The relationship between access to nature and anxiety levels across countries

Aino Karjalainen

1. Introduction

This project's aim is to investigate whether countries with higher forest coverage tend to have lower rates of anxiety disorders. This visualization project combines data on national forest area coverage and global mental health trends to provide a multi-scale perspective from individuals to societies. The topic is closely linked to the UN Sustainable Development Goals, specifically Goal 3 (Good Health and Well-being) as well as Goal 15 (Life on land). These goals highlight the interconnectedness between humans and nature, emphasizing that environmental well-being and human mental well-being are mutually dependent.

Mental health problems, such as anxiety disorders, have become significantly more common in recent years around the world. Young people and students in particular have reported increased stress and anxiety. At the same time, urbanization and the decline of nature in people's everyday lives have raised the question: can access to nature have a direct impact on human mental well-being?

The purpose of this project is to highlight this issue through data and visualization. Visualization enables the understanding of complex phenomena and provides perspectives that can support decision-making, urban planning, and mental health policy. The visualization has been created as an interactive HTML web page. The goal is for users to learn about the topic, correlations, and differences by browsing and interacting with the different visualizations and finding interesting information about anxiety levels and forest coverage in different countries.

The idea for this visualization came to me when I was thinking about how the pressures and demands of studying and life in general are reflected differently in different people and also in different countries. I spent last semester as an exchange student, and it broadened my perspective on how the nature and forests of a new country had a positive effect on me. I also noticed that the teaching methods and requirements at another university caused me a different kind of anxiety than at Aalto. I discussed the topic with other exchange students, and we came to the conclusion that there are many noticeable differences. The original idea behind this visualization project was to compare the results before and after the COVID-19 pandemic, but unfortunately, no suitable data was found. In my opinion, it would be important to examine the prevalence of anxiety in the years following the pandemic, as it was a time that affected people around the world in a completely new way. This project could therefore serve as a basis for a future project that would also take this into account.

2. Research question and the aim of the visualization

This project aims to explore whether forest coverage and access to nature are associated with lower national anxiety levels. The research question can be divided into sub-themes such as

- How has the amount of nature and levels of anxiety changed over time?
- Can regional or cultural differences be observed in how nature affects human well-being?

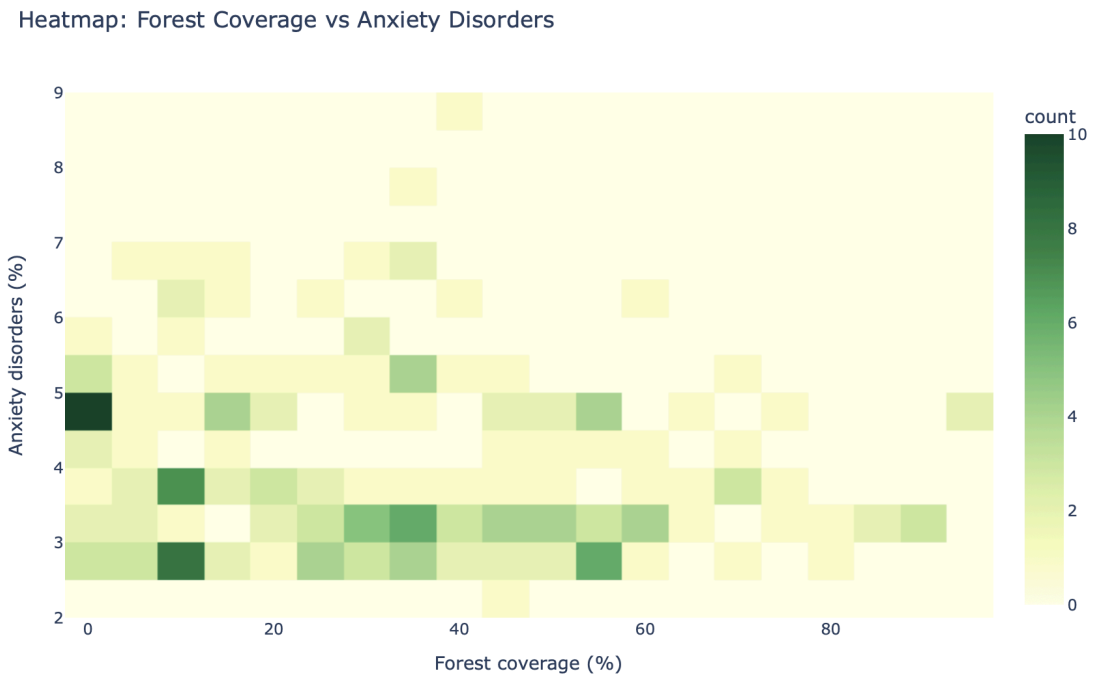

Figure 1: Heatmap between forest coverage and anxiety disorders

Figure 1 heatmap shows that there does not appear to be a clear linear relationship between forest coverage and the prevalence of anxiety disorders in different countries. Anxiety rates remain fairly stable (around 3-6%) regardless of whether a country has a large or small forest coverage. However, the map shows some clusters: countries with very little or moderate forest coverage (0-40%) form more clear clusters, while highly forested countries are scattered and do not form a consistent pattern in terms of anxiety. This suggests that forest coverage alone does not explain the differences in anxiety levels between countries, but that other social, economic, and cultural factors are likely to have a greater influence.

Regardless of the results, the aim of this visualization is to create discussion on the topic and illustrate possible connections between these topics, not prove cause-and-effect relationships. For example, the visualization can be used to show that the prevalence of anxiety is lower in countries with high forest cover, or that the connection is different in certain areas. This visualization can also be used in the help of discovering connection to other mental health related issues such as depression for example.

3. Datasets

This visualization uses two different datasets, both sourced from the Kaggle website. The first dataset, Forest Cover by Country 1990–2020, shows the forest coverage (as a percentage of land area) in different countries. The purpose of this dataset is to serve as an indicator of the accessibility of nature and the extent to which residents of different countries have opportunities to access nature. The aim is to combine this information with anxiety levels in order to investigate whether there is a correlation between forest cover and mental health.

The second dataset, Global trends in mental health disorders, describes the prevalence of various mental health disorders (anxiety, depression, substance abuse disorders etc.) by country and year (between 1990 and 2017). From this data, only the data related to anxiety will be used, and the general purpose of this is to provide a broader context for how mental health problems have developed over time globally.

However, these datasets have limitations that should be taken into account in their interpretation. For example, mental health data is affected by differences in diagnostic practices between countries, and methods for measuring anxiety disorders are not entirely consistent. In addition, there is significant underreporting in developing countries, as healthcare resources are limited and the stigma associated with mental health can prevent people from seeking treatment. Cultural differences also affect how anxiety is understood and expressed, which weakens the comparability of the data. It is also important to note that anxiety does not necessarily mean a diagnosed disorder, it can also reflect a self-noticed feeling that might not be reported in the data.

The limitations with the forest data relate to the amount of forest, that does not indicate the quality or diversity of the forest or what kind of well-being effects it might have. The dataset does not include information on the accessibility of forests, so it does not indicate how easily people can access nature in their everyday lives. Furthermore, the data does not take into account urbanization, which has a strong impact on how close people are physically to forests or natural environments.

Even if there is an absolute amount of forest, it may be located in areas that are not accessible to the population (e.g., Siberia or the Amazon). Therefore, the amount of forest is not necessarily the best indicator of nature's accessibility or its potential effects on mental health. These limitations emphasize that the results of the visualizations should be interpreted as indicative, not as direct cause-and-effect relationships.

4. Visualization plan, purpose and intended audience

The plan is to present the data for this visualization on two different levels. The first level is the national level, where the differences between countries in terms of feelings of anxiety and possible links between forest cover and mental health will be compared.

The second level is the global level, where the aim is to show the development of anxiety on an annual and geographical basis. The aim is to show whether anxiety levels have increased or decreased and how they may be linked to environmental changes.

The main purpose of this visualization is to increase understanding of how access to nature and the amount of green space can affect people's experiences of anxiety in different countries. The visualization provides a tool for understanding the regional differences between mental health and nature and stimulates discussion on what solutions can be implemented to support well-being.

The visualization is aimed particularly at researchers, urban planners, and mental health professionals, such as healthcare professionals and policymakers. It may also be of interest to students and the wider public who are interested in the topic or who have personal experience of anxiety and the well-being effects of nature.

The visualization provides information that can support decision-making in both urban planning and mental health policy. It helps to understand why preserving nature and increasing green spaces is important for public health. At the same time, it highlights the connection between nature and well-being, showing that the environment and mental health are not separate but mutually reinforcing factors.

5. **Theme**

The core theme of this visualization is the interaction between humans and the environment, particularly the potential impact of nature on mental health. The project examines two perspectives: the amount of forest coverage and the prevalence of anxiety disorders in different countries. The aim is to find possible connections between them. The theme is based on the idea that the decline of natural environments and increasing urbanization can have a negative impact on people's mental health, while the opportunity to see and experience nature can have a positive effect. This visualization highlights the fact that, although no direct linear connection between the two has been found, the topic is surrounded by a broader theme: human well-being is strongly linked to the surrounding reality. The findings support the UN's sustainable development goals, which remind us that nature and human well-being are strongly connected.

6. **Space**

Space plays a key role in this visualization. The visualization depicts geographical differences between forests and anxiety, highlighting how these variables are located on global maps. The visualization uses a world map and regional comparisons to highlight how different continents and countries differ in terms of these two factors. Spatial data analysis shows that no single region stands out clearly from the others in terms of forest cover, but rather highlights that a variety of social, economic, and cultural factors influence the issue. However, spatial description can be used to form an overall picture of regional clusters and

dynamics. A future perspective for such a project would be to examine, for example, only one country or continent and use it to compare regional differences within the country, if suitable data can be found.

7. Time

Analysing time is another important dimension of this project. The visualization includes a timeline that allows users to view changes in forest cover in different countries between 1990 and 2020. The timeline makes it easy for users to identify differences and changes on the world map with different colors. The time dynamics reveal that although the amount of forest has decreased in many countries, some countries have also seen an increase in forest coverage. A long-term observation of mental health data (from 1990 to 2017) also shows that anxiety levels have remained fairly stable, with no clear long-term trend. A time-based analysis allows us to consider whether changes in nature and mental health have occurred simultaneously, in opposite directions, or completely independently of each other. Although the project's visualizations do not reveal a strong time correlation between these two phenomena, taking time into account helps us understand that the natural environment and mental health are constantly evolving in changing societies.

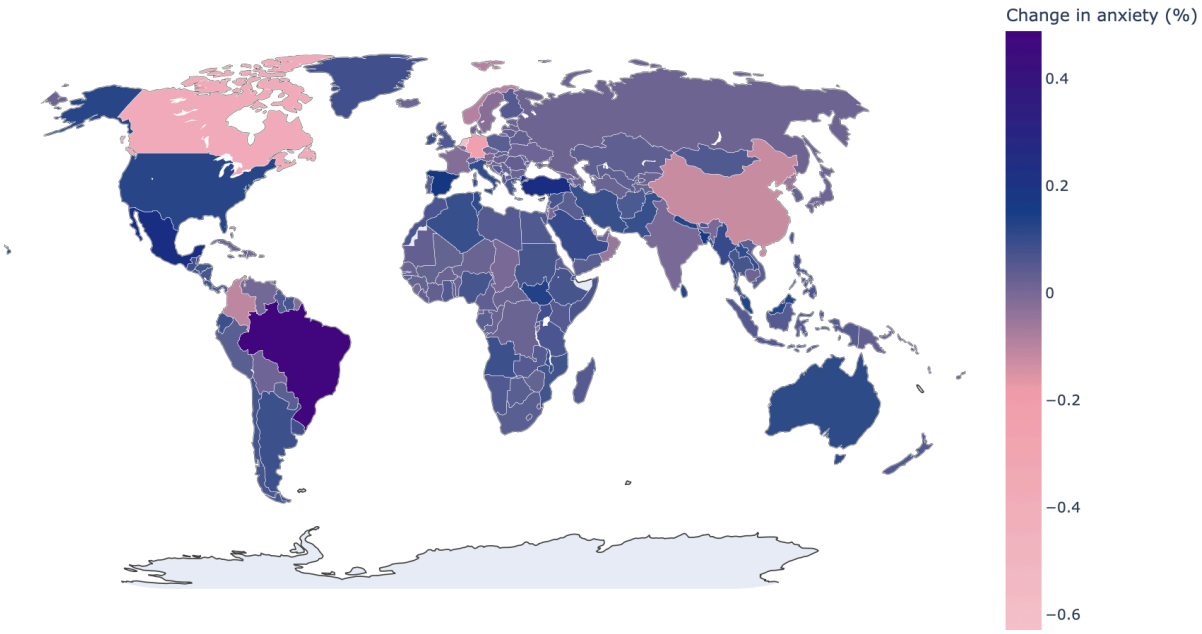

Figure 2: Change in global anxiety 1990-2017

Figure 2 shows the countries where anxiety has increased and where it has decreased compared to the previous situation. The map shows that the change has been most significant in Brazil, for example, while the difference in European and Asian countries is very slight. It is also important to note that although the average level of anxiety has remained fairly stable at the global level, there may be significant changes in individual countries. The visualization highlights that temporal developments cannot necessarily be explained solely by

environmental factors. This highlights the need to examine the topic from multiple perspectives in future research.

The changes over time can be examined in greater depth by studying individual countries whose development differs more clearly from each other. The forest coverage and global anxiety maps show that Brazil's forest coverage decreased from 68.2 percent to 59.4 percent between 1995 and 2017. During the same period, the country's anxiety level rose from 5.58% to 6.07%. Although the change is not large in absolute terms, it is in line with the Figure 1 heat map: most countries have anxiety levels of 3–6 percent regardless of forest coverage, which explains why Brazil's clear decline in forest cover is not reflected in a significant change in anxiety.

Another example is New Zealand. It has the highest anxiety level of all countries in 2017. The country's forest coverage has remained virtually unchanged between 1995 and 2017 (36.5% -> 37.6%). The level of anxiety has increased only marginally during these years, from 8.49% to 8.54%, which is consistent with the observations in Figure 1 heatmap: at higher forest coverage levels, anxiety varies widely without a clear trend, as reflected in the very small change in the figures for New Zealand.

These two more detailed examinations highlight the fact that changes in forest coverage do not go hand in hand with changes in anxiety levels. The data from Brazil shows that a significant decline in forest cover does not automatically lead to a decline in mental health, and the figures from New Zealand show that stable forest coverage does not guarantee a significant change in anxiety levels either.

8. Conclusion

The results of the project show that there is no clear linear relationship between forest cover and the prevalence of anxiety disorders in different countries. However, these visualizations show that both nature coverage and mental health vary between countries due to many social, economic, and cultural factors. Although the natural environment may be important for well-being, this effect is not directly reflected in national statistics.

It was important for the project to examine the topic from multiple perspectives, such as time, space, and theme, and in conclusion, it can be said that these perspectives helped to form a clear whole. Each perspective brought new aspects to the content and allowed users to explore the topic in greater depth.

References:

1. Forest area dataset

Raghurayirath. (n.d.). *Population growth vs. forest cover* [Data set]. Kaggle. https://www.kaggle.com/datasets/raghurayirath/population-growth-vs-forest-cover

2. Global trends dataset

The Devastator. (n.d.). *Global trends in mental health disorder* [Data set]. Kaggle. https://www.kaggle.com/datasets/thedevastator/uncover-global-trends-in-mental-health-disorder

HTML web page references:

Picture: Screenshot-2022-10-07-at-18.58.46.png

Disclosure: I used artificial intelligence to help me create the visualizations. I used the ChatGPT-5 model to write and correct the Jupyter notebook code, to help me create the HTML webpage and I also asked for help in coming up with ideas for the visualizations.