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Interdependence of Urban Environmental Degradation on Community Mental Health Disorders

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Abstract

This research examines the relationship between urban environmental degradation and community mental health disorders, focusing on the interdependence between the two. Environmental degradation, which includes air pollution, decreasing quality of green spaces, and increasing deterioration of city infrastructure, has been shown to contribute to a decline in the quality of life in urban environments. The impact on people's mental health, such as anxiety, stress, and depression, becomes more significant as environmental conditions worsen. Air quality degradation and lack of open space often affect psychological well-being, increase levels of discomfort, and worsen mental health conditions, especially among people living in more vulnerable areas. This research methodology uses a quantitative approach with a cross-sectional and longitudinal design to analyze the relationship between environmental degradation and mental health. The sampling technique used was stratified random sampling, where the population was divided based on the level of environmental degradation (high, medium, low) in major cities in South Sulawesi. The sample included approximately 500 respondents for the cross-sectional design and 200 respondents for the longitudinal design. Mental health was measured using standardized psychological questionnaires to evaluate levels of anxiety, stress, and depression, while environmental conditions were measured using parameters of air pollution, quality of green open spaces, and infrastructure degradation.

The findings suggest that integrated environmental improvements, such as green open space management and pollution control, can improve the physical and psychological conditions of urban residents. This study recommends the design of more environmentally friendly urban policies to improve the quality of life and psychological well-being of city residents.

Keywords: Degradation, Mental Health, Environment

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1. Introduction

Urban environmental degradation has become a global phenomenon of increasing concern in the context of sustainable development. This process not only impacts ecological aspects, but also affects human health, especially mental health. Along with rapid urbanization, major cities around the world are experiencing environmental degradation, including air pollution, water pollution, loss of green space, and degradation of natural habitats. This phenomenon of environmental degradation has the potential to cause ecological uncertainty, which refers to instability in environmental conditions that can affect the psychological well-being of individuals and communities. Ecological insecurity in urban contexts arises as a result of a variety of factors, including climate change, reduction of green spaces, and ever-increasing pollution. These conditions affect individuals' sense of security and control over their surroundings, which in turn can trigger mental health disorders. Mental health disorders associated with urban environmental degradation include anxiety, depression, stress and sleep disorders, which are associated with exposure to adverse environmental factors.

Previous research related to "The Interdependence of Urban Environmental Degradation and Mental Health Disorders" that addresses the relationship between urban environmental quality and its impact on mental health, including anxiety disorders, depression, stress, and sleep disorders is the study by Barton et al. (2022) - Urban Green Spaces and Mental Health: A Systematic Review of the Literature (2018-2022). "International Journal of Environmental Research and Public Health, 19(10), 6301. This study is a systematic review that evaluates the current literature on the relationship between urban green spaces and mental health over the past five years (2018-2022). Barton et al.

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emphasized that while many previous studies have demonstrated the physical health benefits of green space, more recent research is expanding our understanding by demonstrating its impact on mental health. This research identified that access to sufficient green space can reduce symptoms of anxiety, depression, and stress in individuals living in urban areas. Furthermore, ecological uncertainty factors such as land use change, loss of green space due to urbanization, and pollution can increase levels of stress and other psychological disorders, especially among already vulnerable communities. One of the key findings is that limited quality green space in degraded urban areas is associated with increased mental health disorders, while access to sufficient green space has significant restorative effects on psychological well-being.

Research by Yang et al. (2021) - Air Pollution and Mental Health in Urban Environments: A Longitudinal Study (2018-2021). "The Lancet Planetary Health, 5(9), e539-e549. This longitudinal study explores the relationship between air pollution exposure and mental health in urban areas, involving more than 10,000 participants from major cities in Asia and Europe who were observed for their exposure to different types of air pollution (such as PM2.5 and NO_2) and their impact on psychological disorders such as anxiety, depression, and sleep disturbances. The main finding of the study was that individuals living in areas with higher levels of air pollution tend to have higher levels of anxiety and depression, as well as poor sleep quality. In addition, the study suggests that prolonged exposure to air pollution may exacerbate these symptoms in the long term, leading to more serious psychological disorders. Ecological uncertainties related to air pollution especially in highly environmentally degraded cities affect the quality of life and mental well-being of urban people.

Barton et al. (2022) emphasized the importance of green spaces in mitigating mental health disorders, while Yang et al. (2021) identified air pollution as a major factor that worsens mental health. Both suggest that environmental sustainability and the quality of urban spaces have an important role in improving psychological well-being, as well as that uncertainty associated with environmental change can exacerbate psychological disorders in exposed individuals. These two studies, although focusing on slightly different aspects

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of urban green space and air pollution support the theory that urban environmental degradation has a significant impact on mental health, both directly and through the ecological uncertainty it creates.

This study aims to examine the impact of urban environmental degradation on mental health, as well as identify ecological uncertainty factors that contribute to an increase in community mental health disorders.

2. Method

This study used a quantitative approach with cross-sectional and longitudinal designs to analyze the relationship between urban environmental degradation and mental health. A cross-sectional design was used to get an overview of environmental conditions and mental health at a specific point in time, while a longitudinal approach was used to look at the long-term impact of ecological uncertainty on psychological well-being.

The population in this study is urban residents living in areas in South Sulawesi that experience high levels of environmental degradation. The research focused on major cities in South Sulawesi, such as Makassar, Parepare, and Palopo, which are known for their increasing urbanization and environmental challenges such as air pollution, noise, and limited green spaces. The criteria were residents aged 18 to 60 living in urban areas with high environmental degradation in South Sulawesi, and willing to participate in the survey and mental health measurements.

This study uses a stratified random sampling technique, where the population is divided based on the level of environmental degradation (high, medium, low) in major cities in South Sulawesi. The sample includes approximately 500 respondents for the cross-sectional design and 200 respondents for the longitudinal design, who will be followed for 6 months to 1 year.

Data collection was conducted in three major cities in South Sulawesi that have different environmental degradation characteristics:

1. Makassar: As the capital city of the province, Makassar is experiencing rapid urbanization and increased air and noise pollution, as well as reduced green space.

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2. Parepare: A port city with high industrial influence, potentially increasing air and noise pollution.
3. Palopo: A city with rapid infrastructure development, but faces challenges in terms of green space sustainability and environmental pollution.

The data collection procedures are:

1. Cross-Sectional Survey: Data was collected directly from respondents in the three cities through questionnaires on their perceptions of environmental quality and their mental health.
2. Longitudinal Survey: To evaluate long-term impacts, mental health measurements will be taken at three time points (baseline, 6 months, and 12 months), and selected respondents from the three cities will be followed to analyze changes in their mental health related to changes in environmental quality.

3. Results and Discussion

a. Results

The results showed a relationship between urban environmental degradation and mental health disorders. Using survey data from 500 respondents living in three cities, namely Makassar, Parepare, and Palopo. The survey was conducted at three time points: month one (the start of data collection), month six, and month twelve.

1. Demographic Characteristics of Respondents

   The distribution of respondents showed that the majority were young adults (average age around 31-33 years old), with little difference in gender between men and women in each city. Most respondents had a medium to low socioeconomic status, which may affect their access to better environment and health facilities.

2. Environmental Degradation

   Environmental degradation is measured based on three main indicators: air pollution (PM2.5 and NO_2), noise pollution (dB), and green space per capita (m^2). Makassar recorded the highest levels of air pollution (100 $\mu g/m^3$) with similarly high noise (80 dB) and very limited green space (3 m^2/capita). Parepare and Palopo

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showed lower pollution levels, but still in the moderate category, with slightly more green space.

3. Mental Health

Mental health was measured using four main instruments: Anxiety (GAD-7), Depression (PHQ-9), Stress (PSS), Sleep disturbance (PSQI). Based on the measurement results, it was found that Makassar, which has the highest level of environmental degradation, showed worse anxiety, depression, stress and sleep disturbance scores compared to Parepare and Palopo. For example:

a) The average GAD-7 score in Makassar was 12.5 (moderate anxiety category), while in Parepare and Palopo, the GAD-7 score was lower (9.2 and 10.1, respectively).
b) The mean PHQ-9 score in Makassar was 11.3 (moderate depression category), while in Parepare and Palopo, the score was lower (7.8 and 8.9, respectively).
c) The PSS score in Makassar was 22.5 (high stress category), higher compared to Parepare and Palopo (16.8 and 18.4, respectively).
d) PSQI scores in Makassar showed greater sleep disturbance, with an average of 11.8, while Parepare and Palopo showed lower scores (7.5 and 8.2).

4. Regression Analysis

Regression analysis showed that air pollution, noise, and lack of green space were significantly associated with anxiety, depression, stress, and sleep disturbance. The regression coefficients showed that every 1 $\mu g/m^3$ increase in air pollution (PM2.5) was associated with an increase in poorer mental health scores. Similarly, noise pollution and lack of green space worsened the mental state of respondents.

5. Longitudinal Mental Health Changes

Longitudinal measurements of 200 respondents showed significant changes in mental health over 12 months. Respondents in Makassar experienced greater increases in anxiety, depression, stress and sleep disorder scores, along with worse neighborhood degradation. On the other hand, Parepare and Palopo showed more moderate improvements.

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The following is the table:

Table 1:
Population and Research Sample

City	Number of Respondents	Average Age	Gender	Socioeconomic Status
Makassar	200	32,5 years	52% Male, 48% Female	40% Middle, 60% Low
Parepare	150	33,0 years	50% Male, 50% Female	50% Middle, 50% Low
Palopo	150	31,0 years	53% Male, 47% Female	45% Middle, 55% Low

Explanation of Table 1:

1) Number of Respondents: This table shows the distribution of respondents who participated in the study by city. Makassar has the highest number of respondents, followed by Parepare and Palopo.
2) Average Age: The average age of respondents across the three cities shows that the majority of participants were in young adulthood to middle age, which is the age group most vulnerable to the impact of environmental degradation on mental health.
3) Gender: The gender distribution was relatively balanced, with little difference between men and women. This allowed the study to identify whether there were significant differences between genders in the response to environmental degradation.
4) Socio-economic Status: The study also recorded the socio-economic status of the respondents. The majority of respondents were from middle to low socioeconomic status, which may affect their access to healthy environments and mental health facilities. This disparity is important as groups with lower socioeconomic status tend to be more vulnerable to negative environmental impacts.

Table 2: Data Collection

Type of Data Collection	Method	Cities Involved	Instruments	Time
Cross-Sectional Survey	Survey Mental Health and Environmental Perception Questionnaire	Makassar, Parepare, Palopo	- Generalized Anxiety Disorder 7 (GAD-7) - Patient Health Questionnaire 9 (PHQ-9) - Perceived Stress Scale (PSS) - Pittsburgh Sleep Quality Index (PSQI)	Month 1 (Start of Collection)

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Type of Data Collection	Method	Cities Involved	Instruments	Time
Longitudinal Survey	Mental Health Questionnaire and Environmental Perceptions	Makassar, Parepare, Palopo	- GAD-7, PHQ-9, PSS, PSQI, plus air quality and noise measurements	Month 1, Month 6, Month 12

Explanation of Table 2:

1) Types of Data Collection: This table shows the two main methods for data collection, namely cross-sectional and longitudinal surveys. Cross-sectional surveys are conducted at the start of data collection, while longitudinal surveys are conducted over 12 months to see changes over time.
2) Methods: The mental health survey used questionnaires to measure mental disorders in individuals, while the neighborhood perception survey assessed how respondents rated the condition of their neighborhood. The survey was conducted in three different cities in South Sulawesi.
3) Instruments Used:
   a) GAD-7 to measure anxiety,
   b) PHQ-9 to measure depression,
   c) PSS to measure stress level,
   d) PSQI to assess sleep disturbance.
   e) Air quality and noise measurements were taken to link environmental factors with mental health outcomes.
4) Time of Collection: The cross-sectional survey was conducted at month one, while the longitudinal survey was conducted at month one, month six, and month twelve to look at changes in mental health over time.

Table 3: Environmental Quality Measurement

Type of Environmental Degradation	Makassar	Parepare	Palopo	Measurement Method
Air Pollution (PM2.5, NO_2)	100 µg/m³ (High)	60 µg/m³ (Medium)	50 µg/m³ (Medium)	Local Air Quality Monitoring Station
Noise Pollution (dB)	80 dB (High)	70 dB (Medium)	65 dB (Medium)	Noise Measuring Device

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Type of Environmental Degradation	Makassar	Parepare	Palopo	Measurement Method
Green Space (m^2/kapita)	3 m^2/kapita (Low)	5 m^2/kapita (Medium)	6 m^2/kapita (Medium)	Satellite Citra & GIS Data

Explanation of Table 3:

1) Air Pollution (PM2.5, NO_2): This table measures the level of air pollution in each city, showing that Makassar has the highest level of air pollution (100 µg/m^3), followed by Parepare and Palopo with lower levels. Air pollution plays an important role in mental health, especially in adding to anxiety and depression.
2) Noise Pollution (dB): Noise is an environmental factor that has a direct impact on mental health. Makassar has the highest noise level (80 dB), while Palopo has lower noise (65 dB).
3) Green Space (m^2/capita): The size of green space in Makassar is very low, with only 3 m^2/capita, which likely contributes to increased stress and sleep disturbances. Parepare and Palopo have more green space, indicating better environmental quality.

Table 4: Mental Health Measurement

Mental Health Disorders	Instrument	Score Range	Score Interpretation
Anxiety	Generalized Anxiety Disorder 7 (GAD-7)	0–21 (Likert Scale)	0-5: No anxiety, 6-10: Mild, 11-15: Moderate, 16-21: Severe
Depression	Patient Health Questionnaire 9 (PHQ-9)	0–27 (Likert Scale)	0-4: No depression, 5-9: Mild, 10-14: Moderate, 15-19: Severe, 20-27: Very Severe
Stress	Perceived Stress Scale (PSS)	0–40 (Likert Scale)	0-13: Low, 14-26: Moderate, 27-40: High
Sleep Disorders	Pittsburgh Sleep Quality Index (PSQI)	0–21 (Likert Scale)	0-5: Quality Sleep, 6-10: Moderate Sleep, 11-21: Sleep Disorder

Explanation of Table 4:

1) Anxiety (GAD-7), Depression (PHQ-9), Stress (PSS), and Sleep Disturbance (PSQI) are instruments used to measure aspects of mental health. This table shows the score

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ranges and interpretations for each instrument, which allows researchers to classify the level of mental disorders experienced by respondents.

2) Score Interpretation: Based on the scores obtained, mental disorders can be grouped into categories indicating severity (mild, moderate, severe, or very severe). For example, a GAD-7 score between 6-10 indicates mild anxiety, while higher scores indicate more severe anxiety.

Table 5: Longitudinal Data Collection

Time Point	Mental Health Questionnaire	Environmental Quality Measures	Duration
Month 1	GAD-7, PHQ-9, PSS, PSQI	Measurements of air pollution, noise, green space, ecological uncertainty	Start of Study
Month 6	GAD-7, PHQ-9, PSS, PSQI	Monitoring air quality, noise, green space	Mid-point Evaluation
Month 12	GAD-7, PHQ-9, PSS, PSQI	Monitoring of air quality, noise, green space	End of Study

Explanation of Table 5:

This table describes the longitudinal data collection steps, which were conducted at three time points: month 1, month 6, and month 12. At each time point, mental health measurements using the GAD-7, PHQ-9, PSS, and PSQI, as well as environmental quality measurements were conducted to assess changes over time. This longitudinal approach provided a clearer picture of how environmental degradation and mental health quality changed over the study period.

b. Discussion

Urban environmental degradation has become an important issue in public health research, particularly in relation to its impact on individuals' mental well-being. The urban environmental degradation faced by many large cities in Indonesia, including those identified in this study, has a major impact on mental health disorders, such as anxiety, depression, stress and sleep disorders. This discussion will analyze the impact of urban environmental degradation on mental health and identify ecological uncertainty factors that contribute to the increase in mental health disorders, based on the findings in this study.

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I. Impact of Urban Environmental Degradation on Mental Health

Environmental degradation occurring in urban areas can be viewed as one of the social-ecological factors that directly affect the mental well-being of residents. The main factors contributing to this degradation are air pollution, noise, and limited green space. Each of these elements has an impact that not only damages physical health but also increases the risk of psychological disorders.

1. Air Pollution and Mental Health

Air pollution, especially concentrations of small particles such as PM2.5, NO_2, and CO_2, is one of the main impacts of urban environmental degradation that can damage the respiratory system and increase various physical health risks. However, the impacts of air pollution are not limited to the physical, as long-term exposure to this pollution is also associated with increased mental health disorders. In this study, respondents living in Makassar, which has the highest air pollution levels, showed greater increases in anxiety, depression and stress compared to those living in Parepare and Palopo, which have better air quality. Some of the mechanisms underlying this relationship include:

a) Systemic Inflammation: Air pollution can cause systemic inflammation in the body, which in turn can affect brain function and increase the risk of psychological disorders.
b) Oxidative Stress: Inhaled pollutant particles can cause oxidative stress in the body, which is linked to changes in brain structure and function, potentially exacerbating symptoms of anxiety and depression.
c) Uncertainty and Tension: Persistent air pollution can create a sense of uncertainty about the future and concern for personal health, exacerbating mental disorders.

2. Urban Noise and Mental Health

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Noise is another form of pollution that is often found in big cities, and has a significant negative impact on mental health. Loud and uncontrolled sounds can disrupt sleep quality, causing increased stress, anxiety and emotional tension. The results of this study show that in cities like Makassar, with higher noise levels (up to 80 dB), many respondents reported sleep disturbances and stress. Ongoing sleep disturbances increase vulnerability to anxiety and depression, as poor sleep can worsen overall physical and mental conditions. This research shows that constant noise increases the production of stress hormones, such as cortisol, which leads to increased mental disorders.

3. Green Spaces and Mental Health

The lack of green space in cities not only affects air quality but also reduces opportunities for individuals to engage in relaxing and stress-reducing recreational activities. Green open spaces such as parks and public areas have the potential to improve quality of life, relieve stress, and improve mental health in general. On the other hand, areas with minimal green space can worsen anxiety and depression, especially in crowded big cities. In Makassar, where green space per capita is very limited, many respondents reported higher levels of anxiety and stress. Research shows that access to green space contributes to reduced stress, anxiety, and depression. Green spaces support physical and social activities that help reduce mental tension and improve mood.

II. Ecological Uncertainty Factors Contributing to the Increase in Mental Health Disorders

Ecological uncertainty refers to the instability and uncertainty that arises from environmental degradation and rapid environmental change. This can create ongoing mental strain on individuals, leading to increased mental health disorders. In the context of this research, several factors of ecological uncertainty that contribute to mental health disorders include:

1. Climate Change and Environmental Uncertainty

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Uncertainty related to climate change (e.g., temperature extremes, changes in rainfall patterns, or natural disasters) can increase feelings of anxiety and fear about the future. Urban residents often feel unprepared to face the impacts of climate change, especially if they live in vulnerable areas that are prone to natural disasters or environmental damage. Uncertainty about future environmental quality increases anxiety regarding personal health and the future of families. In areas with high air pollution and poor environmental management, this uncertainty is an additional factor that exacerbates mental disorders. In Makassar, for example, unexpected climate change or uncertainty related to air pollution management exacerbated respondents' anxiety levels.

2. **Crisis in the Availability of Natural Resources**

The crisis in the availability of natural resources, especially clean water and limited green space, creates uncertainty that can worsen the psychological conditions of urban communities. In this study, uncertainty about the availability of natural resources such as deteriorating air quality or lack of public facilities increased stress and anxiety. The inability to access basic facilities or safe natural resources adds to feelings of insecurity and mental strain.

3. **Social Ecological Stress**

Socio-ecological stress refers to the tension experienced by individuals or communities due to environmental changes or damage that affect their daily lives. When urban environments are degraded (e.g., by air pollution, noise, or destruction of green spaces), individuals feel insecurity in their broader lives, potentially compounding mental disorders. These stresses are exacerbated by uncertainty regarding mitigation efforts or changes in environmental policy that may be ineffective. In cities with severe environmental degradation such as Makassar, uncertainty about government efforts and policies taken to improve these conditions can increase social and emotional tensions among residents.

4. **Loss of Connection with Nature (Nature Deficit Disorder)**

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Loss of connection with nature, or what is known as nature deficit disorder, is a condition where individuals feel isolated from nature due to fast-paced urban life and limited green space. This phenomenon adds to the ecological uncertainty felt by urban communities, where the lack of opportunities to interact with nature causes increased stress and mental disorders. Decreased access to nature also reduces opportunities for recreational activities that can help reduce anxiety and depression.

The impact of urban environmental degradation on mental health is very real, with air pollution, noise and limited green space as the main factors that worsen the psychological health of residents. Ecological uncertainties, such as climate change, natural resource crises, and social-ecological stress, contribute further to the increase in mental health disorders. This research shows the importance of improving environmental quality to reduce negative impacts on mental health and provide better well-being for urban communities.

4. Conclusion

This research shows that urban environmental degradation has a significant impact on people's mental health. Environmental factors such as air pollution, noise and limited green space play a major role in increasing the risk of mental health disorders, including anxiety, depression, stress and sleep disorders. These findings underscore the importance of environmental quality as a major determinant of the psychological well-being of individuals living in large cities.

1. Impact of Urban Environmental Degradation on Mental Health

Environmental degradation, particularly air and noise pollution, affects mental health in complex ways. Long-term exposure to air pollution increases the risk of mental disorders due to inflammatory processes that occur in the body and brain. Noise, which is often found in big cities, not only disrupts sleep quality but also affects stress levels, anxiety and overall psychological health. The lack of green space or open space accessible to the community also worsens mental conditions, due to reduced

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opportunities for physical activity and recreation, which are known to have positive effects in reducing stress and improving mood.

2. Ecological Uncertainty Factors Contributing to the Increase in Mental Health Disorders. Ecological uncertainty related to urban environmental degradation also contributes to an increase in mental health disorders. Some of the main factors that create ecological uncertainty include:
   a) Climate Change – Uncertainty about the impacts of climate change, such as natural disasters or extreme weather conditions, creates anxiety about the future, increases feelings of insecurity in individuals, and exacerbates mental health disorders.
   b) Natural Resource Availability Crisis – Uncertainty regarding the availability of natural resources, such as clean water, healthy air, and limited green space, increases emotional and social tensions. This makes people feel unsafe and isolated.
   c) Social Ecological Stress – Environmental degradation and society's inability to cope with that damage contributes to social-ecological stress, which is associated with increased anxiety and emotional tension.
   d) Loss of Connection with Nature – Loss of access to nature and green spaces due to dense urbanization also reduces opportunities for psychological relaxation and recovery, worsening the mental state of the population.

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