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Eco-URBAN : Approach to Development Sustainable Green City

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ABSTRACT

Cities are centers of high natural resource utilization activities that contribute to the development of global environmental issues. Urban planning should be integrated with environmental planning in order to achieve sustainable development. This study aims to examine the position of the ecological urban concept in the concept of city ecology and sustainable cities. The method used in this study is a literature review of publications related to the concept of ecocity, urban ecology and sustainable city. The concept of green city development seeks to answer the issue of climate change through adaptation and mitigation actions, through attributes: green planning and design, green open space, green waste, green transportation, green water, green energy, green building, and green community.

Keywords: *City planning, environmental issues, sustainable development, ecocity, urban ecology, sustainable city, green city*

1. INTRODUCTION

Currently , the city is a center of activity that has a high level of utilization of natural resources so that it contributes greatly to the development of global environmental issues. If viewed from the environmental point of view, the city is considered a source of ecological problems because it is related to the imbalance between the need and the supply of natural resources. Environmental science studies suggest that urban planning should be integrated with environmental planning in order to achieve sustainable development. The challenges that will be faced by cities in the future are increasingly complex, so the stages of development must be understood so that they can be anticipated in the urban planning process.

According to (World Economic Forum, 2017) city development consists of 4 (four) stages along with the increasingly complex aspects and approaches that must be considered , namely : 1) *rudimentary* (basic needs and access to the poor) ; 2) *functional* (use of technology for energy efficiency ; 3) community cohesion and *reuse recycling* patterns *;* 4) *integrated* (social conditions and aspirations) ; and 5) *scalable* (rapid adaptation process and integrated approach).

Cities in Indonesia continue to experience physical growth and expansion over time , not only in areas within the city but also to areas outside the city itself. This has an impact on the process of urbanization in the areas around the city, resulting in changes to the spatial structure of the city and the area around it.

Changes in the spatial form of urban settlements that continue to develop in the world's cities also threaten the sustainability of the environment in urban areas. In general , the evolving spatial form has resulted in negative sustainability performance in many cities in the world, both in environmental, social and economic aspects. These spatial changes lead to the use of large resources from the natural environment , such as : land, energy, water, materials, and also the disposal of large amounts of garbage and waste into the natural environment. Spatial forms that cause environmental problems are associated with urban patterns known as *urban sprawl* . Environmental problems occur because of the extensive conversion of green land and wetlands into built-up land which causes damage to ecosystem (Arbury, 2005).

The expansion of urban space is associated with continuous urbanization , where the processes of modernization and globalization are adopted in it and hence the principles of capitalism and neo-liberalism are adhered to. Modernization and globalization were adopted by the ruling government as a national development strategy and placed cities at the center of national development (McGee, 2009).

Urban planning in the 21st century is an important milestone in the shift of classical urban planning science to science that is more responsive to technological developments, innovation and the existence of global development goals (SDGs) (Sutriadi, 2018). needed to cope with the development of urban areas in the future . This is related to the challenges and development of the city, both the meaning and approach of the city and the city environment.

New approaches to urban planning are essential in an effort to understand increasingly complex urban processes. Approach The form of a city based on ecology, the integration of humans and ecology in different urban contexts in space and time is increasingly important to be studied in the future as an effort to deal with the shift in the meaning of the city and to deal with environmental conditions as an element with limited availability. Therefore , This study aims to examine the position of the *ecological urban* concept in the concept of city ecology and sustainable cities. The results of this study are expected to provide an overview of the urban planning approach that is in accordance with the conceptualization of the city related to aspects of the urban environment (Mayona, 2021).

2. METHOD

The method used in this study is a literature review based on the development of publication times related to the concept of *ecocity , urban ecology* and *sustainable city* .

3. DISCUSSION

3.1 Urban Ecology Concept

According to the concept of *urban ecology* , the city is understood as a place where humans and other living things interact with each other, related to the behavior of living things and natural and

artificial resources that can change the urban environment (Doughlas, 2015). In general, in the concept *of urban ecology* , the city consists of a structure in the form of a component/urban habitat and a function in the form of a series of adaptation processes and the development of urban components (Doughlas, 2015). Based on this concept, the structure and function of ecology have an important meaning in the life system of a city. In addition, the urban system also contains the dominant components of social institutions, culture and behavior, and the built environment.

The description *of urban ecology* , according to Niemelä & MacDonnell (2011), is an approach that is dominated by the field of biology, where the city is seen as a unique type of natural ecosystem in urban planning. In this approach, human activities are considered as something separate from humans and the main focus is on the concepts, processes, disturbances, structures and functions of urban ecological systems. Ecological cities have foresight, that urban development must consider the sustainability or future of the city. A sustainable city is a city that is based on a just, healthy and productive community, supported by a conducive environment. The Ministry of Environment (2008) states that the notion of an ecological city is an approach to urban development based on ecological principles.

Urban *ecology* principles developed by Pickett and Cadenasso (2012), including:

a. City (*city*) and urban (*urban*) is a human ecosystem in which socio-economic and ecological processes provide feedback to each other.
b. *Urban* areas consist of remnant vegetation or watersheds that have recently emerged that exhibit an ecological function.
c. *Urban* flora and fauna are diverse, and this diversity has many dimensions (eg taxonomy, phylogenetic, function, geographic origin).
d. Human judgments and perceptions are the key links between the social and ecological components of human ecosystems.
e. Ecological processes are not evenly distributed throughout big cities, service limitations and the level of danger are often associated with the location of poor communities, discriminated against, or with other limitations.
f. *Urban* formations have a heterogeneous scale, and scale heterogeneity is particularly pronounced in older cities and suburbs
g. *Urban* formation reflects the planning, incidental, and indirect effects of social and environmental decisions.
h. *Urban* formation is a dynamic phenomenon and shows contrasts through time and across regions that express different cultural and economic contexts of urbanization.
i. *Urban design* and development projects at various scales can be treated as experiments, and used to expose the ecological effects of various design and management strategies

j. The definitions of the boundaries and content of the urban systems model were defined by the researchers based on their research questions or the spatial scope of the intended application.
k. Urban comparisons can be framed as linear transects or as abstract gradients, and abstract comparisons recognize the spatial complexity of urban heterogeneity.
l. Urban land cover and land use extends and participates with rural land or illegal use.
m. Water fluctuations, including water supply, sewage, and water management, relate to cities and urbanization areas around the world, and link them explicitly to larger areas .

Meanwhile, the conceptual framework of *urban ecology* developed by Albert et al (2003) can be seen in **Figure 1.** below:

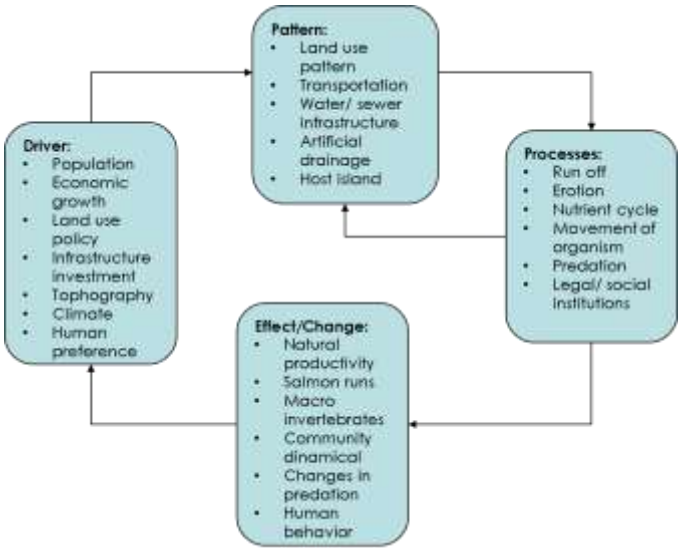

Image 1. *Urban* Ecology Conceptual Framework

Urban *ecology* is the study of the biotic and abiotic structures and functions of *cities* . The urban ecological structure consists of the number, size, composition, and nature of the components, and consists of a biotic and a biotic components. Functionality is the process by which species adapt or evolve in urban environments.

3.2 The Development of the Concept of the Ecologycal City

Ecocity is a city concept that develops along with the development of the historical perspective of the city's ecology and the complexity of the city's environmental problems. *Ecocity* is expected to be a concept that is able to answer the challenges of urban environmental issues and is considered important with consideration (Mayona, 2021):

a. *Ecocity* which was initially developed was a human settlement model that had an independent and sustainable natural ecosystem structure and function. The concept integrates natural and cultural diversity in an integrated design through the use of technology;

b. *The Ecocity* concept is a concept that has developed in line with the paradigms and movements of *Appropriate Technology (AT)* , *Community Economic Development (CED)* , *social ecology* , *the green movement* , *bioregionalism* and *sustainable development* ;

c. *Ecocity* when compared to *neotraditional city forms* , *urban containment* , and *compact cities has a value advantage in ecological design* criteria. and the provision of renewable energy;

d. *Ecocity* is a form of city that focuses on the concept of evolution, *coexistence* , adaptation and community resilience in the structure and function of the city, efficient use of energy, efforts to reduce damage to nature and create an attractive environment for the community (Register (2006), (Roseland, 1997), (Gaffron & Skala, 2005), (Hes & Bush, 2018).In the *Ecocity concept* , there are 4 important pillars developed, namely *urban design* , *bio-geophysical conditions* , *socio-cultural features* , *ecological imperatives* supported by 18 standards to measure achievement *eco-city* condition .

Ecocity concept is studied based on theoretical and practical developments that have developed since the concept was initiated , as illustrated in (**Figure 2)** below :

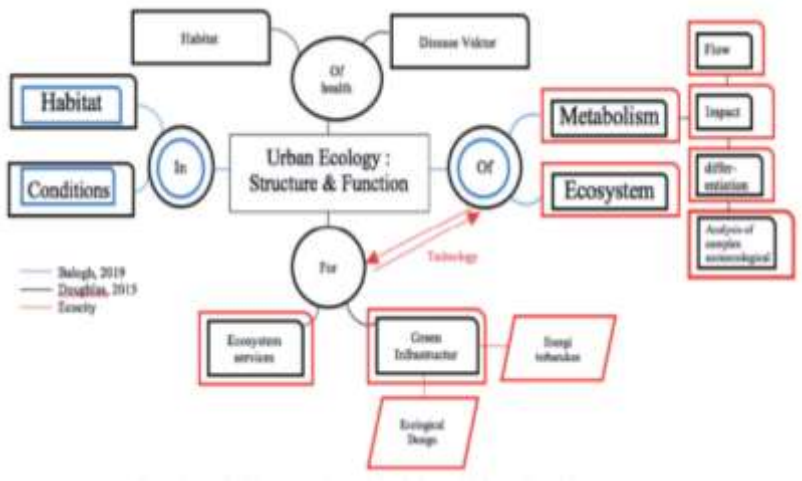

Figure 2 . *Ecocity* Concept in *Urban Ecology*

Theoretically the *ecocity concept* is stated by experts as follows (Mayona, 2021):

a. Richard Register (1987) is the founder of *Ecocity Builders* , a non-profit organization based in Berkley, California that defines an ecocity as a human settlement with an independent and sustainable model of the structure and function of natural ecosystems. This understanding focuses on efforts to maintain the balance of the ecosystem in the consumption and production processes. In that sense, the city system must be balanced and no resources are depleted or extracted at a higher rate than those created by nature. This definition refers to the condition that the city must be ecologically neutral in every subsystem of the city. *Ecocity* emerged as a reaction to the crisis in the city's condition as an effort to think about the importance of

rebuilding space through ecological principles. The principle includes consideration of the role of the city and the evolution of urban civilization. The key factors in the evolution of the city are density, diversity, form and function of the city as well as public awareness of rebuilding and rethinking within it; and understand the city as a *living organism* ;

b. In 1997, M. Roseland, a professor at Simon Fraser University in British Columbia, published an article on the dimensions of *ecocity* and discussed the origins of *e -city* . He studied the evolution of the application of the *ecocity concept* for 10 years in terms of the dimensions and orientation that occurred. He also argues that there are other approaches to defining a " *sustainable community* ", namely determining the necessary conditions for a sustainable community through efficient land use, reduced consumption, increased livelihoods, and sustainable governance;
c. In a further development, Duncan Crowley discussed that it was time for global cities transformed into an *ecocity* with the hypothesis that climate change requires ecological solutions, eternal growth will affect human life so that it requires good growth through anti- and post-capitalist views, and creative heritage is needed as a city strategy related to the start of new cultural stories .

3.3 The Position of the Ecocity Concept in the Urban Ecology Concept

Urban planning and development in the concept of an *ecological city (ecocity)* requires an ecological aspect approach in overcoming the urban environment. The ecological perspective of the city develops from the city as an organism to an ecosystem perspective . In the development of the conceptualization of the city, there are three environmental approaches that can be used, namely : the *urban ecology approach* , the *flows approach* , and *the biosocial approach* (Currie & Musango, 2017; Currie & Musango, 2017). In this study, *urban ecology* is used as an approach with the author's consideration that the concept of *urban ecology* has advantages in interpreting urban shifts in an ecosystem perspective because urban ecology is related to how cities process energy or materials relative to the environment, cities as a unique type of environment. natural ecosystems where human activities in this approach are separated from humans themselves and have the main focus on the concepts, processes, disturbances, structures and functions of urban ecological systems. The definition *of urban ecology* shows several groupings of meaning, namely:

a. *Urban ecology* consists of *ecology of cities* which is the metabolism of the entire city as an ecosystem with various interrelated subsystems and *ecology in cities* which focuses more on habitats within cities and how these habitat conditions can change or move the structure and function of ecological systems (Hall & Balogh, 2019);
b. *Urban ecology* consists of (Doughlas, 2015) :

- *The ecology of health in urban areas* : the city consists of habitats for humans and disease vectors and includes the role of urban nature in supporting human well-being.
- *Ecology in towns and cities* : urban areas as habitat for wildlife, plants, and other organisms.
- *The ecology of cities as a whole* : the flow of energy, water, materials, and information into and out of urban areas as well as internal and external impacts; differences in urban areas; rural-urban; and analysis of complex urban socio-ecological systems
- *Ecology for cities* : enhancing ecosystem services provided through urban green infrastructure in order to build resilience to change, including environmental change, and to enhance urban sustainability and enhance community cohesion.

Judging from the development of *urban ecology* and *ecological city* , at first it showed that the development of *urban* ecology focuses on organisms within cities , including animals and plants until the early 1970s. Subsequent developments , the focus shifted to the city as an ecosystem and multidisciplinary and integrative knowledge by incorporating a further human component. The development of *ecocity is in line* with the early development of *urban ecology* , which is the basis of aesthetic forms in urban design . City design focuses on the development of the beauty of the city . In subsequent developments, efforts to improve the quality of the urban environment due to the development of industrial areas resulted in ecological principles and green technology to support the ecological design of a city. From the social side of society , the environmental movement is growing as a form of responding to rapid urban development and the effects of globalization.

The development of *ecocity* in the urban ecological system is related to the city as a human-dominated system with the following conditions : 1) Humans dominate the earth's ecosystem ; 2) Development of more realistic models for ecological systems will lead to greater success in finding solutions to environmental problems ; 3) A relatively new ecological concept , namely the city as an ecosystem where humans live in it. Studying cities as ecosystems in a new paradigm of ecosystem science (Grimm, Grove, Pickett, & Redman, 2008; Grimm, Grove, Pickett, & Redman, 2008) increases the collective awareness of ecologists about urban ecosystems which contributes to the development of concepts that apply to all ecosystems. Therefore , these developments show the importance of discussing the relationship of social theory that includes individual perceptions, needs, values, and knowledge to the sustainability of the planning process through intensive participation of relevant stakeholders. An understanding of how cities work in an ecological sense is aware of the fact that humans live in them and must depend on proper management to maintain an acceptable quality of life for the foreseeable future.

Ecocity when viewed based on the theory, practice and approach of urban ecology that has been described previously, can be concluded as a concept that balances the city's metabolism (*ecology of cities*) on the independence of the structure and function of natural ecosystems where humans play a

role in determining the adaptation process and urban development. Human integration as a social aspect with urban metabolism is related to human interactions with urban ecosystems (**Fig . 2**). The city's metabolic process becomes an important basis in providing *ecology for cities in the* form of ecosystem services and green infrastructure *(* ecological design , renewable energy). The social approach as an effort to understand human actions and influences on ecosystems within the framework *of urban ecology* is important to use an integrated approach to social and ecological aspects (*socio-ecological*). The development of the concept of *ecocity* , *urban ecology* and sustainable city can be seen in (**Figure 3)**

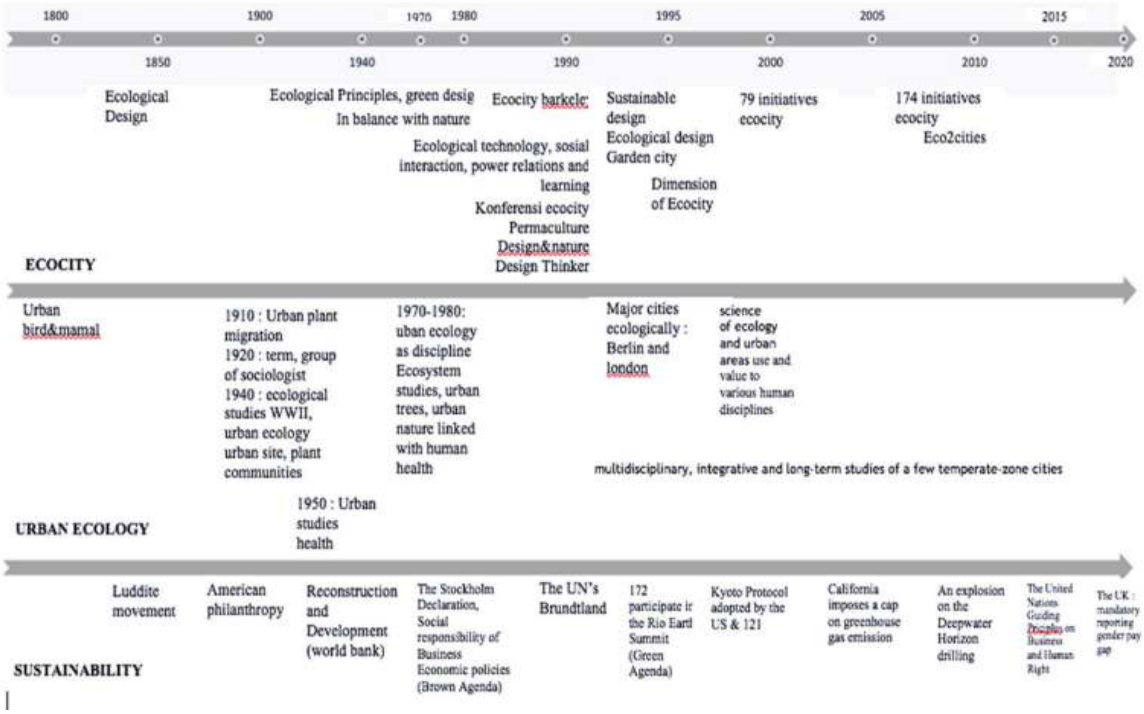

Figure 3 . *Ecocity* Concept Development Timeline, Urban Ecology And Sustainability (Source: //corporatecitizenship.com/sustainabilitytimeline/)

3.4 Sustainable Green Vity Development Concept

The increase in population in urban areas (urbanization) and the decline in the quality of the urban environment have brought various consequences for problems in Indonesia, including an increase in urban poverty, traffic congestion, rising sea levels, uneven fulfillment of infrastructure needs, increasing number of slums, and flood. A number of these problems contribute to increasing the effects of global warming (climate change).

The concept of green city development is one of the solutions offered in contributing to the problem of climate change through adaptation and mitigation actions. A green city is a city that was built by not sacrificing city assets, but continuously cultivating all assets, namely people, the environment, and built infrastructure. Some of the characteristics of a green city include effectively

and efficiently utilizing water and energy resources, reducing waste, implementing an integrated transportation system, ensuring environmental health, as well as synergizing the natural and artificial environment based on urban planning and design that supports the principles of sustainable development (environmental, social and environmental). , and economics). There is 8 (eight) attributes of a green city, namely:

a. **Green planning and design** : urban planning and design that adapts to the biophysical conditions of the area.
b. **Green open space** : creating a network of green open spaces.
c. **Green waste** : efforts to apply 3 R (reduce, reuse, recycle).
d. **Green transportation** : development of sustainable transportation/mass transportation.
e. **Green water** : efficient use of water resources.
f. **Green energy** : the use of energy sources that are efficient and environmentally friendly .
g. **Green building** : development of energy efficient buildings.
h. **Green community** : sensitivity, concern, and the active role of the community in developing the attributes of a green city. Environmentally friendly building construction is a vital element in the realization of a green city.

The initial stages of the embodiment of this green city are also focused on 3 (three) attributes, namely : *green planning and design* , *green open space* , and *green community* . Efforts to realize a green city through the achievement of eight attributes require the role, support and commitment of all stakeholders, namely : the community, local government , the private sector, and other sectors. Law Number 26 of 2007 concerning Spatial Planning explicitly mandates a minimum of 30% of the city area in the form of green open space (RTH) with a composition of 20% public green open space and 10 percent private green open space. The allocation of this green space is stipulated in a regional regulation (perda) regarding the regency/municipal RTRW.

The strategy towards 30% green open space is to prepare a green open space master plan and legalize the green open space regulation, determine areas that should not be built, green buildings, and increase the area of new green open spaces. In addition, increasing community participation, developing green corridors, acquiring private green open spaces, and improving the quality of urban green open spaces.

Green City is known as an ecological city. An ecological city can also be said to be a healthy city. This means that there is a balance between urban development and development with environmental sustainability. A healthy city is also a condition of a city that is safe, comfortable, clean, and healthy for its residents to inhabit by optimizing the socio-economic potential of the community through empowering community forums, facilitated by related sectors and in sync with urban planning. To be able to make it happen, it takes effort from every individual member of the community and all related parties (*stakeholders*). This concept is in accordance with the approaches

presented by Hill, Ebenezer Howard, Patrick Geddes, Alexander, Lewis Mumford, and Ian McHarg. The implication of the approaches presented above is to avoid the development of undeveloped areas. This emphasizes the need for development plans for new cities and towns that take into account local ecological conditions and minimize the adverse impacts of urban development, further ensuring urban development which in itself creates local natural assets (Hidayat, 2017).

There are several approaches *Green City* that can be applied in the management of city development.

a. The first approach, is *Smart Green City Planning* . This approach consists of 5 (five) main concepts , namely : the concept of an ecologically balanced area that can be done by balancing water, CO2, and energy.
b. The second approach is the concept of an ecological village which consists of determining the location of the area, architecture, and transportation with examples of application, including: conformity to topography, wind corridors, water circulation to control microclimate, fuel efficiency, and public transportation.
c. approach , the concept of a *wind corridor housing complex* , with a strategy to reduce the impact of warming. The trick is to build green open spaces, control air circulation, and create a green city. Fourth, the concept of a *water circulating complex* . The strategy is to recycle rainwater to become raw water. Fifth, the concept of a rain-fed garden (*rain garden*).
d. The fourth approach is the CPULS (Continuous Productive *Urban Landscapes) concept* . The concept of greening the city is a continuous landscape development in *urban* and *rural relations and* is a productive landscape.
e. The final approach is the *Integrated Tropical City* . This concept is suitable for cities that have a tropical climate like Indonesia. The core concept is to have special attention on climate aspects, such as protection against weather, urban forestry by increasing vegetation to reduce *Urban Heat Island* . It is not impossible if Indonesia applies it like other special concept cities (Abu Dhabi with its Urban Utopia or Tianjin with its Eco-city), considering that Indonesia has a tropical climate.

The advantage of the *Green City concept* is that it can meet the needs of the existence of Green Open Space (RTH) in an area, so that it can reduce and even solve environmental problems, natural disasters, low air pollution, flood free, low noise and other environmental problems . However, apart from its advantages, this concept has its drawbacks as well. Its application to each area cannot be generalized because each area requires a separate study. At least it should be known about local characteristics, macro climate, and so on. For example, in mountainous areas, green open space is used to resist landslides and erosion, on the coast to avoid tidal waves, tsunamis, in big cities to reduce air pollution, and in housing, it is used to reduce noise.

So , green open space in each city has a different ecological function. Besides that, its current application is that most of the implementation of reforestation is not conceptual, giving rise to an image of reforestation without looking at who can take positive benefits from reforestation (Hidayat, 2017) .

4. CONCLUSION

The Cities are centers of high natural resource utilization activities that contribute to the development of global environmental issues. Urban planning should be integrated with environmental planning in order to achieve sustainable development to answer the issue of climate change through adaptation and mitigation actions, through attributes: green planning and design, green open space, green waste, green transportation, green water, green energy, green building, and green community.

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