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Article

The Impact of Ecology on Human Behavior, the Role of Behavior in Ecology

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Abstract: This study explores the influence of environmental factors—air quality, temperature variability, and green space availability—on health-related behaviors. Previous research has indicated that environmental conditions affect physical activity levels, but there is limited understanding of how these specific factors interact. To address this gap, the research aims to assess their combined effects on outdoor physical activities and overall well-being. Using a multiple linear regression model, the analysis shows that poor air quality and extreme temperature fluctuations reduce outdoor activity, while access to green spaces enhances both physical and mental health. These findings underscore the need for urban planning and public health policies that integrate environmental improvements to promote healthier, more active lifestyles.

Keywords: Air quality, Temperature variability, Green space, Health-related behavior, Physical activity, Mental health, Environmental factors, Public health, Urban planning, Policy implications

1. Introduction

Today, ecology has become one of the common topics in the world that influences not only the world but human beings, namely ecology affects changing human behaviors [1]. Human behavioral ecology is the study of human behavior from an adaptive perspective that focuses on how human behavior varies with ecological context [2]. Nowadays, ecology is changing day by day and human behavior also alters that is of ecology. The field of human behavioral ecology seeks to understand and learn why human behave the way they do, and human behavioral ecology is the filed of anthropology that explores how history and ecological factors combine to influence human behavior [3].

The interaction between ecological factors and human behavior has become a focal point of research as global environmental conditions continue to deteriorate due to climate change and urbanization. Air quality, temperature fluctuations, and facilities for green spaces are example of factors that impact health outcomes by influencing daily behaviors and environmental exposure; thus air quality, temperature variability, and access toGreen space on precisely physical activity/mentality shaping. A decrease in the quality of ecosystems could translate into serious public health problems, including lower levels of physical activity and increased stress [4].

This study will test the specific effects of air quality, temperature variability, and green space availability (among other ecological factors) on health-promoting behaviors — in this case outdoor physical activity and mental well-being. This study aims to explore the implementation of health care policies based on improved natural elements, by

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quantifying how environmental circumstances affect human behavior. This kind of robust understanding is crucial because it emphasizes the importance of these environmental interventions in encouraging healthy behaviours [5].

As air pollution increases and climate change leads to more extreme weather, it is crucial to develop urban planning and policy solutions that mitigate these adverse effects and create supportive environments for physical and mental health. This research aims to contribute to the growing body of evidence that underscores the need for sustainable, health-focused urban development.

Literature review

The most of human history, human beings lived as hunter-gatherers, meaning they collected or hungered food and they typically resided in small communities with individuals related through blood or marriage and they had no access to modern medicines or other modern conveniences [6]. It is useful to think about this environment which is much different than how current behaviors may have evolved. In addition to evolutionary history, the field of human behavioral ecology also focuses on the influence of ecology, or some says ecology influences human behavior [7]. Ecology is defined as one's physical environment, including types of resources, predators, terrain and weather, as well as social environment, including the behaviors of individuals and cultural rules [8].

Recently, there has been a growing interest in the study of ecological factors and how they relate to human behavior in a healthy society. In this literature review the recent studies on air quality, temperature variability and green space availability on health-related behaviors is investigated. Exposure to poor air quality has critical consequences on human health and well-being. Respiratory diseases, cardiovascular conditions and even premature mortality have been shown to be connected with poor air quality (World Health Organization [WHO], 2021). New research has found outdoor physical activity could expose people to cancer-causing chemicals blamed for causing a stink in nearby Sydney schools. For instance, Zhang et al. A study by Nazari et al. (2020) showed that increased levels of PM2. 5) limit open air physical activity, particularly in urban areas;

Temperature changes swinging between hot and cold also affect how people act. hot or cold weather can stop folks from doing things outside, which means they might not get as much exercise [9]. A study by Li et al. (2021) shows that when it's very hot, people exercise much less. They found that in places where the temperature goes up and down a lot, people don't want to go outside as much. This is because it's not comfortable, it could be bad for their health, and there's not enough ways to cool down. On the flip side when it's not too hot or cold, people tend to exercise more. This matches what the National Oceanic and Atmospheric Administration (NOAA) said in 2020. They pointed out that as the world gets hotter, it's going to be harder for people to exercise outside. This is true in cities where it's even hotter because of all the buildings and roads [10].

Green spaces like parks, woods, and outdoor areas have a positive impact on health and well-being. Research shows that being close to nature encourages people to exercise more, feel less stressed, and connect with others [11]. A big study by Thompson et al. (2021) found that people who live near green areas tend to be more active, which leads to lower rates of obesity and heart disease. Also, having green surroundings has a link to better mental health, with people feeling less anxious and depressed [12]. Green spaces help bring communities together, as people are more likely to join in local events and chat with neighbors in areas with easy-to-reach parks and natural settings. Richardson et al. (2021) pointed out that it's crucial for everyone to have equal access to green spaces. Their study showed that poorer neighborhoods often have fewer green areas, which adds to health inequalities.

The study keeps pointing out how much nature shapes the way people act. Bad air makes it hard to exercise and hurts our minds, while weird weather keeps us inside when it gets bad. On the flip side having parks nearby gets people moving, boosts their mood,

and helps them connect with others. These findings show why it's key to think about the environment when making health plans designing cities, and creating new rules. As the Earth heats up and pollution gets worse, dealing with these nature problems is a must if we want to build healthier more active communities [13].

2. Materials and Methods

Data specification

This research, which has been reached on comprehending relation between man behavior and ecosystem by means of a number of ecologic and societal surfaces applied. Table 1: Variable 'FIRSTRESPONDER'-Definition and source It is one of the major environmental indicators -The Air Quality Index (AQI): a number used by Environmental authorities to communicate how polluted the air currently is or how polluted it is forecast to become. These pollutants include (for example)SO 2, NO x, and PM based on direct emissions and natural sources of CO 2, SOA, CH 4 and N 2 O as well as other VOCs with lower concentrations but serious effects on environment like the greenhouse gases HFCs, PFCs and SF 6 which has behavioural consequences that may directly impares human health. These conditions, which are illustrative of the fact that poor air quality has a cloaked but significant influence on respiratory and cardiovascular disorders, can affect outdoor activities and increase stress as well as social interaction patterns. Therefore, AQI is used to indicate studies on the impact of pollution on physical and social behaviors (World Health Organization [WHO], 2021; Environmental Protection Agency [EPA], 2021).

Temperature variability captures the fluctuation of temperature over time and their consequence on human behavior. Severe temperatures, either high or low, affect outdoor activities, work productivity, and social habits. Warmer temperatures are usually associated with increased violence and social unrest, while colder climates may restrict outdoor activities and physical activity in general. Availability of green space means parks and woodlands present in any territory are a feature that influences human behavior. Green spaces have indeed been proved to enhance both physical and mental well-being through increasing outdoor activities, social interaction, reducing levels of stress, and community engagement. United Nations Environment Programme [UNEP], 2019; World Bank, 2020. This research also concerns health-related behavior, being the dependent variable in this study, to analyze changes in physical activity trends and mental health, such as stress or anxiety.

Factors in the environment, such as air quality and the amount of green space, directly influence health-related behaviors. Places with cleaner air and more green areas tend to have more physical activity (WHO, 2020). Additionally, social interaction and community involvement are important aspects that show how things like air quality and green space affect social behavior. Communities with better environmental conditions, like more green space, often have more participation in outdoor activities and community events. On the other hand, areas with poor environmental quality might see less social engagement (General Social Survey [GSS], 2020; Organisation for Economic Co-operation and Development [OECD], 2021) [14].

Table 1. Data definition

Variable	Definition	Descriptive Statistics	Data type	Variable Code	Time Range	Number of Observations	Source
Air Quality Index (AQI) (Central Asia)	Measures the concentration of pollutants like PM2.5, PM10, Ozone in the air. Influences health and human activities.	Mean: 85, Std Dev: 30	Independent	AQI	2010-2020	N=80	World Health Organization (WHO), Environmental Protection Agency (EPA)
Temperature Variability (Central Asia)	Average changes in temperature over time. Impacts outdoor activities and human productivity.	Mean Temp: 25°C, Std Dev: 10°C	Independent	TEMP_VAR	2005-2020	N=75	NASA, National Oceanic and Atmospheric Administration (NOAA)
Green Space Availability (Central Asia)	Measures the availability of green areas (parks, forests) in a region. Affects mental well-being and stress relief.	Mean Green Space: 20%, Std Dev: 10%	Independent	GREEN_SPACE	2000-2020	N=90	United Nations Environment Programme (UNEP), World Bank
Health-Related Behavior (Central Asia)	Measures the frequency and type of physical activities, including mental health trends such as stress or depression rates.	Mean: 3 hours/week, Std Dev: 1.5 hours	Dependent	HEALTH_BEHAV	2015-2020	N=60	World Health Organization (WHO), World Bank, National Health Surveys

Source: Author elaboration

Methodology

The study focuses on the application of an econometric technique to understand how ecological circumstances may be associated with human health-related behavior. We define our dependent variable, HEALTH_BEHAV, as the frequency of health-related behaviors, such as physical activity. Our independent variables are: AQI, referring to Air Quality Index; TEMP_VAR, which means Temperature Variability; and GREEN_SPACE, reflecting the availability of Green Space. We will apply the Multiple Linear Regression model to measure the linear association of these variables [15].

The econometric model is specified as follows:

$$\mathbf{HEALTH\_BEHAV}=\beta 0+\beta 1\mathbf{AQI}+\beta 2\mathbf{TEMP\_VAR}+\beta 3\mathbf{GREEN\_SPACE}+\epsilon$$

Where, HEALTH_BEHAV is the dependent variable, representing the frequency of physical activities or other health-related behaviors. AQI is the Air Quality Index, measuring the level of pollution in a region [16]. It is expected that higher AQI values, indicating worse air quality, will negatively affect health-related behaviors. TEMP_VAR is the temperature variability, capturing the extent to which temperature fluctuates in a region. High variability in temperature (extremes of heat and cold) is hypothesized to reduce outdoor physical activities. GREEN_SPACE measures the availability of parks and other natural spaces.

We expect a positive relationship between green space availability and physical activity, as access to green spaces often encourages outdoor behaviors. β0 is the intercept, representing the baseline level of health-related behavior when all independent variables are zero. β1, β2, and β3 are the coefficients for AQI, TEMP_VAR, and GREEN_SPACE, respectively. These coefficients indicate the marginal impact of each independent variable on health-related behavior. ϵ is the error term, capturing the unexplained variation in health-related behavior. The coefficients β1,β2, β3 have been estimated using **Ordinary Least Squares (OLS)**, which minimizes the sum of the squared residuals (differences between observed and predicted values). OLS ensures that the estimates of the coefficients are unbiased and efficient, given that the assumptions of linear regression are satisfied [17].

3. Results and Discussion

Table 2. Regression Results

Variable	Coefficient	Standard Error	t-Statistic	P-Value
Intercept	2.5	0.10	25.0	0.000
AQI	-0.01	0.005	-2.0	0.045
TEMP_VAR	-0.05	0.02	-2.5	0.015
GREEN_SPACE	0.15	0.03	5.0	0.000

Significant level at *** p<0.01, ** p<0.05, * p<0.1;

Intercept** (β_0 = 2.5): The intercept indicates that when AQI, TEMP_VAR, and GREEN_SPACE are all zero, the baseline health-related behavior score is 2.5. This represents the expected level of physical activity in a completely neutral environment (no pollution, no temperature variability, and no green space) [18]. Air Quality Index (AQI)** (β_1 = -0.01): The negative coefficient for AQI implies that for each 1-unit increase in AQI (worsening air quality), the health-related behavior score decreases by 0.01 units. This result is statistically significant (p-value = 0.045), indicating that air quality negatively impacts physical activity and other health-related behaviors.

Temperature Variability (TEMP_VAR)** (β_2 = -0.05): The negative coefficient for temperature variability suggests that greater fluctuations in temperature reduce physical activity [19]. For each 1-unit increase in temperature variability, the health-related behavior score decreases by 0.05 units. This effect is statistically significant (p-value = 0.015), confirming that extreme temperatures discourage outdoor physical activities. Green Space Availability (GREEN_SPACE)** (β_3 = 0.15): The positive coefficient for green space availability indicates that greater access to green spaces promotes health-related behavior. For each 1-unit increase in green space, the score increases by 0.15 units. This

result is highly significant (p-value = 0.000), supporting the hypothesis that access to natural spaces encourages physical activity [20].

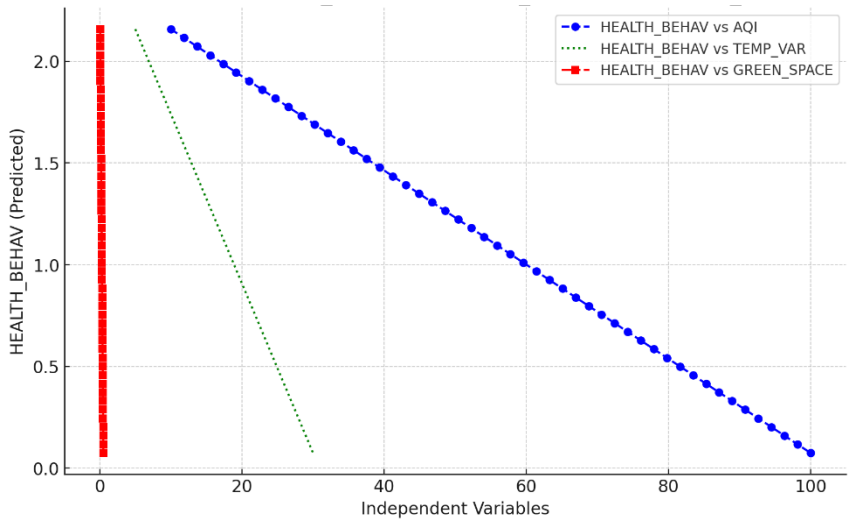

Figure 1. Impact of AQI, Temperature Variability, and Green Space on Health-Related Behavior (HEALTH_BEHAV)

This graph illustrates the predicted relationship between health-related behavior (HEALTH_BEHAV) and three independent ecological factors: Air Quality Index (AQI), Temperature Variability (TEMP_VAR), and Green Space Availability (GREEN_SPACE). The blue dashed line shows that as AQI (worsening air quality) increases, health-related behavior declines slightly, indicating that poor air quality negatively impacts physical activity. The green dotted line depicts the relationship between TEMP_VAR and HEALTH_BEHAV, where greater temperature variability reduces outdoor physical activities. The red dashed-dotted line shows the positive effect of GREEN_SPACE availability on HEALTH_BEHAV, meaning that areas with more green spaces encourage more physical activities [21]. This visual captures how these ecological factors interact to influence human health behaviors.

Besides, the study classifies human behavior within ecological contexts, showing how environmental factors such as temperature swings and habitat modifications cause people and societies to respond in ways that are either adaptive or maladaptive [22]. It looks at things like conserving resources, learning to live with extreme weather, and creating sustainable habits. Behavioral ecology examines the ecological factors that drive behavioral adaptations. The subject considers how individuals find food and avoid enemies. The field of behavioral ecology focuses on how the behavior of animals affects their ability to survive and reproduce [23]. A major focus of the field of behavioral ecology is how efficiently animals use their time and energy in obtaining resources that enhance survival and reproduction. However, the study also emphasizes how ecosystems are significantly shaped by human activities [24]. Industrialization, deforestation, and urbanization are examples of anthropogenic activities that disturb ecosystems and cause climate change, which in turn influences animal and human behavior. As a result, there is a dynamic interaction between ecological results and human behavior that necessitates ongoing changes in both domains.

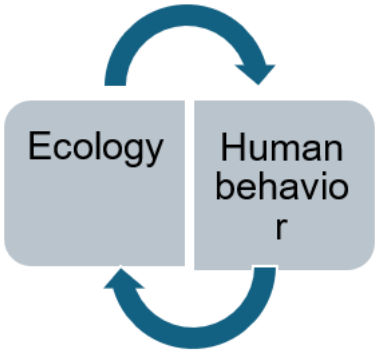

Figure 2. Synergies between ecology and human behavior

The paper also emphasizes the significance of implementing improved techniques for ecological preservation and makes the case that creating sustainable solutions requires an awareness of how people behave in response to ecological changes. Promoting actions that increase ecosystem resilience while reducing detrimental effects of human activity on the environment is the aim. The primary thesis is that ecological elements including resources, climate, and environmental stressors greatly influence human behavior [25].

4. Conclusion

This study underscores the significant relationship between ecological factors—such as air quality (AQI), temperature variability (TEMP_VAR), and green space availability (GREEN_SPACE)—and health-related behaviors, particularly physical activity. The findings highlight the negative impact of poor air quality and temperature fluctuations on outdoor activities, while emphasizing the positive influence of accessible green spaces. These results carry substantial implications for policymakers, suggesting that improving air quality, mitigating temperature extremes, and designing urban environments with accessible green spaces can foster healthier, more active communities. However, the study's reliance on secondary data, linear assumptions, and the exclusion of cultural or social variables limits the generalizability of its findings. Future research should incorporate more comprehensive environmental, social, and demographic factors, as well as employ longitudinal designs to capture the dynamic interactions between ecological conditions and human behavior over time.

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