



Article

The Impact of Ecology On Human Behavior, The Role Of Behavior In Ecology

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Abstract: This study investigates the relationship between ecological factors—air quality, temperature variability, and green space availability—and health-related behaviors. Using a multiple linear regression model, the analysis reveals that poor air quality and extreme temperature fluctuations negatively impact outdoor physical activities, while access to green spaces significantly promotes physical and mental well-being. The findings highlight the importance of addressing environmental factors through public policy to foster healthier, more active populations. This research provides evidence for integrating environmental improvements into urban planning and health promotion strategies

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 (Richerson PJ, Boyd & Bettinger, 2001). Human behavioral ecology is the study of human behavior from an adaptive perspective that focuses on how human behavior varies with ecological context (Smith, 2011). 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 (Tucker, 2007).

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.

This study will test the specific effects of air quality, temperature variability, and green space availability (among other ecological factors) on health-promoting behaviors

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— 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 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.

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.

The most of human history, human beings lived as hunter-gatherers, meaning they collected or hunted for 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 (Nettle, 2011). 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 say ecology influences human behavior (Pollet & Nettle, 2008). 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 (Rende, 2005).

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 PM_{2.5} 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. 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.

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 (Hartig et al. 2020). 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 (James et al. 2022). 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.

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)SO₂, NO_x, and PM based on direct emissions and natural sources of CO₂, SOA, CH₄ and N₂O as well as other VOCs with lower concentrations but serious effects on environment like the greenhouse gases HFCs, PFCs and SF₆ 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).

Table 1 Data definition

Variable	Definition	Descriptive Statistics	Data type	Variable Code	Time Range	Number of Observations	Source
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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.

The econometric model is specified as follows:

$$\text{HEALTH_BEHAV} = \beta_0 + \beta_1 \text{AQI} + \beta_2 \text{TEMP_VAR} + \beta_3 \text{GREEN_SPACE} + \epsilon$$

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. 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. β_0 is

the intercept, representing the baseline level of health-related behavior when all independent variables are zero. β_1 , β_2 , and β_3 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 $\beta_1, \beta_2, \beta_3$ 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.

3. Results

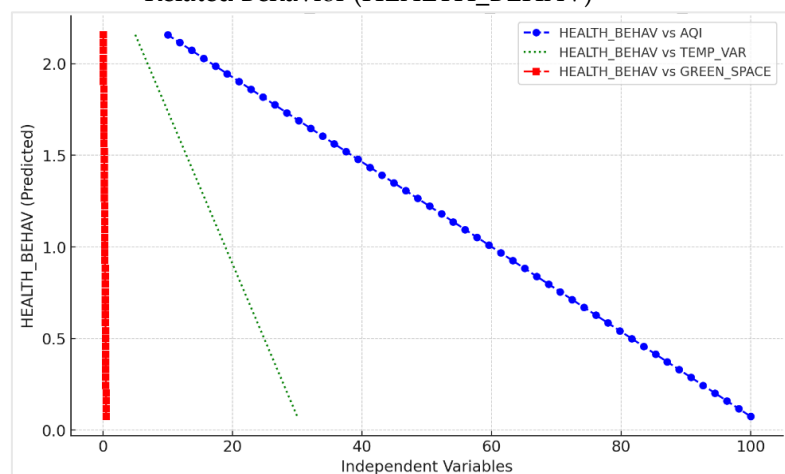
Table 2 Regression Results

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** ($\beta_0 = 2.5$): 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). Air Quality Index (AQI)** ($\beta_1 = -0.01$): 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)** ($\beta_2 = -0.05$): The negative coefficient for temperature variability suggests that greater fluctuations in temperature reduce physical activity. 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)** ($\beta_3 = 0.15$): 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.

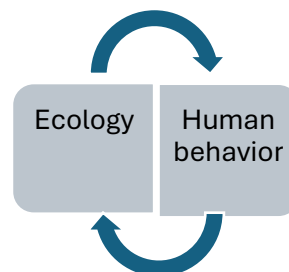
Figure 1 Impact of AQI, Temperature Variability, and Green Space on Health-Related Behavior (HEALTH_BEHAV)



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. 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. 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. 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. 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.

4. Conclusion

The results of the regression analysis indicate a clear relationship between ecological factors and human health-related behaviors. The study demonstrates that air quality (AQI), temperature variability (TEMP_VAR), and green space availability (GREEN_SPACE) significantly affect physical activity and overall health-related behavior.

The negative coefficient for AQI illustrates that worsening air quality leads to a decline in health-related activities. Poor air quality hinders outdoor activities, which may

have a detrimental affect on physical well-being. This study highlights the significance of improving air quality to support healthy living.

The negative coefficient for TEMP_VAR signifies that dramatic temperature changes reduce PA. High level of temperature change, especially in very hot or cold places discourages people to outdoor activity. In addition, this points out that the environment could influence behaviour, and reducing temperature fluctuations might promote more consistent levels of physical activity.

The positive and highly significant correlation for GREEN_SPACE, reflecting the better health-related activities with parks and other green space. Green environments have been associated with higher levels of physical activity, social interaction and well-being. The research highlights the importance of connecting urban design with natural settings to create places that encourage people to be physically active, healthier and happier communities.

The study finds many important policy avenues for advancing health through the environment. Regulation of the emission and support of cleaner alternatives should guide policymakers in minimizing air pollution. Urban cooling technologies like tree planting and green roofs will alleviate the impacts related to temperature fluctuations, however in order for outdoor activities to continue functioning during toxic weather, measures need to be adapted. It is essential to create green spaces, as it enables physical lifestyle and mental health. However, urban development should promote equitable access to these places. Public health campaigns might help to increase knowledge of the benefits of outdoor activities and green environments. Finally, a well-designed campus or shade routes and cooling zones may help to invest in climate-resilient infrastructure that would enable population level protection against heat extremes and promote active living. This legislation will help create healthier, more active communities and reduce healthcare costs.

The major shortcomings of this study are: First, it relies on data collected previously by others, which may lack all relevant local environmental and behavioral factors. Then, in its statistical treatment, the assumption is made that associations between variables are linear and direct; this means missing the more subtle ways in which nature and human behavior may interact. The research concerns only fundamental ecological problems and does not include specific cultural, social, or demographic factors that might influence behaviors. Not least, limitations to small sample size and data collection method can make generalization of the findings to larger populations or other contexts problematic.

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