Do Biodiversity Metrics Positively Correlate with Environmental, Well-being and Economic Indicators?

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By

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Abstract

The purpose of this study is to better understand the relationship between human well-being and biodiversity by country. Using four different well-being indicator sets and six different metrics measuring biodiversity, the research team conducted 24 unique regression analyses to identify potential relationships between each dataset. It was determined that minimal correlation exists on a global scale between human well-being and high levels of biodiversity, but further country-specific research may reveal effective policies that promote both well-being and biodiversity. The report also includes research on policy relating to biodiversity for Germany and Norway to better understand country-specific performance and legislative effectiveness. The report concludes with recommendations for further studies to be conducted or funded by the International Fund for Animal Welfare.

Introduction

About IFAW

The International Fund for Animal Welfare, known as IFAW, is a US-based non-profit committed to creating a world where animals and people thrive together by rescuing animals, protecting animal populations, and preserving habitats worldwide (IFAW, 2019). Founded in 1969 by Brian Davies, IFAW's first initiative was to end the commercial hunt for whitecoat seals on the east coast of Canada (IFAW, 2019). According to their 2019 annual report, the organization's initiatives have expanded to preserve and protect endemic species around the world. Since its inception, IFAW has developed and applied programs that protect a wide range of species, from terrestrial to marine animals worldwide. To ensure lasting impacts, IFAW

partners with local communities, non-governmental organizations, and governments to create real-world solutions.

Today, IFAW continues to invest its resources into developing conservation programs. Some of IFAW's current projects include protecting critical habitats and keystone species in Africa, landscape conservation efforts in Asia, and disaster response efforts in the aftermath of the deadly Camp Fire which ravaged Butte County, California (IFAW, 2019).

IFAW has concurrently created infrastructure and influence around the world in order to build consensus for animal welfare and conservation. In their 2019 annual report, IFAW calls on policymakers to tip the scales in favor of endangered species and habitats (IFAW, 2019). IFAW continues to further its mission by partnering with local organizations to influence biodiversity-related policy around the world.

The Task

IFAW has tasked the research team to examine the relationship between human well-being and levels of biodiversity by comparing existing well-being indicator sets and biodiversity metrics. The goal is to discover whether or not IFAW could use these comparisons to prove that human well-being and strong biodiversity metrics are positively correlated. The data generated by this capstone will be used by IFAW internally in an effort to strategically influence policy and policymakers to support better resource allocation. The tasks assigned to the capstones are as follow:

I. Students will review current indicators used to assess parameters, such as economic performance, social well-being, and biodiversity and environmental sustainability to determine which indicator(s) in each category would be most useful to assess a country's performance when compared to other countries.

II. Students will review all of the data and identify patterns. Do the countries that rank highly on the "happiness" polls/scales also rank highly on social wellbeing indicators? Are they also particularly economically rich and/or biodiverse?

In addition to investigating the best metrics and indicators for this endeavor, the research team also analyzed relationships between these sets. The team found indicators and metrics that pull data from a large number of countries in order to analyze global trends. As part of the deliverable of this project, this report will suggest next steps for IFAW's research and policy teams.

Shortcomings of Gross Domestic Product

Gross Domestic Product (GDP) is widely used as a primary economic indicator, representing the sum total of the market value of all goods and services produced within a country in a given year (Konchitchki & Panos, 2014). This metric is limited by the fact that it does not consider health, happiness, environment, or long-term stability, and often fails to accurately reflect economic realities (Easterlin, 2013). For instance, millions of dollars are spent on reconstruction and emergency aid as a result of natural disasters each year. These costs are reflected by an increase in GDP, even though no economic progress is achieved by rebuilding what was destroyed. GDP

calculates only the short-term economic activity and fails to measure long-term health, welfare or well-being in the country. GDP is therefore an unreliable indicator of human well-being.

Over the past decade a number of alternative indicators, referred to as well-being indicators in this paper, were created to offer a more holistic alternative to GDP. These indicators were developed to reflect a complete picture of a country's development, including factors such as health and living conditions, education levels, and more.

What are we looking for?

The purpose of this project is to investigate the current state of well-being indicators and attempt to determine if any relationship exists between these well-being indicators and global biodiversity metrics.

IFAW aims to use this information to strengthen the case for wildlife protections to policymakers, and to direct fundraising efforts more efficiently. The organization seeks to reveal a positive correlation, indicating that biodiversity protections may benefit human well-being. If this type of correlation is found, IFAW will have a stronger argument in favor of biodiversity protections and their human benefits to present to policymakers.

Biodiversity Indicators

Biodiversity is defined as the "the variability among living organisms, both terrestrial and aquatic, it includes the variety within species, among species and within ecosystems" (Wright, 2018). There are hundreds of metrics that measure aspects of biodiversity, including extinction

rates, protected area coverage, and abundance of native terrestrial species. Several existing indicator sets bundle multiple biodiversity metrics into one set in an attempt to provide a holistic picture of biodiversity health. The indicator sets below were selected by the research team because they measure biodiversity-related metrics for a majority of countries, such as threatened species level, protected area coverage, and natural resource utilization.

IUCN Red List Index

The International Union for Conservation of Nature (IUCN) Red List of Threatened Species is widely known as one of the most comprehensive databases on the conservation status of animal, fungi, and plant species. The Red List Index (RLI) was developed by the IUCN to show trends in overall extinction risk for species in order to track progress in efforts to reduce biodiversity loss (IUCN, 2020). The RLI has been continuously updated since 1996 and measures five taxonomic groups: birds, mammals, amphibians, cycads, and corals (IUCN, 2020). Each group is given a score between 0 and 1, with 1 equating to "least concern," meaning it is not expected to face extinction in the near future. The index has been disaggregated to show national and regional RLI, weighted by the fraction of each species' distribution occurring within a particular country or region, a reflection of its survival probability. RLI is an attempt to reflect genuine status changes (true decline or improvement in biodiversity), as the status of a species can change due to error in assessments, taxonomic revisions, new information about a population, etc. (IUCN, 2020)

Ecological Footprint

Created and maintained by the Global Footprint Network, the Ecological Footprint Explorer database aims to measure the resource demand of individuals, governments, and business against the natural regenerative capacity of the Earth (Global Footprint Network, 2019). The Ecological Footprint Index compares a country's resources and space usage with resource and space availability to determine biocapacity reserves or deficits (Global Footprint Network, 2019). Countries that are "biocapacity creditors" have a biocapacity that exceeds its population's ecological footprint, which is reflected in a positive score in the Index. Countries are considered "biocapacity debtors" when the ecological footprint of their population exceeds their biocapacity, which is reflected in a negative score (Global Footprint Network, 2019). Scores are presented as a percentage (the percentage that biocapacity exceeds the country's ecological footprint). Granular data such as carbon sequestration, cropland, fishing grounds, forest products, and grazing land is available. Over 200 countries are represented in this index (Global Footprint Network, 2019).

Marine Trophic Index

The Marine Trophic Index (MTI) tracks the mean trophic level of fish catches from an ecosystem, subsequently tracking the health of exploited species in response to fishing pressure (Pauly *et al.*, 2020). The Convention on Biological Diversity (CBD) identified the individual indicators for this index in order to monitor marine biodiversity loss. However, this index is imperfect as declines in trophic levels can be masked by geographic expansion and/or the development of offshore fisheries where higher trophic levels can overwhelm fishing-down effects closer inshore (Pauly *et al.*, 2020). The region-based MTI (RMTI) accounts for the

potential geographic expansion of fisheries by comparing potential catch to actual catch (Pauly *et al.*, 2020). The index was created by the organization Sea Around Us, which presents fisheries and fisheries-related data at spatial scales in an attempt to assess the impact of fisheries on the marine ecosystems of the world (Pauly *et al.*, 2020). The Sea Around Us is a research initiative at the University of British Columbia.

Ocean Health Index

This comprehensive framework, hosted by the National Centre for Ecological Analysis and Synthesis, scores 220 countries and territories including the Antarctic region and 15 sections of the high seas (Ocean Health Index, 2020). Each country/area is graded in ten "goals" which include food provisions, artisanal fishing opportunities, natural products, carbon storage, coastal protection, tourism and recreation, coastal livelihoods and economies, sense of place, clean water, and biodiversity (Ocean Health Index, 2020). Each region receives a score out of 100 for each of these categories, receiving a high score if maximum sustainable benefits are gained in ways that do not compromise the ocean's ability to deliver those benefits in the future. (Ocean Health Index, 2020). A region's score is an average of its goals scores.

Protected Area Coverage

The Protected Area Coverage Index was created through the Biodiversity Indicators Partnership (BPI) and the Programme of Work on Protected Areas of the Convention on Biological Diversity (CBD), and aims to establish a comprehensive, ecologically representative and equitably managed network of terrestrial and marine protected areas (Biodiversity Indicator Partnerships, 2020). The index measures the policy response to biodiversity loss by country, assuming that an

increase in protected area coverage indicates increased efforts by a government and civil society to achieve long-term conservation of biodiversity (Biodiversity Indicator Partnerships, 2020).

Global Biodiversity Engagement

Conservation International created the Global Biodiversity Engagement Index in an effort to measure public awareness of the intrinsic value of biodiversity ("Global Biodiversity Engagement Indicator"). This Index is meant to promote the understanding and willingness of individuals to make the necessary changes and actions as well as generate political will for governments to enact policies that protect biodiversity ("Global Biodiversity Engagement Indicator"). The Index was created by studying keyword searches collected from global data from Twitter, online newspapers, and global trends. Keywords searched included scientific names for several thousand plant and animal species as well as terms like "climate change," "ecosystem services," and "endangered species" ("Global Biodiversity Engagement Indicator"). This data was synthesized to generate a monthly indicator for every country on earth. Our capstone team created an annual average of these scores in order to compare them to other metrics.

Happiness and Well-being Metrics

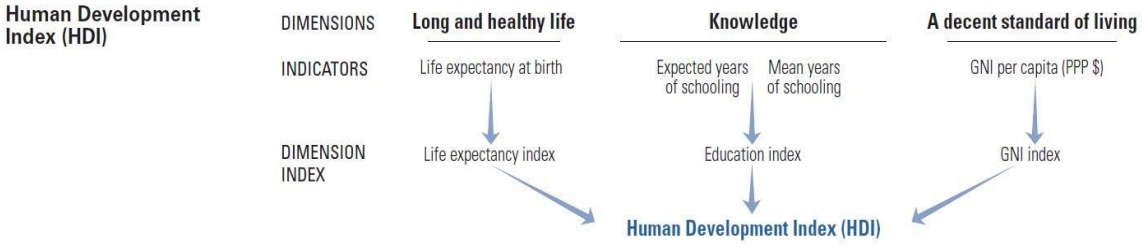
Four human well-being indexes were chosen to compare with the above biodiversity indicators in order to run regression analyses and identify possible relationships between the datasets. Analysis of multiple well-being indicators was necessary to provide a broad and clear picture of the state of well-being measurement, and to insulate this research against any inconsistencies within any given index. The research team selected the following indexes based on the quality and availability of data.

Human Development Index (HDI)

The Human Development Index (HDI) was created as part of the United Nations Development Programme (UNDP) in order to detail a complete assessment of a country's state of development that includes economic growth in conjunction with health, standard of living, and education metrics (UNDP, 2019). HDI metrics are organized into three categories: "Long and Healthy Life," which includes life expectancy at birth; "Knowledge," which is measured by average years of schooling for adults aged 25 or over and expected years of schooling for children; and "Decent Standard of Living," which is measured by gross national income per capita (UNDP, 2019). The resulting Human Development Index was created by aggregating the scores for these three HDI dimension indices into a composite index using geometric mean (UNDP, 2019).

The HDI provides an overview of selected well-being categories, such as income, lifespan and education, but does not include factors such as inequality, poverty or safety and security (UNDP, 2019).

Figure 1: Human Development Index Composition



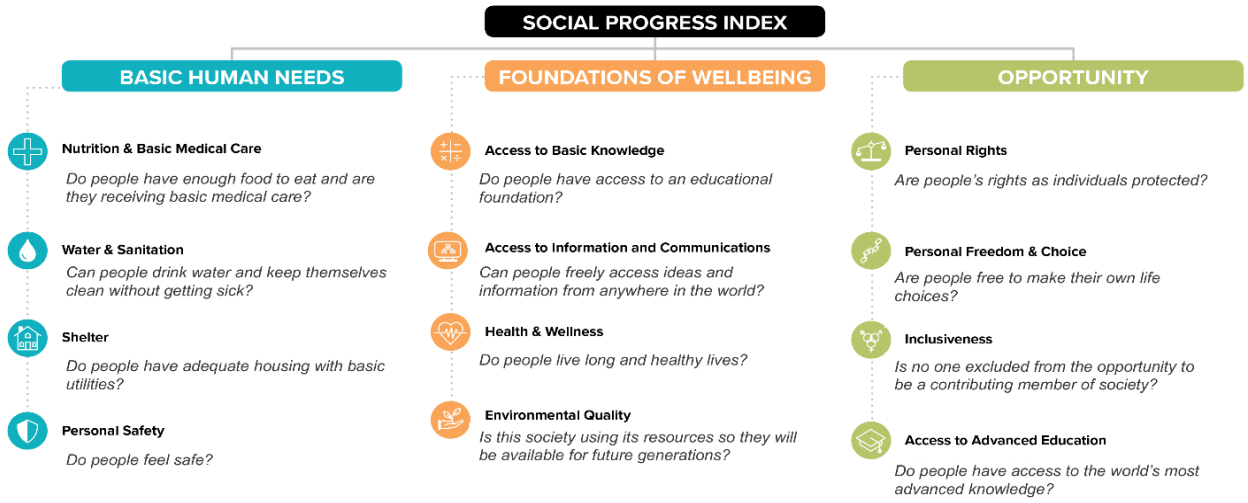
(http://hdr.undp.org/sites/default/files/hdi_2019.jpg)

Social Progress Index (SPI)

The Social Progress Index (SPI) was developed in an attempt to redefine the success of a society by measuring quality of life—it is devoid of economic indicators as it is designed to complement

economic measures such as GDP (Social Progress Imperative, 2018). The SPI is divided into three dimensions: Basic Human Needs, Foundations of Well-being, and Opportunity. This index was developed in order to provide policymakers with a supplemental measure of development, independent of economic indicators, in keeping with the belief that "economic development is important, but strong economies alone do not guarantee strong societies" (Social Progress Imperative, 2018).

Figure 2: Social Progress Index Composition



(https://www.socialprogress.org/assets/downloads/resources/2019/2019-framework-questions.pdf)

The Social Progress Index dimensions represent broad categories that are intended to define social progress, and are calculated using the equally-weighted average of each country's score on each dimension (Stern *et al., 2016*). Each dimension consists of four unique but related components (Stern *et al., 2016*). A country's dimension score is calculated using the equally-weighted average of those four components. Each component is composed of indicators, which measure "as many valid aspects of the component as possible," which are aggregated using a weighted average, where the weights are determined by individual analysis (Stern *et al., 2016*).

Sustainable Development Goals Index (SDG Index)

The Sustainable Development Goals Index (SDG Index) tracks country performance on the 17 SDGs as defined by the United Nations in 2015 (Stiftung & SDSN, 2019). This index comprises scores from 0 to100 based on equally weighted averages of relative country performance on each SDG for 227 countries as well as regional averages (Stiftung & SDSN, 2019). This index relies on data relevant to all 17 SDGs, which focus largely on extreme poverty and access to basic services and infrastructure. As a result, scores tend to be lower among low-income countries (Stiftung & SDSN, 2019). The index also tracks legislative implementation of the SDGs, so scores tend to be better among countries with active United Nations engagement (Stiftung & SDSN, 2019).

Sustainable Development Goals Well-being Index

The research team created a custom index using the SDG index data, in order to refine the data into an additional index that was focused exclusively on well-being. Sixteen SDG indicator datasets were selected out of dozens in order to represent a more specific set of factors intended to capture a cross section of health, well-being and living conditions within 228 countries. This custom index was created to supplement the UN's SDG Index by focusing on specific data that is most relevant to this research, while excluding data that is not relevant. The methodology for the creation of this index is detailed below in the Methods section. The data used in the creation of this index can be found in Appendix I.

Methods

Creating the Sustainable Development Goals Well-Being Index

The United Nations regularly updates and reports on each nation's individual progress toward the Sustainable Development Goals (Stiftung & SDSN, 2019). This database is available to the

public for download and was used to create the research team's proprietary Sustainable Development Goals Well-being Index for all countries studied.

The sixteen specific indicator datasets were chosen in order to focus this new index on national well-being, while disregarding irrelevant metrics included in the broader Sustainable Development Goals Index developed by the United Nations. The Sustainable Development Goals Well-Being Index data focuses solely on access to basic services, economic, intergenerational and gender equity, safety and prevalence of violence and mental and physical health. This data was collected, organized and synthesized into an index of 228 countries.

The data points chosen for the new index are:

- Proportion of population using basic drinking water services
- Proportion of population using safely managed drinking water services
- Proportion of population using basic sanitation services
- Proportion of population using safely managed sanitation services
- Proportion of population with access to electricity
- Proportion of population subjected to physical violence in the previous 12 months
- Suicide mortality rate
- Proportion of youth not in education
- Employment or training
- Adolescent birth rate
- Proportion of women of reproductive age who have their need for family planning satisfied with modern methods
- Proportion of births attended by skilled health personnel
- Proportion of population with large (greater than 25%) household expenditures on health
- Proportion of population below international poverty line
- Proportion of population below national poverty line
- Prevalence of severe food insecurity in the adult population.

Data collected for each country and indicator from 2015 to 2019 was averaged into a single data point per country. Countries were then ranked based on their average performance relative to each other within each dataset. Each country was then given a score for each metric by dividing its rank by the total number of countries studied and subtracting that number from 1. This

resulted in a unique score between 0 and 1, with 1 representing the highest possible score. An equally weighted average of each country's sixteen indicator scores was taken in order to produce the aggregated Sustainable Development Goals Well-being Index score. Raw data and results of this process can be found in Appendix I**.**

Data Sourcing and Collection

At the beginning of the research process, IFAW shared several reports including the Social Progress Index, The Human Development Report, and "True Well-being for Animals and People" (Allgood *et al*., 2016), in order to provide the research team with a better understanding of the research they had already conducted. The report, "True Well-being for Animals and People" was instrumental in helping the team to identify reliable data for the social this project. The Biodiversity Indicators Partnership website was also used as a springboard for early analysis and identification of relevant biodiversity indicators. Once selected, the indicators were studied internally.

The research team compiled a list of over 100 indicators for use in the analysis, (See Appendices II and III). For the purpose of establishing a standard methodology for research, the team selected four main categories that the chosen indicators needed to reflect: happiness, economic, social, and environmental metrics.

The indicators were then divided among the team members for further research and analysis. Team members reviewed the methodology of the indicators, and identified the most relevant quantitative data. Indicators were also vetted for important factors covered, as well as

relevance. As this project aims to provide a global perspective, the indicators were evaluated to ensure each covered a sufficient number of countries.

Data Analysis Using Regression

After a thorough indicator screening process, six biodiversity indexes were selected: Marine Trophic Level, Ocean Health Index, Global Biodiversity Engagement, Ecological Footprint, IUCN Red List, and Protected Area Coverage Ratio. The four well-being metrics selected were: Human Development Index, Social Progress Index, SDG Global Index, and SDG Well-being Index.

First, regression analysis plots had to be created to investigate the relationships between well-being indicators and biodiversity metrics. This was done by creating scatter plots in Microsoft Excel and applying a linear trendline to visually inspect any correlations, where the independent variables, in this case well-being indicators, were plotted on the x-axis, and dependent variables, in this case the biodiversity metrics, were plotted on the y-axis. It is noteworthy to mention that some of the data points in the biodiversity metrics were considered as outliers and so were removed to get a more realistic trend. These are highlighted in Appendix III.

Next, for each case, two important parameters were calculated to quantitatively identify if any correlation exists between the two indicators based on the regression plot: the slope of the regression line and Pearson's correlation coefficient, or more simply: the r-value. While the slope can indicate the strength of the linear relationship between the two variables, the r-values of the plots are used in the analysis of this research to measure the linear correlation strength between

the two quantitative variables, and the slope is used to confirm such results. R-values are presented as values from -1 to 1. The closer to -1 or 1 the stronger the correlation, where -1 indicates the correlation is negative and 1 indicates the correlation is positive. If the r-value is 0, the correlation is weak.

Results

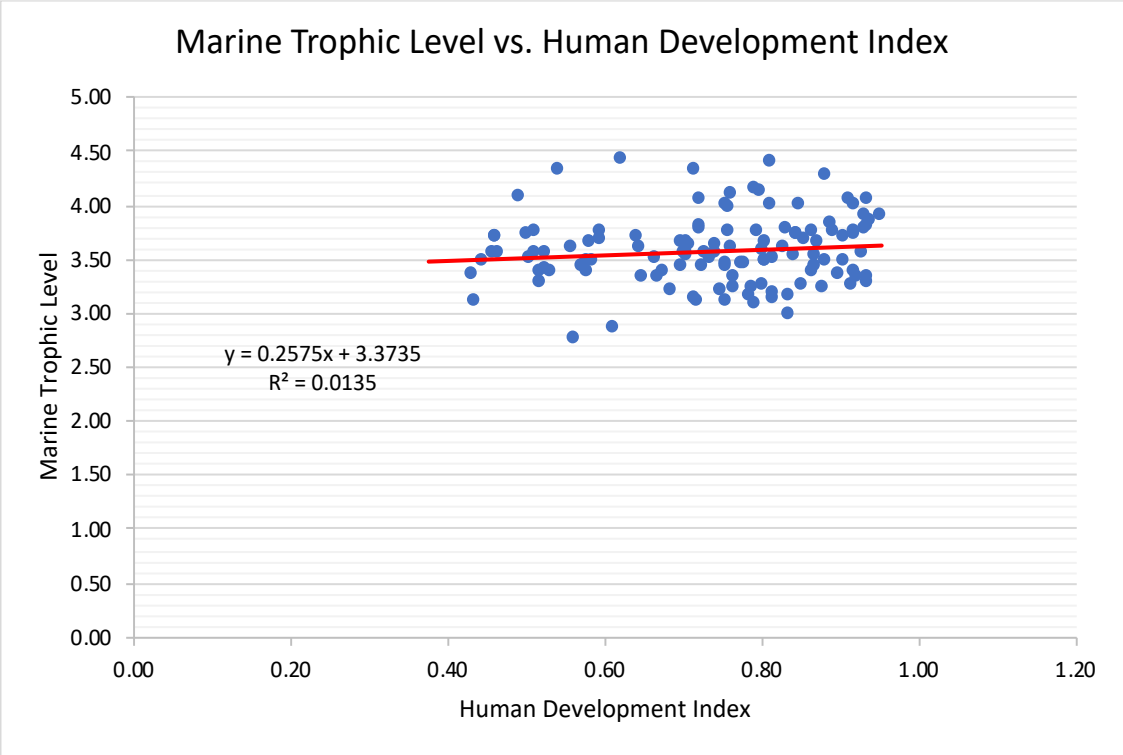


Chart 1: Regression Analysis of Marine Trophic Level versus Human Development Index (HDI)

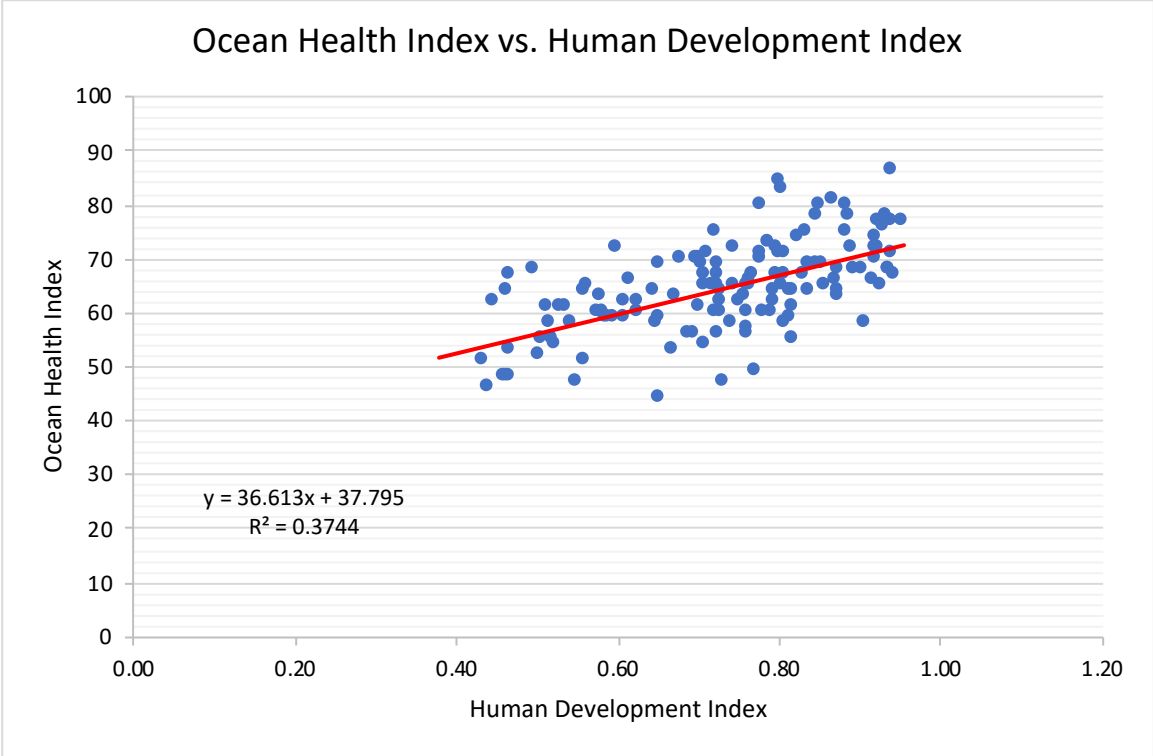


Chart 2: Regression Analysis of Ocean Health Index versus Human Development Index (HDI)

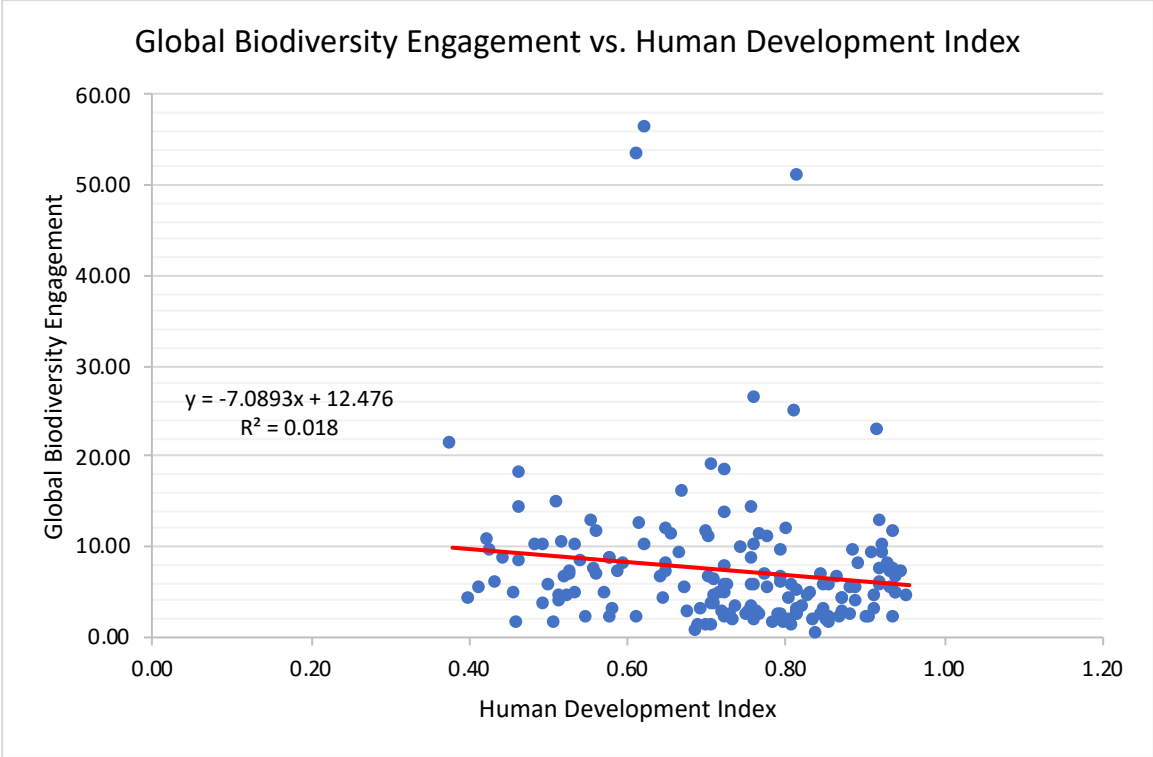


Chart 3: Regression Analysis of Global Biodiversity Engagement versus Human Development Index (HDI)

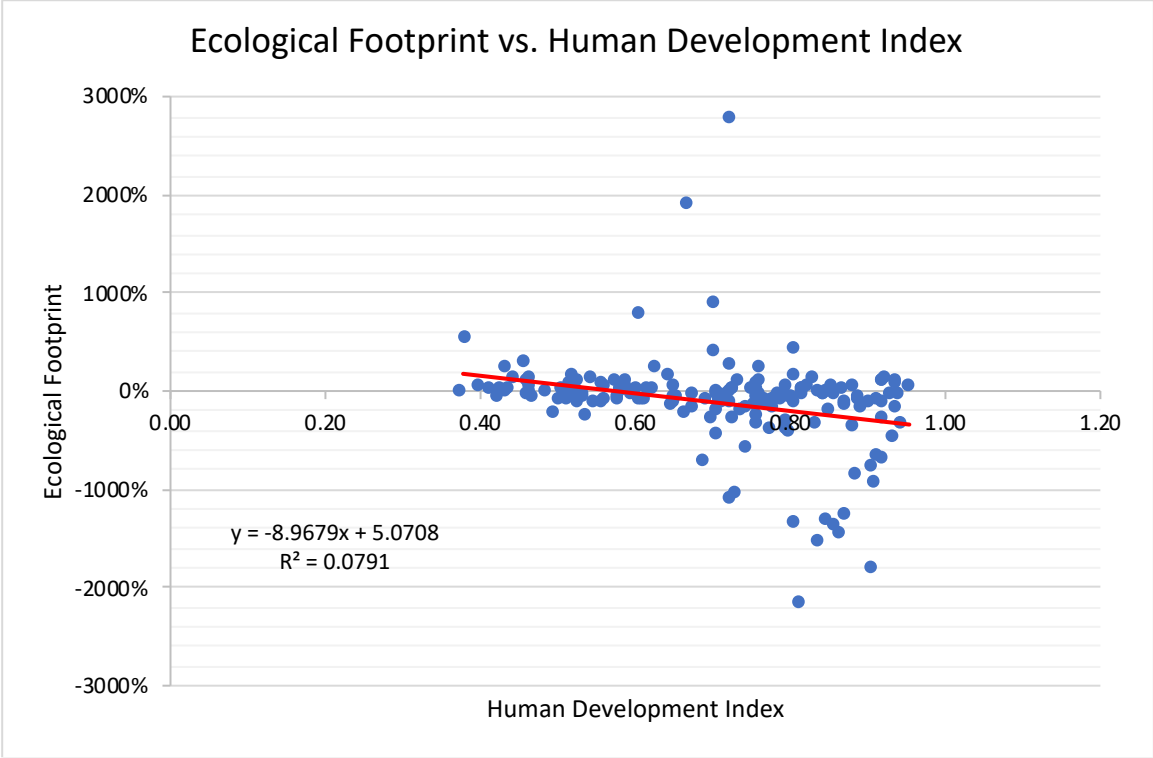


Chart 4: Regression Analysis of Ecological Footprint versus Human Development Index (HDI)

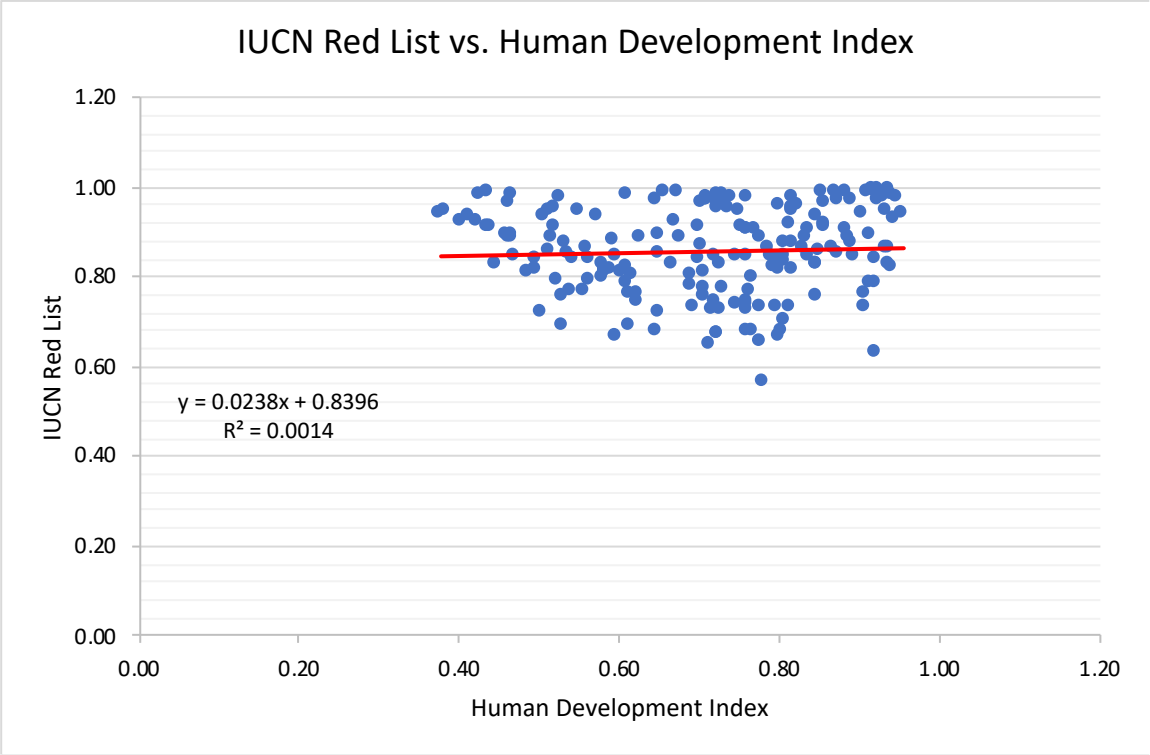


Chart 5: Regression Analysis of IUCN Red List versus Human Development Index (HDI)

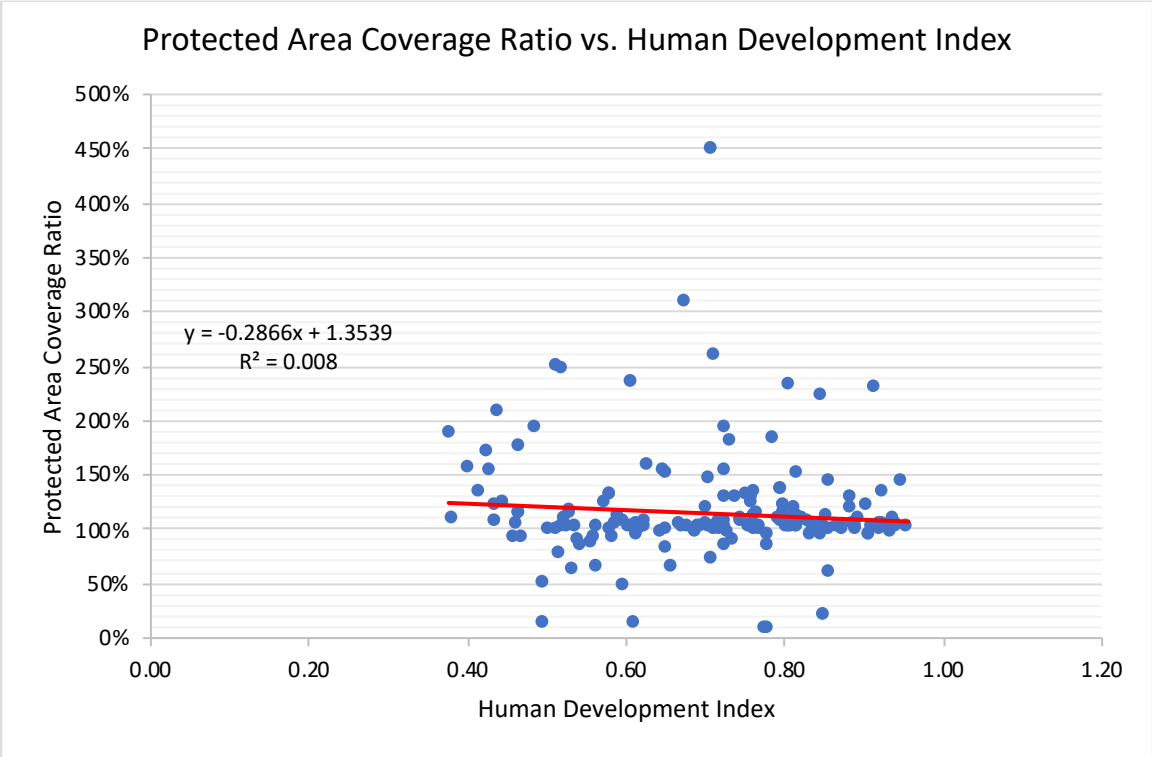


Chart 6: Regression Analysis of Protected Area Coverage Ratio versus Human Development Index (HDI)

Table 1: Regression Analysis Results (R-values)

	Human Development Index (HDI)	Social Progress Index	SDG Global Index	SDG Well-being Index
Marine Trophic Level	0.12	0.20	0.10	0.15
Ocean Health Index	0.61	0.64	0.58	0.55
Global Biodiversity Engagement	-0.13	-0.15	-0.20	-0.10
Ecological Footprint	-0.28	-0.24	-0.17	-0.43
IUCN Red List	0.04	0.022	0.08	0.02
Protected Area Coverage Ratio	-0.09	-0.10	-0.09	-0.05

Table 2: Regression Analysis Results (Slope)

	Human Development Index (HDI)	Social Progress Index	SDG Global Index	SDG Well-being Index
Marine Trophic Level	0.26	0.00	0.00	0.28
Ocean Health Index	36.61	0.35	0.51	25.87
Global Biodiversity Engagement	-7.09	-0.04	-0.08	-4.54
Ecological Footprint	-8.97	-0.08	-0.08	-11.22
IUCN Red List	0.02	0.00	0.00	0.01
Protected Area Coverage Ratio	-0.29	0.00	0.00	-0.14

Observations

Tables 1 and 2 show the regression analysis results of the r-value and slope of the regression line, respectively. Charts 1 through 6 are examples of regression analysis plots for a number of the indicators studied. Based on Table 1, which shows the r-value results of regression analysis between well-being indicators and biodiversity metrics, it can be inferred that all the investigated indicators and metrics have moderate, weak, or very weak correlations; these correlations were positive or negative.

Nevertheless, the Ocean Health Index has the strongest positive relationship with the Social Progress Index, with an r-value of 0.64 (see Table 1) and has a moderate positive correlation with the rest of the well-being indicators. The regression analysis plot for this relationship can be seen in Chart 1.

Global Biodiversity Engagement and the Ecological Footprint Index have weak negative relationships across the wellbeing indicators, whereas Protected Area Coverage Ratio has a very

weak negative correlation, as shown in Table 1. Examples of the regression plot results can be seen in Charts 2, 3 and 4; Global Biodiversity Engagement vs. Social Progress Level, Ecological Footprint vs. SDG Global Index and Protected Area Coverage Ratio vs. Human Development Index (HDI), respectively.

Marine Trophic Level and IUCN Red List showed weak positive correlations across the four well-being indicators where the IUCN Red List showed the lowest r-values, indicating very weak positive correlations across well-being indicators (see Table 1). Similarly, examples of the regression plot results can be seen in Charts 5 and 6; Marine Trophic Level vs. Human Development Index (HDI) and IUCN Red List vs. SDG Well-being Index, respectively. The raw data used to produce these analyses can be found in Appendices II and III. The remaining regression analysis charts generated for this research can be found in Appendix IV.

Country-Specific Analysis

For the purpose of identifying policies that improve biodiversity, the research team selected two countries that ranked highly in both human well-being and biodiversity metrics. To do so, the team examined the regression analysis for the Human Development Index (HDI) in order to isolate the top five ranking countries for both Protected Area Coverage and the IUCN Active Red List. The HDI was chosen for this ranking because it represents the greatest number of countries and is the most likely to be used by policymakers. Protected Area Coverage and the IUCN Active Red List were chosen because habitat change and species diversity were important factors to the client. Through this ranking, both Norway and Germany appeared in the top five of

both regression analyses. The team performed qualitative research on both country's biodiversity policies to provide successful examples of biodiversity-related policies for the client.

Country Specific Analysis

Norway

Norway has relatively low levels of biodiversity (an estimated 41,000 species of multicellular organisms), primarily due to its cold northern climate, short growing season, and high humidity ("Country Profiles: Norway"). However, the country contains high levels of marine diversity as well as 14% of the world's bumble bee species and 6-10% of the world's moss and lichen species ("Country Profiles: Norway"). Nature-related recreation and tourism are essential to the Norwegian economy, and access to nature is widely recognized as a cultural right ("Country Profiles: Norway"). Cultural and economic appreciation for nature has driven the government of Norway to establish several policies aimed at preserving and growing endemic populations. The government laid out its commitment to improving the management of nature, incorporating climate-resiliency management measures, strengthening biodiversity expertise, safeguarding species and habitats, and adapting new tools and instruments for their variety of ecosystems in its 2015 Biodiversity Action Plan ("Nature for Life," 2015).

The fishing industry is vital to the economies of Norwegian coastal communities, which have depended upon subsidies from the government since 1964 (Jentoft & Mikalsen, 1987). Norway's dedication to preserving fish stocks was instigated by the severe depletion of spring spawning herring which peaked in the 1960s, triggering nation-wide policy changes in an effort to rebuild stock and maintain long-term sustainability (Gullestad, 2013). International and national policy and management changes were instrumental in restocking the population. Internationally,

economic zones were extended by 200 nautical miles, and joint management programs were established with neighboring countries (Gullestad, 2013). Nationally, several technical regulations were implemented, including an effective ban on discard in an attempt to reduce overfishing as well as food waste, and the establishment of total allowable catches (TACs) (Gullestad, 2013).

From a cultural perspective, Norwegians have embraced the concept of friluftsliv, which translates to "free air life" and describes a philosophical lifestyle that is based on the freedom in nature and the spiritual connectedness with the landscape (Gelter, 1999). The concept of friluftsliv is reflected in the unwritten law of "Allemansraätten," ("everyone's right") which allows everyone access to land, even private property (Gelter, 1999). The romantic "back-to-nature" movement of the 18th century introduced friluftsliv to Norway's upper class by way of music, art, and poetry, emphasizing the importance of Norwegian identity to landscape to a class that no longer needed to hunt or fish for themselves (Gelter, 1999). The world's first tourism organization (1868) revitalized the term to further their efforts to "foster people's good health through skiing and other nature experiences to better cope with the urban and industrial development" (Gelter, 1999). Today, the concept of friluftsliv is taught in schools, embedded in national tourism, and remains a prominent part of national identity.

Germany

As of 2020, Germany has made great effort to protect biodiversity through policies addressing agriculture, land use, and transportation. The Federal Minister for the Environment, Dr. Barbara Hendricks, made it a top priority for her office in 2014 and has been working to implement the

2020 biodiversity-related targets outlined in the National Strategy on Biodiversity, which was adopted by the government in 2007 (Hendricks, 2020). Germany submits annual updates to the Convention of Biological Diversity to ensure they are tracking progress and implementing necessary policies to reach their goals. They have outlined ten action areas and each action area includes 3-8 corresponding policy measures. The ten action areas are: Fields and Meadows, Coasts and Marine Waters, Floodplains, Forests, Wilderness, Protected Areas, Greening Our Cities, International Responsibility, Knowledge and Understanding, and Financing (Hendricks, 2020).

While Germany has implemented many policies to improve biodiversity, they have still seen a decrease over time. The main factors related to this decline are farming and forestry, landscape fragmentation, urban sprawl, pollution, invasive species, and climate change ("German Biodiversity Facts"). With over 50% of their land capacity devoted to agriculture, they've had to implement many policies specifically addressing sustainable land use ("German Biodiversity Facts").

The Federal Agency for Nature Conservation states that "protected areas belong to the most important instruments of nature conservation and site protection contributes effectively to the conservation of species and habitats" ("Protected Areas"). Germany passed the Federal Nature Conservation Act in 2002 designating different land protections, including nature conservation areas, national parks, biosphere reserves, landscape protection areas, and nature parks. Each designation is classified by size, protection purpose, and conservation objective ("Protected Areas"). One of the requirements listed in Germany's Federal Nature Conservation Act is that at

least 10% of land must be interlinked biotopes with protected area status. Looking forward, Germany hopes to prioritize large-scale conservation areas by creating a national action plan for protected areas ("Protected Areas").

Conclusions

Challenges, Gaps in Available Data

Throughout the course of our research the team faced several difficult decisions regarding the selection of the well-being and biodiversity metrics. Due to the global scope of the client's work, the datasets used needed to facilitate the study of global patterns. This global scale required the use of datasets that include information on many countries if not all, and to have one aggregate indicator number or score representing the entire dataset. The research team also looked for well-being indexes that included many different measures of a country's performance, including environmental, economic, social, and happiness indicators.

One index that represents the complexity of this challenge is the Organization for Economic Co-operation and Development (OECD) Better Life Index, which is put together on a bi-annual basis and measures 11 different metrics on human well-being, including income and wealth, jobs and earnings, housing, health, education, work-life balance, environment, social connections, civic engagement, safety, and subjective well-being (OECD, 2020). Initially this indicator seemed very robust in the metrics it included, but only covered 41 countries. It also did not summarize its components into one overall index number, making analyses on multiple different indicators inside one index difficult to perform. There were many similar examples of promising indexes that were excluded due to the small number of countries included, the lack of a single

index figure, and/or too few indicators represented. A list of all of the well-being indexes researched can be found in Appendix II.

Another challenge encountered while researching the biodiversity metrics was accessibility of datasets to the research team. Much of the current research performed on biodiversity-related metrics is done by non-profit organizations. Occasionally, the desired data was blocked by expensive paywalls or otherwise inaccessible. Attempts were made to contact these non-profits, but many failed to respond to data requests. This limited the number of usable biodiversity datasets, but those included in the study still represent a wide range of factors regarding biodiversity. Please see Appendix V for a list of all biodiversity metrics considered and Appendix III for all raw biodiversity metrics data.

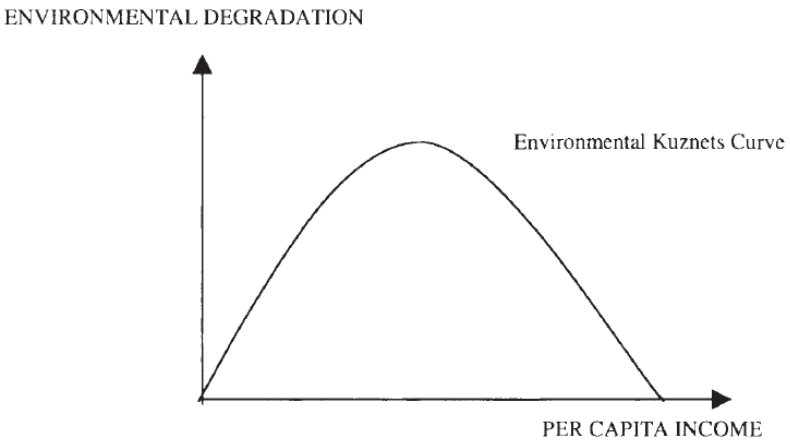
While there were minor roadblocks encountered during the data analysis phase of the project, running regression analyses between each well-being index and biodiversity metric proved less challenging than originally anticipated. However, the results of the regression analysis show almost no correlation between any of the biodiversity metrics and well-being indexes. This made it difficult to recommend policy to the client.

The challenges presented throughout the project did not have a significant impact on the results. All data used during the project represented well-researched information from reputable organizations. Although the analysis did not indicate a relationship between well-being and biodiversity metrics, there are still many conclusions that can be understood from this research.

Biodiversity, Well-being and the Environmental Kuznets Curve

Although this analysis found only weak (positive and negative) correlations between well-being indexes and biodiversity metrics, other noteworthy conclusions can be inferred. Above all else, this study highlights the substantial complexities of the social and economic circumstances which converge to inform the well-being of a given population. The countless variables which influence the state of a country's well-being, biodiversity and capacity to legislate wildlife protections are inextricably linked to the nature and history of economic development. The process of identifying countries for more specific analysis involved finding the five countries which showed the strongest positive correlations between well-being indexes and biodiversity metrics. All Four of the five top performers identified were wealthy, European countries. This not only speaks to the influence of economic development on overall well-being, but on the capacity for and ability to prioritize environmental protections as well. This relationship between environmental degradation and per capital income is elucidated by the bell-shaped Environmental Kuznets Curve (Borghesi, 2019).

Figure 3: Environmental Kuznets Curve



(Borghesi, 2019)

Economists have used this curve to explain how environmental degradation is initially spurred by rapid industrialization, but begins to decline as advances in technology eventually provide for more efficiency in increased economic production (Borghesi, 2019). As per capita income increases, inequality decreases, and populations are free to prioritize luxuries like environmental protection and progressive environmental laws (Azad, 2014; Borghesi, 2019). By virtue of the nature of the history of human development, wealthier countries tend to have reached the right side of their Environmental Kuznets Curve as poorer countries entered the nascent stages of development on the left side of their own curves (Azad, 2014). This has provided opportunities for wealthy, developed and now environmentally conscious countries like Germany and Norway to outsource their own environmentally destructive industries to the developing world (Azad, 2014). In doing so, these wealthy nations can compound the threats to biodiversity in the developing world while simultaneously stifling well-being. The interconnectedness of development, industry, well-being and the environment may suggest that robust, national biodiversity protections depend on strengthened economic equity. Once a national economy develops beyond the point of subsistence, the population will be free to prioritize biodiversity. Focused efforts on reducing inequity between the developed and developing world will likely result in improved biodiversity protections globally.

Recommended Action

It may be possible to draw a more meaningful conclusion on the relationship between biodiversity and human well-being by shifting to a focus on individuals. This endeavor has shown the complications associated with attempting to derive correlations between large datasets with substantial numbers of dependent variables. These variables must be removed in order to

hone observations on only what is relevant, so an experiment designed to measure individual happiness and well-being against daily interaction with and proximity to biodiversity may prove more fruitful. Numerous similar studies have identified the positive impacts of exposure to nature on self-reported satisfaction and happiness as well as measured mental health and performance (Williams, 2017). Such studies can provide a framework for IFAW to measure individual responses to exposure to biodiversity. For the purpose of this study, individual surveys should be conducted on self-reported well-being metrics before and after exposure to biodiversity, as well as among individuals living within various proximities to biodiversity centers in order to narrow focus on only desired observations. Such a study may be better suited to reveal the direct relationship between biodiversity and well-being while disregarding the complexities of development that clouded the analysis in this paper.

For the purpose of citing this paper, please use the following format:

Al-Borshaid, H., Cheung, K., Iraci, N., Kelman, A., Liu , C., Nahle, R.P., & Nichols, A. *Do Biodiversity Metrics Positively Correlate with Environmental, Well-being and Economic Indicators?* Prepared for The International Fund for Animal Welfare As part of The Integrative Capstone Workshop in Sustainability Management. Master of Science in Sustainability Management Program in the School of Professional Studies/Earth Institute, Columbia University, New York, NY USA. May 5th, 2020.

Works Cited

Allgood, B., Ratchford, M., & Large, K., “Measuring What Matters: True Well-being for Animals and People.” International Fund for Animal Welfare, (2016)

Ava A., "Remedies for Foreign Citizens Subjected to Outsourced Pollution: A Case Study of American Big Oil in the Ecuadorian Amazon." Florida A & M University Law Review 9, no. 2 (Spring 2014): 277-308

Biodiversity Indicator Partnerships, “Protected Area Coverage.” 2020 UNEP WCMC. Web accessed 31 March 2020, (2020)

<https://www.bipindicators.net/indicators/coverage-of-protected-areas-terrestrial-and-marine>

Borghesi, S., “The Environmental Kuznets Curve: A Critical Survey.” Economic Institutions and Environmental Policy. Routledge, (2019): 201-225

“Country Profiles: Norway - Main Details.” Convention on Biological Diversity. Web. Accessed 7 April (2020)

<https://www.cbd.int/countries/?country=no>

Easterlin, R. A., "Happiness, Growth, and Public Policy." Economic Inquiry 51, no. 1, (2013): 1-15

Gelter, H., “Friluftsliv: The Scandinavian Philosophy of Outdoor Life.” Canadian Journal of Environmental Education, vol. 5 (1999)

“Germany Biodiversity Facts”, Convention on Biological Diversity. Web. <https://www.cbd.int/countries/?country=de>

Global Biodiversity Engagement Indicator. Conservation International. Web Accessed 31 March 2020. (2020)

<http://biodiversityengagementindicator.com/>

Works Cited

Global Footprint Network. “Country Trends.” Web Accessed 30 March 2020. (2019)

<https://www.footprintnetwork.org/>

Gullestad, P., Aglen, A., Bjordal, A., Blom, G., Johansen, S., Krog, J., Misund, O. A., Røttingen, I., “Changing Attitudes 1970–2012: Evolution of the Norwegian Management Framework to Prevent Overfishing and to Secure Long-Term Sustainability,” ICES Journal of Marine Science, vol. 71, issue 2, (Winter 2014): 173-182

Hendricks, B., “Nature Conservation Action Programme,” Federal Ministry for the Environment and Nature Conservation, (2020)

<https://www.cbd.int/doc/world/de/de-nbsap-v2-en.pdf>

IFAW, Ocean Noise Reduction—Global. Web. Accessed April 6, 2020 (2019) <https://www.ifaw.org/international/projects/ocean-noise-reduction-global>

IFAW, Wildlife Cybercrime Prevention—Global | Web. Accessed April 6, 2020 (2019) <https://www.ifaw.org/international/projects/wildlife-cybercrime-prevention-global>

IUCN, “The IUCN Red List of Threatened Species.” Version 2020-1. Web Accessed 30 March 2020. (2019)

<https://www.iucnredlist.org>

Jentoft S., Mikalsen, K. H., “Government Subsidies in Norwegian Fisheries: Regional Development or Political Favouritism?” Marine Policy, vol. 11 (1987): 217-228

Konchitchki, Y., and Panos N. P., "Accounting Earnings and Gross Domestic Product." Journal of Accounting and Economics 57, no. 1, (2014): 76-88

“Nature for Life: Norway’s Biodiversity Action Plan.” Ministry of Climate and Environment, 18 December (2015)

<https://www.cbd.int/doc/world/no/no-nbsap-v4-en.pdf>

Works Cited

Ocean Health Index. "Annual Scores and Rankings." web Accessed 30 March 2020. (2020)
<http://www.oceanhealthindex.org/region-scores/annual-scores-and-rankings>

OECD (Organisation for Economic Co-operation and Development), "Hows Life? 2020: Measuring Well-being." OECD, Paris, (2020)

Pauly D, Zeller D, and Palomares M.L.D. (Editors) "Sea Around Us: Concepts, Design and Data," Marine Trophic Index. University of British Columbia, (2020)

"Protected Areas", German Federal Agency for Nature Conservation. Web <https://www.bfn.de/en/activities/protected-areas.html>

Social Progress Imperative, "Index to Action to Impact." Web. (2018)
<www.socialprogress.org>

Stern, S., Wares, A., Hellman, T., "The Social Progress Index Methodological Report," Social Progress Imperative, (2016)

Stiftung, B. and Sustainable Development Solutions Network, "Transformations to Achieve the Sustainable Development Goals: Includes the SDG Index and Dashboards," United Nations Sustainable Development Report, (2019)

UNDP, "Beyond Income, Beyond Averages, Beyond Today: Inequalities in Human Development in the 21st Century." Human Development Report. United Nations Development Programme, New York, (2019)

Williams, F., "The Nature Fix: Why Nature Makes Us Happier, Healthier, and More Creative." WW Norton & Company, (2017)

Wright, R. T., "Framework For a Sustainable Future - A Paradox: What is the Real State of The Planet?" *Environmental Science: Toward a Sustainable Future*. Jones & Bartlett Publishers, (2018): 3-22

Appendix I: Sustainable Development Well-being Index

Country	Average Score	Index Rank
French Polynesia	0.99533	1
Gibraltar	0.99461	2
Monaco	0.99382	3
Saint Kitts and Nevis	0.99360	4
United States Virgin Islands	0.99078	5
China, Macao	0.98416	6
Liechtenstein	0.97698	7
Kuwait	0.96678	8
Bermuda	0.93330	9
Singapore	0.93196	10
China, Hong Kong	0.93061	11
Andorra	0.92416	12
Austria	0.91933	13
Curaçao	0.90494	14
San Marino	0.90223	15
Bahrain	0.89174	16
Martinique	0.89154	17
Netherlands	0.88817	18
Malta	0.87751	19
Wallis and Futuna Islands	0.87588	20
Palau	0.87214	21
Bahamas	0.86897	22
Qatar	0.86666	23
Guadeloupe	0.86084	24
Israel	0.86019	25
Germany	0.85812	26
Isle of Man	0.85454	27
Switzerland	0.85235	28
Denmark	0.84840	29
Luxembourg	0.84501	30
Dominica	0.84395	31
United Arab Emirates	0.84387	32
Tonga	0.84278	33
Spain	0.84012	34
Belgium	0.83993	35
Antigua and Barbuda	0.83917	36
Czechia	0.83876	37
Faroe Islands	0.83388	38
Brunei Darussalam	0.83365	39

New Caledonia	0.83306	40
Norway	0.82691	41
Saudi Arabia	0.82606	42
Saint Helena	0.82374	43
Cyprus	0.81779	44
Sint Maarten	0.81740	45
Japan	0.81576	46
Republic of Korea	0.81263	47
Niue	0.81249	48
Sweden	0.81186	49
Malaysia	0.80912	50
Estonia	0.80698	51
Finland	0.80696	52
Anguilla	0.80667	53
Greenland	0.80550	54
Greece	0.80420	55
Syrian Arab Republic	0.80410	56
United Kingdom	0.79731	57
Northern Mariana Islands	0.79656	58
Slovenia	0.79313	59
Thailand	0.78724	60
Maldives	0.77896	61
New Zealand	0.77844	62
Uzbekistan	0.77809	63
Portugal	0.77804	64
Tokelau	0.77495	65
United States of America	0.77309	66
Italy	0.77196	67
Hungary	0.77180	68
Trinidad and Tobago	0.76834	69
Turkmenistan	0.76826	70
Saint Vincent and the Grenadines	0.76358	71
Kazakhstan	0.76092	72
Iceland	0.76077	73
Guam	0.75852	74
Jamaica	0.75767	75
France	0.75386	76
Australia	0.74683	77
Barbados	0.74666	78
Slovakia	0.74564	79
Canada	0.74486	80
Falkland Islands	0.73734	81

Aruba	0.73705	82
Croatia	0.73520	83
Ireland	0.73365	84
Oman	0.73277	85
Latvia	0.73274	86
Poland	0.73261	87
Saint Pierre and Miquelon	0.67086	88
Grenada	0.72113	89
Turks and Caicos Islands	0.70726	90
Turkey	0.70725	91
China	0.70677	92
Cayman Islands	0.70432	93
Lithuania	0.70339	94
Jordan	0.70103	95
Viet Nam	0.69464	96
Tunisia	0.69341	97
Seychelles	0.68993	98
Islamic Republic of Iran	0.68641	99
Uruguay	0.68434	100
Fiji	0.68116	101
Belarus	0.68070	102
Saint Lucia	0.72519	103
Azerbaijan	0.66786	104
Channel Islands	0.66611	105
Indonesia	0.65856	106
Libya	0.65643	107
Costa Rica	0.65369	108
Ukraine	0.64802	109
Cook Islands	0.64248	110
Montenegro	0.64218	111
Chile	0.64158	112
Bhutan	0.64060	113
Mauritius	0.63376	114
Bulgaria	0.63174	115
Dominican Republic	0.63017	116
Egypt	0.62901	117
Sri Lanka	0.62885	118
Montserrat	0.61854	119
Russian Federation	0.61003	120
Venezuela	0.60911	121
Puerto Rico	0.60708	122
Georgia	0.60296	123

Iraq	0.59928	124
State of Palestine	0.59583	125
Panama	0.59455	126
North Macedonia	0.59235	127
Bosnia and Herzegovina	0.58907	128
Lebanon	0.58205	129
Serbia	0.58016	130
Romania	0.58007	131
Algeria	0.57943	132
Morocco	0.57805	133
Cuba	0.57522	134
Paraguay	0.57159	135
French Guiana	0.56836	136
Kyrgyzstan	0.56331	137
Sao Tome and Principe	0.56153	138
Marshall Islands	0.56142	139
Ecuador	0.55966	140
Brazil	0.55841	141
Mexico	0.55481	142
Samoa	0.55258	143
Armenia	0.54683	144
Cabo Verde	0.54676	145
Argentina	0.54262	146
Tajikistan	0.54195	147
Nauru	0.54145	148
Republic of Moldova	0.54017	149
Democratic People's Republic of Korea	0.53871	150
Peru	0.53747	151
Belize	0.53234	152
El Salvador	0.53126	153
Colombia	0.52817	154
Polynesia	0.52133	155
Guatemala	0.51302	156
Albania	0.50717	157
Gabon	0.49764	158
Philippines	0.49531	159
Tuvalu	0.49098	160
Pakistan	0.48876	161
Myanmar	0.48600	162
Comoros	0.48439	163
South Africa	0.47797	164
Gambia	0.47576	165

Micronesia	0.47440	166
Mongolia	0.47405	167
Suriname	0.47206	168
Vanuatu	0.47135	169
Djibouti	0.46714	170
Yemen	0.46075	171
Nicaragua	0.45438	172
Kiribati	0.45086	173
India	0.44982	174
Botswana	0.44311	175
Cambodia	0.43994	176
Kenya	0.43923	177
Guinea-Bissau	0.43884	178
Guyana	0.43657	179
Bolivia	0.43624	180
Namibia	0.43598	181
Madagascar	0.43361	182
Mayotte	0.43237	183
Timor-Leste	0.43028	184
Rwanda	0.42968	185
Somalia	0.42510	186
Honduras	0.42470	187
Malawi	0.42265	188
Sudan	0.41367	189
Ghana	0.40899	190
Nepal	0.40629	191
Papua New Guinea	0.40377	192
Congo	0.40055	193
Mauritania	0.39945	194
Zimbabwe	0.39911	195
Burundi	0.39745	196
Bangladesh	0.39614	197
Mozambique	0.38306	198
Afghanistan	0.37609	199
Equatorial Guinea	0.36915	200
Mali	0.36813	201
Democratic Republic of the Congo	0.36307	202
Eritrea	0.36213	203
Angola	0.36012	204
Ethiopia	0.35933	205
Lao People's Democratic Republic	0.35844	206
Togo	0.35580	207

Solomon Islands	0.35229	208
Cameroon	0.34510	209
Senegal	0.33893	210
Zambia	0.33528	211
Burkina Faso	0.33432	212
Tanzania	0.33039	213
Benin	0.32635	214
Haiti	0.32452	215
South Sudan	0.32428	216
Eswatini	0.30840	217
Lesotho	0.30760	218
Uganda	0.29992	219
Liberia	0.29682	220
Chad	0.29267	221
Guinea	0.28983	222
Nigeria	0.28874	223
Niger	0.28193	224
Côte d'Ivoire	0.26906	225
Sierra Leone	0.24872	226
Melanesia	0.19543	227
Central African Republic	0.14286	228

Appendix II: Well-being Index Raw Data used in Regression Analysis

Country	Human Development Index (HDI)	Social Progress Index	SDG Global Index	SDG Wellbeing Index (created)
Afghanistan	0.50	38.6	49.65	0.38
Albania	0.79	71.57	70.27	0.51
Algeria	0.76	67.06	71.10	0.58
Andorra	0.86	-	-	0.92
Angola	0.57	42.58	51.32	0.36
Antigua and Barbuda	0.78	-	-	0.84
Argentina	0.83	76.86	72.35	0.54
Armenia	0.76	71.14	68.77	0.55
Australia	0.94	88.02	73.89	0.75
Austria	0.91	86.4	81.07	0.92
Azerbaijan	0.75	-	70.46	0.67
Bahamas	0.81	-	-	0.87
Bahrain	0.84	-	68.72	0.89
Bangladesh	0.61	54.11	60.88	0.40
Barbados	0.81	77.89	-	0.75
Belarus	0.82	73.9	77.44	0.68
Belgium	0.92	86.77	78.89	0.84
Belize	0.72	-	62.55	0.53
Benin	0.52	51.07	50.85	0.33
Bhutan	0.62	67.26	67.58	0.64
Bolivia	0.70	63.66	68.39	0.44
Bosnia and Herzegovina	0.77	-	69.39	0.59
Botswana	0.73	65.58	59.77	0.44
Brazil	0.76	72.87	70.62	0.56
Brunei Darussalam	0.85	-	-	0.83
Bulgaria	0.82	76.17	74.52	0.63
Burkina Faso	0.43	47.82	52.40	0.33
Burundi	0.42	39.09	51.55	0.40
Cabo Verde	0.65	68.55	65.05	0.55
Cambodia	0.58	50.36	61.78	0.44
Cameroon	0.56	48.04	56.02	0.35
Canada	0.92	88.81	77.89	0.74
Central African Republic	0.38	28.05	39.08	0.14
Chad	0.40	28.79	42.79	0.29
Chile	0.85	80.02	75.61	0.64

China	0.76	64.54	73.21	0.71
Colombia	0.76	70.31	69.57	0.53
Comoros	0.54	52.04	52.98	0.48
Congo (Republic of)	0.61	45.67	54.22	0.40
Congo (Democratic Republic of)	0.46	36.77	44.95	0.36
Costa Rica	0.79	80.65	74.98	0.65
Côte d'Ivoire	0.52	50.56	55.70	0.27
Croatia	0.84	79.21	77.79	0.74
Cuba	0.78	67.42	70.82	0.58
Cyprus	0.87	83.14	70.14	0.82
Czechia	0.89	-	-	0.84
Denmark	0.93	90.09	85.22	0.85
Djibouti	0.50	48.05	51.36	0.47
Dominica	0.72	-	-	0.84
Dominican Republic	0.75	67.15	69.76	0.63
Ecuador	0.76	71.88	72.29	0.56
Egypt	0.70	61.71	66.21	0.63
El Salvador	0.67	64.65	66.73	0.53
Equatorial Guinea	0.59	-	-	0.37
Eritrea	0.43	31.61	-	0.36
Estonia	0.88	83.98	80.22	0.81
Eswatini	0.61	51.21	51.69	0.31
Ethiopia	0.47	45.41	53.25	0.36
Fiji	0.72	63.85	70.07	0.68
Finland	0.93	89.56	82.82	0.81
France	0.89	87.79	81.49	0.75
Gabon	0.70	-	64.76	0.50
Gambia	0.47	52.9	55.00	0.48
Georgia	0.79	71.34	68.91	0.60
Germany	0.94	88.84	81.07	0.86
Ghana	0.60	61.75	63.80	0.41
Greece	0.87	82.48	71.41	0.80
Grenada	0.76	-	-	0.72
Guatemala	0.65	59.67	59.65	0.51
Guinea	0.47	40.59	52.81	0.29
Guinea-Bissau	0.46	-	-	0.44
Guyana	0.67	63.74	61.41	0.44
Haiti	0.50	-	48.44	0.32
Honduras	0.62	60.31	63.41	0.42
Hong Kong, China (SAR)	0.94	-	-	0.93

Hungary	0.85	78.77	76.89	0.77
Iceland	0.94	89.29	79.20	0.76
India	0.65	59.1	61.08	0.45
Indonesia	0.71	65.52	64.19	0.66
Iran	0.80	65.15	70.49	0.69
Iraq	0.69	-	60.79	0.60
Ireland	0.94	87.97	78.22	0.73
Israel	0.91	81.44	71.53	0.86
Italy	0.88	85.69	75.79	0.77
Jamaica	0.73	72.58	68.80	0.76
Japan	0.92	88.34	78.92	0.82
Jordan	0.72	69.57	68.09	0.70
Kazakhstan	0.82	68.2	68.71	0.76
Kenya	0.58	53.51	57.03	0.44
Kiribati	0.62	-	-	0.45
Korea Democratic People's Rep.	-	-	-	0.54
Korea	0.91	85.61	78.33	0.81
Kuwait	0.81	-	63.51	0.97
Kyrgyzstan	0.67	66.64	-	0.56
Laos	0.60	-	-	0.36
Latvia	0.85	80.42	77.13	0.73
Lebanon	0.73	64.98	65.67	0.58
Lesotho	0.52	48.44	50.94	0.31
Liberia	0.47	46.67	48.18	0.30
Libya	0.71	-	-	0.66
Liechtenstein	0.92	-	-	0.98
Lithuania	0.87	81.3	75.10	0.70
Luxembourg	0.91	87.66	74.78	0.85
Madagascar	0.52	43.58	46.70	0.43
Malawi	0.49	50.52	51.38	0.42
Malaysia	0.80	74.17	69.56	0.81
Maldives	0.72	-	72.12	0.78
Mali	0.43	45.98	50.21	0.37
Malta	0.89	82.63	76.11	0.88
Marshall Islands	0.70	-	-	0.56
Mauritania	0.53	42.45	53.33	0.40
Mauritius	0.80	74.88	63.59	0.63
Mexico	0.77	71.51	68.51	0.55
Micronesia	0.61	-	-	0.47
Moldova	0.71	67.58	74.41	0.54

Monaco	-	-	-	0.99
Mongolia	0.74	65.6	64.69	0.47
Montenegro	0.82	71.16	67.25	0.64
Morocco	0.68	66.04	69.07	0.58
Mozambique	0.45	45.39	53.03	0.38
Myanmar	0.58	52.65	62.18	0.49
Namibia	0.65	-	59.87	0.44
Nauru	-	-	-	0.54
Nepal	0.58	60.23	63.93	0.41
Netherlands	0.93	88.31	80.38	0.89
New Zealand	0.92	88.93	79.50	0.78
Nicaragua	0.65	58.97	67.94	0.45
Niger	0.38	41.74	49.45	0.28
Nigeria	0.53	49.2	46.41	0.29
North Macedonia	0.76	-	69.38	0.59
Norway	0.95	90.95	80.66	0.83
Oman	0.83	69.08	67.86	0.73
Pakistan	0.56	48.2	55.57	0.49
Palau	0.81	-	-	0.87
Palestine	0.69	-	-	0.60
Panama	0.80	73.96	66.31	0.59
Papua New Guinea	0.54	38.59	51.62	0.40
Paraguay	0.72	67.2	67.52	0.57
Peru	0.76	71.31	71.19	0.54
Philippines	0.71	63.4	64.94	0.50
Poland	0.87	81.25	75.93	0.73
Portugal	0.85	87.12	76.43	0.78
Qatar	0.85	69.37	66.28	0.87
Romania	0.82	74.81	72.73	0.58
Russian Federation	0.82	69.71	70.94	0.61
Rwanda	0.54	52.96	56.02	0.43
Saint Kitts and Nevis	0.78	-	-	0.99
Saint Lucia	0.75	-	-	0.73
Saint Vincent and the Grenadines	0.73	-	-	0.76
Samoa	0.71	-	-	0.55
San Marino	-	-	-	0.90
Sao Tome and Principe	0.61	61.42	65.48	0.56
Saudi Arabia	0.86	63.95	64.84	0.83
Senegal	0.51	58.59	57.30	0.34
Serbia	0.80	71.59	72.49	0.58

Seychelles	0.80	-	-	0.69
Sierra Leone	0.44	49.09	49.24	0.25
Singapore	0.94	83.23	69.62	0.93
Slovakia	0.86	80.43	-	0.75
Slovenia	0.90	85.8	79.41	0.79
Solomon Islands	0.56	-	-	0.35
Somalia	-	-	-	0.43
South Africa	0.71	67.44	61.48	0.48
South Sudan	0.41	24.44	-	0.32
Spain	0.89	87.47	77.84	0.84
Sri Lanka	0.78	69.09	65.84	0.63
Sudan	0.51	41.59	51.36	0.41
Suriname	0.72	67.27	67.03	0.47
Sweden	0.94	89.45	84.99	0.81
Switzerland	0.95	89.89	78.84	0.85
Syria	0.55	-	58.13	0.80
Tajikistan	0.66	54.92	69.23	0.54
Tanzania	0.53	52.69	55.82	0.33
Thailand	0.77	67.47	73.00	0.79
Timor-Leste	0.63	55.8	-	0.43
Togo	0.51	48.58	51.60	0.36
Tonga	0.72	-	-	0.84
Trinidad and Tobago	0.80	-	67.56	0.77
Tunisia	0.74	72.33	69.99	0.69
Turkey	0.81	67.49	68.49	0.71
Turkmenistan	0.71	55.57	64.26	0.77
Tuvalu	-	-	-	0.49
Uganda	0.53	-	52.57	0.30
Ukraine	0.75	66.97	72.81	0.65
United Arab Emirates	0.87	69.84	69.71	0.84
United Kingdom	0.92	87.98	79.38	0.80
United States	0.92	83.62	74.52	0.77
Uruguay	0.81	77.77	72.55	0.68
Uzbekistan	0.71	59.83	71.13	0.78
Vanuatu	0.60	-	59.87	0.47
Venezuela	0.73	-	63.05	0.61
Viet Nam	0.69	-	71.09	0.69
Yemen	0.46	-	53.70	0.46
Zambia	0.59	-	52.62	0.34
Zimbabwe	0.56	46.58	59.67	0.40

Appendix III: Biodiversity Metrics Raw Data used in Regression Analysis

Country	Marine Trophic Level	Ocean Health Index	Global Biodiversity Engagement	Ecological Footprint	IUCN Red List	Protected Area Coverage Ratio
Afghanistan	-	-	3.63	-	0.84	49%
Albania	3.21	60	2.33	-95%	0.84	109%
Algeria	3.43	56	5.46	-354%	0.90	129%
Andorra	-	-	5.53	-	0.92	58%
Angola	3.41	60	4.62	92%	0.93	122%
Antigua and Barbuda	-	80	6.66	-413%	0.89	8%
Argentina	3.58	67	4.28	103%	0.86	105%
Armenia	-	-	1.83	-144%	0.85	103%
Australia	4.04	77	11.52	85%	0.83	100%
Austria	-	-	4.32	-107%	0.89	102%
Azerbaijan	-	-	2.64	-169%	0.91	100%
Bahamas	3.24	83	-	146%	0.70	100%
Bahrain	2.96	64	0.31	-1560%	0.84	-
Bangladesh	2.85	66	2.03	-107%	0.76	93%
Barbados	4.00	59	24.79	-2190%	0.91	119%
Belarus	-	-	2.96	-31%	0.97	106%
Belgium	3.25	72	5.53	-696%	0.99	99%
Belize	3.10	60	2.61	-42%	0.74	100%
Benin	3.27	55	-	-59%	0.91	247%
Bhutan	-	-	12.35	12%	0.80	99%
Bolivia	-	-	11.02	397%	0.87	145%
Bosnia and Herzegovina	3.21	49	2.16	-95%	0.91	100%
Botswana	-	-	5.67	14%	0.98	96%
Brazil	3.98	65	5.42	209%	0.90	134%
Brunei Darussalam	3.51	-	-	-51%	0.83	221%
Bulgaria	3.11	64	2.36	-6%	0.94	100%

Burkina Faso	-	-	5.73	-21%	0.99	121%
Burundi	-	-	10.51	-72%	0.92	169%
Cabo Verde	-	69	7.90	-140%	0.89	81%
Cambodia	3.47	60	2.07	-24%	0.82	130%
Cameroon	2.74	65	11.40	23%	0.84	100%
Canada	3.75	72	10.15	95%	0.97	104%
Central African Republic	-	-	-	529%	0.94	107%
Chad	-	-	4.14	24%	0.92	154%
Chile	3.73	69	6.70	-22%	0.76	93%
China	3.45	63	3.14	-278%	0.74	127%
Colombia	3.75	57	9.96	78%	0.74	110%
Comoros	-	-	-	-259%	0.76	88%
Congo (Republic of)	-	59	-	772%	0.98	233%
Congo (Democratic Republic of the)	3.55	48	4.62	264%	0.89	90%
Costa Rica	4.15	62	6.34	-72%	0.82	135%
Côte d'Ivoire	-	-	4.49	58%	0.89	75%
Croatia	3.14	69	1.78	-24%	0.90	100%
Cuba	3.45	71	11.01	-119%	0.65	84%
Cyprus	3.65	63	4.18	-1270%	0.98	100%
Czechia	-	-	3.67	-115%	0.97	99%
Denmark	3.53	76	8.09	-63%	0.97	101%
Djibouti	4.07	68	10.06	-233%	0.82	12%
Dominica	4.05	56	-	-125%	0.67	192%
Dominican Republic	3.62	72	9.76	-180%	0.73	105%
Ecuador	3.98	-	14.26	16%	0.68	102%
Egypt	3.41	70	1.01	-303%	0.91	117%
El Salvador	3.49	53	9.13	-246%	0.83	103%
Equatorial Guinea	3.46	59	-	39%	0.81	104%
Eritrea	3.34	51	-	220%	0.91	106%

Estonia	3.22	75	2.45	35%	0.99	128%
Eswatini	-	-	-	-118%	0.82	100%
Ethiopia	-	-	32.02	-72%	0.84	91%
Fiji	3.76	69	18.40	-34%	0.67	84%
Finland	3.32	65	9.26	102%	0.99	134%
France	3.82	72	5.32	-87%	0.87	101%
Gabon	3.65	61	11.43	866%	0.96	103%
Gambia	-	67	17.93	-37%	0.98	113%
Georgia	3.14	73	1.55	-61%	0.86	182%
Germany	3.28	86	4.62	-199%	0.98	103%
Ghana	3.67	59	7.90	-49%	0.84	106%
Greece	3.51	68	4.11	-174%	0.85	99%
Grenada	4.10	65	26.30	-39%	0.76	98%
Guatemala	-	59	11.78	-83%	0.72	98%
Guinea	3.53	48	8.09	28%	0.89	174%
Guinea-Bissau	-	48	-	94%	0.96	103%
Guyana	3.31	63	15.93	1900%	0.92	100%
Haiti	3.72	52	5.61	-108%	0.72	99%
Honduras	-	60	9.97	-2%	0.74	105%
Hong Kong, China (SAR)	-	-	4.68	-	0.82	-
Hungary	-	-	2.26	-46%	0.93	102%
Iceland	3.80	71	2.06	-	0.86	107%
India	3.58	58	4.04	-173%	0.68	152%
Indonesia	3.52	65	3.60	-32%	0.75	72%
Iran	-	67	2.40	-337%	0.84	105%
Iraq	3.20	56	0.59	-722%	0.80	96%
Ireland	3.83	67	6.50	-52%	0.93	100%
Israel	3.69	58	2.15	-1840%	0.76	93%
Italy	3.46	80	5.28	-371%	0.90	119%

Jamaica	3.43	60	13.58	-286%	0.72	128%
Japan	4.05	66	3.03	-672%	0.78	228%
Jordan	-	65	2.08	-1120%	0.96	101%
Kazakhstan	-	-	4.90	-54%	0.87	150%
Kenya	3.37	63	8.58	-109%	0.80	130%
Kiribati	4.40	62	56.31	-	0.76	100%
Korea Democratic People's Rep.	-	-	-	-57%	0.90	-
Korea	3.46	-	-	-797%	0.73	93%
Kuwait	3.63	71	1.19	-1350%	0.85	107%
Kyrgyzstan	-	-	5.31	-42%	0.98	308%
Lao People's Democratic Rep.	-	-	-	3%	0.81	102%
Latvia	3.24	69	1.72	34%	0.99	111%
Lebanon	3.54	47	2.30	-1060%	0.96	179%
Lesotho	-	-	10.44	-88%	0.95	100%
Liberia	3.70	53	14.13	109%	0.89	114%
Libya	3.54	54	1.13	-458%	0.97	-
Liechtenstein	-	-	22.90	-	0.99	100%
Lithuania	3.36	66	2.10	-7%	0.99	101%
Luxembourg	-	-	9.13	-943%	0.99	100%
Madagascar	3.38	54	6.41	152%	0.79	109%
Malawi	-	-	10.04	-37%	0.81	193%
Malaysia	3.57	65	4.06	-73%	0.68	232%
Maldives	4.30	75	4.59	-	0.84	106%
Mali	-	-	9.36	-2%	0.98	153%
Malta	4.25	78	9.31	-869%	0.88	103%
Marshall Islands	-	70	-	-	0.84	-
Mauritania	3.39	61	4.24	74%	0.98	100%
Mauritius	3.73	72	6.00	-397%	0.40	136%
Mexico	3.33	67	11.28	-122%	0.68	98%

Micronesia	-	-	53.45	-	0.69	103%
Moldova	-	-	3.45	-45%	0.97	-
Monaco	-	63	10.22	-	0.76	322%
Mongolia	-	-	1.61	84%	0.95	89%
Montenegro	3.18	55	2.25	-21%	0.81	1111%
Morocco	3.38	70	2.48	-187%	0.89	101%
Mozambique	3.46	62	8.42	120%	0.83	122%
Myanmar	3.63	59	2.90	14%	0.81	91%
Namibia	3.69	64	6.52	139%	0.97	97%
Nauru	-	62	-	-	0.77	-
Nepal	-	-	8.40	-90%	0.83	99%
Netherlands	3.90	78	6.96	-487%	0.94	97%
New Zealand	4.00	77	12.58	97%	0.63	101%
Nicaragua	3.32	44	7.00	26%	0.85	151%
Niger	-	-	21.36	-22%	0.94	186%
Nigeria	3.36	61	4.81	-59%	0.87	61%
North Macedonia	-	-	-	-81%	0.97	-
Norway	3.89	77	4.40	32%	0.94	100%
Oman	3.77	75	4.72	-352%	0.89	93%
Pakistan	3.60	51	7.30	-129%	0.86	92%
Palau	4.39	64	51.06	-	0.73	100%
Palestine	-	-	1.24	-	0.78	100%
Panama	3.07	64	9.54	22%	0.73	136%
Papua New Guinea	4.30	58	8.34	105%	0.84	84%
Paraguay	-	-	4.70	240%	0.95	102%
Peru	3.09	60	8.47	65%	0.72	122%
Philippines	3.61	71	6.04	-143%	0.64	101%
Poland	3.42	64	2.66	-122%	0.97	102%
Portugal	4.00	80	5.57	-225%	0.85	100%

Qatar	3.71	78	3.02	-1340%	0.83	19%
Romania	3.50	61	2.54	-8%	0.95	111%
Russian Federation	-	74	3.11	35%	0.96	107%
Rwanda	-	-	10.06	-70%	0.85	101%
Saint Kitts and Nevis	-	70	-	-	0.73	8%
Saint Lucia	3.55	65	-	-603%	0.84	107%
Saint Vincent and the Grenadines	-	62	-	-	0.77	9087%
Samoa	3.63	67	18.93	-56%	0.81	449%
San Marino	-	-	18.17	-	0.99	-
Sao Tome and Principe	-	62	-	-96%	0.79	11%
Saudi Arabia	3.67	65	1.94	-1390%	0.91	98%
Senegal	3.73	58	3.87	-17%	0.94	99%
Serbia	-	-	1.51	-73%	0.96	120%
Seychelles	4.12	84	11.69	-	0.66	100%
Sierra Leone	3.09	46	-	-5%	0.91	207%
Singapore	3.77	68	5.27	9950%	0.86	99%
Slovakia	-	-	1.36	-40%	0.96	143%
Slovenia	3.34	68	1.98	-129%	0.94	121%
Solomon Islands	-	64	12.58	67%	0.77	85%
Somalia	3.99	50	13.48	-13%	0.90	-
South Africa	3.55	69	6.48	-229%	0.77	100%
South Sudan	-	-	5.39	9%	0.93	133%
Spain	3.75	68	8.00	-194%	0.84	107%
Sri Lanka	3.44	60	5.22	-198%	0.56	93%
Sudan	3.49	55	1.38	-9%	0.93	735%
Suriname	3.78	67	7.62	2750%	0.98	106%
Sweden	3.32	68	7.42	48%	0.99	104%
Switzerland	-	-	7.17	-362%	0.97	143%
Syria	-	47	2.01	-120%	0.94	-

Tajikistan	-	-	11.14	-81%	0.99	65%
Tanzania	3.55	-	7.01	-20%	0.69	116%
Thailand	3.59	66	2.68	-111%	0.80	112%
Timor-Leste	-	-	-	208%	0.89	157%
Togo	3.53	61	14.63	-109%	0.85	248%
Tonga	3.13	65	-	-105%	0.73	99%
Trinidad and Tobago	-	71	-	-439%	0.81	114%
Tunisia	3.50	58	3.10	-206%	0.97	127%
Turkey	3.46	58	1.63	-133%	0.88	100%
Turkmenistan	-	-	-	-113%	0.98	99%
Tuvalu	4.41	71	51.32	-	0.84	100%
Uganda	-	-	6.65	-120%	0.75	113%
Ukraine	3.20	62	2.25	-2%	0.95	131%
United Arab Emirates	3.73	81	6.50	-1480%	0.86	100%
United Kingdom	3.37	74	5.98	-301%	0.78	102%
United States	3.71	70	7.45	-122%	0.84	103%
Uruguay	3.47	67	5.45	419%	0.83	100%
Uzbekistan	-	-	4.40	-127%	0.97	259%
Vanuatu	3.75	72	38.76	-	0.66	47%
Venezuela	-	64	5.44	0%	0.83	152%
Viet Nam	-	56	3.03	-108%	0.73	101%
Yemen	3.69	64	1.44	-61%	0.88	841%
Zambia	-	-	7.19	98%	0.88	110%
Zimbabwe	-	-	6.68	-114%	0.79	65%

*The values in the cells greyed out were excluded from the regression analysis because they contain outliers.

Appendix IV: Complete Results of Regression Analyses

Results

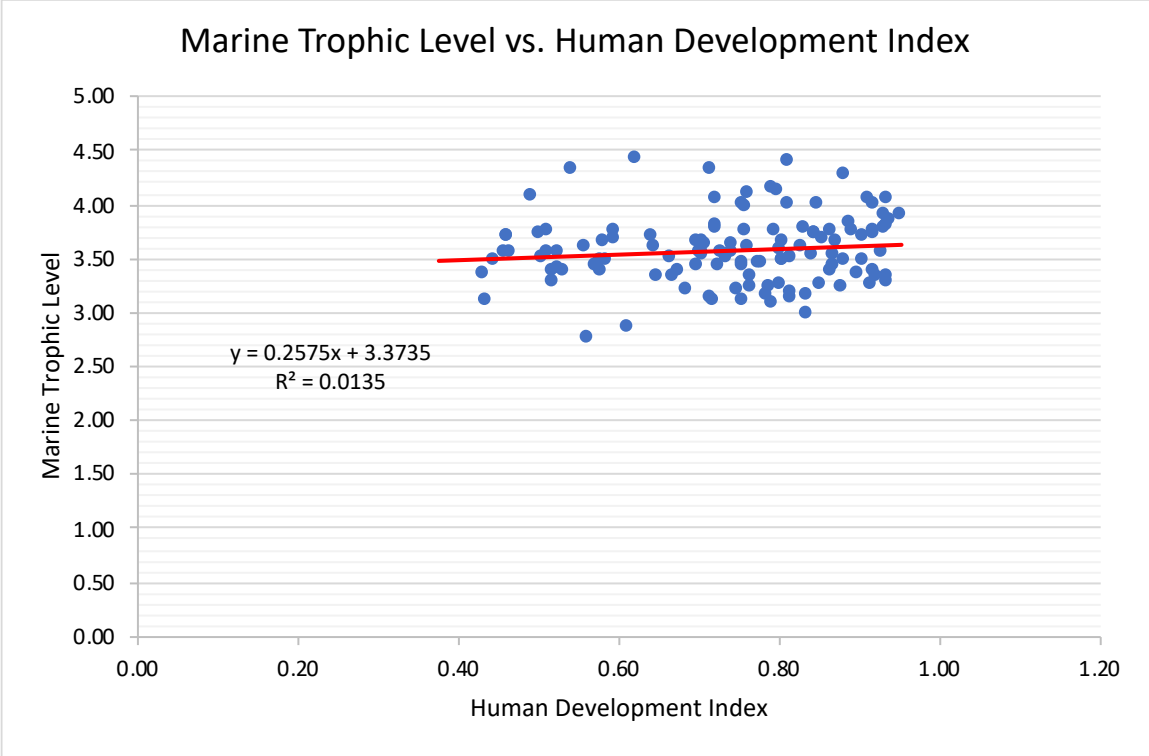


Chart 1: Regression Analysis of Marine Tropic Level versus Human Development Index (HDI)

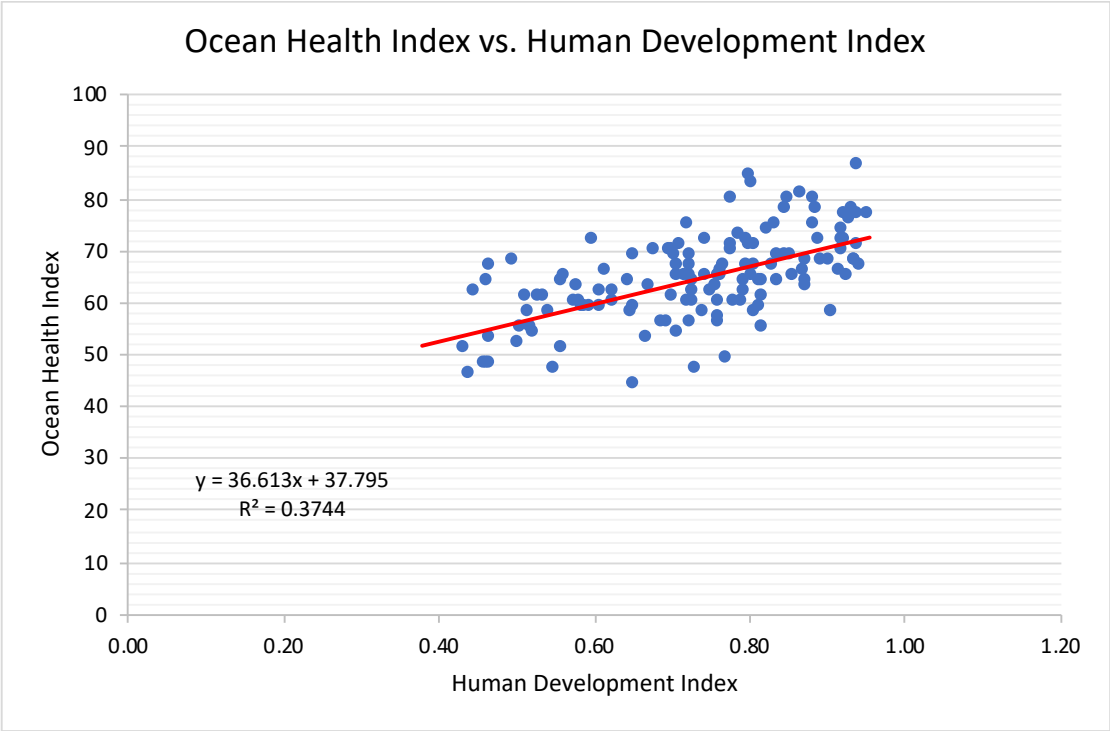


Chart 2: Regression Analysis of Ocean Health Index versus Human Development Index (HDI)

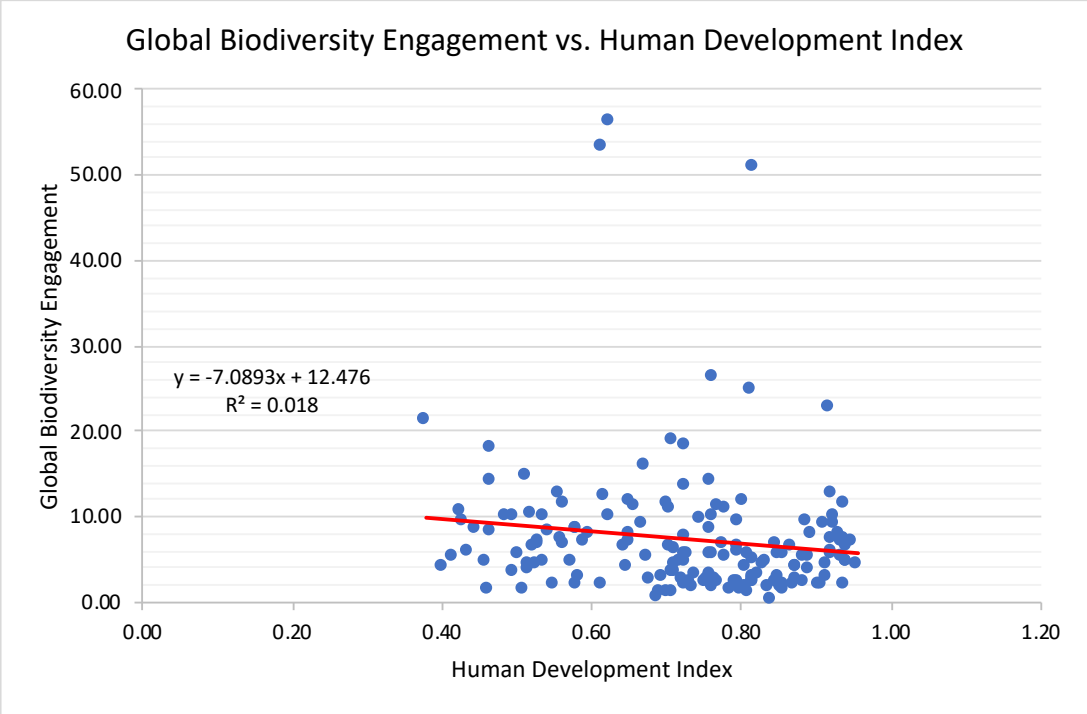


Chart 3: Regression Analysis of Global Biodiversity Engagement versus Human Development Index (HDI)

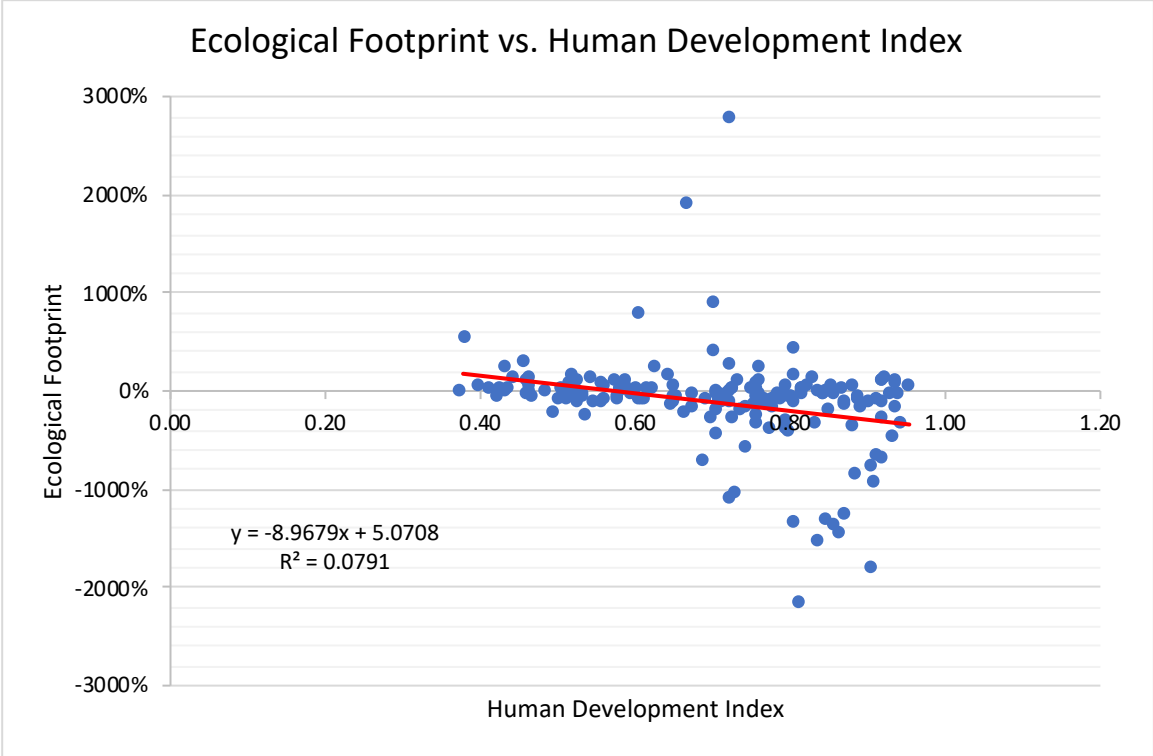


Chart 4: Regression Analysis of Ecological Footprint versus Human Development Index (HDI)

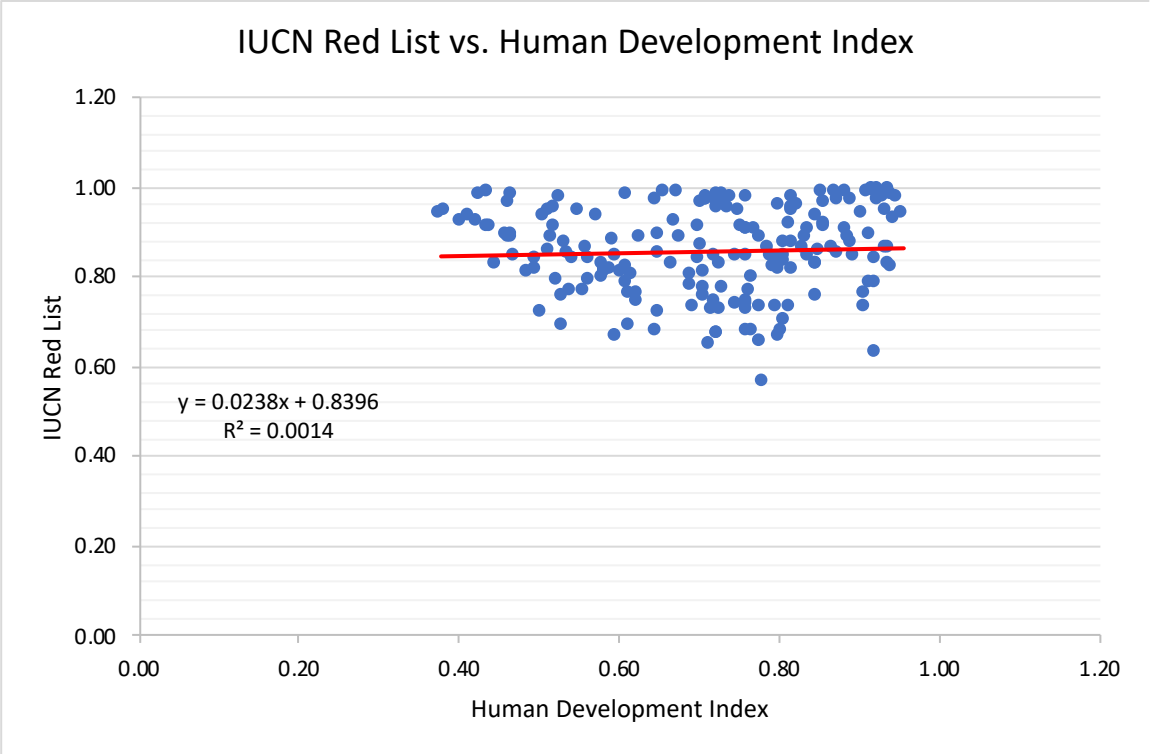


Chart 5: Regression Analysis of IUCN Red List versus Human Development Index (HDI)

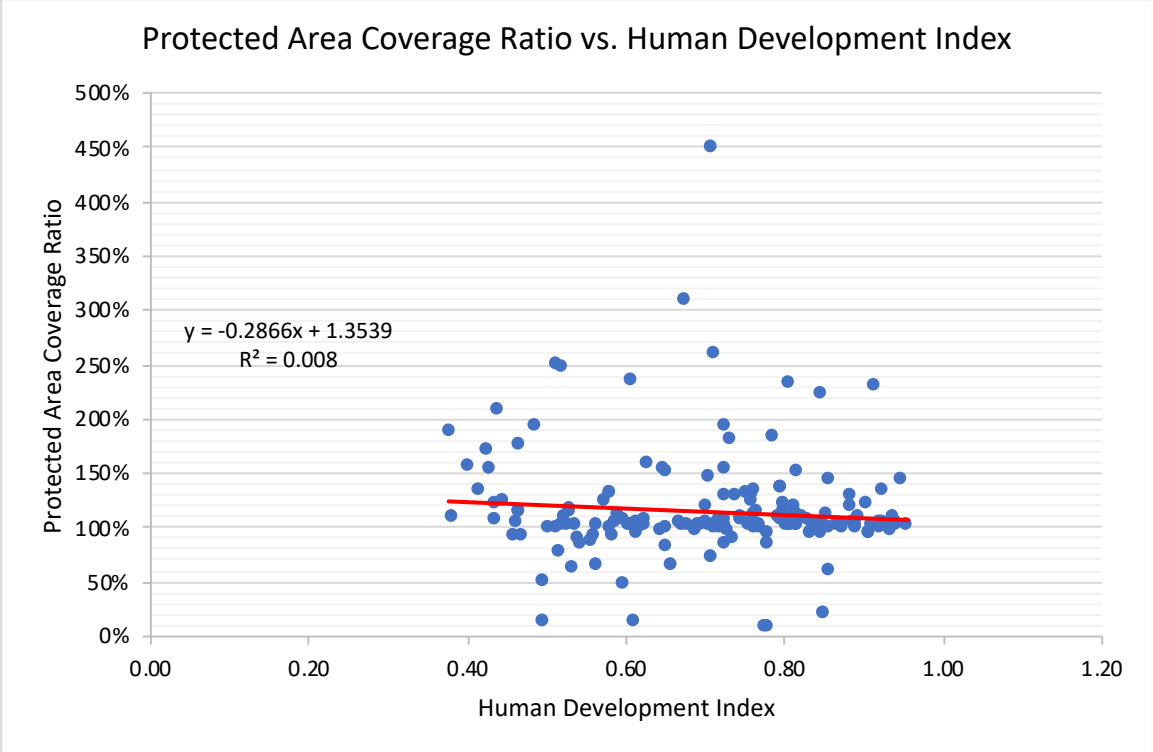


Chart 6: Regression Analysis of Protected Area Coverage Ratio versus Human Development Index (HDI)

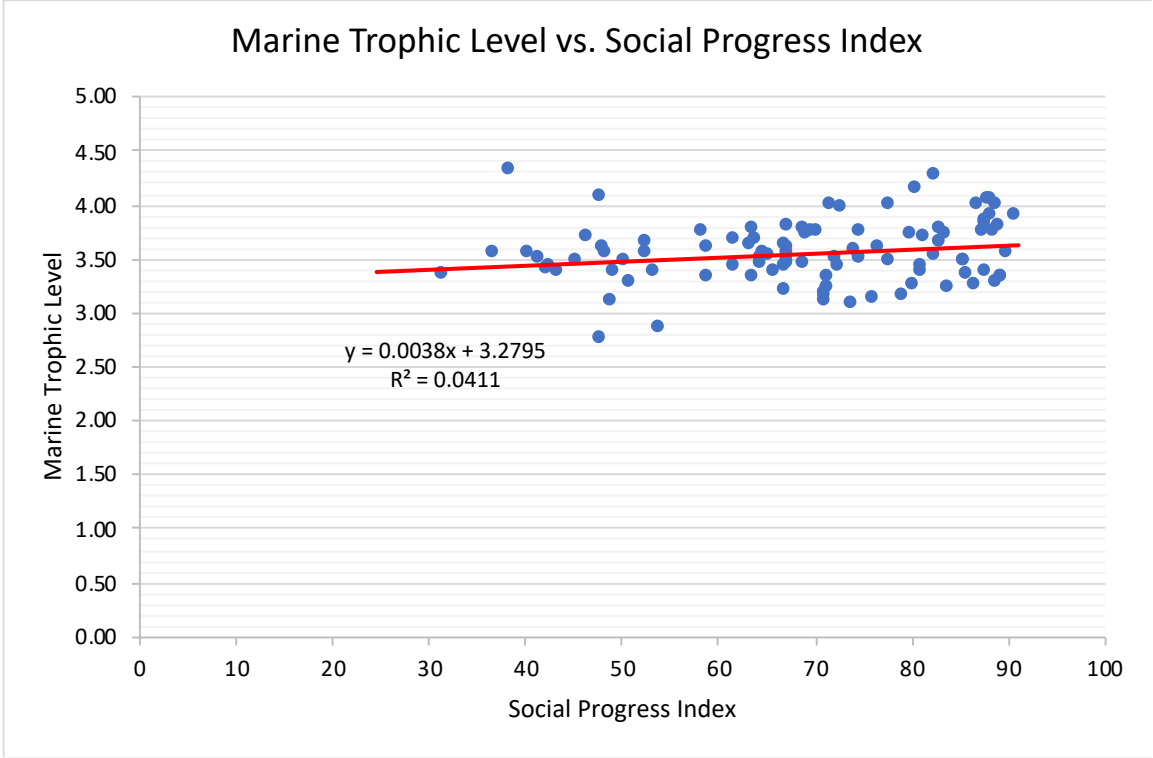


Chart 7: Regression Analysis of Marine Tropic Level versus Social Progress Level

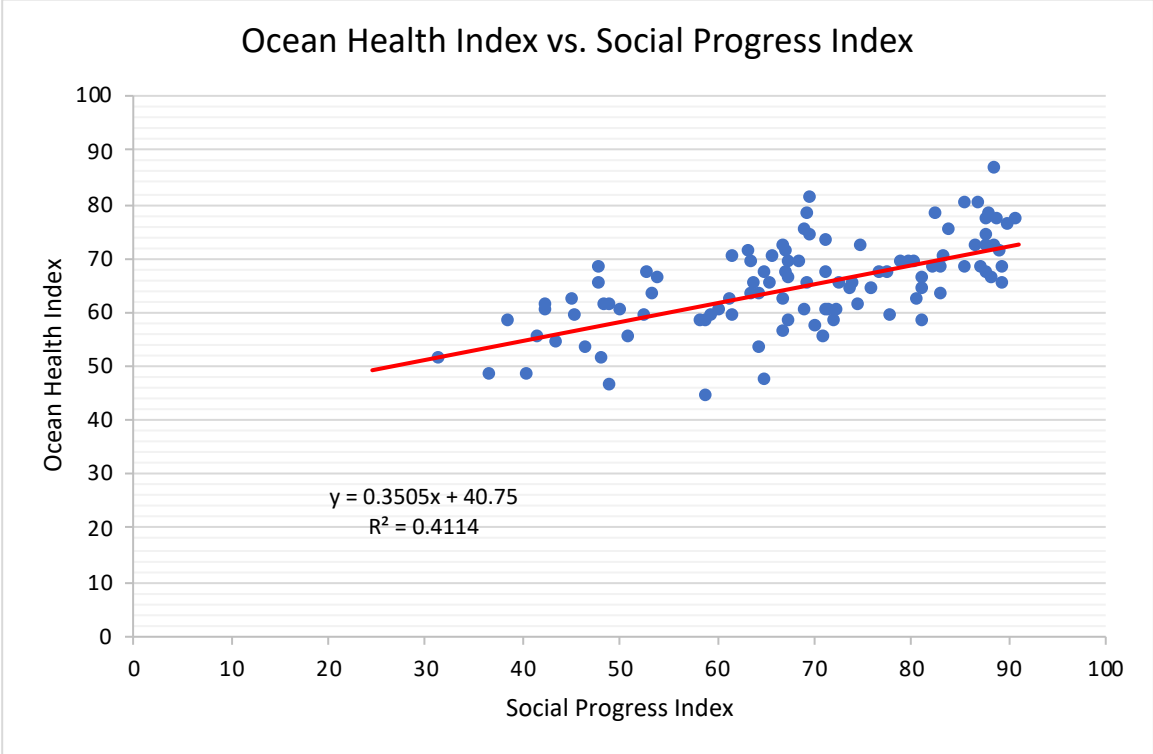


Chart 8: Regression Analysis of Ocean Health Index versus Social Progress Level

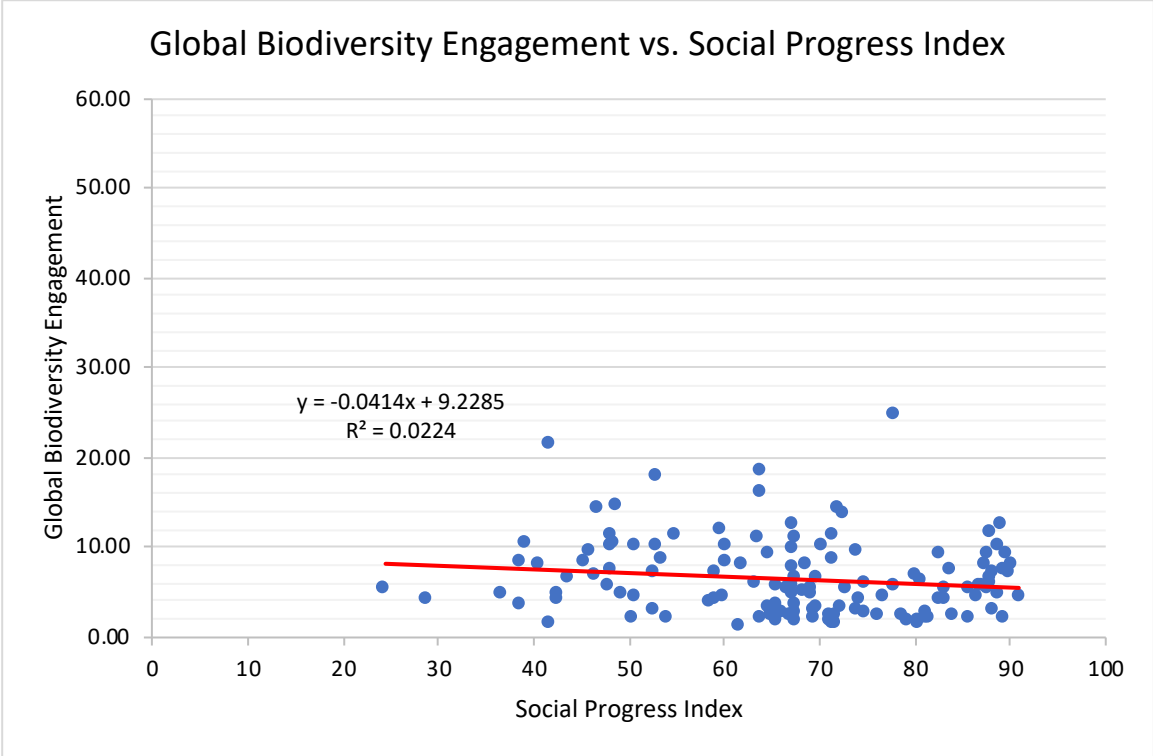


Chart 9: Regression Analysis of Global Biodiversity Engagement versus Social Progress Level

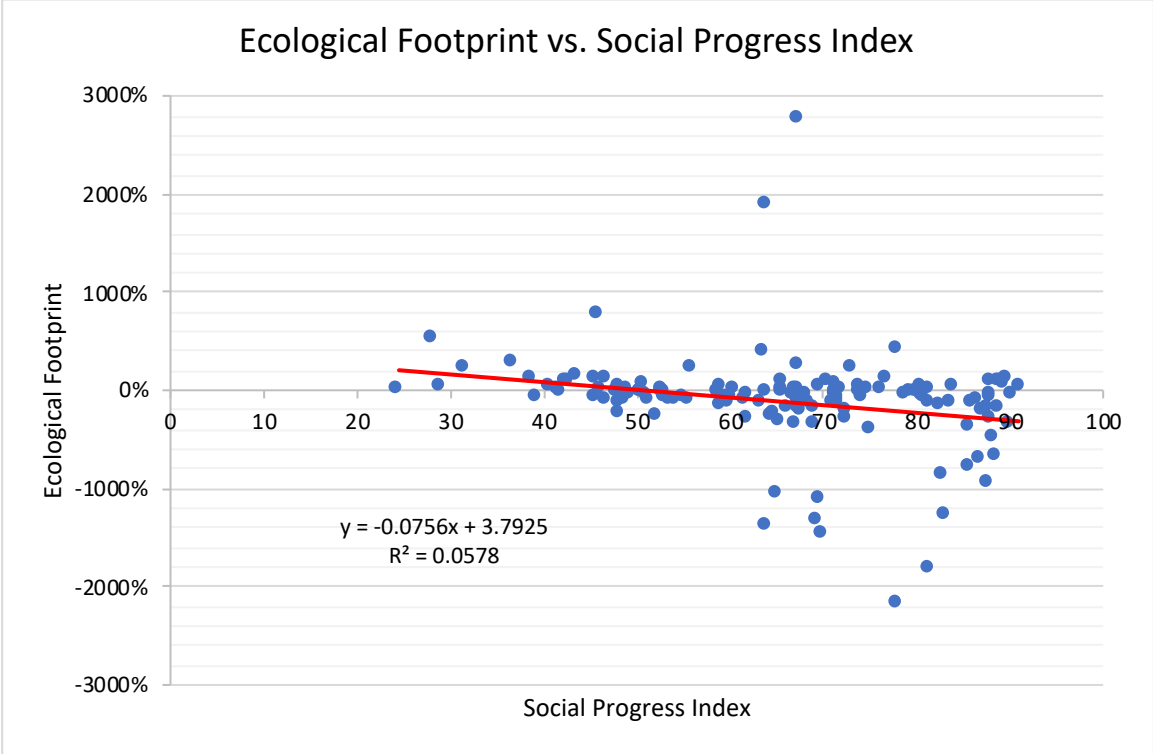


Chart 10: Regression Analysis of Ecological Footprint versus Social Progress Level

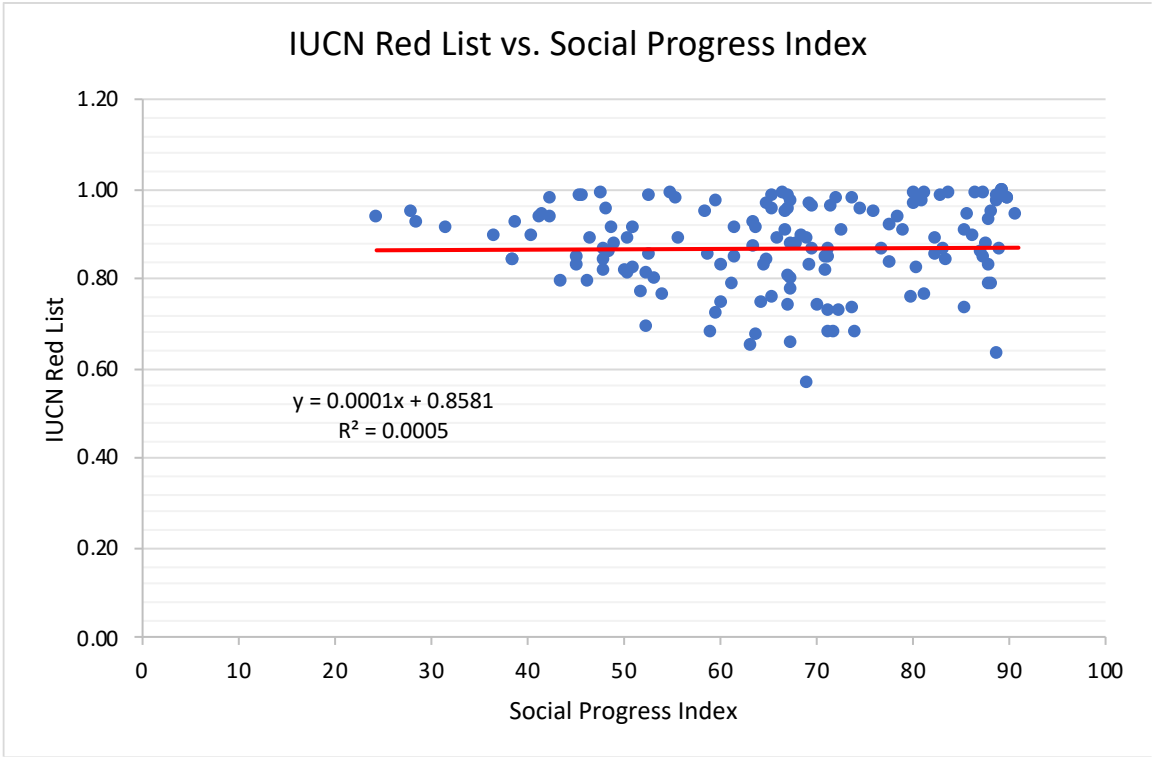


Chart 11: Regression Analysis of IUCN Red List versus Social Progress Level

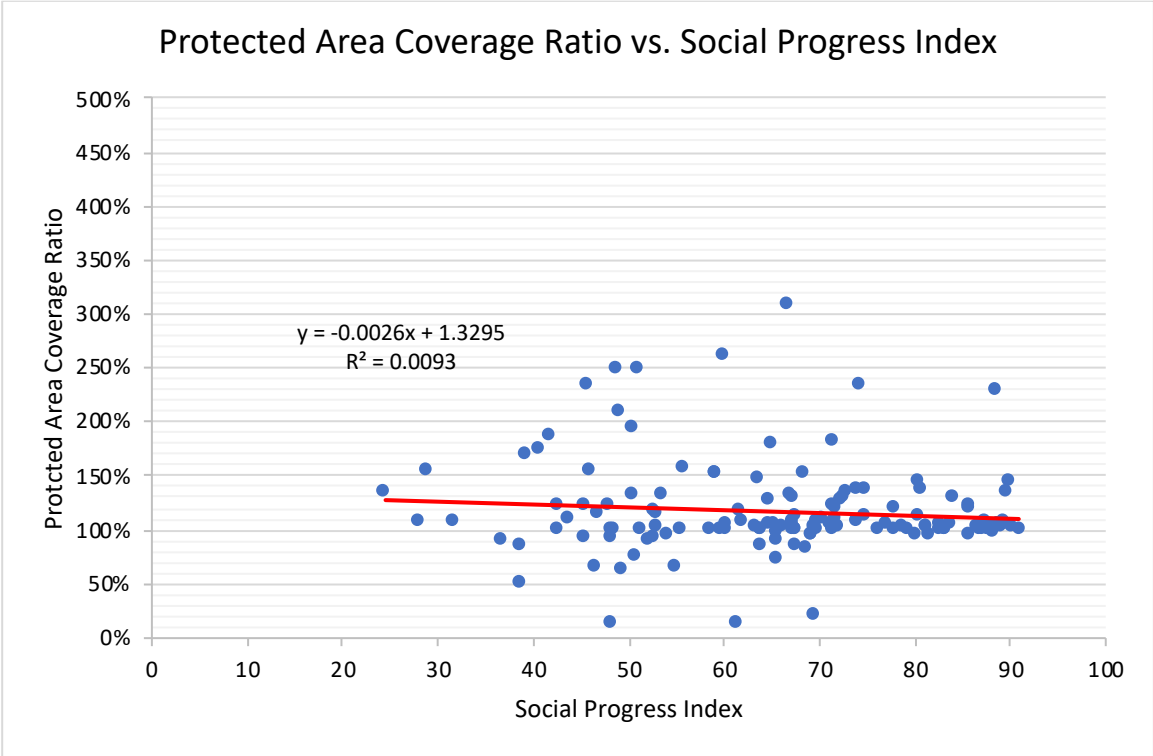


Chart 12: Regression Analysis of Protected Area Coverage versus Social Progress Level

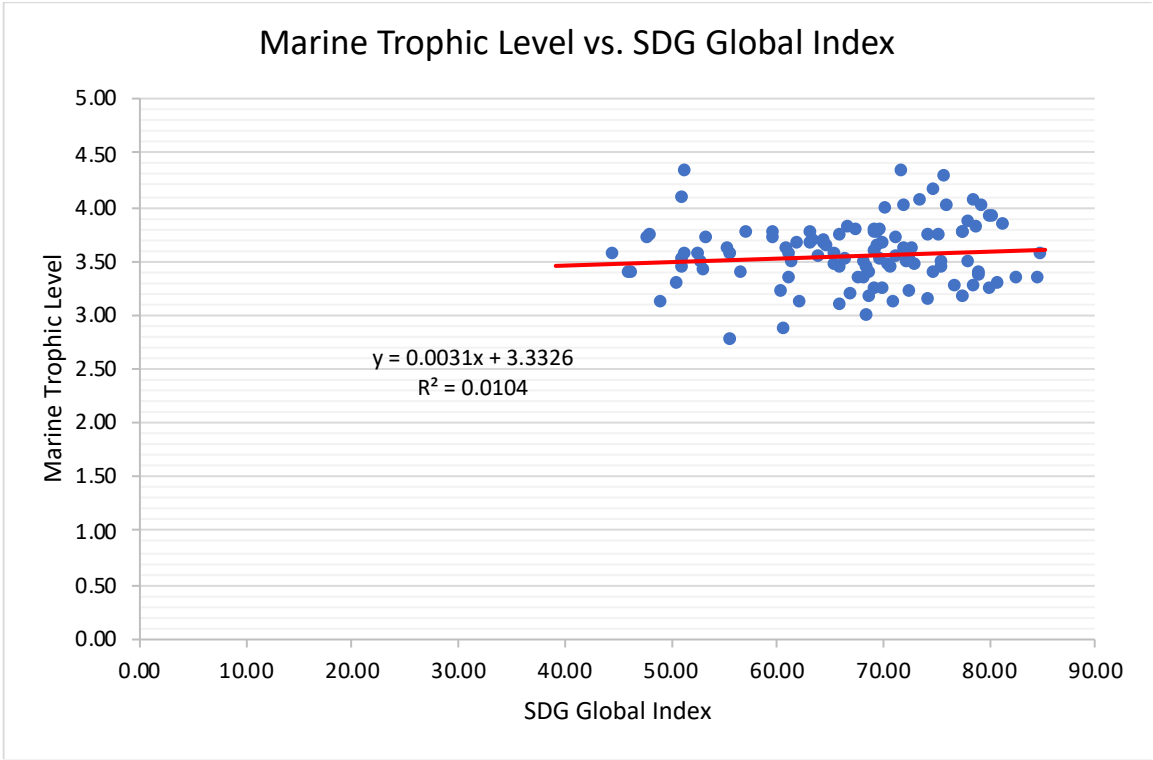


Chart 13: Regression Analysis of Marine Tropic Level versus SDG Global Index

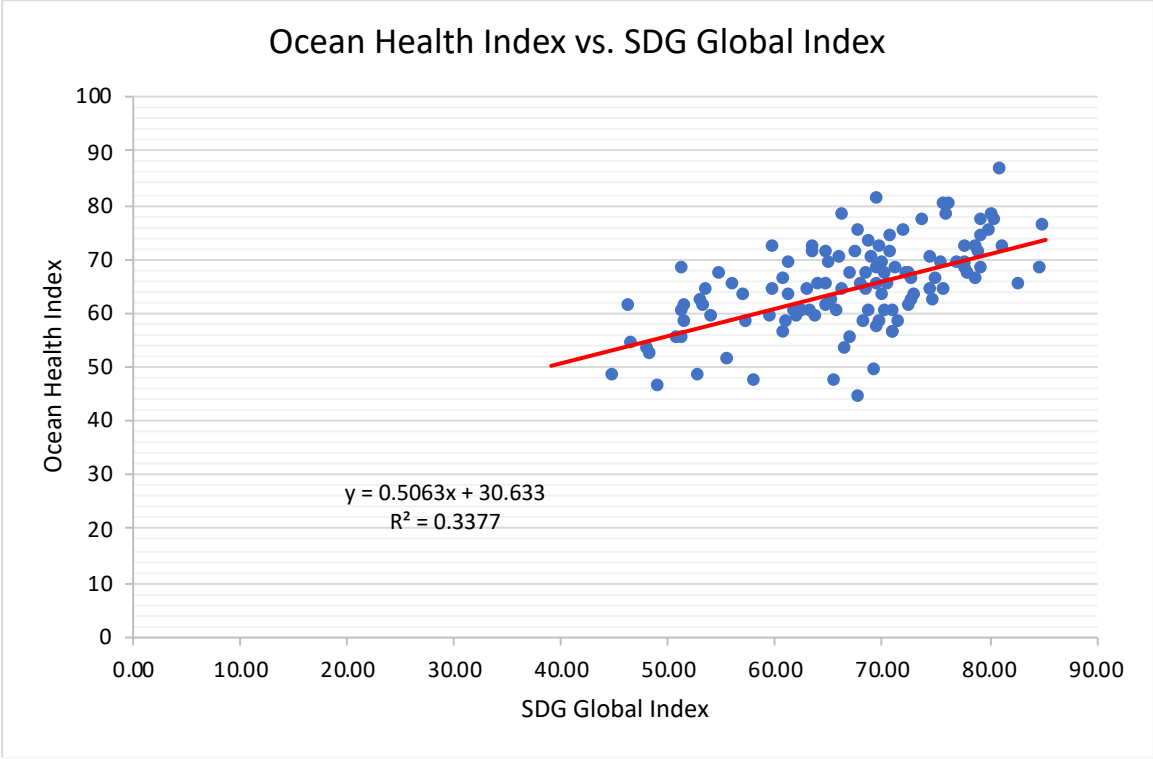


Chart 14: Regression Analysis of Ocean Health Index versus SDG Global Index

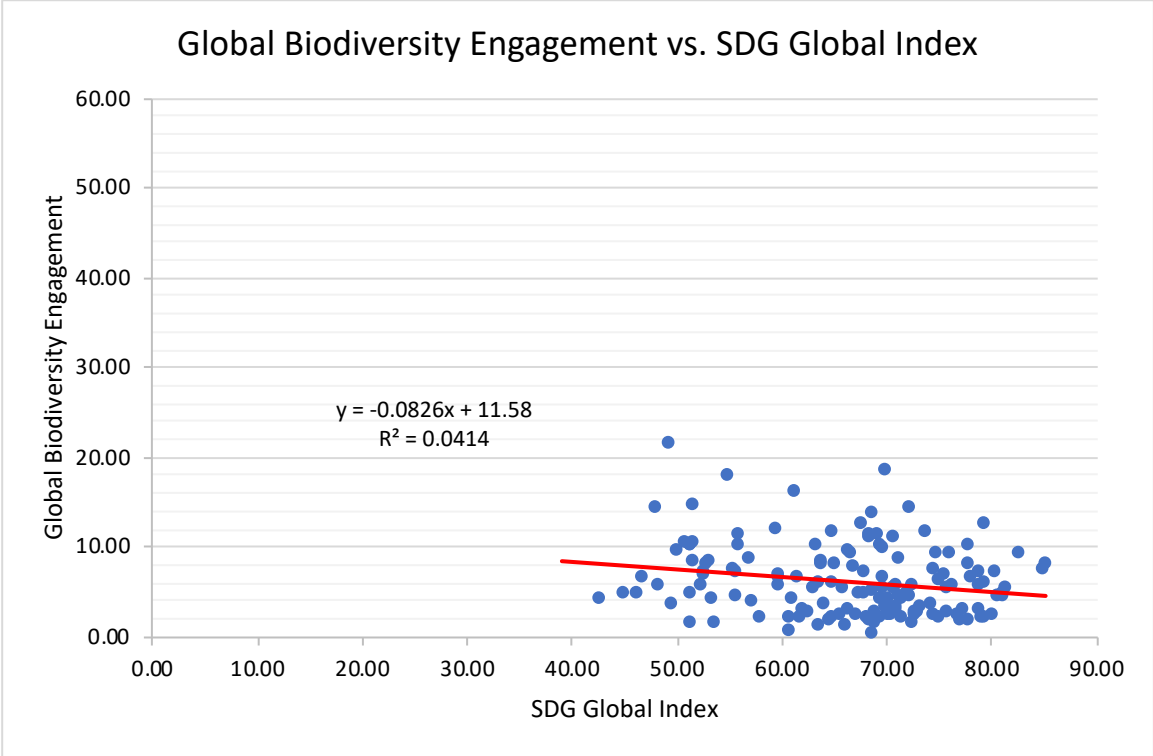


Chart 15: Regression Analysis of Global Biodiversity Engagement versus SDG Global Index

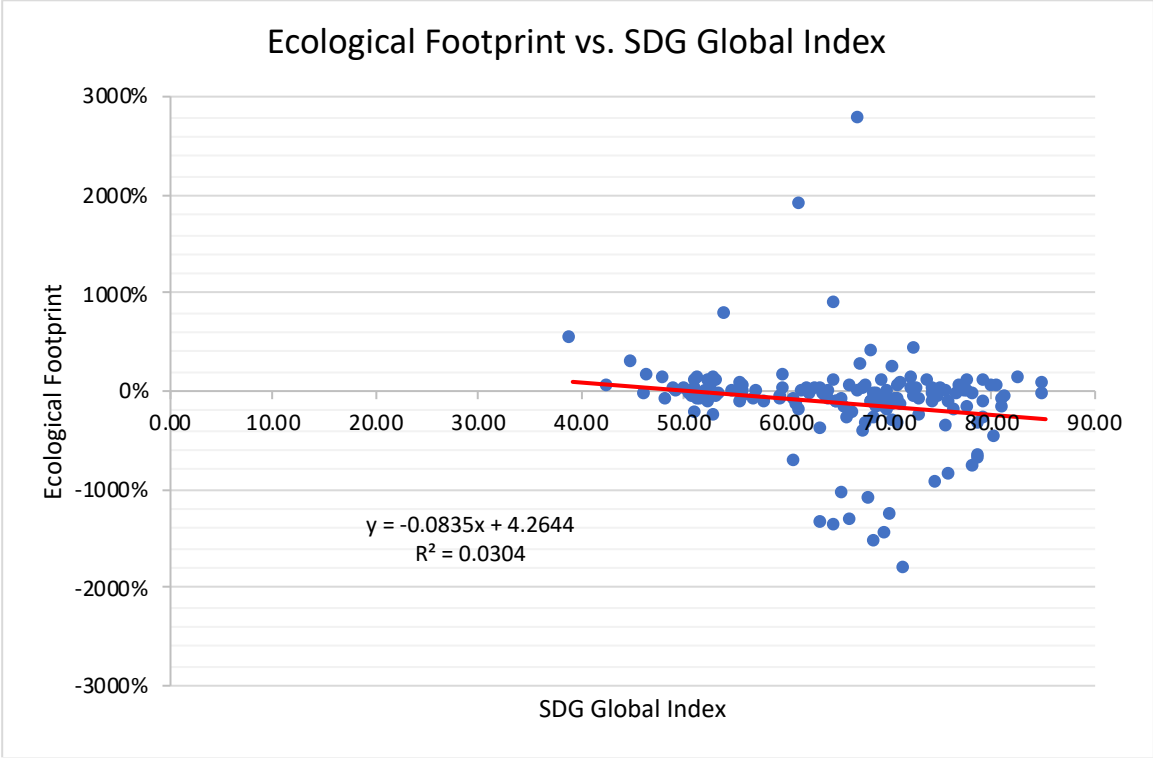


Chart 16: Regression Analysis of Ecological Footprint versus SDG Global Index

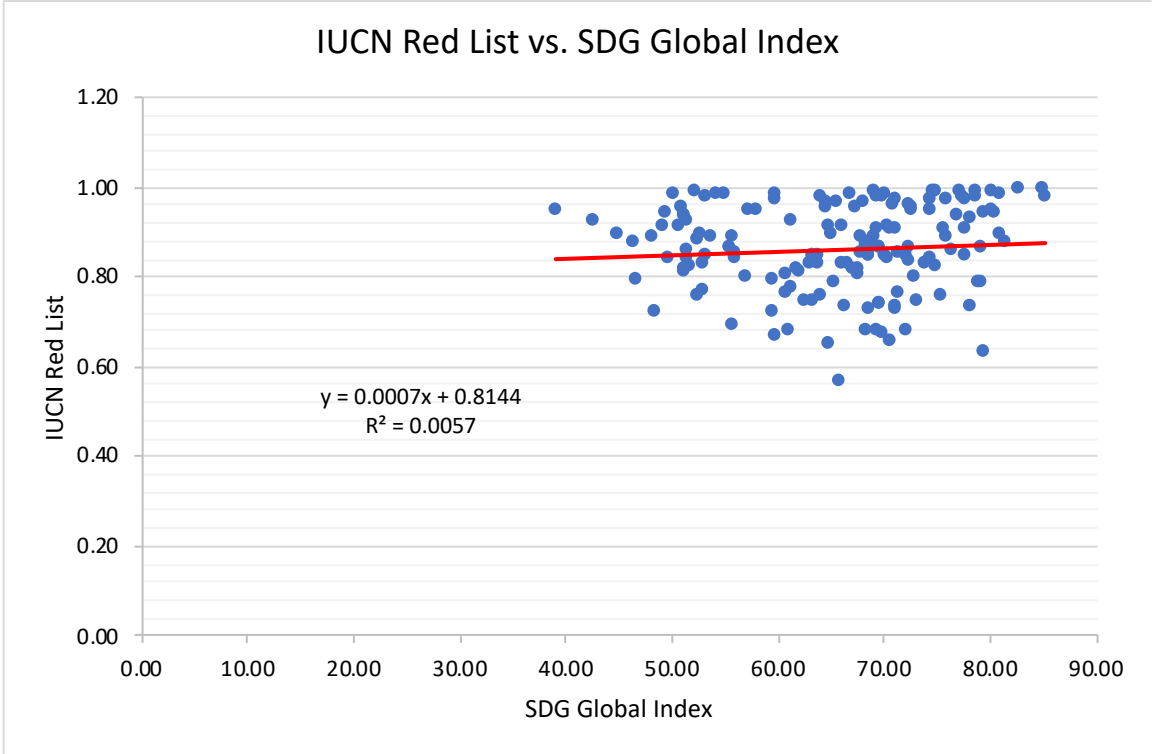


Chart 17: Regression Analysis of IUCN Red List versus SDG Global Index

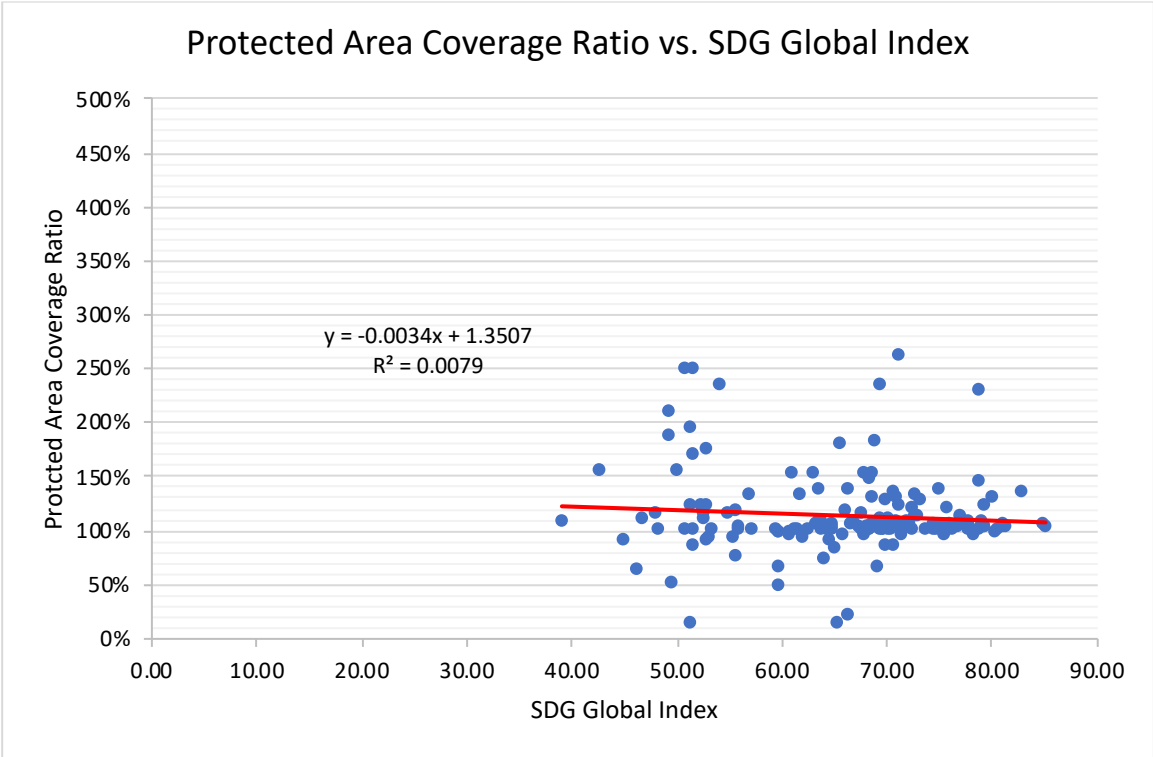


Chart 18: Regression Analysis of Protected Area Coverage Ratio versus SDG Global Index

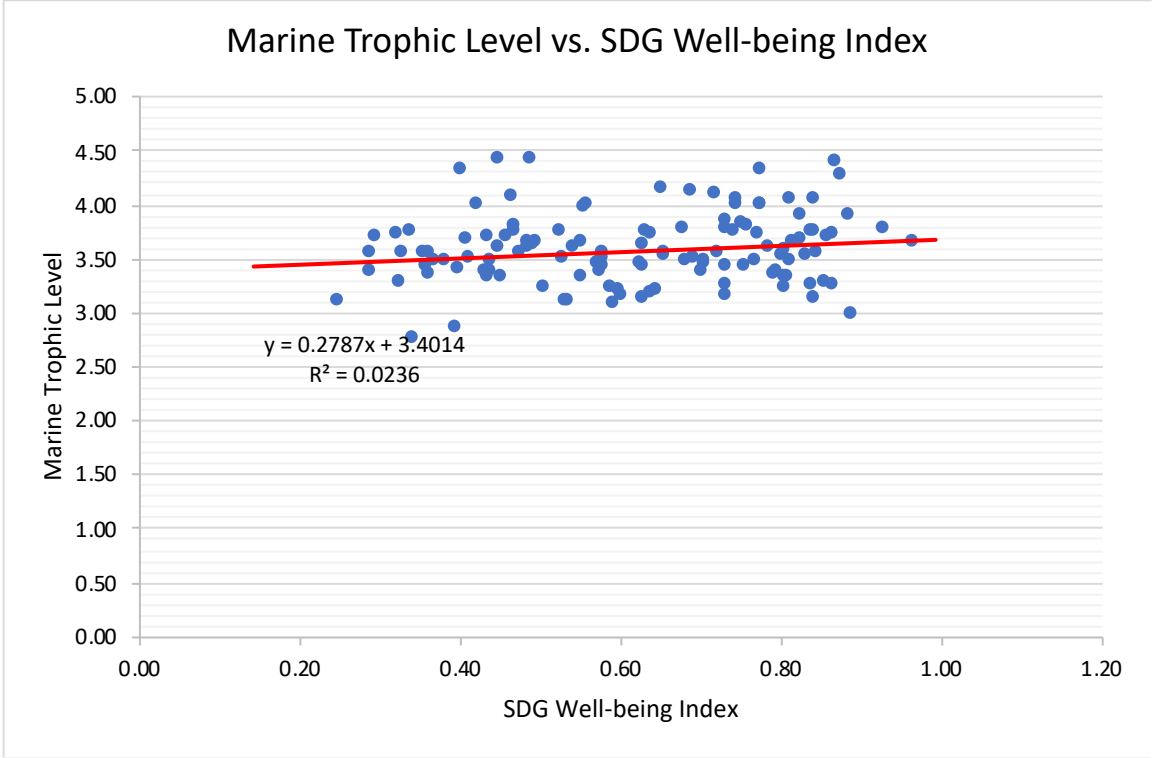


Chart 19: Regression Analysis of Marine Trophic Level versus SDG Well-being Index

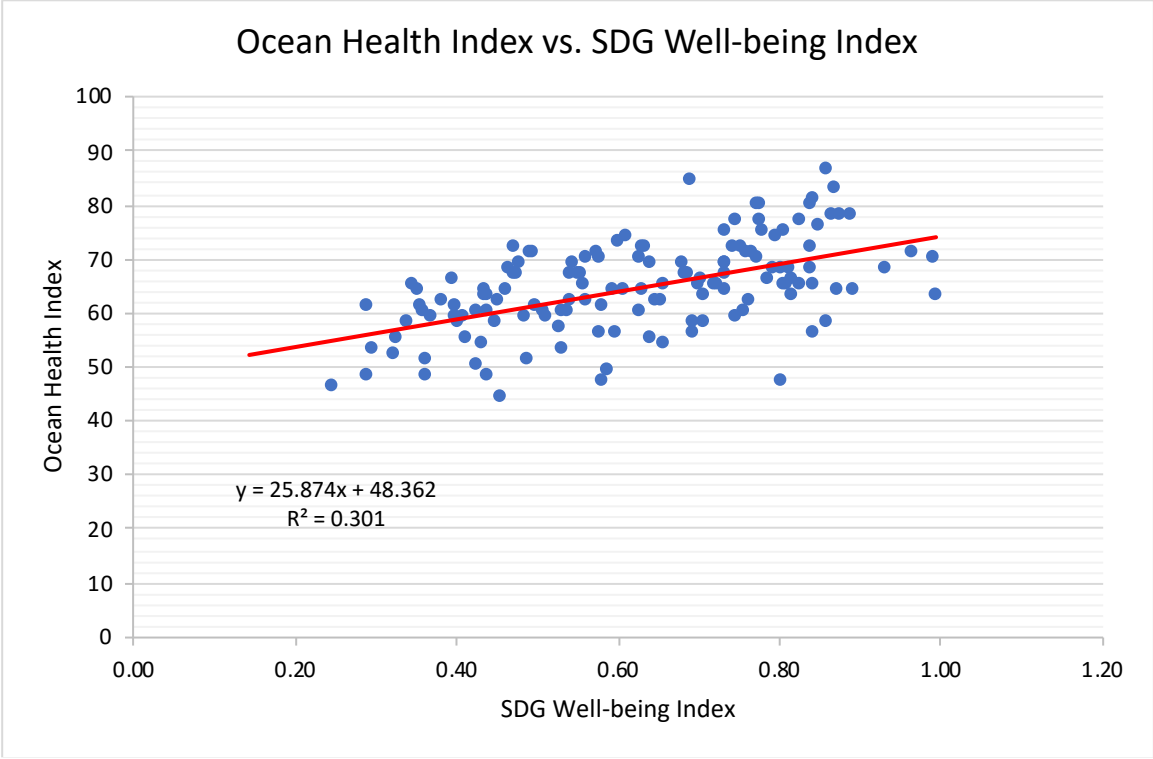


Chart 20: Regression Analysis of Ocean Health Index versus SDG Well-being Index

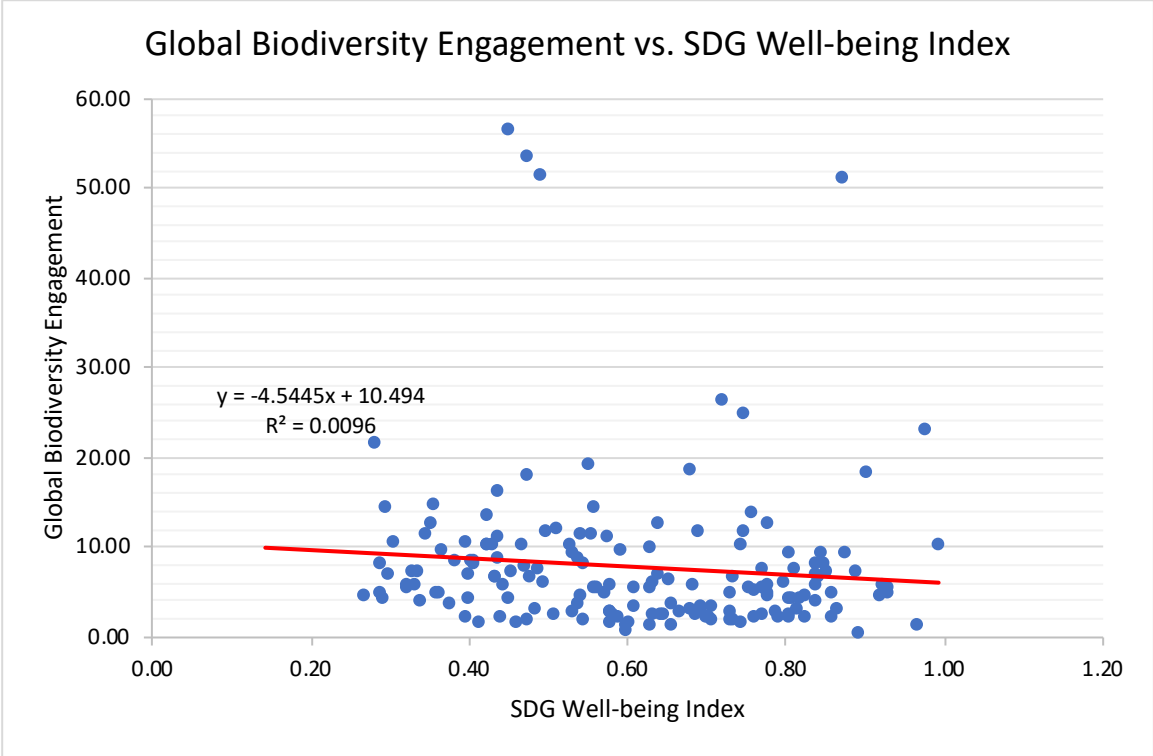


Chart 21: Regression Analysis of Global Biodiversity Engagement versus SDG Well-being Index

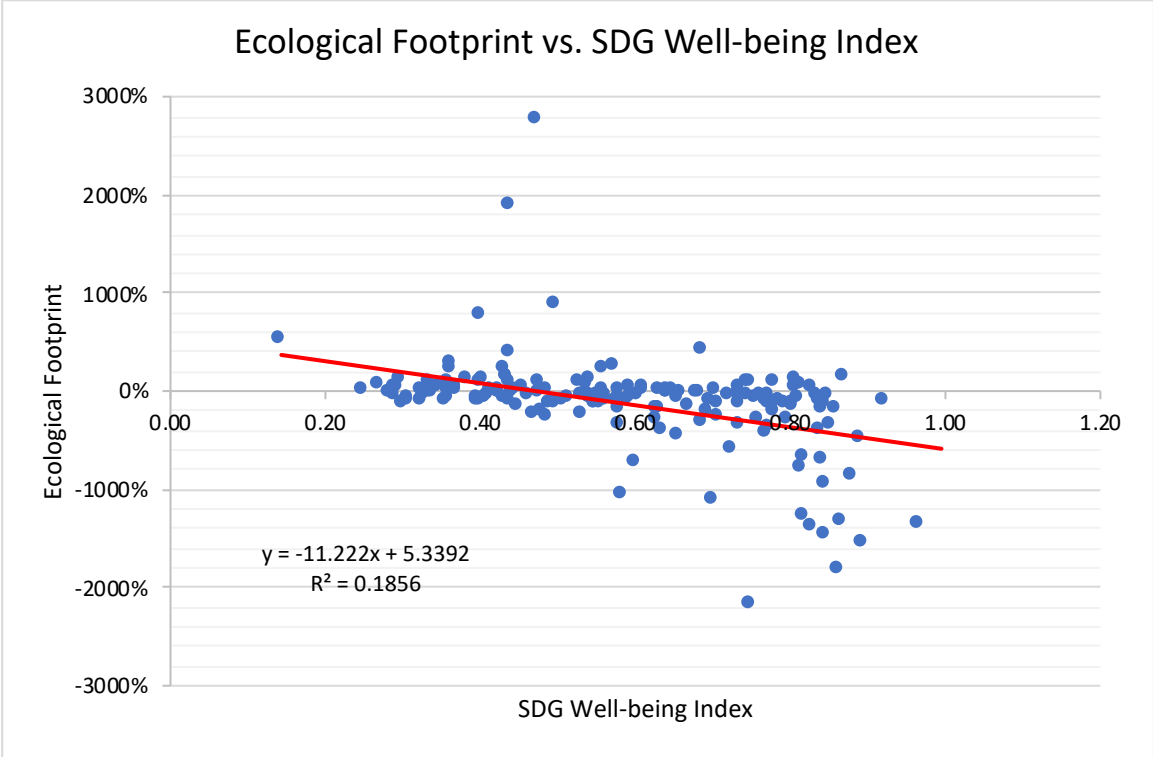


Chart 22: Regression Analysis of Ecological Footprint versus SDG Well-being Index

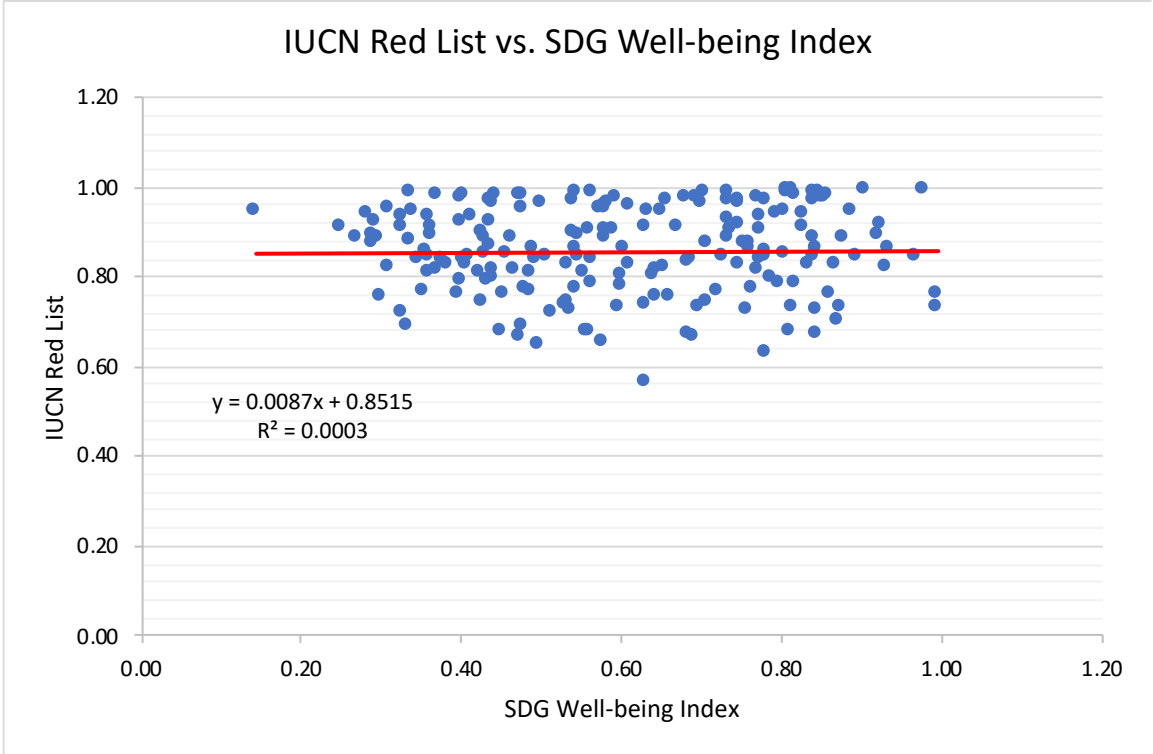


Chart 23: Regression Analysis of IUCN Red List versus SDG Well-being Index

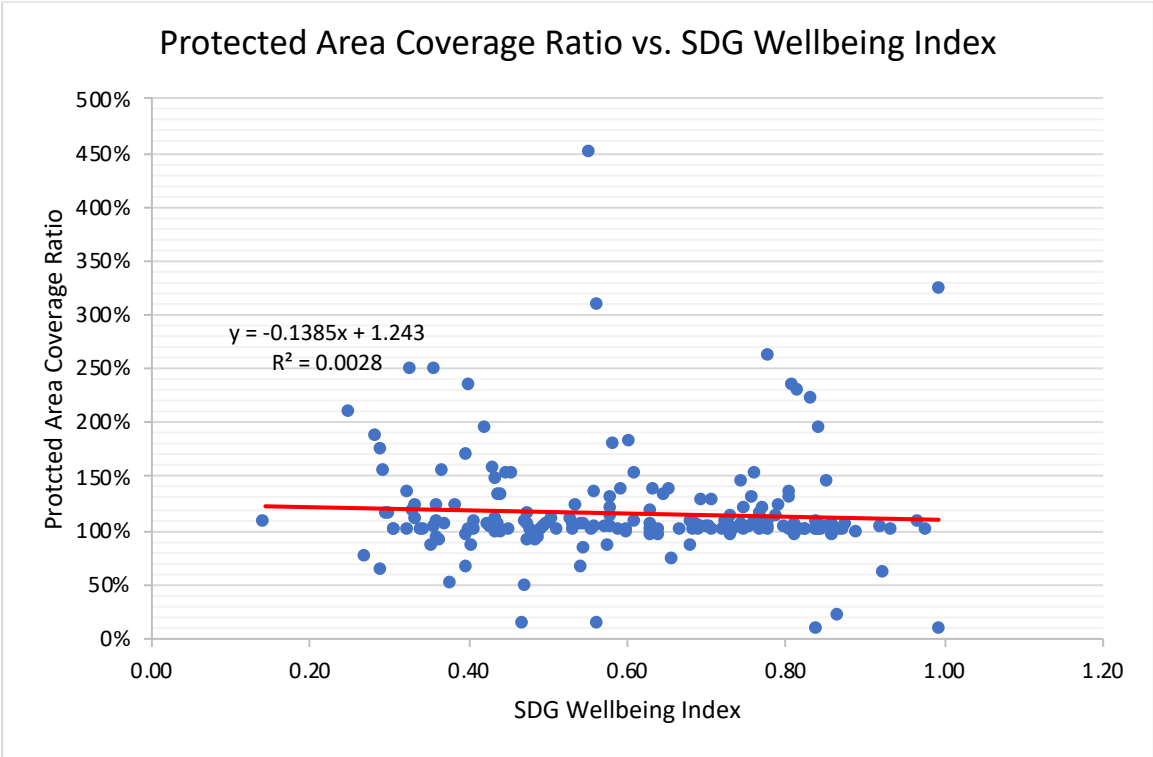


Chart 24: Regression Analysis of Protected Area Coverage Ratio versus SDG Well-being Index

Table 1: Regression Analysis Results (R-values)

	Human Development Index (HDI)	Social Progress Index	SDG Global Index	SDG Wellbeing Index
Marine Trophic Level	0.12	0.20	0.10	0.15
Ocean Health Index	0.61	0.64	0.58	0.55
Global Biodiversity Engagement	-0.13	-0.15	-0.20	-0.10
Ecological Footprint	-0.28	-0.24	-0.17	-0.43
IUCN Red List	0.04	0.022	0.08	0.02
Protected Area Coverage Ratio	-0.09	-0.10	-0.09	-0.05

Table 2: Regression Analysis Results (Slope)

	Human Development Index (HDI)	Social Progress Index	SDG Global Index	SDG Wellbeing Index
Marine Trophic Level	0.26	0.00	0.00	0.28
Ocean Health Index	36.61	0.35	0.51	25.87
Global Biodiversity Engagement	-7.09	-0.04	-0.08	-4.54
Ecological Footprint	-8.97	-0.08	-0.08	-11.22
IUCN Red List	0.02	0.00	0.00	0.01
Protected Area Coverage Ratio	-0.29	0.00	0.00	-0.14

Table 3: Regression Analysis Results (Intercept)

	Human Development Index (HDI)	Social Progress Index	SDG Global Index	SDG Wellbeing Index
Marine Trophic Level	3.37	3.28	3.33	3.40
Ocean Health Index	37.80	40.75	30.63	48.36
Global Biodiversity Engagement	12.48	9.23	11.58	10.49
Ecological Footprint	5.07	3.79	4.26	5.34
IUCN Red List	0.84	0.86	0.81	0.85
Protected Area Coverage Ratio	1.35	1.33	1.35	1.24

Table 4: Ranked Biodiversity Metrics for each Global Indicators Systems based on their R-values

	Human Development Index (HDI)
Ecological Footprint	-0.28
Global Biodiversity Engagement	-0.13
Protected Area Coverage Ratio	-0.09
IUCN Red List	0.04
Marine Trophic Level	0.12
Ocean Health Index	0.61

	SDG Global Index
Ecological Footprint	-0.17
Global Biodiversity Engagement	-0.20
Protected Area Coverage Ratio	-0.09
IUCN Red List	0.08
Marine Trophic Level	0.10
Ocean Health Index	0.58

	Social Progress Index
Ecological Footprint	-0.24
Global Biodiversity Engagement	-0.15
Protected Area Coverage Ratio	-0.10
IUCN Red List	0.02
Marine Trophic Level	0.20
Ocean Health Index	0.64

	SDG Well-being Index
Ecological Footprint	-0.43
Global Biodiversity Engagement	-0.10
Protected Area Coverage Ratio	-0.05
IUCN Red List	0.02
Marine Trophic Level	0.15
Ocean Health Index	0.55

Appendix V: All Biodiversity Metrics Examined

Indicator	Short Description
Global Biodiversity Engagement Indicator	This Index was created by studying keyword searches collected from global data from Twitter, online newspapers, and global trends. Keywords searched included scientific names for several thousand plant and animal species as well as terms like "climate change," "ecosystem services," and "endangered species." This data was synthesized to generate a monthly indicator for every country on earth.
Ecological Footprint	The Ecological Footprint Index compares a country's resources and space usage with resource and space availability to determine biocapacity reserves or deficits. Countries that are Biocapacity Creditors have a biocapacity that exceeds its population's ecological footprint, which is reflected in a positive score in the Index. Countries are considered Biocapacity Debtors when the ecological footprint of their population exceeds their biocapacity, which is reflected in a negative score. Scores are presented as a percentage
Number of countries with biodiversity-related fees, taxes and permits	Fees paid to the government based on an increase in polluting product and taxation on negative environmental activities
Number of countries with biodiversity-related tradable permit schemes	Tradable permits used to allocate environmentally degrading units, such as CO2e (i.e. cap and trade)
Protected area coverage	Measures the policy response to biodiversity loss by country, assuming that an increase in protected area coverage indicates increased efforts by a government and civil society to achieve long-term conservation of biodiversity.
Protected Area Coverage of Key Biodiversity Areas	KBAs are sites that contribute to the global persistence of biodiversity, of which 18,000 have been identified on land and at sea. Shows trends in protected key biodiversity area coverage over time.
Living Planet Index	Shows trends in populations of species
Marine Trophic Index	Measures trophic level for large marine ecosystems to understand if fish stocks are being overexploited
Biodiversity Intactness Index	Estimates how the average abundance of native terrestrial species in a region compares with their abundances before pronounced human impacts.
IUCN Red List Index	Show trends in overall extinction risk for species.
Ocean Health Index	Measures ocean health from global to local scales.
Official Development Assistance for Biodiversity	Monitors development finance targeting the objectives of the Rio Conventions on climate change, biodiversity and desertification. Data are reported by members of the OECD DAC to the Creditor Reporting System (CRS) using the so-called Rio markers.
Number of Countries with Developed or Revised NBSAPs	This indicator measures how many Convention of Biological Diversity (CBD) Parties have developed and revised their National Biodiversity Strategy and Action Plans (NBSAPs) in line with the CBD Strategic Plan.