

## Mitigating Climate Change Towards Livable City (Case: Bandung City, West Java)

June Ekawati, Herdi Sofari, Winda Rahmawati, Suci Indah Permata, Edo Setiawan

Universitas Kebangsaan Republik Indonesia, Bandung, Indonesia

Corresponding e-mail: [ekawatijune@gmail.com](mailto:ekawatijune@gmail.com)

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**Abstract.** The increase in environmental problems due to climate change means that people in big cities need to carry out mitigation by reducing carbon emissions in their residential areas to make city areas more livable. This research aims to explore various problems and impacts of climate change in the city of Bandung as well as mitigation efforts carried out by the community to reduce carbon emissions while creating a livable city. The research method is qualitative-descriptive with primary data collection through interviews and field observations. The research was conducted in 4 urban village settlement locations, namely Cibunut Kampong in *Kelurahan* Kebon Pisang, *Kelurahan* Antapani Tengah, *Kelurahan* Neglasari, and *Kelurahan* Cisaranten Kidul, Bandung City. The research results showed that there are several spatial and environmental problems in the effort to achieve a livable Bandung City. The climate change mitigation efforts that have been implemented by the community in their residential areas while creating a more livable city area are by adding and managing green open space, independent waste management, managing *Buruan sae* (Urban farming) programs and vertical gardens, creating bio pores and absorption wells, maintaining environmental cleanliness and establishing collaboration with various related institutions.

Keywords: climate change, mitigation, carbon emission, kampong, livable city

### 1. Introduction

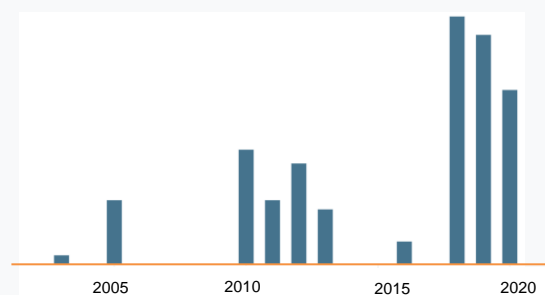
Environmental issues, such as the impact of climate change, carbon emissions, and global warming, which have the potential to cause various disasters for life, are currently increasingly hot topics of discussion throughout the world (Buton et al., 2023; Haryanto & Prahara, 2019). The increase in greenhouse gas (GHG) concentrations in the earth's atmosphere caused by CO<sub>2</sub> emissions, especially those resulting from urban areas, contributes significantly to climate change and global warming. Climate change is a long-term change in the average weather patterns that determine the local, regional, and global climate on Earth. These changes have broad impacts, such as changes in the amount of rainfall, changes in temperature, changes in the earth's climate, and even changes in where rain and snow usually fall on Earth. Changes in global mean surface temperature reported on the NASA website (<https://climate.nasa.gov/global-warming-vs-climate-change/>) warn all countries about the threat of climate change impacts.

An urban environment that is comfortable to live in and carry out activities embodies a livable city when viewed from physical and non-physical variables (Kristarani, 2015; Martin et al., 2019; Siagian et al., 2022). The 1945 Indonesian Constitution, Article 28 H Paragraph 1 also states that "*Everyone has the right to live in physical and spiritual prosperity, to have a place to live, and to have a good and healthy living environment.*" Therefore, all Indonesian people must obtain their right to live in a good residential environment in a livable area. Some areas that are vulnerable and have a high risk of disaster in villages or cities, of course, cannot be called livable areas. Likewise, settlements that are located in polluted areas due to air or water pollution so that the environment becomes unhealthy, of course, cannot be called livable areas.

The increase in environmental problems in big cities makes it difficult for a city to meet the targets on the national urban development roadmap where 100% of livable city indicators are realized in all cities by 2025 (Sulaiman, 2018). The environment is one of the determining aspects in creating a livable city so city development that does not pay attention to environmental aspects will affect the city's achievement of becoming livable (Shah Muslim Albimaly et al., 2022).

The housing sector in urban settlements is also inseparable from environmental problems including carbon emissions, starting from the planning and design stage, construction, and operation, to the building demolition stage (Buton et al., 2023). Energy consumption in the household sector, including lighting, cooking, air conditioning, and the use of vehicles for mobility, also produces carbon emissions. Total CO<sub>2</sub> emissions for the household sector in Indonesia consist of 3.8% direct CO<sub>2</sub> emissions and 20.7% indirect CO<sub>2</sub> emissions (Latifa et al., 2022). Energy consumption in the building sector is one of the largest in Indonesia, besides the household, transportation, and industrial sectors (Sanvia & Garniwa, 2018).

Increasing GHG concentrations, especially CO<sub>2</sub> in the atmosphere, will further increase global warming. Therefore, to create a habitable city, the general public and all stakeholders need to collaborate and participate in mitigation efforts to reduce CO<sub>2</sub> emissions in residential environments because climate change is the most serious challenge that must be faced this century (Wulandari et al., 2013). According to Law of the Republic of Indonesia Number 24 of 2007, mitigation is a series of efforts to reduce disaster risk, both through physical development and awareness and increasing capacity to face disaster threats. The term mitigation is usually associated with disaster problems, where disaster mitigation can be in the form of structural mitigation related to physical development and construction efforts as well as non-structural or non-physical mitigation (Buchori et al., 2018; Ekawati et al., 2022; Saravanan, 2016; Wikantiyoso, 2010). In this research, the mitigation carried out is in the form of a series of efforts to reduce the risk or impact of climate change which can worsen the living conditions of people in urban kampong settlements such as water scarcity, excessive air temperature increases, increased frequency of flood disasters, pollution, and even food shortages by means of reducing carbon emissions produced by people's daily activities in residential areas.



**Chart 1.** Intensity of flood events in Bandung City 2003-2020 (Source: <https://bandungbergerak.id/article/detail/1606/data-intensitas-banjir-di-kota-bandung-2003-2020-meninggi-seiring-fenomena-penurunan-muka-tanah>, 2022)

The city of Bandung is one of the cities that is in the average tier range on the MLCI (Most Lively City Index) from IAP (*Ikatan Ahli Perencanaan* or the Association of Planning Experts) in 2017 and 2022. This means that the city of Bandung is still not comfortable to live in. Several areas in the city of Bandung are uninhabitable because they have an increasing trend of floods and landslides. Some slum areas are even located in polluted environments such as on river banks and around landfills that are unfit for habitation. Another environmental issue that is strongly felt by people in the city of Bandung is the increase in air temperature (Puspitojati & Samsuudin, 2015) because, since time immemorial, Bandung has been famous for its cool air. This condition is further exacerbated by very high population density and the impact of climate

change which also increases the potential for disaster events. In Chart 1, it can be seen that the trend of flood intensity in the city of Bandung in 2003-2020 has increased. BPS (Badan Pusat Statistik or Indonesian Central Statistics Agency) estimates that in 2020, 56.7% of Indonesia's population will live in urban areas, while in 2035 the urban population in Indonesia will be 66.6% (Purwanto & Darmawan, 2022).

In MLCI 2017, IAP uses 7 variables, namely city physical, environmental quality, transportation-accessibility, facilities, utilities, economic and social (Hisyam, 2021). The 2022 MLCI uses 28 variables, so it is much better than before. Additional environmental variables included in the 2022 MLCI are city cleanliness, solid waste, city park facilities, and liquid waste and drainage management. The city safety variable that has just been included in the 2022 MLCI is very important and crucial, because if a city is at high risk of disaster, then no matter how well the city is built, the city will still be uninhabitable. City safety variables, it should not be limited to how the city survives and adapts to provide a sense of security to citizens because disaster problems are also related to environmental problems that have the potential for disaster, preparedness from the community, city government, and other stakeholders, regulatory issues and disaster mitigation efforts that must be done continuously.

Research related to livable cities is generally about assessing the livability level of a city (Fanggidae, 2023; Shah Muslim Albimaly et al., 2022). Meanwhile, research on carbon emissions is more diverse, such as assessing household carbon emissions (Indrawati, Ervina Dwi, Hermawan, 2015; Latifa et al., 2022; Wulandari et al., 2013), government policies (Buton et al., 2023), levels of carbon absorption (Febriansyah et al., 2022; Momongan et al., 2017; Sarasidehe et al., 2023). The novelty of this research is that it examines the connection and intersection of livable city variables with climate change mitigation efforts in reducing carbon emissions carried out by communities in urban kampong residential areas. This theme has not been discussed in previous research.

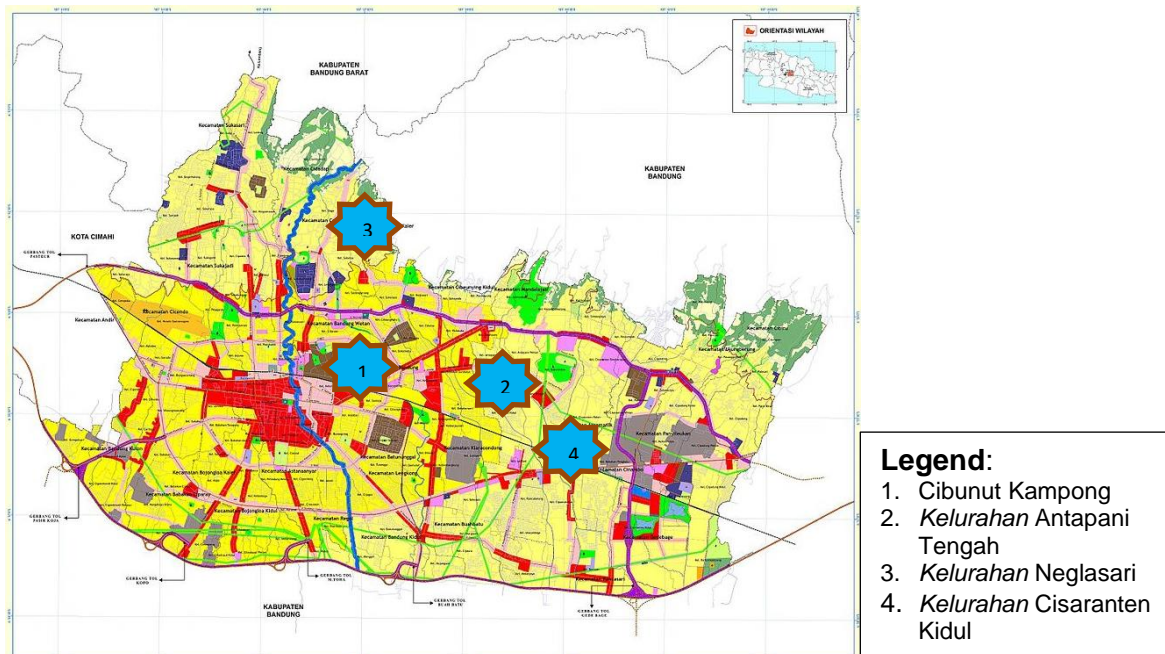
The impact of climate change, which is now starting to be felt by people in the city of Bandung, needs to be socialized more massively so that more people have the awareness to actively participate in mitigation efforts in their respective settlements. From the various problems that have been described, the formulation of the problem in this research is what the problems and impacts of climate change are in the city of Bandung and how climate change mitigation efforts, especially in reducing carbon emissions, in residential environments are carried out by the community to create livable urban residential areas. The aim of this research is to describe climate change mitigation efforts carried out in residential areas in Bandung City as a basis for considering the importance of including more environmental aspects in the livable city variable. The benefit of this research is to further explore the mitigation efforts that have been carried out by the community in overcoming the impacts of climate change by reducing carbon emissions in their residential environment so that it can become a role model for settlements in other areas in managing urban kampong residential environments that are more livable even though they have limited land.

## **2. Methods**

The research method used is descriptive-qualitative, where primary data collection is carried out through interviews with several sources at the study location and field surveys. Meanwhile, secondary data was obtained from statistical data and data from several previous related studies conducted by other researchers. This descriptive-qualitative method is more suitable for use in this research because it will be able to provide a better description of the various problems that exist to achieve the goal of becoming a more livable Bandung City, regarding the condition of the urban kampong settlements which are the study locations as well as a

description of the efforts made by the community in mitigating climate change by managing the environment and reducing carbon emissions in residential areas.

The research sites were carried out in the following four urban kampung residential areas from four different *kelurahan* (urban villages):

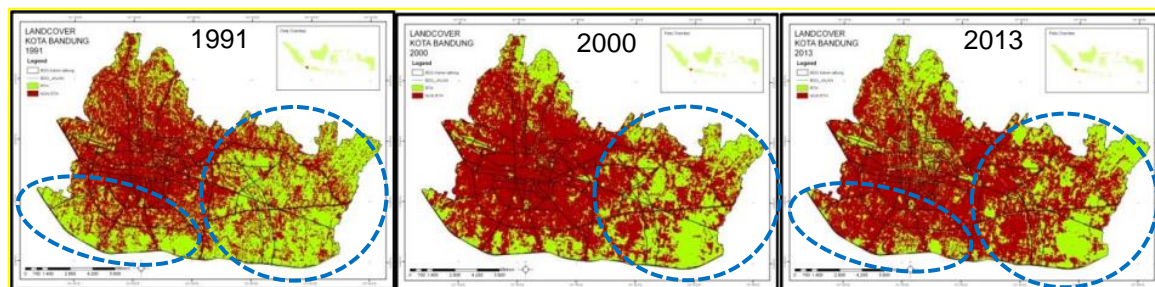


**Figure 1:** Study sites on the Bandung City map (Source: Processed from [https://commons.wikimedia.org/wiki/File:Peta\\_Rencana\\_Pola\\_Ruang\\_RTRW\\_Kota\\_Bandung\\_2011-2031\\_TTD.JPG](https://commons.wikimedia.org/wiki/File:Peta_Rencana_Pola_Ruang_RTRW_Kota_Bandung_2011-2031_TTD.JPG))

### 3. Discussion

#### 3.1. Spatial and Environmental Problems to Achieve a More Livable City of Bandung

The city of Bandung is one of the large cities that actively produces pollutants, where carbon emissions are a significant contributor to air pollution and climate change which hurt human health and increase the potential for various disasters. Various problems related to urban space that occur and become a driving factor for the emergence of various environmental problems are population growth in the city of Bandung. The population in Bandung City in 2023 is 2,555,187 people, which means an increase of 74,723 people or 3.01% from the population in 2019 of 2,480,464 (Bandung City Population and Civil Registry Office, 2023). Large population growth will certainly result in an increase in the need for land, both for housing and other public facilities so that people can live a decent life. This causes quite massive changes in land use and land cover from open green land to non-green land for other functions as shown in Figure 2 which shows changes in land cover in 1991, 2000, and 2013. This change in land cover will certainly have an impact on many things, especially the environment.



**Figure 2:** Landcover Changes in Bandung City in 1991, 2000 and 2013  
(Source: Processed from Budiman et al., 2014)

Another problem related to urban space that causes several areas to become uninhabitable is the large number of slum areas due to the very dense settlements in urban villages in the city of Bandung. According to data from the Bandung City Government's Housing and Settlement Area Department for residential areas, in 2015 there was 1450 Ha (8.7% of total city area) of slum areas, which in 2020 reduced to 491 Ha and in 2021 there was 468,031 Ha (2.8% of total city area) of slum areas remaining (<https://www.detik.com/jabar/berita/d-6144309/dpkp-cepat-cause-emergence-of-slum-di-bandung-city>). This large slum area is still a complicated problem that needs to be addressed immediately to move towards a more livable city of Bandung.

Environmental problems in the city of Bandung are problems that often attract public attention because they increase the potential for disasters. The potential and risk of disaster in several areas make these areas uninhabitable even though other indicators are rated quite well. Some environmental problems related to climate change that are felt by the community and require solutions to achieve a more livable city include:

- Increased air temperature, especially during the day, makes people less comfortable in their activities (Puspitojati & Samsuudin, 2015)
- Poor waste management, especially after the Sarimukti landfill fire (<https://www.kompas.id/baca/nusantara/2023/11/06/kuota-pembuangan-masih-terbatas-sampah-kota-bandung-menumpuk-di-jalan>)
- Flood events are becoming more frequent (Chart 1)
- Availability and quality of clean water (<https://bandungbergerak.id/article/detail/15862/manajemen-pengelolaan-air-bersih-kota-bandung-masih-lemah>)
- Water and air pollution are getting worse (Puspitojati & Samsuudin, 2015)
- Lack of green open space, which is currently still 12.25% of the city's land area (<https://bandungkota.bps.go.id/statictable/2021/03/25/1459/potensi-ruang-terbuka-hijau-rth-di-kota-bandung-2020-.html>).

### 3.2. Climate Change Mitigation Efforts at the Study Sites

Residential activities have the potential to produce carbon emissions, especially those resulting from the use of motorized vehicles that use fossil fuels, and cooking activities that use LPG (Liquid Petroleum Gas) or electrical energy equipment for household appliances (Indrawati, Ervina Dwi, Hermawan, 2015). To reduce the impact of climate change felt over the past few years, reduce carbon emissions in residential environments, and achieve the target of a more livable city, communities in several villages in Bandung City have begun to carry out various mitigation efforts. This effort was partly initiated and coordinated directly by several village community leaders such as neighborhood heads by inviting all residents to participate.

Concern for the regional environment is the focus of community attention, especially those in very dense urban kampong settlements, to make their settlements more livable. Several urban

kampongs that were the locations of this research were successful in becoming winners in the *Kang Pisman Award* competition at the city level organized by the Bandung city government. Concern for the environment is a climate change mitigation effort carried out by the community in several study locations to achieve a more livable and net zero emission city of Bandung.

### 3.2.1 Cibunut Kampong, Kelurahan Kebon Pisang

This kampong is located on Jalan Sunda, Kebon Pisang, Sumur Bandung District, Bandung City. Cibunut Kampong is the winner of the 1st *Kang Pisman Award Waste Management Competition* at the Bandung City level, so it deserves to be a role model for other kampong. To move towards a livable city, Cibunut Kampong has carried out many innovations in terms of waste management and other mitigation efforts related to climate change and reducing carbon emissions which were initiated by the community with a very good level of participation.

Some of the mitigation efforts that have been carried out in Cibunut Kampong, Bandung, in dealing with climate change by reducing carbon emissions in their settlements are:

#### 1. Changing land use

The change in land use from empty, unoccupied land in the kampong to green open space was carried out by the community so that they could plant the land with various vegetation and trees so that the air in the village felt cooler and more comfortable. This is an excellent climate change structural mitigation effort (because green open space is very useful in contributing to providing oxygen in residential environments).

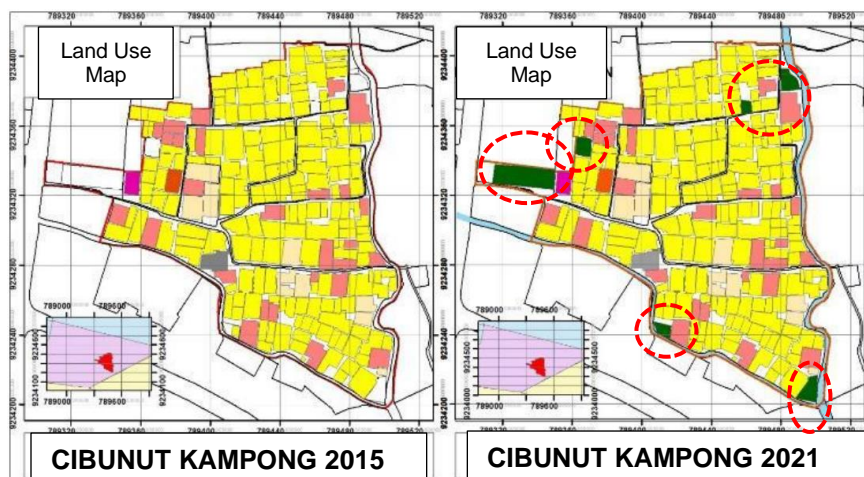


Figure 3: Land use Change of Cibunut Kampong, Bandung (Source: Processed from Firdaus, 2021)

In Figure 3, it can be seen that the residential density in this kampong is very high, and there is almost no space left to plant trees because the distance between houses is very close. On the 2021 map, there is a change in land use, where empty, unoccupied land has been turned into green open space. This change means that Cibunut Kampong can "breathe" more because there are additional trees that produce oxygen and can absorb pollutants, especially carbon emissions, in their settlement.

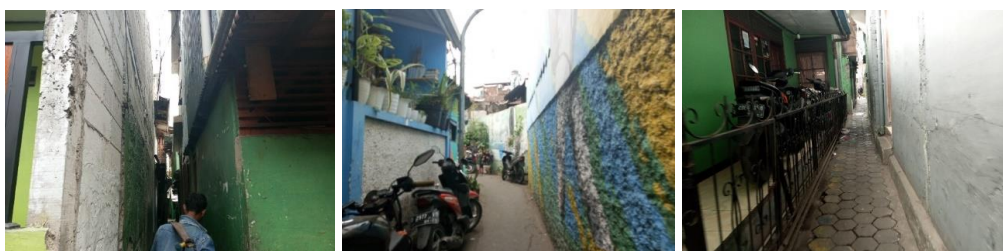


Figure 4: Circulation path in Cibunut Kampong, Bandung (Source: Author documentation, 2023)

In Figure 4, it can be seen that the access roads for circulation between residential buildings are very narrow (around 0.50 – 1.00 meters), so they can only be passed by motorbikes, bicycles, and pedestrians. Almost no house buildings have open yards left that can be planted with vegetation in this kampong.

## 2. Planting vegetation in possible locations.

Community efforts to mitigate climate change to make their settlements into more livable areas while reducing carbon emissions are carried out by planting a variety of vegetation in their residential environments. The community has planted vegetation in the form of trees and potted plants on a massive scale by creating vertical gardens around house buildings or in the form of rows of pots on the edge of house fences arranged horizontally and making media for vines which also function as canopies (Figure 5). The addition of vegetation in this kampong makes the air fresher and more comfortable, as well as absorbing greenhouse gas pollutants in the residential environment.



**Figure 5:** Planting vegetation in Cibunut Kampong, Bandung (Source: Author documentation, 2023)

## 3. Waste management

For household waste management, this kampong implements a waste processing program called Kang Pisman (*kurangi, pisahkan dan manfaatkan* or reduce, separate, and utilize) which is also useful in non-structural mitigation efforts against climate change towards livable residential areas. Waste management is running well and the results can be utilized by residents (Figure 6). Organic waste that has been sorted in each house is collected and then processed into compost, while plastic waste is collected and deposited in the waste bank at the relevant city office so that the community benefits from the plastic waste deposited.



**Figure 6:** Waste management in Cibunut Kampong, Bandung (Source: Author documentation, 2023)

## 4. Installation of Biopore in several locations to increase rainwater absorption.

Climate change mitigation efforts in the form of installing biopores are rarely carried out in other locations. However, with high awareness, the community in Cibunut Kampong installed biopores in several locations (Figure 7) to reduce the volume of organic waste thrown into landfills, as well as help absorb water into the soil and prevent flooding.



Figure 7: Biopores in Cibunut Kampong, Bandung (Source: Author documentation, 2023)

5. Maintain the cleanliness of the environment so that Cibunut Kampong becomes a clean, beautiful, and creative village and continue to educate the general public who come to visit about waste management and the importance of loving the environment.

### 3.2.2 Kelurahan Antapani Tengah

Settlements in Antapani Tengah sub-district, Antapani District, Bandung City, have moderate population density (Figure 8). Antapani Tengah Subdistrict won 2nd place in the 2023 *Kang Pisman* (Reduce, Separate and Utilize) Award Competition for the main category organized by the Bandung City Government. This sub-district has one waste processing site and *Buruan Sae* which is located in RW 09. *Buruan sae* is an integrated urban farming program from the Food and Agriculture Service of the Bandung City Government which is carried out in community yards or existing land to meet family food needs or sold in micro quantities.

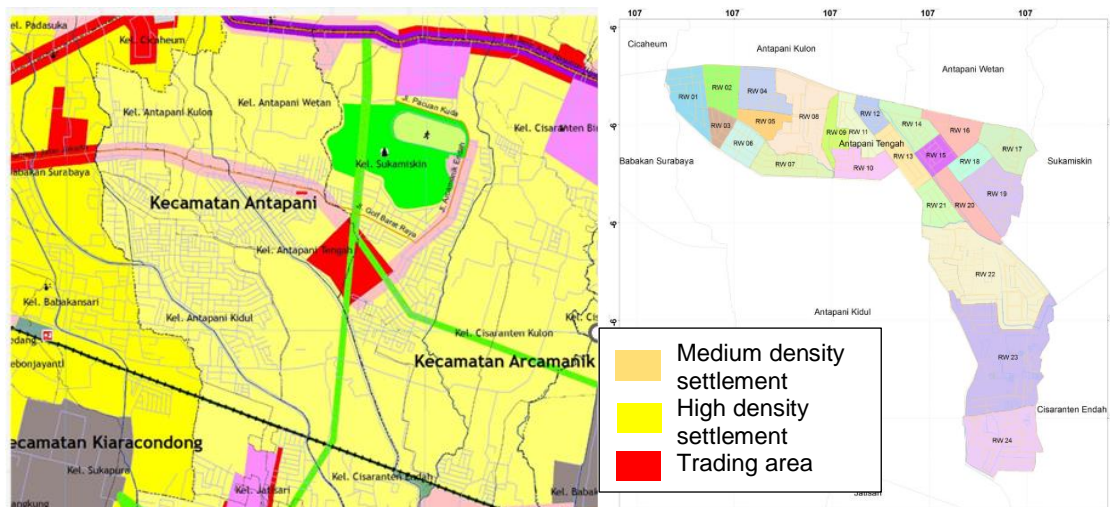


Figure 8: Land use and Kelurahan Antapani Tengah, Bandung Map (Source: <https://multisite.bandung.go.id/kelurahan-antapani-tengah/profilkelurahan/sejarah-visi-dan-misi/>)

Figure 9 shows several structural and non-structural climate change mitigation efforts carried out by the community to reduce carbon emissions and create livable residential areas in Kelurahan Antapani Tengah:

1. Management of green open space by the community which is used for urban farming, waste management, and public space
2. Processing organic, inorganic, and residual waste.
3. *Buruan Sae* is the creation of integrated urban farming, the results of which can be utilized by the community itself so that it is very beneficial for the food security of families in the area.
4. Planting vegetation through aquaponic media in buckets, the results of which can be utilized by the community itself
5. Maggot breeding by utilizing organic waste deposited by the community

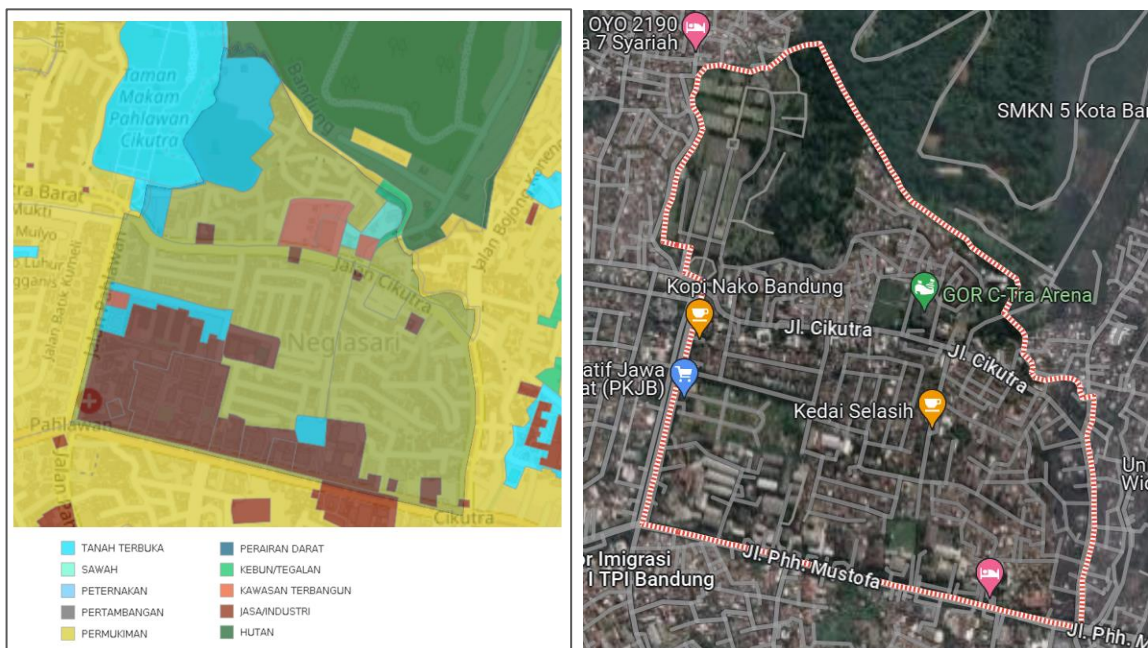




**Figure 9:** Mitigation on *Kelurahan Antapani Tengah*, Bandung (Source: Author documentation, 2023)

### 3.2.3 *Kelurahan Neglasari*

*Kelurahan Neglasari* is located in Cibeunying Kaler District, Bandung City, where land use consists of residential areas, services/industry, open land, built-up areas, and rice fields (Figure 10). This sub-district has 3 open green spaces even though the settlements are quite dense, namely *Neglasari Park* (located in RW 02), *Kunang-kunang Park* (in RW 07), and *Cidurian Park* (in RW 08). Based on the typology, the existing Green Open Space at this study site only consists of non-natural open space. Settlements in the *Kelurahan Neglasari* are dominated by unplanned urban kampong settlements, where the land area of the houses is limited so most do not have sufficient yard space for private green open space. Others are in the form of formal housing that is planned and equipped with public spaces, close to main road access, commercial facilities, education, and others,



**Figure 10:** Land Use and Map of *Kelurahan Neglasari*, Bandung (Source: Google Earth, 2023)

The problem of population density in this sub-district is reduced by the large amount of green open space and open land that functions as a burial location. The availability of green open space provides added value as a livable city area. Apart from that, *Kelurahan* Neglasari also won 1st place in the 2023 *Kang Pisman* Award Competition organized by the Bandung City Government for the Main Category. Several climate change mitigation efforts that have been implemented by the community and relevant stakeholders in this sub-district (Figure 11) are as follows:

1. Provision and management of open land as green open space and public space. The existence of several green open spaces in this area is very beneficial for the community because the vegetation in the form of trees and other shrubs can absorb carbon and other GHG emissions and produce oxygen in residential environments.
2. Waste management by establishing a waste bank to manage non-organic waste and independent waste sorting (using buckets)
3. Create biopores in some areas
4. Maintain a clean environment so that people feel comfortable doing their activities and settlements become more comfortable to live in.
5. Innovation in making glazed bricks (composters). Further processing of waste into valuable products like this needs to continue to be encouraged and supported by the city government.



Figure 11: Mitigation on Neglasari Sub-district, Bandung (Source: Author documentation, 2023)

### 3.2.4 Kelurahan Cisaranten Kidul

*Kelurahan* Cisaranten Kidul is located in Gedebage District, Bandung City adjacent to the Al Jabbar Mosque (Figure 12). This sub-district has 16 RWs with land use characteristics as residential, services, and trade. Cisaranten Kidul Village has 2 open green spaces, namely Electric Park and Boseh Summarecon Park.

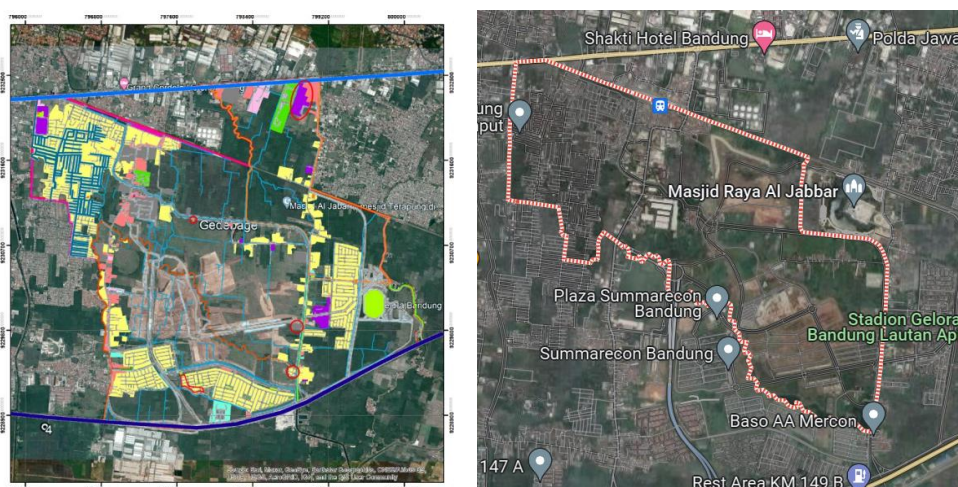


Figure 12: Land Use and Map of *Kelurahan* Cisaranten Kidul, Bandung (Source: Aziz & Raharjo, 2022; Google Earth, 2023)

The mitigation efforts initiated and carried out by the community together with relevant stakeholders to reduce carbon emissions and make residential areas healthier and more livable are:

1. Providing and managing open land into adequate green open space which is very useful in absorbing carbon emissions, especially CO<sub>2</sub> and GHG which pollute the air in the area and producing oxygen to improve public health.
2. Activate the *Buruan Sae* program, which is integrated urban farming. This urban farming program, which is equipped with nurseries, wells, and huts, utilizes limited land that is not occupied by buildings by planting vegetables, fruit, and even tubers so that it is very beneficial for the food security of local communities.
3. Cooking center management combined with urban farming, is managed to anticipate toddlers who experience malnutrition in the environment.
4. Pay attention to environmental cleanliness, support energy-efficient transportation by providing more comfortable pedestrian paths and bus stops and the use of public transportation to reduce environmental pollution.



**Figure 13:** Mitigation on *Kelurahan Cisaranten Kidul, Bandung* (Source: Author documentation, 2023)

The success in maintaining environmental cleanliness, managing green open space and urban farming programs on limited land in *Kelurahan Cisaranten Kidul*, apart from making residential areas greener and more beautiful (Figure 13), also increases the success of achieving the net zero emission program and making the city of Bandung livable.

From the four study locations above, several factors can be analyzed which are key to the success of mitigation efforts in the four study locations above, including:

- The role of community leaders at the RT and RW level who are very diligent and persistent in initiating, inviting, gathering and mobilizing the community to participate;
- The closeness of community relations in the Bandung city village settlements which are the study locations is very good so that the community has the awareness to work together to find solutions and overcome various problems faced in their respective residential environments;
- Very good level of community participation and full awareness of participating in the implementation of various environmental programs in their settlements;
- Support from the city government starting from the smallest units at the sub-district level which is very good in supporting community participation in various competition events and outreach on the theme of environmental management.

Table 1: Climate Change Mitigation Efforts at the Study Sites (Source: author analysis, 2023)

Study Sites	Cibunut	Antapani Tengah	Neglasari	Cisaranten Kidul
Availability of green open space	Very less	Not enough	Adequate	Very Adequate
Environmental Cleanliness	Very good	Very good	Very good	Very good
Waste management	Very good	Very good	Very good	Good
Black water management	Very less	Not enough	Very good	Good
<i>Buruan sae</i> / urban farming	Not enough	Very good	Good	Very good
Vertical garden	Very good	Good	Very good	Nothing
Infiltration wells	Not enough	Good	Very good	Good
Biopores	Adequate	Not enough	Not enough	Nothing
Creativity dan participation	Very good	Very good	Very good	Very good
Institutional cooperation and support	Very good	Very good	Very good	Very good

In Table 1, the conditions for green open space availability in the four locations are very different. In Cibunut Kampong, the provision of green open space is indeed experiencing difficulties due to the unavailability of land so it is not possible to implement the *Buruan Sae* program, but limited land has made the community take the initiative to create vertical gardens to increase the coolness of the settlement and biopores to reduce the risk of flooding in their area. For creativity and innovation, the people in these four locations have been very good at implementing mitigation efforts, such as further processing of waste into openwork bricks which are a recycled product with more economic value in Neglasari, and excellent management of *Buruan Sae* program in Neglasari, Antapani Tengah and Cisaranten Kidul.

As the final part of the discussion, the research results have outlined mitigation efforts that have been carried out by the community, both structural and non-structural (Buchori et al., 2018; Ekawati et al., 2022; Saravanan, 2016; Wikantiyoso, 2010) which are related to several variables of livable cities in 2022. Research This does not aim to calculate how much carbon absorption capacity of all the vegetation that has been planted (Febriansyah et al., 2022; Momongan et al., 2017; Sarasidehe et al., 2023) and how much carbon emissions are produced by daily household activities in the settlement as carried out in previous research (Indrawati, Ervina Dwi, Hermawan, 2015; Latifa et al., 2022; Wulandari et al., 2013) and whether the various mitigation efforts are sufficient to reduce the emissions produced. However, physically, the residential environment in the four study locations has now transformed to become much cleaner, more attractive, healthier and more comfortable, more creative, and more livable even though the urban villages remain very densely populated.

The research findings show that various climate change mitigation efforts by the community, especially in reducing carbon emissions, have resulted in significant changes in the environmental conditions of settlements in the four study locations to become much better, more comfortable and more livable. The community's concern and role in environmental problems by carrying out various mitigation efforts to reduce carbon emissions has the potential to increase the regional index to become more livable. This means that additional "environment-related variables" included in the 2022 MLCI, namely city cleanliness, solid waste, city park facilities and dirty water and drainage management, can play an important role in increasing the livability index of a city. If compared with the previous livable city variables, where there were only 7 variables (Hisyam, 2021) with only 1 environmental variable, then the

increase in the livable city index from the environmental sector that might be obtained would be less significant.

## 6. Conclusion

From the description of various environmental problems and the impact of climate change in the city of Bandung as well as the mitigation efforts carried out by the community in urban kampong settlements to reduce carbon emissions and create more livable areas, it can be concluded that the people in the city of Bandung are already experiencing the impacts of climate change in their settlements. The spatial and environmental problems in the city of Bandung include changes in land cover and land use, especially in the East and South parts of Bandung, slum settlements, lack of green open space, flood disasters which are becoming more frequent, increased pollution (air, water and land) and waste management. the city is not good.

In overcoming the impact of climate change in residential environments, there are several mitigation efforts that have been implemented by the community in several kampong settlements in the city of Bandung and can be used as role models, including the addition and management of green open space in locations where it is still possible, independent waste management, management of Buruan Sae programs (urban farming) and vertical gardens, making biopores and absorption wells, maintaining environmental cleanliness and collaborating with various institutions to support the success of climate change mitigation programs. Therefore, education about the risks and mitigation of disasters due to climate change in every city area needs to continue to be carried out and socialized to people at all age levels to create a more livable city.

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