmental degradation of the cities and countryside of Iraq and the destructive effects of dust storms, which requires a reordering of priorities, by making attention to the rehabilitation of the degraded environment one of the most important priorities of the government[4], especially the rehabilitation of degraded desert areas, and taking remedial and preventive measures to restore the health of these areas, improve the characteristics of their soil and vegetation cover and become one of the most important pillars for the development of the environment in them, and an integral part of plans for Sustainable Development. It calls on the government to take immediate and urgent measures because it cannot afford to wait, as not doing so at present will complicate matters and exacerbate the problem. Hence the initiative of the ambassador and permanent representative of Iraq to the United Nations Food and Agriculture Organization (FAO)to propose the formation of a supreme national body to address this serious national problem and to stop the deterioration by developing plans based on comprehensive environmental studies, taking measures to protect soil and vegetation, intensifying agriculture, especially the propagation of drought-resistant trees, monitoring the movement of sand and stopping its encroachment. It was also proposed that a national green belt with an integrated road map be established to achieve this project [5].

It is open, un built areas surrounding cities, intended to limit urban sprawl other than Disciplined, preserving the natural environment and improving the quality of life of urban residents [6]. There are several types of green belts, the so-called regional green belt, which is a continuous extension of land reserved for environmental functions or recreational purposes, and therefore, settlement or other uses that are functionally incompatible are prohibited. The green belt can be viewed as a planning" tool "or a policy" tool"; it is the importance of these functions that determines the importance or appropriateness of the green belt. the main function of green belts has been to guide and contain urban development. there are several reasons why this is important or necessary. urban containment can help ensure effective land use and service delivery in the city, as

it protects agricultural land [7]. Definition of the regional green belt: - it is an open extension of pre-existing natural, forest, or agricultural areas arranged in coordination and planning around the orbits of cities or urban areas or in some parts thereof, a green area located on the outskirts of cities, and it is often crescent-shaped, composed of various plants, herbs and windbreaks and can include lakes, nurseries and Meadows as well, usually forming a green corridor to urban sites.[8].

The term green hedge is defined as an alternative to the green belt policy, and the green barrier can be used for the protection of open land. this strategy helps to shape urban growth during its development. it preserves and strengthens the links between urban and rural areas and facilitates positive Land Management [9] .The distinctive purpose of the green barrier is to avoid merging between large built-up areas and villages. In contrast, the purposes of assistance in urban renewal or verification of unrestricted extension characterize the green belt policy, which the green barrier lacks [10] .

However, the green barrier as an urban policy in several countries, such as Britain, Germany, and others, cannot compete with the green belt that is mainstream. It is an urban policy only at the local level in the UK. Both plans for these two examples can be dated back to Abercrombie's Greater London Regional Plan as inspiration, while their form is quite different. These two cities have developed themselves with extensive urbanization and sprawl along Green barriers [6].Whatever the form and name, all these green spaces or structures are used to maintain and promote urban growth as well as reduce and control it[11], while the green belt is a more commonly used designation than green barrier, both help to define open land around urban areas[12].

Protection and delimitation are incompatible with the expansion of urban development in rural areas and have become a concern for designers because unreasonable expansion means unnecessary increases in the cost of communal services, the conflict between agricultural and urban activities, and the loss of open spaces and natural beauty around urban areas [13]. By establishing borders between cities and the surrounding open space, the "global" solution to restrict urbanization is seen to be found in the green belt concept. [14], and this policy paralleled the rise of modern city planning in the nineteenth century and was pioneered in the United Kingdom by [15] and widely accepted all over the world, among Europe, Asia, Oceania and North America. It is a landmark for planners who have struggled to bring urban sprawl under control and to separate Urban from rural areas [16] strictly. As defined by According to the Royal Town Planning Institute (RTPI) [17], an urban policy called a "green belt" is intended to prevent sprawl and safeguard cities. It is also understood to be "an urban shaping tool intended to control urban growth at the regional and sub-regional levels." " [18].

There are other models of green belts such as the perimeter model, which is a continuous green belt surrounding the central city. This green wedges model are strips of open land extending to the city center and separating the built-up areas. This green heart model is a large open area located within a multi-center urban area, the protected areas model, a system of protected areas surrounding the city, the ecological network model, a system of areas with high environmental value and links between them. Urban growth boundary model, a line that defines a growth boundary The city protects the open areas located outside it [19].

The green belt is of great importance for urban planners as it helps in urban regeneration by encouraging the recycling of abandoned and other urban land [20] it also preserves the character of historical cities by preventing the integration of urban areas and preventing urban expansion by keeping areas open and undeveloped permanently and effectively as it protects the natural environment from the incursion of Urban Development and improves the aesthetic appeal of urban areas and provides recreational areas for urban residents [21]and at the same time preserves the character of rural communities close to urban areas that determine the expansion of the city requires designers to encourage the redevelopment of urban areas and finally, the green belt provides a buffer zone that helps reduce pollution and improve the quality of Urban the air also preserves wildlife habitats and diversity Biology [22] Green belts face many challenges, including urban pressure, changes However, green belts remain an important planning tool that can Green belts also act as invisible borders, preserving natural spaces, improving air quality, and providing recreational opportunities for urban residents. Their effectiveness varies by location and country, but their importance remains undiminished and irreplaceable despite the opposition of some planners [23].

The role of the green belt in Environmental Protection:

The green belt is a green plant area in urban areas or outside it that has been created naturally or with the intervention of planners and designers in the urban or agricultural field, that extends to certain areas and a certain depth, to achieve benefits in several areas .Although it is impossible to enumerate all the benefits and functions of green belts in this article, it is known that green belts, whether natural or created next to or within cities, play many vital roles [24]. The goals of preserving and creating green areas and spaces are many and varied, and vary according to the different creators and those in charge of them, according to the tasks envisaged by them, and the geographical, environmental, social, and economic characteristics of the place or city.

The green belt represents the first line of defence to protect the environment from degradation, create an ecological balance in the region, reduce temperatures, achieve economic benefits [green economy], and secure food and consumer crops for the urban area, which contributes to the self-sufficiency of the local market in cities. The success of the Green Belt project around the cities will lead to the formation of a harmonious system between man and the surrounding environment that ensures the protection of the agricultural environment, as well as will work to provide an entertainment outlet to keep pace with the increase in population and urban sprawl in the outskirts of the urban area, represented by tourist and recreational trips and securing a National Botanical Garden in the city [25].Vegetation cover is used in many countries to reduce the impact of dust.

this process is called phytofiltration. A wide vegetative green belt can reduce about half to two-thirds of the falling dust. phenotypic characteristics such as leaf arrangement on branches, leaf form and size, surface characteristics, and presence and absence of surface coating, and the deposition of waxy substances are important factors on which the phytofiltration process depends to trap dust from the surrounding air [26]. Certain types of vegetation can efficiently absorb CO2 from the atmosphere. absorb air pollutants. As it intercepts tons of factory dust, acting as a sound damper on busy highways and factory areas with loud sounds, many Plants have the ability to capture airborne dust. and reduce the concentration of dangerous and poisonous gases such as SO2, CO2, etc., the susceptibility of trees to the removal of air pollutants such as SO2, HFC, and some chemicals involved in photochemical reactions and the collection of heavy metals from the air, including lead (Pb) and mercury (Hg). Trees transform air pollutants after absorbing them. into harmless compounds via a number of physiological mechanisms, and of course, all types of trees not be able to regulate air pollution. Only those that can withstand Pollutants may function as pollution mitigators, the increased vegetation cover in towns, cities, and Industrial Enterprises holds great Possibility of controlling air pollution since plants can remove pollutants in three different ways, namely leaf uptake, deposition of particles and aerosols on the surface of the leaves and the fall of particles due to the slowed air movement on the (downwind) side of the vegetation [27]. Particles suspended are deposited on surfaces in the atmosphere of plants through the processes of precipitation in the presence of gravity, impaction when eddy currents are present, and precipitation when precipitation is present.Precipitation generally causes particles to accumulate on the upper surfaces of plant components and is most .significant containing big particles. The form, density, and other characteristics of the particles affect how quickly they sediment. The impact happens when air moves rapidly over the obstacle and the air stream splits, but the Because of their momentum, airborne particles prefer to travel in a straight line. and collide with the barrier. The effectiveness of the gathering by collision is the main means of sedimentation if the size of the particles is within 10 micrometers or more, the size of the obstacle is within a centimeter, the speed of approach is within 1 M / S or more, as well as the surface of the collection is wet or sticky with the presence of bristles or adheres in one way or another [28].

[29] presented information showing that petioles on leaves are a particle Impactor and much more efficient than twigs [stems] or leaf blades. For particles with dimensions of 1to5 micrometers, impaction isn't effective and the interception of delicate hairs on vegetation is probably the most efficient retention mechanism off [30]. The speed of precipitation typically states the transition of atmospheric particles to naturally occurring surfaces. For instance, aerosols with less than one micrometre in size, the deposition speeds are much lower compared to big particles like pollen and spores with a diameter of 20-40 micrometers. The most prevalent association between trace metals and micro-particles is that of heavy metals in polluted atmospheres. Trace element investigations carried out in roadside, Urban and industrial settings have made a major contribution to the amount of heavy metals that may build up on plant surfaces Based on a survey of sources, the efficiency of particle removal for trees was estimated based on the following assumptions [31]. The average speed of particle deposition for trees1 CM SEC-1 and for grass and bushes 0.8 cm SEC-1, the index of leaf area is For deciduous trees, see 5.1, 2.3 for conifers, about 2 hectares of leaf area for deciduous trees, and 1 hectare of surface area for conifers per hectare-1 of the land area.Below we summarize the essence of findings from field surveys and experimental studies conducted by many researchers on how greenery helps reduce air pollution.Plants are capable of intercepting and retaining airborne particles highly variable and depends mainly on: the size and shape, humidity, and surface texture of the fragments, as well as the size, shape, humidity, and texture of the intercepted surface plant the surrounding micro-, ultramicro-, and particulate environments of the plant [32]More information regarding the physical and the particle's mechanical characteristics deposition under under regulated circumstances as opposed to the efficiency of accurate capture and trapping of different plants and species in their native habitat, in general the surface roughness of a large sheet with its area increases the efficiency of particle capture of sizes with a diameter of about 5 micrometers (and less). Smooth-leaved species [for example, horse chestnut and yellow poplar] are less efficient than coarse-leaved species (for example, Elm and hazel). The surface roughness reduces the stability of the surrounding layer of air around the Leaf [the area of obstructed airflow] encircling the leaf and hence causes more particle jam. leaf bristles and veins in leaves are also considered to be major contributors to surface roughness. small leaves generally collect particles more efficiently than large leaves. particle deposition [but may not settle on them is heavier at the tip of the leaf and along the margins of the leaves where there is a jagged surrounding layer. Also, irregularly shaped leaves and a large perimeter-to-leaf area ratio gather dust particles more efficiently, and increasing wind speed and particle size usually increase particle deposition speeds. the speed of deposition on petioles and stems is generally several times greater than the speed of deposition on leaf plates. The collection of atmospheric particles by deciduous species in winter may remain very high due to the density of branches and shoots in conifers are generally more effectively deposited and capture particles than deciduous species. more thorough experiments should be conducted on the techniques used to re-capture particles or eliminated from tree surfaces in another way. it has also been found that leaves with abundant trichomes (leaf bristles) are more efficient in accumulating effective particles [33].

The development and design of the green belt include the use of pollution-tolerant plants to improve air quality, the selection of suitable plant species, the determination of climatic indicators, the study of local and prevailing wind direction behaviors and temperatures, the nature of pollutants to reduce their concentration rates in the air, and the general landscape of the area. The design and configuration of the green belt may vary from one location to another and from one industry to another. The oversimplified methodology of just placing some aggregates of trees surrounding an industry might not

accomplish this goal., The planning of the green belt also includes the aesthetics of the landscape and the selection of plant species, as well as taking into account the characteristics of plants such as pathogenesis, canopy structure, foliage shape, average plant height, flowering potential, and overall productivity. This involves a thorough examination of plants in both horticultural and natural settings, to determine their eligibility and potential performance in a demanding environmental situation. The state of physical of contaminants could be gaseous or solid. The former may be either assignable particles or suspended [SPM]. In both cases, they may eventually fall onto the material surfaces and plants; gaseous contaminants might additionally absorb onto surfaces. The pollutant's level of toxicity determines the pollutant's effect on the impact surface. Pollutants that precipitate may hang suspended in the air for a while. catchments but eventually, they are either dried or as a moist deposition deposition on the surfaces of plants, land, water, structures, and other assets. They can additionally be placed on the external surfaces of things or taken in by breath. The impact of these contaminants, both absorbed at the surface and absorbed within the plant system, depends on the features of the influence surface and the pollutant's chemical composition. When it comes to vegetation, Pollution levels that interact with plants are influenced by both internal and external factors that affect stomata opening. Numerous techniques have been established to evaluate a plant's appropriateness for the aforementioned uses. In the field of air pollution ecology research, using plants and bacteria to monitor air pollutants biologically has become routine practice. In short, the green belt The development plan is mostly dependent on the type and level of pollution, the ecosystem's carrying capacity, meteorological conditions, and the quality of the soil and water.[34] .

In most developing countries, specific standards have not yet been established regarding the engineering of the green belt and vegetation related to the various needs of pollution mitigation. industrial to industrial differences exist in the green belt's breadth and vegetation mix. Depending on the source of pollution, Germany and the Netherlands have set guidelines for the width of the green belt that should be constructed around the specified area of activity. As a result, the German green belt's width varies from 100 metres in the vicinity of business centres to 2000 metres in the vicinity of large industry. especially those that are located in isolation due to their high pollution potential. In the Netherlands, the required green belt width ranges 50 meters for light and non-polluting enterprises, compared to more than 500 meters for heavy industries [28].

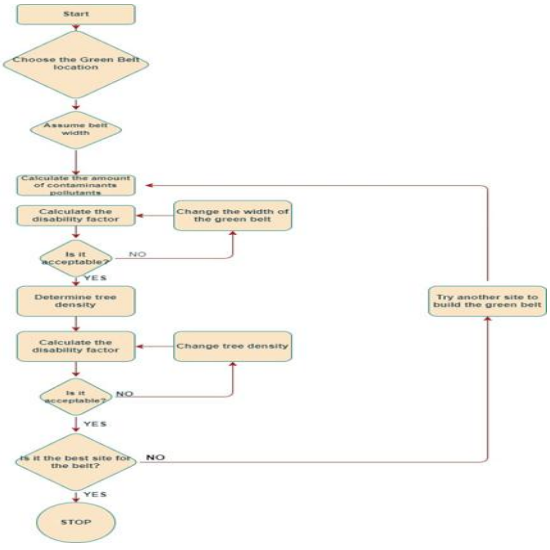
Meteorological considerations:

In order to control the movement, dispersion, and destiny of air pollutants in the atmosphere, meteorological conditions are crucial [35]. Frequent inversions in stable atmospheric layers are regarded as unfavourable atmospheric conditions because they facilitate the buildup of pollutants in nearby locations. However, the atmosphere's instability and turbulence encourage a greater dispersion of contaminants, which lessens the negative impacts of hazardous emissions. The region's prevailing climatic criteria have a substantial impact on the quantity and quality of pollutants contributed to the air environment. In addition, solar radiation, precipitation, temperature, humidity, wind direction, speed, and temperature inversion conditions are significant meteorological indicators. In addition to those above, the region's topography is crucial for dispersion, diffusion, and dilution, public transport, and the fall of contaminants. Under various meteorological circumstances, a given concentration of pollutants may eventually reach a varied ambient concentration. As a result, the rate of emission remains constant, yet the ambient concentration of pollutants may vary across different regions due to varying meteorological circumstances. [36].

The design of the green belt [green belt] is based on the coefficient of pollution obstruction:

Af = QWB/QB

The element of blockage Af, a metric used to assess the efficacy of the green belt, is the mass flow ratio over the same distance in the absence of the green belt. [QWB]and across the green belt [QB] Algorithm of creation and design of the green belt[32]



Selection of trees and other plants for the green belt

It is very important to establish conditions and features for trees and shrubs that are preferred to be planted when creating the green belt, and the choice of plant species is preferably based on the dominant species and adapted to local conditions, which have special specifications to withstand the environmental loads of the belt such as rapid growth rate and rapid development of the canopy and leaves to select plant species depending on the surrounding conditions, moreover, subject to Depending on the topographic-climatic conditions and the regional ecological situation, the selection of suitable trees and other plant species for this purpose should be based on criteria such as dense foliage and tangled leaves, be perennial and evergreen, large leaf area, acclimatized native plant, resistant to known air pollutants and able to maintain the ecological and hydrological balance of the region [28].

Of these, the last three attributes are required of the bushes to be planted. Other types of plants, such as herbaceous plants, should be selected and be durable and compatible with other species grown in the green belt. It is necessary to find out the level of pollution tolerance of trees and other plants before choosing them for planting in the green belt [37] [38] came up with a formula for the air pollution tolerance index [APTI] based on leaf indices to assess the tolerance level of trees. It is suggested that trees with a high Apti value are suitable for reducing gaseous pollutants. In contrast, trees with a high dust-holding capacity should be selected to control dust pollution .

Cultivation and management of the Green Belt:

For planting trees, healthy and blooming seedlings with a height of about 1 M should be selected to avoid mortality. Pits measuring 1 M × 1 M × 1 M should be drilled at the desired points in a repeating pattern in a triangular shape. For planting tall shrubs and dwarf trees, a spacing of 4.5 m between plants and rows is sufficient, while medium and tall trees should be planted in the middle and back rows with a distance of 6-7 and 8-10 m, respectively, depending on the available space. It is also recommended to plant at close distances to accommodate a larger number of trees per unit area, which leads to an increase in the [10] 50 g / hole or any pesticide suitable for the control of insects and soil-borne pests [37].Seedlings should be transplanted preferably during the rainy season and replanting should be done without delay if there is an injury or damage to the trees, proper care and maintenance of seedlings at the initial stage for 2-3 years are necessary, it helps the rapid development of the tree canopy, a process that is highly required to obtain an effective green belt [38].Close-cropping with a three-tiered system, with the preservation of dwarf trees with a round canopy exposed to emission sources, followed by medium and tall trees with a cylindrical canopy, is ideal for green belts in industrial areas because all plants are exposed to pollutants [39]. This helps shift emissions upwards as plants act as a physical barrier .

Closer planting also leads to taller trees with deeper roots and ultimately produces more biomass per unit area and more efficient absorption of pollutants [40]. It is recommended that trees be planted in a tight arrangement in multiple rows to intersect with the wind direction and trap and absorb pollutants better. The trees of the first front rows act as an absorbent layer for pollutants while the core area [rear rows] cleans the air, and the width of the outer area of the plantation should be 3-4 times larger than the core area, depending on space availability [41]. To design the green belt as a city layout in urban areas, the planting pattern should be slightly different from industrial areas, preferring to plant dwarf trees and shrubs in multiple rows along the perimeter and surrounded by medium and tall trees gradually towards the center so that all plants can intercept pollutants from different directions [40].

Conclusions:

1. Choosing plants that are tolerant of air pollution and can effectively absorb pollutants.
2. Planting trees and shrubs in a tight arrangement in multiple rows to intersect with the wind direction to trap and absorb pollutants. Plant trees and shrubs at close distances to accommodate a larger number of plants per unit area
3. It is better that the width of the rows of trees outward be 3-4 times greater than the width of the rows of trees planted in the middle or next to them.
4. Select trees with a high Air Pollution Tolerance Index (APTI) value for reducing gaseous pollutants, and trees with a high dust-holding capacity for controlling dust pollution.

REFERENCES

[1.] Jasim, S.N. and Alfatlawi, A.M., 2023, July. The Application of Geospatial Technologies in the Study of Vegetation Cover, Assessment and Comparison of Plant Diversity in the Al-Jadriyah Complex "University of Baghdad and Al-Nahrain". In IOP Conference Series: Earth and Environmental Science (Vol. 1215, No. 1, p. 012043).

[2.] Mikhaylov, A., Moiseev, N., Aleshin, K. and Burkhardt, T., 2020. Global climate change and greenhouse effect. Entrepreneurship and Sustainability Issues, 7[4], p.2897.

[3.] Alhesnawi, A.Sh., Alsalman, I. M.,Najem, Abd. N., 2019. Some Physical and Chemical Characteristics of Dust Falling on Kerbela City, Iraq. Journal of Engineering and Applied Sciences, 14[6], 9340–9344.

[4.] Awadh, S.M., 2023. Impact of North African sand and dust storms on the Middle East using Iraq as an example: Causes, sources, and mitigation. Atmosphere, 14[1], p.180.

[5.] Sissakian, V., Al-Ansari, N. and Knutsson, S.013. Sand and dust storm events in Iraq. Journal of Natural Science, 5[10], pp.1084-1094.

[6.] Mace, A., 2018. The metropolitan green belt, changing an institution. Progress in Planning, 121, pp.1-28.

[7.] Svensson, J., Bubnicki, J.W., Jonsson, B.G., Andersson, J. and Mikusiński, G., 2020. Conservation significance of intact forest landscapes in the Scandinavian Mountains Green Belt. Landscape Ecology, 35, pp.2113-2131
[8.] Hong, W. and Guo, R., 2017. Indicators for quantitative evaluation of the social services function of urban greenbelt systems: A case study of Shenzhen, China. Ecological Indicators, 75, pp.259-267.
[9.] Dclg.,2001. Strategic gap and green wedge policies in structure plan: main report. Retrieved April 29, 2012, from DCLG.
[10.] Dclg,2007. Homes for the Future: More Affordable, More Sustainable. Retrieved on April 29, 2012, from DCLG
[11.] Ståhle, A. & Caballero, L.2010. Greening metropolitan growth Integrating nature recreation, compactness, and spaciousness in regional development planning. International Journal of Urban Sustainable Development, 2[1-2], 64-84.
[12.] Dhakal KP, Chevalier LR. 2017. Managing urban stormwater for urban sustainability: Barriers and policy solutions for green infrastructure application. Journal of environmental management. 2017 Dec 1;203:171-81..
[13.] Nelson, A.,1985. A unifying view of greenbelt influences on regional land values and implications for regional planning policy, Growth and Change, April, 16[2], pp. 43–48.
[14.] Amati, M. [Ed.],2008. Urban Green Belts in the Twenty-first Century [London: Ashgate].
[15.] Amati, M.,2007. From a Blanket to a Patchwork: The Practicalities of Reforming the London Green Belt. Journal of Environmental Planning and Management, Vol. 50, No. 5, 579 594, September 2007
[16.] Gunn, S., 2006., Green Belts: A Review of the Regions' Responses to a Changing Housing Agenda. Journal of Environmental Planning and Management, Vol. 50, No. 5, 595 616
[17.] De Oliveira, F.L., 2017. Green wedge urbanism: history, theory and contemporary practice. Bloomsbury Publishing.
[18.] Nelson, A.,1994. Oregon's urban growth boundary policy as a landmark planning tool. In C. Abbott, D. Howe, & S. Adler [Eds.], Planning the Oregon way: a twenty-year evaluation [pp. [page numbers]. Corvallis, Oregon: Oregon State University Press.
[19.] Song, W.2023. Retain the common ground: implications of research on the fringe belt and urban green infrastructure for urban landscape revitalization, a case of Quanzhou. Landscape Research, 481, pp.64-87.
[20.] Zhao, W., Wang, Y., Chen, D., Wang, L. and Tang, X., 2021. Exploring the influencing factors of the recreational utilization and evaluation of urban ecological protection green belts for urban renewal: a case study in Shanghai. International Journal of Environmental Research and Public Health, 18[19], p.10244.
[21.] Nwalusi, D.M., Ibem, E.O. and Okeke, O.F., 2021. Assessment of the role of greenbelts in environmental and socio-economic development of urban areas in southeast Nigeria. Civil Engineering and Architecture, 9[2], pp.545-557.
[22.] Semeraro, T., Scarano, A., Buccolieri, R., Santino, A. and Aarrevaara, E., 2021. Planning of urban green spaces: An ecological perspective on human benefits. Land, 10[2], p.105.
[23.] Amati, M., 2016. Urban green belts in the twenty-first century. Routledge.
[24.] Mohseni M. M., 2017. Green Belt, a Local Approach For Environmental Challenges. MANZAR, the Scientific Journal of Landscape, 8[37], 56-65.
[25.] Singh, S. N. and Tripathi, R. D. 2007. Environmental bioremediation technologies. Springer Science and Business Media.
[26.] Tewari, D. N.: 1994, Urban Forestry. Indian Forester 120647–657.
[27.] Kong, L., Yu, H., Chen, M., Piao, Z., Dang, J. and Sui, Y., 2019. Effects of particle matter on the plant: A review. Phyton, 88[4], p.367.
[28.] Khan FI, Abbasi SA. Attenuation of gaseous pollutants by greenbelts. Environmental Monitoring and Assessment. 2000 Sep;64:457-75.
[29.] Perini, K., Ottelé, M., Giulini, S., Magliocco, A. and Roccotiello, E., 2017. Quantification of fine dust deposition on different plant species in a vertical greening system. Ecological Engineering, 100, pp.268-276.
[30.] Wang, S., Li, K., Liang, S., Zhang, P., Lin, G. and Wang, X., 2017. An integrated method for the control factor identification of resources and environmental carrying capacity in coastal zones: A case study in Qingdao, China. Ocean & coastal management, 142, pp.90-97.
[31.] Yang, J., Ji, Z., Kang, S., Zhang, Q., Chen, X. and Lee, S.Y., 2019. Spatiotemporal variations of air pollutants in western China and their relationship to meteorological factors and emission sources. Environmental Pollution, 254, p.112952.
[32.] Abbasi, S. A. and Vineethan, S. V.: 1998, Impacts of Industries on Suburban Environment, Discovery Publishing House, New Delhi, 233 pp.
[33.] Ogunkunle, C.O., Suleiman, L.B., Oyedeji, S., Awotoye, O.O. and Fatoba, P.O., 2015. Assessing the air pollution tolerance index and anticipated performance index of some tree species for biomonitoring environmental health. Agroforestry Systems, 89, pp.447-454.

[34.] Singh, S. K., and Rao, D. N. 1983. Evaluation of plants for their tolerance to air pollution. Proceedings of the symposium on air pollution control, 1, 218–224.
[35.] Ely, M.E., 2010. Integrating trees into the design of the city: expert opinions on developing more sustainable practices for planting street trees in Australian cities [Doctoral dissertation].
[36.] Sharma, S. C., Sharga, A. N., and Roy, R. K. 1991. Landscaping of industrial regions. Horticulture—new technology and applications.Netherlands: Kluwer Academic
[37.] Cheng, H., Liu, C. and Kang, L., 2020. Experimental study on the effect of plant spacing, number of rows, and arrangement on the airflow field of forest belt in a wind tunnel. Journal of Arid Environments, 178, p.104169.
[38.] Sharma, S. C., Sharga, A. N., and Roy, R. K. [1994]. Abatement of industrial pollution by landscaping. Indian Journal of Environmental Protection, 14 [2], 95–97.
[39.] Muthusaravanan, S., Sivarajasekar, N., Vivek, J.S., Paramasivan, T., Naushad, M., Prakashmaran, J., Gayathri, V. and Al-Duaij, O.K., 2018. Phytoremediation of heavy metals: mechanisms, methods, and enhancements. Environmental chemistry letters, 16, pp.1339-1359
[40.] Feeley, K.J., Wu, J., Xu, G. and Yu, M., 2011. Determinants of plant species richness and patterns of nestedness in fragmented landscapes: evidence from land-bridge islands. Landscape Ecology, 26, pp.1405-1417.
[41.] Ingold, C. T.: 1971, Fungal Spores, Clarendon Press, Oxford, 302 pp.

دور الحزام الاخضر في تقليل الملوثات في المدن.

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الخلاصة

المقال يناقش دور الأحزمة الخضراء في تقليل الملوثات في المدن. الحزام الأخضر هو شريط من الأرض المحيطة بالمدينة أو المنطقة الصناعية، مصمم لتقليل تلوث الهواء من خلال اعتراض الملوثات قبل أن تنتشر أكثر. يبرز المقال أهمية الأحزمة الخضراء في تقليل تلوث الهواء، تحسين جودة الهواء، وتعزيز بيئة صحية. كما يتناول تصميم وإدارة الأحزمة الخضراء، بما في ذلك اختيار أنواع النباتات، أنماط الزراعة، وممارسات الصيانة. ويؤكد المقال على أهمية اختيار النباتات التي تتحمل تلوث الهواء ويمكنها امتصاص الملوثات بفعالية. يناقش المقال أيضًا أهمية الظروف الجوية في تنظيم نقل وانتشار الملوثات في الغلاف الجوي. ويشير إلى الحاجة إلى نهج شامل للتحكم في تلوث الهواء، بما في ذلك استخدام الأحزمة الخضراء، تقنيات تقليل الانبعاثات، ونظم مراقبة التلوث. بشكل عام، يبرز المقال أهمية الأحزمة الخضراء في تقليل تلوث الهواء وتعزيز بيئة صحية. ويشدد على الحاجة إلى نهج شامل للتحكم في تلوث الهواء وأهمية اختيار الأنواع النباتية المناسبة وتصميمها لتحقيق تقليل فعال للتلوث.

الكلمات المفتاحية :حزام أخضر، المنظر الطبيعي، جودة الهواء