

PAPER • OPEN ACCESS

Greening Houses in the Age of Climate Change

To cite this article: Huynh Tan Hoi and Nguyen Tan Danh 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **505** 012016

View the [article online](#) for updates and enhancements.

You may also like

- [Con Dao's Positional Resources: Potential and Orientation in Value Promotion](#)
N T A Nguyet and N V Bau
- [Assessment of resources of road machines working in the conditions of tropical climate](#)
Vladimir Zorin and Le Tchong Tuan
- [Moho depth of the northern Vietnam and Gulf of Tonkin from 3D inverse interpretation of gravity anomaly data](#)
Nguyen Nhu Trung, Phan Thi Hong, Bui Van Nam et al.



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Greening Houses in the Age of Climate Change

Huynh Tan Hoi^{1*} and Nguyen Tan Danh²

1 Language Department, FPT University, Vietnam

2 IT Department, FPT University, Vietnam

Email: hthcolin@gmail.com

Abstract. Currently, the atmosphere of some major cities of Vietnam is quite polluted. Once the air protection is improved, the quality of life is also positively changed. In order to have a fresh air environment, the first thing is to increase the absorption of emissions through increasing the green area. However, big cities do not have enough land to grow trees, so planting solutions on the roof or on the wall is the most appropriate choice. Many green buildings in the world are considered as environmentally friendly buildings and create a cool feeling between the summer days of tropical countries. This paper aims to confirm the role of trees in protecting and improving the environment. The mentioned solutions aim to further enhance the importance of nature for the densely populated and polluted areas.

1. Introduction

Climate change is one of the biggest challenges facing humanity, seriously impacting production, life and the environment on a global scale. Rising temperatures, sea level rise cause flooding, salinization of water sources, affecting agricultural production, great risks for industry and socio-economic system in the future. These issues have been and will make profound changes in global development as well as security processes such as energy, clean water, food, accommodation, employment, diplomacy, culture, economy and trade [1].

According to the United Nations, Vietnam is one of the five countries most seriously affected by climate change. Coastal provinces in the Mekong River Delta and the Northern Coastal regions will suffer the most. According to a United Nations Development Program survey, in 2018, more than 31,000 houses in Vietnam were flooded and damaged by natural disasters.

Global emissions hit a record 37 billion tons last year and the last five years were the hottest five years in human history. Experts predict that the Earth's temperature could increase by 6 - 7 degrees Celsius by 2100 if countries do not cut greenhouse gas emissions. At least, part of the earth's 0.6°C has been warming during the 20th century.

Forest fires are ongoing and increasingly difficult to control, more frequent and more violent storms, acidified oceans, rising sea levels, dying coral reefs, and melting glaciers. flowing, desertification situation is increasingly widespread, a series of ancient vegetation in the East Antarctic is at risk of disappearing permanently. These are the clearest evidences for the untold impacts caused by climate change.

2. Research content

2.1 The increase in population



According to the International Finance Corporation (IFC), the World Bank's demand for construction in developing countries is increasing rapidly every year. It is expected that by 2030, more than 50% of newly built works will be concentrated in Asia.

Also according to the assessment of this organization, in recent years Vietnam has been one of the countries with high economic growth and urbanization, construction works and high-rise buildings sprouting like "mushrooms after rain". However, along with that development process also has many consequences, causing adverse effects on the ecological environment. The construction industry is one of the most energy consuming industries in Vietnam, accounting for 36% of the country's total electricity consumption (Figure 1).



Figure 1. Black smoke erupts from the Uong Bi thermal power plant (Quang Ninh)

With the current rapid urbanization rate, it is expected that by 2015, Vietnam will have about 850 cities and 1,000 cities by 2025. In particular, in big cities like Hanoi and Ho Chi Minh City, the speed of urbanization along with high population concentration leads to many security issues such as population pressure, urban transport infrastructure as well as services provided for urban life including health, education, culture, entertainment, environment, etc.

Therefore, according to experts, if building green buildings, we can reduce the negative impacts of the buildings on the health of the people using the works, also help improve the use of resources in the building such as water, fuel, energy, etc. But according to calculations by Danish experts, if the investor spends about 5% of the cost of construction according to energy efficiency standards will save 50% of the electricity used. Thereby, the investor only takes 5 years to recover the initial capital [1-3].

Greening is an important element of an ecological urban. The urban green area is not only a part of the greened land but also focuses on the aesthetic factors, creating a green space in harmony with the architectural landscape, nature and at the same time, creating a part of toxicity. unique, accents for the project. Therefore, understanding and investing properly in the green area requires not only a master plan but also a lot of care and responsibility of the investors. This contributes to the reason why the fact that the speed of urbanization of our country in general and Ho Chi Minh City in particular is happening quickly but the number of urban areas meeting the requirements of the development trend is very small, if not speaking is rare [4].

According to leading experts, since the process of urbanization began in the 1990s up to now, in Ho Chi Minh City, many urban areas have paid much attention to developing green areas. However, ecological urban development is a difficult problem and an urgent requirement to ensure sustainable development.

In particular, Phu My Hung new city (a district belongs to Ho Chi Minh city) is considered typical of sustainable urban planning and development. Phu My Hung is the city with the highest green coverage in Ho Chi Minh City with an average green density of 8.9m² per capita. Currently Phu My Hung has

greened (including the surface of the lake) more than 423,341m², with more than 17 types of trees and about 300 kinds of flowers and grass distributed appropriately according to the designs of famous Vietnamese designers, Singapore, etc. made with beautiful shape, both modern and fit the traditional aesthetic tastes of Vietnam. With the current rapid urbanization rate, this development process also has many consequences, causing adverse effects on the ecological environment [4].

2.2 Urban air harms and risk for ecosystems

Planetary climate will also change radically in the short and long term. Plants regulate the water cycle by acting as a biological pump, that is, they draw water from the soil and bring it into the atmosphere by converting it from liquid to vapour. In this way, forests contribute to clouds and rain. Trees also help prevent flooding by capturing water instead of letting it rush into rivers and lakes and by creating a buffer zone for coastal communities before storm surges. The tree holds the soil, otherwise the soil will be washed away in the rain. Tree roots are structured to help the microbial population grow. Without trees, previously forested areas will become drier and more vulnerable to severe drought [3]. If it rains, flooding will cause disaster, massive erosion will impact the oceans, clogging reefs and the world of marine life. Islands with lost trees will no longer be protected from the ocean, and many islands will be swept away. In addition to regulating the water cycle, plants also have a local cooling effect. They provide shade that maintains the soil temperature and, because it is the coolest shade in the surroundings, they absorb rather than reflect heat. In the process of evaporation, they also use the energy from solar radiation to convert liquid water into steam. If all of these cooling functions are lost, most places that once had trees immediately became warmer [5].

2.3 The green plants are narrowing

Since humans started farming 12,000 years ago, we have cleared nearly half of the 5.8 trillion trees in the world, according to a study published in Nature journal in 2015. Most deforestation has occurred in recent years. Since the beginning of the industrial era, forests have fallen by 32%. Especially in the tropics, much of the world's remaining three trillion trees is declining rapidly, with about 15 billion trees being cut down every year.

2.4 The important role of the "green lung" to the earth

The total area can plant trees on earth is 900 million hectares, can absorb 205 billion tons of carbon (accounting for more than 60% of CO₂ emissions from humans). The restoration of forests also contributes to reducing air emissions to the lowest level in nearly a century.

The tropics are the best place for reforestation because of the hot, humid climate and heavy rain, which helps the trees grow faster. However, most countries in the world can plant trees on arable land and even in urban areas, such as planting trees at home and greening the rooftops with crops. The recovery of "green lungs" is the best solution available today to contribute to effectively responding to climate change. Accordingly, people around the world actively plant trees or fund these efforts [6].

3. Application of green architecture

Human economic activities not only create impacts on the earth's ecological system, but also damage the living environment. Due to climate change, we should adjust and slow down this process. Taipei 101, a typical architecture of Taiwan, also exemplifies the commitment to make good use of the earth's resources with the hope of achieving the consensus and strength of everyone as well as implementing the concept of environmental sustainability (Figure 2).



Figure 2. The application of covering green used by FPT University

By combining "Feng shui" with growing trees, this bring a lot of benefits to the buidings. It not only adorns the space to become peaceful, cool, creates fresh green spaces in the middle of noisy towns, some trees also have the ability to purify the air, repel insects, bring good health for family members. Planting "feng shui trees" will also bring good luck, fortune and protect the owner from the unfortunate things in life. We can choose a neat tree in front of the house or dense trees to shield the effects of wind, dust and bad air [7, 8].

4. Designing some plants indoors and outdoors

Epipremnum Aureum is too familiar in the current bonsai list. These plants can be grown indoors and even indoors. Epipremnum aureum belongs to family Araceae and its characteristic is grassy, green all year round and has a long life. Currently, Epipremnum Aureum has been bred and created many different varieties with many different colors and designs (Figure 3).



Figure 3. The image of Epipremnum Aureum

According to many studies, Epipremnum Aureum is one of some ornamental plants that brings fresh space and enhances the aesthetic of our home. Epipremnum Aureum helps relax, comfortable and beautify our home, office and living space.

Not only that, Epipremnum Aureum has the ability to suck toxins from the air, toxic gases emitted from cigarette smoke, gasoline, radiation from electronic devices such as phones, computers, televisions, refrigerators. That is why many families choose to put Epipremnum Aureum indoors.

In addition, it is also used to support kidney disease very well. In medicine, Epipremnum Aureum is also used extensively in traditional remedies to bring healing effects. It brings many fortune, prosperity, luck to the homeowners. With such benefits, Epipremnum Aureum will certainly be a bonsai that we should plant in our home, on the balcony or on our desk.

Environmental experts say the new initiative could help reduce environmental pollution and turn roofs into green, environmentally friendly spaces [8]. Planting greenery on the roof of the house is a new model of planting trees in modern cities. The addition of more trees will contribute to improved air quality and environmental conditions in general (Figure 4).



Figure 4. Planting greens on the roof

Growing green vegetables or fruit trees on millions of rooftops across Egypt can create a significant food supply while saving a lot of farmland and irrigation water, thereby reducing imports. From abroad, saving spending for households. In some countries, especially in the Middle East and Africa, planting on the roof of a house A variety of goals can be met, which will contribute to reducing temperatures in cities.

5. The “standing” gardens

Currently, apartment complexes are chosen to solve the housing problem in big cities, thanks to its convenience and affordable price. But these buildings also bring inconvenience because of the narrow land area, which makes gardening more difficult. Therefore, the establishment of standing gardens for apartments has become the most optimal green solution ever. The concept of “green buildings” evokes an image of a green, cool structure that is in stark contrast to the harsh concrete surfaces of less eco-friendly buildings (Figure 5).



Figure 5. The image of a “standing” garden

Such works besides the walls, the roof system is always transformed into a vertical green lush garden with canopy cover. Currently, standing gardens are growing everywhere. For apartments, standing gardens exist 2 types that are vertical gardens for landscaping of the whole apartment, or standing gardens in each house.

The lush green gardens right at our home can save you space, while not taking up too much care time and being environmentally friendly. Green walls are designed to cover the western surface of the house to minimize the use of electricity as well as cool the building, creating beautiful landscapes with plants and flowers growing green all year round.

A vertical garden system is designed to build the entire front of each apartment. It will create a large green wall, creating a beautiful landscape for the building. Besides, it will help reduce the radiation due to the sun bringing cool fresh air to people here. However, analysts say that the benefits of roof gardens and upright gardens may be overshadowed by the huge maintenance and investment costs. Barriers such as water supply and drainage systems that form part of the roof garden infrastructure are considered. Developed plants must be carefully selected and take into account their ability to withstand the environmental challenges inherent in buildings.

In addition to irrigation requirements, issues such as fertilizer, pesticides and periodic pruning are also discussed. The costs of maintaining trees are exacerbated by the annual hot dry climate of many Asian countries. In fact, in Singapore, it has been applied a lot and shows that putting green gardens on the roofs of old buildings is often difficult and extremely expensive.

6. A few things need to be done immediately

One of the solutions to organize propaganda activities on environmental protection and climate change response, in which, propaganda is visualized such as using banners, slogans, and flyers, etc.

Besides, propaganda in newspapers, radio and television plays an important role. We need to develop long-term categories, TV reports, news articles and articles that reflect environmental protection activities and measures to respond to climate change among young people. We also need to organize reality television programs, interactive television programs on environmental protection between young people and people on television. A key issue is that new technologies which are able to “lead to the necessary reductions in emissions” [9].

Specifically, we need to continue to effectively implement and build and replicate the models and constructions of young people participating in environmental protection and climate change response; support young people's startup ideas, start-up and career models in the field of environmental protection; mobilize union members and youth to use input materials of environmentally friendly production, discharge according to regulations, and build green economic models; guide the establishment and maintenance of youth cooperatives and cooperatives operating in the field of environment; guide the establishment and maintenance of operations of assault youth squads engaged in beach cleaning; teams of young people voluntarily specialize in natural disaster prevention, support people in dealing with environmental incidents; youth clubs volunteering on environmental protection, etc. [10].

Besides, building and scaling up models of response to climate change. Via those activities, we can build pilot models of crop adaptation to climate change, saving electricity and energy; constructing houses to avoid floods and constructing water storage tanks, water filtration tanks, etc. So, to have a spacious green space, can relax with friends and family, there is no other way to enjoy the terrace. Many times the demand is so great that people search for a somewhat compelling nature by shrinking the mountains in the rockery, cutting trees into bonsai, bringing nature into the landscape of the garden, etc.



Figure 6. The image of a fresh vegetable garden on the roof

The terrace quickly becomes the ideal location for modern townhouses to take advantage of. Plant familiar plants like bamboo, areca, banana or papaya, creating a thick green patch. This way of growing feels like a dense garden but only in a very limited area. In order to have this relaxing position to sit and watch must be suitable (figure 6).

There is no need for a lot of green space and space but the material usage will support this idea. For example, creating the image of a quiet park corner requires only a stone bench and lamp post, a pond bank planted with a few lemongrass bushes, a corner of a windy backyard and kites to create a peaceful landscape of the garden.

On the rooftop, it displays your favorite items, the combination of green areas and the display locations so that the proportion and layout are reasonable. In this space, we can use statues, rock layouts, gravel, or other items and knowing how to arrange it will be highly effective.

On the terrace, we can also build walls that enclose the campus, prevent external scenes and sounds, creating a very separate space. When we raise your head to look up high, it will be our own sky. The terrace was built of walls but it opened a few doorways as if creating beautiful frames with seemingly ordinary scenery [11].

The note when constructing small landscape garden on the terrace. Trees are always the first obstacle when people choose to build an upper garden, because of difficulties in soil and fresh drainage system for trees. But with the tendency to choose the terrace as a townhouse garden, many places have chosen, gathering ornamental plants that are suitable for this small landscape garden. When choosing ornamental plants, flowers for the garden on the terrace, you should note the following points:

In order to do that, we need to understand the area, terrain and space to plant trees. From there, we can choose the tree shape (bush, tall straight or vines, low spread, etc. Sturdy waterproofing treatment to ensure that the floor is not damp, in addition, the drainage system must be effective after every watering of the tree. We should select each type of tree with characteristics that suit your home environment. The selected plants should be in harmony, avoiding arbitrary, unbalanced and easy to lose sight.

7. Conclusion

Finding out effective ways to protect the environment and limit climate change is very important. This is the most urgent and necessary work than ever and is not an individual's task. If a country does not respond promptly to climate change, the economic, social, and life difficulties of its people are inevitable. Green is an essential direction for any city for sustainable development. We need to have a resolute attitude as well as to propagate the meaning of deep environmental protection to our lives. From there, we can raise people's awareness and responsibility for the surrounding environment.

8. Conflict of Interest

There is no conflict of interest in the paper.

9. References

- [1] Li, Yanling, and Roger W. Babcock. 2014 Green roofs against pollution and climate change. A review. *Agronomy for Sustainable Development*. **34** 695-705
- [2] Mahmoud, Abubakar, Muhammad Asif, Mohammad Hassanain, Mohammad Babsail, and Muizz Sanni-Anibire. 2017 Energy and economic evaluation of green roofs for residential buildings in hot-humid climates. *Buildings*. **7** 30
- [3] Schmidt, Andreas, Ana Ivanova, and Mike S. Schäfer. 2013 Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries. *Global Environmental Change*. **23** 1233-1248
- [4] Williams, Nicholas SG, John P. Rayner, and Kirsten J. Raynor. 2010 Green roofs for a wide brown land: Opportunities and barriers for rooftop greening in Australia. *Urban Forestry & Urban Greening*. **9** 245-251
- [5] Scholze, Marko, Wolfgang Knorr, Nigel W. Arnell, and I. Colin Prentice. 2006 A climate-change risk analysis for world ecosystems. *Proceedings of the National Academy of Sciences*. **103** 13116-13120
- [6] Bäckstrand, Karin, and Eva Lövbrand. 2006 Planting trees to mitigate climate change: Contested discourses of ecological modernization, green governmentality and civic environmentalism. *Global environmental politics*. **6** 50-75
- [7] Hong, Sun-Kee, In-Ju Song, and Jianguo Wu 2007 Fengshui theory in urban landscape planning. *Urban ecosystems*. **10** 221-237
- [8] Chan, Shihchien. 2015 Green Building Design Related to Feng Shui Issues in Taiwan. *Journal of Engineering and Architecture*. **3** 19-27
- [9] Spence, Alexa, and Nick Pidgeon 2009 Psychology, climate change & sustainable behaviour. *Environment: Science and Policy for Sustainable Development*. **51** 8-18
- [10] Hübler, Michael, Gernot Klepper, and Sonja Peterson 2008 Costs of climate change: the effects of rising temperatures on health and productivity in Germany. *Ecological Economics*. **68** 381-393
- [11] Al-Mumin, Adil, and Abdullah Al-Mohaisen 2006 Greening the Kuwaiti Houses: Studying the Potential of Photovoltaics for Reducing the Electricity Consumption. *Global Built Environment Review GBER Journal*. **5** 3-10

Acknowledgments

I would like to acknowledge encouragement from my colleague, Mr. Nguyen Tan Danh (IT Department) as well as my university.