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The Population Crisis in Sub-Saharan Africa:

Biodiversity Threats and Swedish Foreign Aid Perceptions

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Abbreviations and Acronyms

Cr	Critically endangered
EG	Equatorial Guinea
En	Endangered
FP	Family planning
HWC	Human Wildlife Conflict
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
Sida	The Swedish International Development Cooperation Agency
STD	Species Threat Density
Vu	Vulnerable

Abstract

The global population crisis remains underrepresented in public discourse, despite its critical impact on biodiversity and sustainable development. Population growth intensifies environmental challenges such as habitat loss, exploitation of resources, and greenhouse gas emissions. This thesis examines 1) the relationship between human population density and the threat to wild species in countries in Sub-Saharan Africa, nearly all of which face high population growth, and 2) public support to family planning in international aid to Africa in a donor country, Sweden. Correlation analyses with data from the IUCN Red List and population metrics from the World Bank show a positive association between human population density and species threats across the following taxonomic groups: all assessed vulnerable, endangered, and critically endangered species, Animalia, Plantae, Primates and birds combined, and primates and birds separately. Equatorial Guinea and the Gambia, deviate from the trend in the graph including all assessed species (vulnerable, endangered, and critically endangered), making them the focal point of discussion. In Equatorial Guinea, primates and plants are particularly threatened, while the Gambia mainly experiences threats to birds, both based on the measure *species threat density*. In a survey among 1,333 Swedes, they ranked foreign aid alternatives to Africa. 42% chose democracy and human rights as the highest priority, 41% chose humanitarian aid, 12% chose family planning, while only 5.5% chose trade and business. There were no significant differences in rankings across gender, age, or geographic region; however, respondents with lower education levels were more likely to prioritize family planning compared to those with higher education. Despite little information in Swedish media and books about family planning, Swedes recognized its importance in reducing population growth in Africa. Human population dynamics need to be part of public discourse and policies.

Sammanfattning

Den globala befolkningskrisen är underrepresenterad i offentlig debatt, trots dess kritiska inverkan på biologisk mångfald och hållbar utveckling. Befolkningstillväxten intensifierar miljöutmaningar som förlust av livsmiljöer, exploatering av resurser och utsläpp av växthusgaser. Denna uppsats undersöker 1) förhållandet mellan mänsklig befolkningstäthet och hotet mot vilda arter i länder i Afrika söder om Sahara, som nästan alla står inför hög befolkningstillväxt, och 2) offentligt stöd till familjeplanering i internationellt bistånd till Afrika från givarlandet Sverige. Korrelationsanalyser med data från IUCN:s rödlista och populationsdata från Världsbanken visar ett positivt samband mellan mänsklig befolkningstäthet och hot mot arter i följande taxonomiska grupper: alla bedömda sårbara, hotade och akut hotade arter, djur (Animalia), växter (Plantae), primater och fåglar tillsammans, samt primater och fåglar separat. Ekvatorialguinea och Gambia avviker från trenden i korrelationen som omfattar alla bedömda arter (sårbara, hotade och akut hotade), vilket gör att de står i fokus för diskussionen. I Ekvatorialguinea är det framför allt primater och växter som relativt sett är mest hotade, medan Gambia främst upplever hot mot fåglar, baserat på måttet “densiteten av hotade arter”. I en undersökning bland 1333 svenskar rankades biståndsalternativ till Afrika. 42% valde demokrati och mänskliga rättigheter som högsta prioritet, 41% humanitärt bistånd, 12% familjeplanering medan endast 5,5 procent valde handel och företagande. Det fanns inga signifikanta skillnader i rangordning av alternativen mellan kön, ålder eller geografisk region, men respondenter med lägre utbildningsnivå var mer benägna att prioritera familjeplanering jämfört med dem med högre utbildning. Trots mycket lite information om familjeplanering i svenska medier och böcker, inser svenskarna dess betydelse för att minska befolkningstillväxten i Afrika. Den mänskliga befolkningstillväxten måste vara en del av den offentliga debatten och policy.

1. Introduction

Compared to topics such as climate change and economic inequality, there seems to be an eerie silence surrounding overpopulation. Since the mid-20th century, the global population has increased threefold: from 2.5 billion in 1950 to 8 billion in 2022, marking the fastest population expansion in human history (United Nations, 2022). Today, the global population has surpassed 8 billion, putting an unprecedented strain on Earth's resources and ecosystems (Richie et al, 2024 & UN, 2024). According to the UN, the population is still growing with an expected peak of almost 10.3 billion in 2084 (Richie et al, 2024 & UN, 2024).

1.1. Consequences of Population Growth

The consequences of inaction are severe. As humans encroach upon and transform natural habitats, countless species are pushed toward extinction. Today, the biomass of humans and our domesticated animals (e.g., cows, pigs, horses, sheep, dogs etc) add up to over a billion tons. In contrast, the remaining wild terrestrial mammals' biomass is only twenty million tons (Greenspoon et al, 2023, Götmark & Andersson, 2024). This imbalance not only highlights the scale of human dominance but also the diminishing presence of wildlife, an indicator of future widespread biodiversity loss.

Increasing global consumption, exacerbated by a growing population, are also contributing to an unsustainable strain on natural resources, further accelerating environmental degradation. The UK-based charity Population Matters (previously known as The Optimum Population Trust), have stated that even if the IPCC targets of emission reductions are met, population growth would offset this reduction (OTP 2007, Cited in Foreman, 2014, p. 51). It is therefore surprising that a sustainable population is not listed as one of the United Nation's 17 SDGs, the Sustainable Development Goals (Andersson & Götmark, 2023).

Almost half (44%) of Earth's habitable land is currently used for agriculture, with approximately 80% of that land used to sustain and house livestock (Ritchie & Roser, 2024). This makes agriculture one major reason for biodiversity loss (IPBES, 2019). While agricultural innovations and improved efficiency are seen as potential solutions to reduce the pressures of increased demand, this ignores the environmental impact of livestock production. Alternatives like vertical farming cannot fully replace the need for individuals to change their consumption habits (e.g., reduced meat intake). Although sustainable agricultural practices are essential, it should be recognized that these strategies must be part of a broader approach to address the interconnected challenges of population growth, biodiversity loss, and agriculture (IPBES, 2019)

1.2. Implications for Ecosystems and Global Health

To assess the degree of threat to species, The International Union for Conservation of Nature's Red List of Threatened Species (IUCN) was formed in 1964. It categorizes species into risk levels, from "Least Concern" to "Critically endangered", for conservationists, governments, and researchers interested in biodiversity and prioritizing conservation efforts (IUCN Redlist, 2024). The list has assessed 39246 species in Sub-Saharan Africa and 11346 are categorized as vulnerable, endangered, or critically endangered (IUCN redlist, n.d).

The global lockdowns during the COVID-19 pandemic have shown how human activities can impact wildlife. The documentary *The Year Earth Changed* (Attenborough, 2021) illustrates how reduced human interference led to recovery in ecosystems. In Kenya, cheetah cubs had higher chances of survival as fewer safari vehicles reduced noise pollution, helping mothers call their cubs more effectively after kills (Attenborough, 2021). In Cape Town, African Jackass penguins were able to feed their chicks more often during the day, as quieter beaches allowed multiple trips to the sea, resulting in healthier chicks and successful rearing of twins and second clutches (Attenborough, 2021). These examples emphasize the effect of human presence on ecosystems, showing how even temporary reductions in human activity can allow wildlife to thrive. As the global population continues to grow, the pressure on natural habitats will continue to increase.

In an important study, Bradshaw and Di Minin 2019, analyzed environmental degradation in relation to human population density in 48 African countries based on an overall index including the megafauna conservation status, proportional forest loss, ecological footprint, relative species threat, freshwater removal, livestock density, and cropland extent. The Central African Republic, Botswana and Congo were ranked at the top of environmental performance. However, this does not necessarily indicate active environmental efforts but may reflect lower levels of industrial and urban development or poverty. In contrast, South Africa, Algeria, and Morocco were ranked lowest. Thus, various population densities and activities can influence environmental performance in perhaps surprising ways.

Africa has one of the highest growth rates globally. Projections estimate a rise from 1.5 billion in 2024 to nearly 2.5 billion by 2050 (Sinha & Getachew, 2024). This does not only have negative consequences in terms of environmental degradation. Overcrowded urban areas lead to rapid growth of slums, and many African cities e.g., Nairobi, struggle with inadequate infrastructure and immense pressure on e.g., sanitation, healthcare, and electricity (Bird et al, 2017). Malnutrition and food insecurity is also a remaining problem, as agricultural productivity struggles to keep up with the demand (Adeyeye et al, 2021). Poverty and unemployment are also connected to population growth. Although Africa's economic growth generally has improved recently, there is still a higher demand for jobs than there is supply. Therefore, unemployment rates remain high which contributes to poverty (African Development Bank, 2018). The World Bank reported that almost 40% of people in Sub-Saharan Africa lived on less than $1.90 per day in 2018 (Schoch & Lakner, 2020)

1.3 Addressing Population Growth through Family Planning

Misconceptions about reducing population growth and high fertility rates often focus on coercion and the abuse of human rights. However, ethically fair strategies have proven to be efficient (Götmark & Andersson, 2023, Cafaro, 2021). Key elements of success in voluntary family planning programs include changing social norms about large families, empowering women, improving education, addressing poverty and health, and providing access to contraceptives. Family planning allows individuals to make informed decisions about the number and timing of their children by offering access to contraceptives and reproductive health education (Population Matters, n.d) (Andersson & Götmark, 2024). However, some argue that moderate reforms may not be enough to address the growing environmental crisis associated with overpopulation. Cafaro (2021) suggests that governments should actively encourage smaller family sizes and even consider stricter policies in severely overpopulated nations to ensure environmental sustainability. He argues that reproductive rights need to be balanced with reproductive responsibilities (Cafaro, 2021). Financial incentives and disincentives respectively, that encourage smaller families are presented as one option. Cafaro also advocates for immigration limitations as an important step toward sustainable population levels, as it is inconsistent for governments to encourage their own citizens to have fewer children while simultaneously welcoming large numbers of immigrants. Widespread access to family planning services, contraceptives and abortions should also be guaranteed by governments across the world, as this can help reduce fertility rates (Cafaro, 2021). This approach has demonstrated success in, for example, Rwanda, where the government's policy helped decrease the birth rate from 6.5 in 2000, to 4.5 in 2011. By educating the public, encouraging the use of contraceptives, and promoting family planning as a way to fight poverty, Rwanda surpassed their goal of a birthrate of 4.5, nine years earlier than expected (Corey et al, 2022). Similarly, Ethiopia and Malawi achieved a significant increase in contraception use by implementing family planning. In Ethiopia, the prevalence increased from 6.3% in 2000 to 27.3% by 2011, and in Malawi it rose from 28% in 2004 to 42% by 2010 (USAID/Africa Bureau et al., 2012)

1.4 Swedish Foreign Aid

Swedish foreign aid is mainly coordinated through government's ministry for foreign affairs (Utrikesdepartementet- UD), and the Swedish International Development Cooperation Agency (Sida). Through bilateral and multilateral aid programs, Sida try to meet global challenges, particularly in low- and middle-income countries. Two primary goals are 1) to reduce poverty and promote sustainable development, and 2) to deliver humanitarian aid during e.g., war, famine and other catastrophic conditions (sida.se, 2024). Sweden's foreign aid budget mainly comes from the national budget which is funded through taxpayers. The parliament's goal has been to allocate 1% of the Gross National Product (GNP) to foreign aid (Embassy of Sweden, 2024). Exact numbers for how much of this funding went to Sub-Saharan Africa aren't available.

In 2023, the Swedish Ministry for Foreign Affairs developed a new agenda for foreign aid, replacing the earlier policy framework (2016/17:60). Changes include more focus on protecting Sweden's own interests, aid to Ukraine, as well as the focus on business and trade (Ministry for Foreign Affairs. 2016, Ministry for Foreign Affairs, 2023). These shifts in policy raise questions about the public's opinions, and how they align with the new agenda with respect to Africa. In September 2024, a survey was conducted to examine the opinion of voters, reported below.

2. Aim

The aim of this thesis is two-fold: firstly, seeking to understand and analyze the relationship between population density and threat to wildlife in selected African countries, also with a broader focus on factors causing threat to wildlife. Secondly, the thesis will investigate if the Swedish public recognizes population growth in Africa as an issue that should be prioritized or not, by SIDA.

2.1. Research questions

1. What is the relationship between population density and relative species threat across selected Sub-Saharan African countries, and what factors may be involved in the threats?

2.To what extent does the Swedish public prioritize developmental aid for family planning and birth control initiatives, compared to other aid purposes?

2.2. Hypotheses

1.Sub-Saharan African countries with higher human population density are associated with higher levels of threat to wild species compared to countries with lower population density.

2. Given information about the challenges in Africa, the Swedish public considers family planning a relatively important part of foreign aid priorities compared to other areas such as humanitarian aid, trade and business, and democracy, health, and human rights.

3. Method

3.1. Survey Design

Apart from an extensive literature review, a survey was conducted through the Swedish company "Indikator". It was sent to over 2307 randomly chosen respondents at least 18 years old, representative for the Swedish population, to clarify the Swedish public's

opinions on the type of aid to Africa that should be prioritized. Information about the respondents age, gender, education, and political orientation was included in the survey.

The survey consisted of one question, which was preceded by an informative text to outline current problems and challenges for Africa. This text was formulated as unbiased as possible, trying to ensure equal emphasis to the various challenges the continent is facing. This approach aimed at providing respondents with a balanced overview, preventing any single issue from being unintentionally prioritized. The text and survey question were used in Swedish; the following is an English translation:

Swedish aid primarily aims to combat poverty and hardship. In 2023, Sida distributed SEK 26 billion in aid, of which approximately SEK 10 billion went to Africa. Africa's 54 countries face many challenges, including poverty, corruption, and unstable governments. Climate change and military conflicts are worsening already difficult conditions. Population growth is high, and Africa's population is expected to increase from 1.4 billion today to 3.8 billion by 2100. At the same time, access to modern contraceptives is limited, and women, on average, have 4.2 children. Africa's agriculture is also low in productivity. Growing undernourishment in Africa now affects around 300 million people. Many young people see migration as a way out of unemployment and poverty.

Question:

Which aid do you consider most important for Africa? Rank the options below from 1 (most important) to 4 (least important).

A. For democracy, human rights, gender equality, and health.
B. To alleviate malnutrition, famine, and the consequences of disasters.
C. For family planning and lower population growth through information and advice, free contraceptives, and more clinics.
D. To link aid and trade through new collaborations with businesses and Swedish companies abroad.

While designing the survey, Indikator was concerned that using a question that requires ranking of items could be too challenging for respondents, potentially leading to a lower response rate. Due to budgetary constraints, the survey had to be limited to one single question, which influenced the choice to use a ranking format. However, despite concerns, the survey received a higher number of responses than anticipated, according to Indikator (60% response rate, 1384 responses). Partially answered responses were removed, resulting in 1333 responses that were used in analysis.

3.2. Survey Analysis

The document (Excel file) I received from Indikator showed the categories e.g., age, gender, and education as columns, as well as the rankings for the different aid priorities. The responses for the rankings were named #1 - Viktigast (most important), #2 - Näst Viktigast, #3 - Tredje viktigast, and #4 - Fjärde viktigast (least important), but to allow

quantitative analysis, these were changed to 1, 2, 3, and 4 respectively. Responses only partly answered were removed, i.e., only respondents who ranked all four alternatives were included.

Frequencies were calculated for each alternative in Google Sheets, providing an overview of the distribution of opinions (1-4) across the alternatives. Google Sheets were also used to calculate the average rank and standard deviation for each aid priority, to assess the variation in preferences. To discover trends among different groups, such as age, gender, education, and geographic regions, responses were sorted and examined to identify any differences in how people in these groups responded. The “=countif” function in Google sheets was used to determine the number of respondents in all groups, as well as to determine how many of the respondents ranked a certain alternative as 1,2,3, or 4 respectively. Chi-squared tests were then performed in SPSS to identify significant trends among demographic groups (i.e., with respect to age, education, gender, and geographic region). Data were input into the Crosstabs function, to determine statistical significance.

To facilitate analysis of the survey chi-squared tests were performed between two groups, for males and females, and for ages categorized into <65 year olds and 65+ year olds. Similarly, education was categorized into “highly educated” i.e., people conducting current studies at college or university, or people with a degree from college or university, and “less educated” i.e., elementary school, current upper secondary school/Community college studies, and post-secondary education, not university level. Geographic region was categorized into “city regions” (including Malmö/Lund/Trelleborg metropolitan region, Gothenburg metropolitan region, Stockholm/Södertälje metropolitan region, and larger cities), and “Countryside and Suburban Areas” (including sparsely population areas, intermediate density areas, and densely populated areas).

3.3. Literature Review Process

For the literature review, information was collected through Google Scholar, Scopus, and Web of Science. Keywords used for searches on these databases included: Africa, species threat, Equatorial Guinea, Gambia, conservation, human wildlife conflicts, Rwanda, Uganda, Nigeria, Family planning taboo, conservation policy, bushmeat hunting, Bioko Island, deforestation, primates, birds, wildlife threats, biodiversity, land-use change, amongst others. The book “Man Swarm” by Dave Foreman (2015) was the only book used as a source.

Cited articles were of special interest, however, these were limited for research about the individual countries. Therefore, some uncited articles were also used. Additionally, efforts were made to use the most recent data and up-to-date studies to ensure relevance and accuracy (some newly published good work may not yet have been cited).

3.4. Data Collection for Country Metrics

Population densities and land area for the included countries were collected from worldbank.org, and data for species threat from the IUCN Red list. At worldbank.org, a

search for “population density” and “Land area” respectively provided a list for all countries that included data from 2021. For the species threat data, I individually searched the country’s name on the IUCN website’s main search page. This search generates a filter menu where I selected the categories “Critically Endangered”, “Endangered”, or “Vulnerable” under the Red List Category tab.

Data for specific taxonomic groups such as animalia, plantae, primates, and birds (Aves), were obtained by adding another filter from the taxonomy tab. Searches were done for: animals and plants (excluding marine species) combined and separately, as well as primates and birds combined and separately, resulting in six correlations analyses.

3.5. Species Threat Calculation

To account for differences in country size, I used threatened species density to measure degree of species threat in countries. This was calculated by dividing the assessed number of threatened species (the three categories in IUCN’s Red List) by the total land area of each country, resulting in relative density measures (number of threatened species/km^2). Species threat density (STD) was then plotted against human population density using RStudio, and a Spearman rank correlation analysis was conducted to evaluate the strength of the correlation (r_s-value), and to assess its statistical significance. Correlation analysis was chosen over regression analysis because the primary goal of this study was to evaluate the strength and direction of the relationships between population density and STD, rather than to develop predictive models. Additionally, a Spearman rank correlation was chosen over Pearson correlation because I could not assume a linear relationship between variables, and it is less sensitive to outliers.

In addition to conducting a correlation analysis for all assessed species combined (except marine species) as per the IUCN Red List, analyses were performed for animals and plants separately, and for primates and birds combined, as well as primates and birds separately. This decision was made due to the ecological significance and relatively well-documented data for the two latter groups. Much is still unknown about African taxa, but birds and primates are often recognized as indicator species, reflecting the overall health of ecosystems. Moreover, focusing on these groups addresses the challenge of limited knowledge and data availability for many lesser-studied taxa in Sub-Saharan Africa. By narrowing the scope to birds and primates, the analysis provides a more targeted understanding of the relationship between population density and species threats.

3.6. Country Selection

The countries included in my data were mainland Sub-Saharan African countries and Madagascar. Small island nations (Sao Tomé & Principe, Mayotte, Cabo Verde, Seychelles, Mauritius, and The Comoros) were excluded, as limited land areas often result in outlier values for metrics calculated per square kilometer. Small islands also often have unique ecosystems as well as a high proportion of endemic species, making them particularly vulnerable to threats (Burca, 2024, Mckee et al, 2013). Analyzing these dynamics would require separate research. Such analysis was, however, outside the aim

of the present study. Northern African countries were also excluded, as the focus was Sub-Saharan Africa, where birth rates and population growth are higher. Excluding these regions ensures a more consistent comparison across countries, allowing for a clearer understanding of species threat patterns. Figures, i.e., tables and charts were done in Excel and RStudio respectively. Figure 2 was made with datawrapper.de.

4. Results

4.1. Comparison of Threats to Species Across Organism Groups

The relationship between species threat and human population density in Sub-Saharan Africa was tested among six different organism groups as specified in table 1. A positive relationship was determined among all groups, indicating a significant relationship between STD and population density. Spearman rank correlation analyses were performed for all groups resulting in the following r_s and p values:

Correlation Results Population Density vs. Species Threat Density		
	p-value	r_s-value
All Assessed Species	<0.0001*	0.65
Animalia	<0.0001*	0.71
Plantae	<0.0001*	0.59
Birds + Primates	<0.0001*	0.68
Birds	<0.0001*	0.67
Primates	<0.0001*	0.62

*= *indicates a significant p-value*
Table 1. r_s and p values for the Spearman's correlation analyses

4.1.1. Inclusion of all Assessed Cr, En, Vu Species (Animals & Plants)

The scatterplot in figure 1 shows the relationship between human population density (people/km²) and STD (species/km²) for all cr, en, vu species in Sub-Saharan Africa that have been assessed by the IUCN redlist. A positive relationship is observed, with a correlation coefficient (r_s) of 0.57. Moreover, the p-value for this correlation analysis is <0.0001, indicating a moderately strong relationship but with significance, as the p value is well below 0.05. These results indicate that areas with higher population are associated with greater STD.

Most countries cluster in the lower left part of the graph i.e., around relative lower population and species threat densities (Angola, Botswana, Central African Republic, Chad, Congo, Democratic Republic of The Congo, Mali, Mauritania, Mozambique, Namibia, Niger, South Africa, Sudan, South Sudan, Somalia, Zimbabwe, Zambia), but several outliers are notable. Equatorial Guinea, with a relatively low population density, shows the highest STD. Similarly, the Gambia exhibits a high STD. Rwanda and Burundi, located at the upper right of the graph, demonstrate both high population density and relatively high STD. Possible causes for these deviations from the overall trend will be explored in the discussion section. Other countries deviating from the trend are Madagascar, Eswatini, and Nigeria.

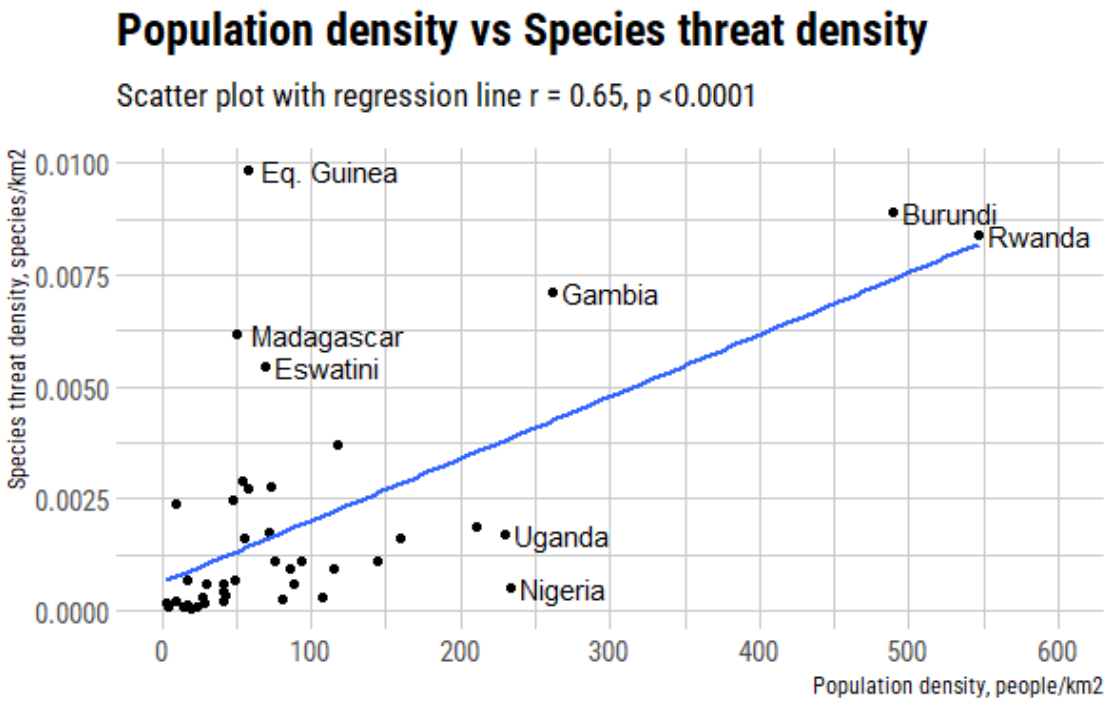

Figure 1. Scatter plot showing the relationship between population density (people/km²) and STD (threatened species/km²) for all assessed species in Sub-Saharan African countries, as per the IUCN Red List (excluding marine species)

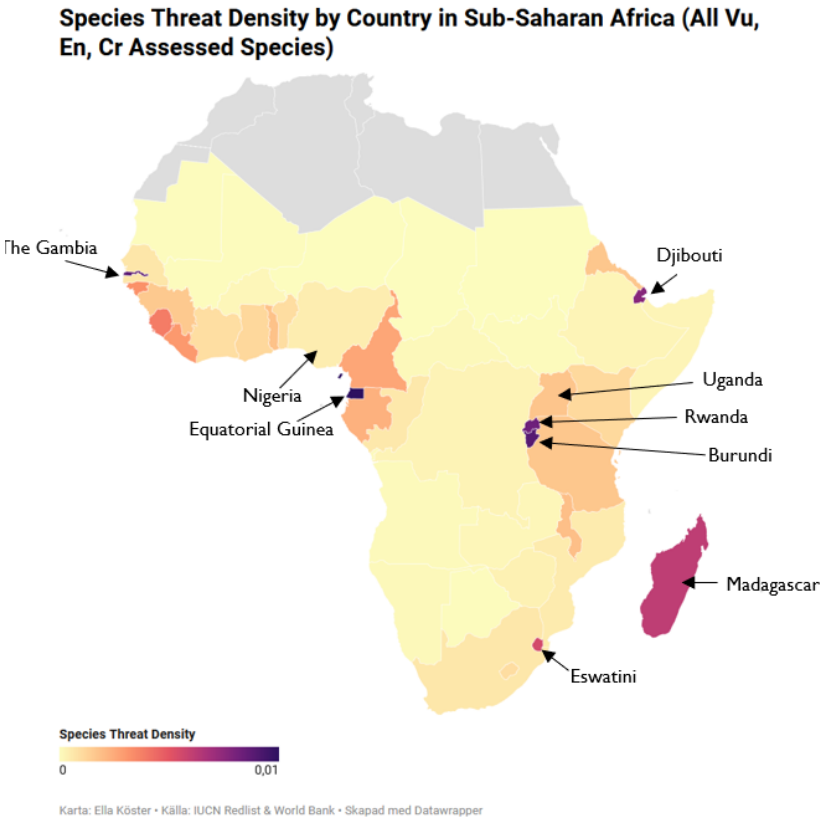

Figure 2. Visualization of relative species threat densities across Sub-Saharan Africa. Ella Köster. 2024.

4.1.2 Species Threat Animalia

When plotting all assessed species within the Animalia kingdom (marine species excluded) the results show a correlation coefficient of r_s=0.67, and significance at p<0.0001. The largest outliers are the Gambia and Djibouti, less pronounced outliers are Equatorial Guinea, Eswatini, Uganda, and Nigeria (Fig. 3).

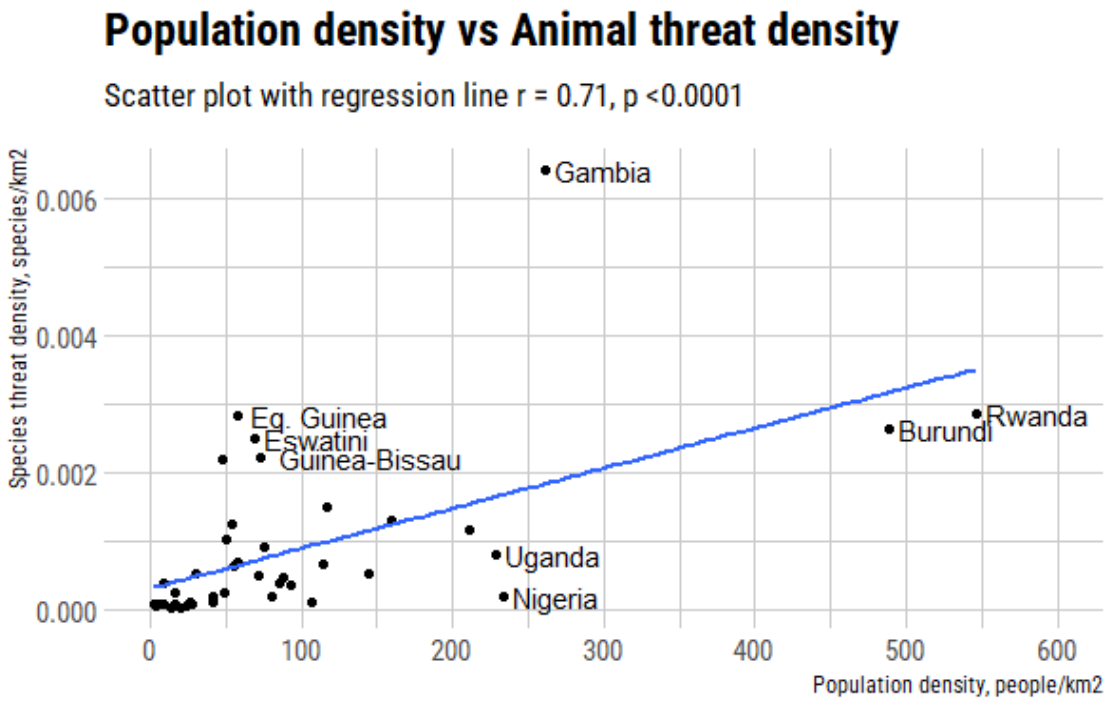

Figure 3. Scatter plot showing the relationship between population density (people/km²) and STD (threatened species/km²) for all assessed Animalia species

Countries clustered in the lower left part of the graph are: Botswana, Namibia, Mauritania, Gabon, Central African Republic, Chad, Mali, South Sudan, Zambia, Mozambique, Sudan, Angola, Democratic Republic of The Congo, Somalia, Zimbabwe, and Congo. These countries have population densities below 50 people/km^2, and a relative STD below 0.001 species/km^2.

4.1.3 Plantae Kingdom

The scatter plot (Fig. 4) for population density vs. STD for the plantae kingdom, showed largely similar results, though somewhat weaker association (r_s=0.59, p= <0.0001). Madagascar emerged as a larger outlier than in previous graphs and the Gambia showed a low threat level, well below the regression line. Seemingly population density has a stronger association with threats to animal species compared to plant species in the Gambia. Rwanda and Burundi also deviate more from the regression line than in previous graphs.

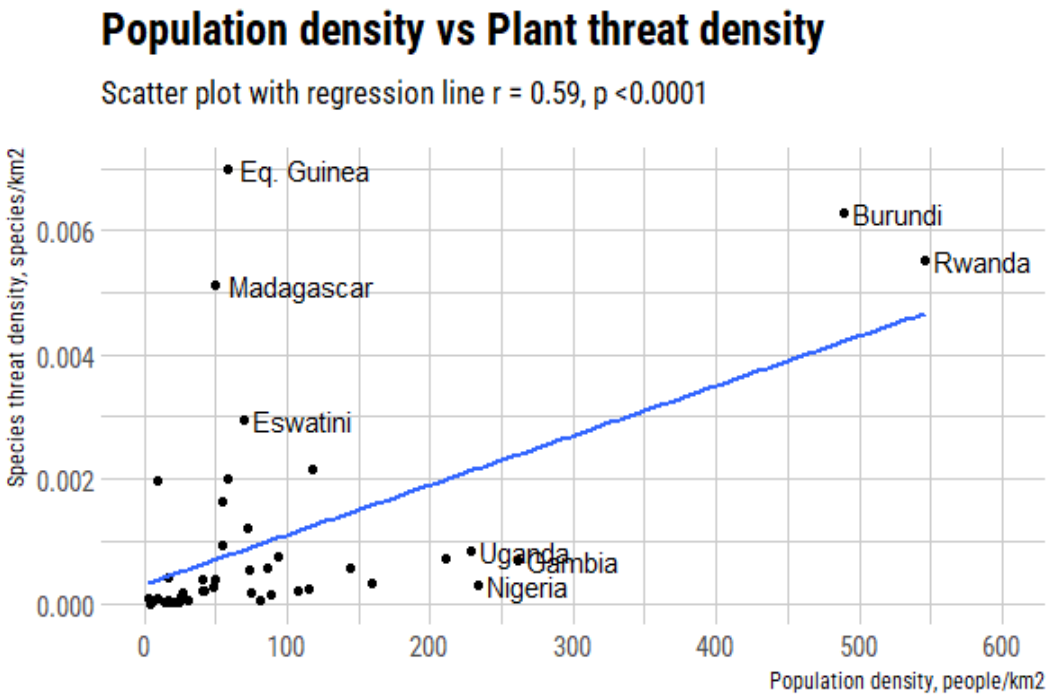

Figure 4. Scatter plot showing the relationship between population density (people/km²) and STD (threatened species/km²) for all assessed Plantae species

Countries clustered in the lower left part of the graph are: Central African Republic, Botswana, Mauritania, Namibia, South Sudan, Angola, Chad, Mali, Namibia, Niger, Somalia, South Africa, Sudan, Zambia, and Zimbabwe. These countries have population densities below 50 people/km^2, and a relative STD below 0.001 species/km^2.

4.1.4. Species Threat for Indicator Species: Primates and Birds combined

The analysis for all Cr, En, Vu primate and bird species generated r_s=0.68 i.e., a moderate relationship between population density and threat density, suggesting that higher population densities are generally associated with higher species threat densities (fig. 5).

The biggest outlier in this group was the Gambia, less pronounced outliers were Eswatini, Djibouti, Uganda and Nigeria. Countries that cluster in the bottom left part of the graph i.e., those with low population densities and low species threat densities are:

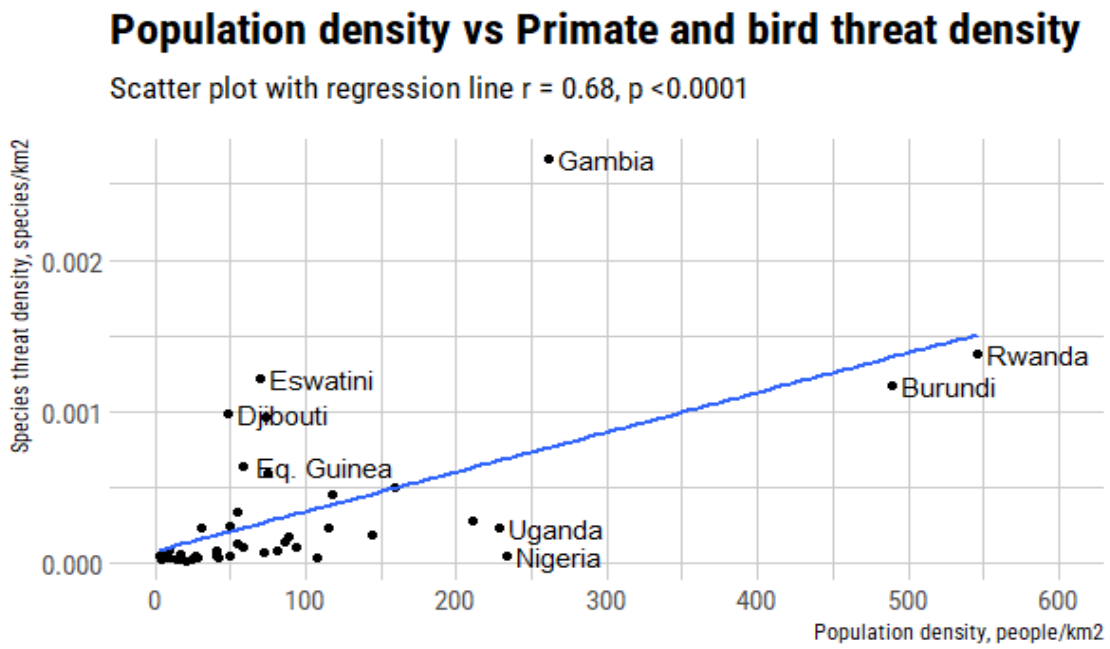

Figure 5. Scatter plot showing the relationship between population density (people/km²) and STD (threatened species/km²) for all assessed primate and bird species

Angola, Botswana, Central African Republic, Chad, Congo, The Democratic Republic of the Congo, Djibouti, Eritrea, Gabon, Mali, Mauritania, Mozambique, Namibia, Niger, Somalia, South Africa, Sudan, Zambia, Zimbabwe, and South Sudan. These countries have population densities below 50 people/km², and a relative STD below 0.0005.

4.1.5. Species Threat for Indicator Species: Primates

To gain more in-depth information about two indicator-species groups, correlation analyses were also performed for primates and birds separately. Birds and primates face different kinds of threats, despite partly overlapping habitat requirements. For primates, deforestation and agricultural expansion is a larger threat, while birds are impacted by many forms of habitat change.

EG has the highest relative threat density, despite a relatively low population density. In Table 2 is an overview of the primate species that are classified as vulnerable, endangered, or critically endangered in EG. All these species are decreasing in numbers, and most are threatened mainly by habitat loss and fragmentation, as well as hunting (IUCN, 2024). Rwanda is close behind EG, although with the largest population density among all the Sub-Saharan African countries. The numbers of vulnerable, endangered, and critically endangered primate species in Rwanda are also steadily declining, facing similar threats as those in EG (IUCN, 2024). Madagascar and Guinea-Bissau also deviate from the trend with relatively high STD despite a low population density.

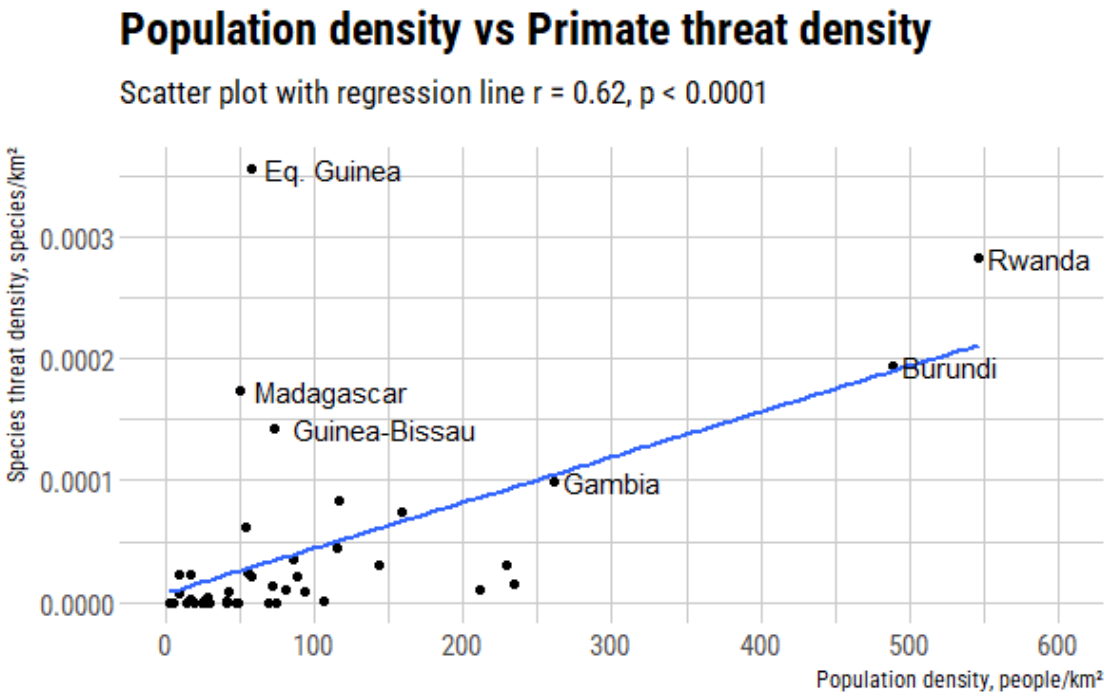

Figure 6. Scatter plot showing the relationship between population density (people/km²) and STD (threatened species/km²) for all assessed Primate species

The countries with population densities below 50 people/km^2 are Angola, Botswana, Central African Republic, Chad, Congo, The Democratic Republic of the Congo, Djibouti, Eritrea, Gabon, Mali, Mauritania, Mozambique, Namibia, Niger, Somalia, South Africa, Sudan, Zambia, Zimbabwe, and South Sudan. These countries have population densities below 50 people/km^2, and a STD below 0.00005.

Threatened Primate Species in Equatorial Guinea
Vulnerable (Vu):
Red-eared Monkey (*Cercopithecus erythrotis*)
Black Colobus (*Colobus satanas*)
Mandrill (*Mandrillus sphinx*)
Grey-cheeked Mangabey (*Lophocebus albigena*)
Endangered (En):
Chimpanzee (*Pan troglodytes*)
Preuss's Monkey (*Allochrocebus preussi*)
Drill (*Madrillus leucophaeus*)
Red-capped Mangabey (*Cercoebus torquatus*)
Critically Endangered (Cr):
Western Gorilla (*Gorilla gorilla*)
Pennant's Red Colobus (*Piliocolobus pennantii*)

Table 2: List of vulnerable, endangered, and critically endangered primate species in EG

4.1.6. Species Threat for Indicator Species: Birds

The separate analysis for bird threat density revealed a r_s value of 0.67 indicating a moderately strong relationship. The p value of <0.0001 shows that the results are statistically significant.

The Gambia is the largest outlier in fig. 7, exhibiting the highest relative bird threat density out of included countries. Reasons for why the Gambia shows greater threat to birds will be further explored in the discussion (see 5.2). Eswatini also shows a relatively high bird threat density despite its relatively low population density.

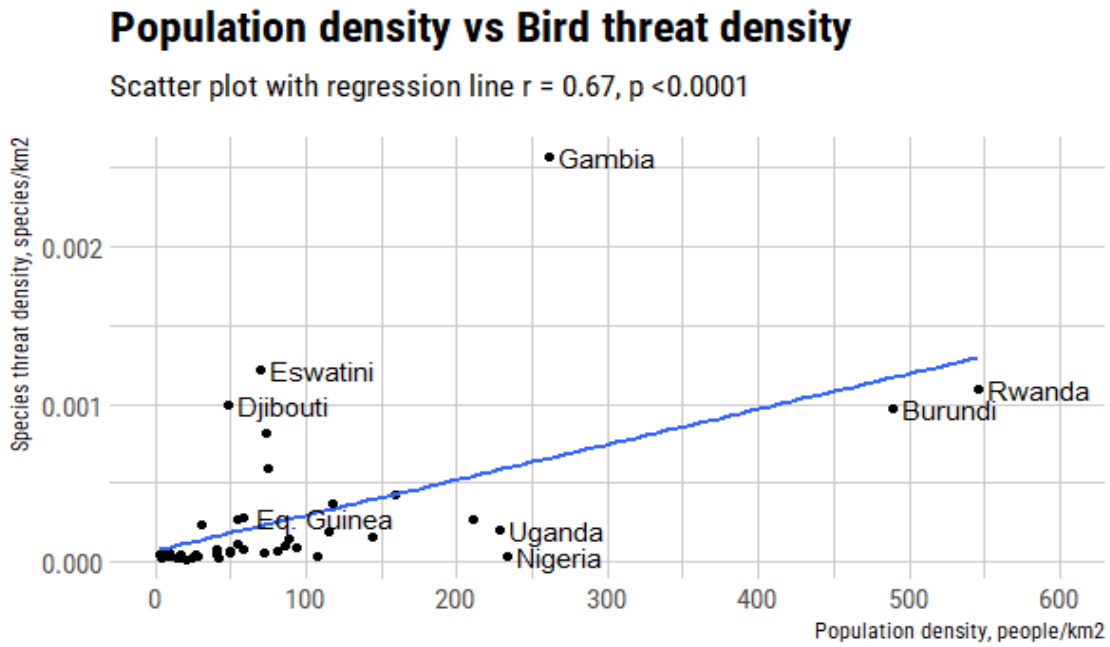

Figure 7. Scatter plot showing the relationship between population density (people/km²) and STD (threatened species/km²) for all assessed bird species

The search results for the Gambia on the IUCN redlist shows a total of 26 species distributed across the three threat categories: 17 species are classified as Vulnerable (Vu), 5 species as Endangered (En), and 4 species as Critically Endangered (Cr) (Table 3). Notably, all critically endangered species are vultures: the Hooded vulture, White-headed vulture, White-backed vulture, and the Rüppell's vulture.

Threatened Bird Species in The Gambia
Vulnerable (Vu):
Black-legged Kittiwake (*Rissa tridactyla*)
Common Pochard (*Aythya ferina*)
Audouin's Gull (*Larus audouinii*)
Curlew Sandpiper (*Calidris ferruginea*)
Red-footed Falcon (*Falco vespertinus*)
Grey Plover (*Pluvialis squatarola*)
European Turtle-dove (*Streptopelia turtur*)
Eurasian Oystercatcher (*Haematopus ostralegus*)
Leach's Storm-petrel (*Hydrobates leucorhous*)
Lesser Yellowlegs (*Tringa flavipes*)
Black Crowned Crane (*Balearica pavonina*)
Buff-breasted Sandpiper (*Calidris subruficollis*)
Northern Ground-hornbill (*Bucorvus abyssinicus*)
Beaudouin's Snake-eagle (*Circaetus beaudouini*)
Tawny Eagle (*Aquila rapax*)
Grey-hooded Capuchin Babbler (*Phyllanthus atripennis*)
Scissor-tailed Kite (*Chelictinia riocourii*)
Endangered (En):
Secretarybird (*Sagittarius serpentarius*)
Lappet-faced Vulture (*Torgos tracheliotos*)
Egyptian Vulture (*Neophron percnopterus*)
Martial Eagle (*Polemaetus bellicosus*)
Bateleur (*Terathopius ecaudatus*)
Critically Endangered (Cr):
Hooded Vulture (*Necrosyrtes monachus*)
White-headed Vulture (*Trigonoceps occipitalis*)
White-backed Vulture (*Gyps africanus*)
Rüppell's Vulture (*Gyps rueppelli*)

Table 3: List of vulnerable, endangered, and critically endangered bird species in the Gambia

4.2. Survey Results

A total of 1333 responses were collected from the survey. The majority of respondents (41.6%) ranked “Democracy, human rights, gender equality, and health” as the most important aid purpose, followed by “To alleviate malnutrition, famine, and the consequences of disasters” (40.8%), “Family planning and lower population growth through information and advice, free contraceptives, and more clinics,” (12.1%), and lastly “To link aid and trade through new collaborations with business and Swedish companies abroad” (5.5%) (see fig. 7)

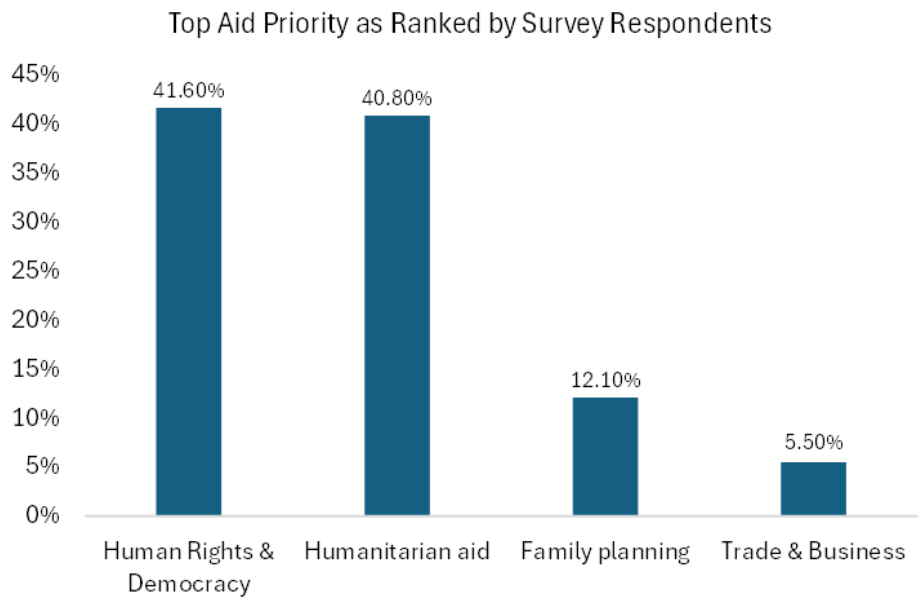

Figure 7. Survey respondents' rankings of top aid priority

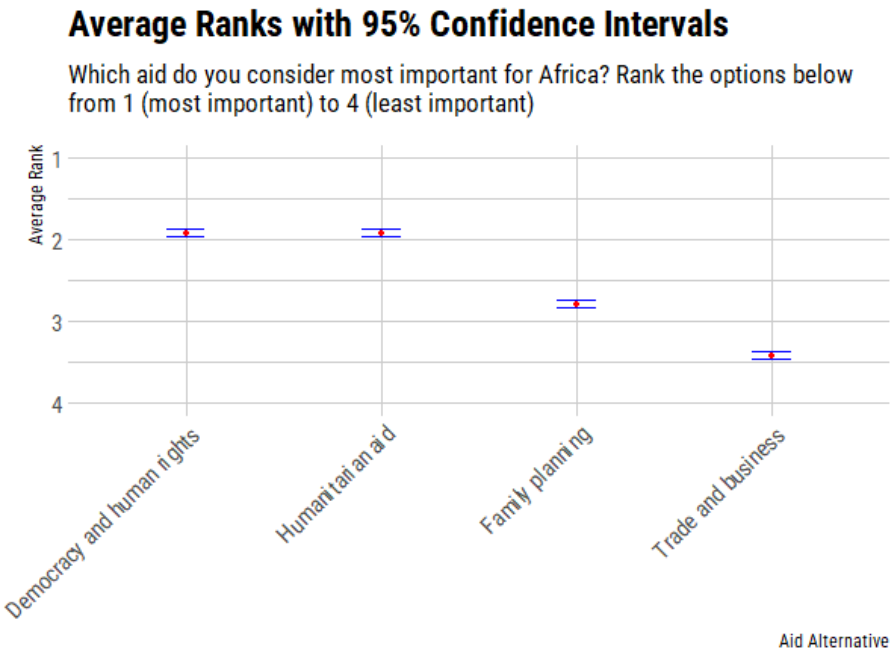

Figure 8. Average ranks of development aid priorities for Africa based on survey responses (N=1333) with 95% confidence intervals

There was no significant difference between genders in prioritizing family planning and reducing population growth, a chi-squared test gave a p value of 0.13. 11.1% (74 respondents) of women and 12.8% (85 respondents) of men ranked it as their top priority. 7 respondents did not specify their gender.

Similarly, different age groups (18-29, 30-49, 50-64 and 65+) also showed relatively similar ranking with respect to family planning; respondents aged 65+ ranked it as the top priority less often (10.1%) than respondents aged 18-29 and 30-49 (13.5%). The distribution across different age groups was not evenly distributed. More respondents belonged to the age group <65 years of age (1018 respondents) compared to 65+ years of age (363 respondents). Nevertheless, the chi-squared test generated a non-significant p value of 0.91 (Table 4). 3 respondents did not specify their age.

The respondents' level of education showed that respondents with lower levels of education (primary school, current studies at upper secondary school, or post-secondary education, not college or university) ranked the family planning option as their top priority more often (15.7%), than those with higher education i.e. current studies at university or those with a degree from college/university (9.7%). The p value showed significance at 0.016 (<0.05) when using the categories "Less Educated" and "Highly Educated" as described in the method section.

Respondents from different geographical areas i.e., "countryside and suburban areas" and "city regions" prioritized FP about equally often (12.6% and 12.0% respectively). The p value (0.16) from the chi-squared test confirmed that there was no statistical significance. The number of respondents in the two categories were not evenly distributed with 318 respondents in the countryside/suburban group, and 864 respondents in the urban group.

Demographic variable	x^2 value	p-value
Age group (<65 vs. 65+)	2.12	0.91
Gender (Men vs. Women)	5.63	0.13
Education (Highly educated vs. Less educated)	15.59	<0.05*
Geographic region	9.34	0.16

**Indicates a significant p-value*
Table 4. Results of chi-squared tests for the different demographic groups

The average ranks for the different aid alternatives are summarized in table 5. Democracy and human rights, and humanitarian aid, share the highest average ranks (1.91), while trade and business is ranked the lowest (3.41). Family planning occupies an intermediate position (2.78). The standard deviations for the aid alternatives indicate a similar level of variability across the responses. Democracy and human rights showed the highest variability (0.94), followed by humanitarian aid and family planning (both 0.93). Trade and business had slightly lower standard deviation (0.88).

Average Ranks and Standard Deviations for Aid Alternatives		
	Average Rank	Standard Deviation
Democracy & Human Rights	1.91	0.94
Humanitarian aid	1.91	0.93
Family planning	2.78	0.93
Trade and Business	3.40	0.88

Table 5. Average rankings and standard deviations for the aid alternatives

There was a clear preference for family planning among respondents associated with right-wing politics (table 6), 21.6% of whom chose it as their most important foreign aid alternative. In comparison, only 9.9% of respondents identified as neither right nor left, and 5.5% of those identifying as left-wing prioritized it.

Table 7 summarizes distributions on political affiliation and education levels. Almost 34% of suburban respondents identified with right-winged politics, compared to almost 37% of urban respondents. The prevalence of highly-educated people in urban areas was 62.7%, compared to countryside/suburban areas 56.3%. 43.4% of countryside/suburban, and 36.7% of urban respondents were categorized as having lower education.

Category	FP Ranked as #1 by Political Affiliation
Right-wing respondents	21.6%
Left-wing respondents	5.5%
Neither left or right wing respondents	9.9%

Table 6. Prioritization of FP by political affiliation

Political Affiliation and Education Levels by Region		
Category	Countryside/suburban	Urban
Right-wing respondents	34%	37%
Left-wing respondents	43%	47%
Neither left or right wing respondents	23%	16%
Highly-educated respondents	56%	63%
Lower-educated respondents	43%	37%

Table 7. Distribution of political affiliations and education levels across countryside/suburban and urban regions

5. Discussion

According to the Merriam-Webster dictionary, overpopulation can be defined as: “The condition of having a population so dense as to cause environmental deterioration, an impaired quality of life, or a population crash “(Merriam-Webster, n.d.). This definition mentions the ecological pressures associated with high population density, which are especially relevant in regions like Sub-Saharan Africa, where birth rates are the highest on Earth (fig.9) (World Population Review, 2024). The aims of this thesis have been to examine the relationship between population

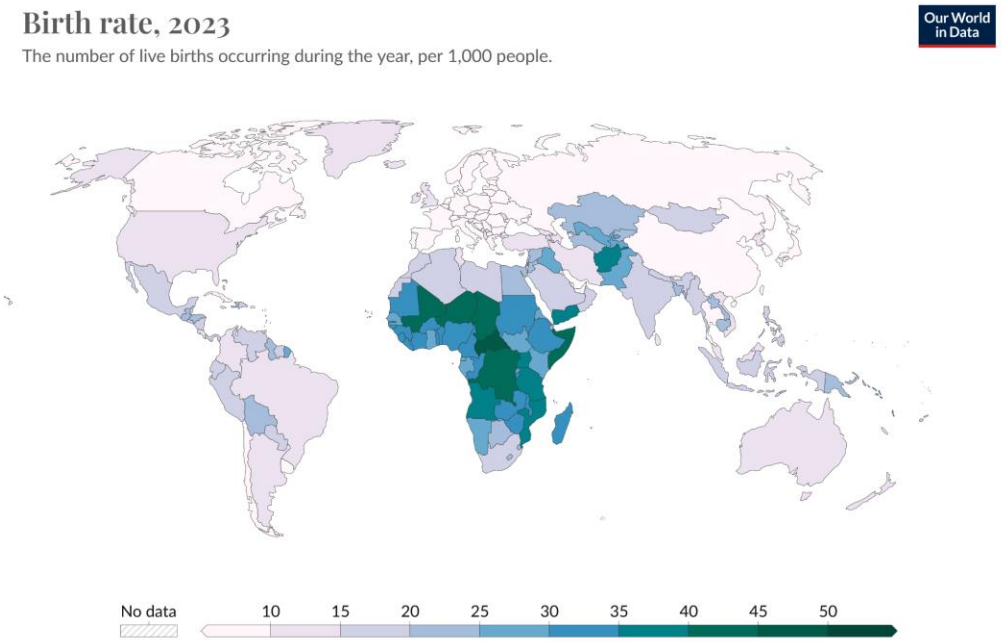

Figure 9: Map showing birth rates around the world. Retrieved from “Our World in Data”. https://ourworldindata.org/grapher/crude-birth-rate

density and relative STD across selected Sub-Saharan African countries, and to investigate the Swedish public’s opinion of how aid alternatives should be prioritized**.** The following discussion examines this relationship by reviewing EG and the Gambia, two countries with high relative STD. By focusing on these outliers, I aim to highlight local threats influencing the high STD.

In 2013 McKee et al, examined the relationship between human population density and threats to birds and mammals on a global scale using regression models, which suggested a strong connection between population density and species threat (for birds and mammals). Their model also allowed them to predict future species threats under different population growth scenarios. My study complements these findings by focusing on Sub-Saharan Africa, providing more localized perspectives.

The slightly higher r_s-value observed for animals (r_s=0.71) compared to plants (r_s=0.59) suggests that the association between population density and STD for animal species is slightly stronger. This could be due to factors such as habitat loss, hunting, and human-

wildlife conflicts (HWC), activities that intuitively can be linked to higher human activity. While land-use change and habitat loss also impact plants, these threats may not always be as directly connected to population density. Other factors, such as logging, or agricultural practices driven by international markets, may instead play a larger role, weakening the direct association to population density. The following discussion also examines the survey results.

It should be clarified that since there is no universal reference for what constitutes "high" or "low" STD, this study relies on relative comparisons between countries to interpret the data.

5.1. Equatorial Guinea

Equatorial Guinea (EG) is an upper middle-income country with a small population of 1.8 million people (World Bank, 2023). Yet it has the highest relative STD for three taxonomic groups (fig. 1, 4 & 6). The country is known for its biodiversity, particularly on Bioko Island, which is considered a biodiversity hotspot (Cronin et al, 2021). Small and biodiversity rich regions, may appear as an outlier with high relative STD because a high number of species, divided by a relatively small land area, naturally results in a higher value for species threat density. This shows how ecological pressures in smaller geographic regions can become elevated in relative terms, even if the absolute number of threatened species is comparable to larger countries (McKee et al, 2013). In Bradshaw and Di Minin's study (Appendix figure 2), species threat was calculated as a ratio, the proportion of species listed as Critically Endangered, Endangered, Vulnerable, or Near Threatened by the IUCN Red List, relative to the total number of species assessed within each country. The study yielded rather similar results for EG (rank 20 out of 48). This suggests that EG's position as an outlier in my study may not be solely linked to its small size or the use of STD as the measure of species threat. It is possible that genuine ecological pressures contribute to its high species threat density.

One such example is the widespread bushmeat trade, mainly on Bioko Island. It is recognized as one of the biggest threats to the country's biodiversity (Convention of Biological Diversity, n.d., Cronin, 2017). The hunting and trade of primate bushmeat is not driven by a necessity as other protein sources are available, rather it is a symbol of wealth and status which likely keeps driving the demand. Bioko has two major protected areas where hunting has been forbidden. However, resources for follow-through are limited, and allow hunting to continue. As a result, primate species, especially monkeys, are declining in Bioko (Cronin et al, 2027) and likely contribute to EG's position at the top of the graph (fig. 6).

EG also exhibits the highest relative plant threat density among the studied countries (fig. 4). This was somewhat surprising, as literature states that EG is a very forest-dense country with around 90% forest cover (United States Forest Service, n.d. & Central African Rainforest Initiative, 2024) as well as a relatively constant forest cover in the last decades (FAO. 2020, CAFI, n.d.). At the same time literature often mentions that deforestation and land-use change is indeed a problem in EG (Burca, 2024, Convention

on Biological Diversity, n.d, Equatorial Guinea and Nature Conservation (BioDB), 2024). How can this discrepancy be explained?

While overall forest cover appears stable at a national scale, this metric may not account for localized habitat degradation, fragmentation, or changes in forest quality. Selective logging, infrastructure development, and conversion of natural forests to plantations or secondary forests may maintain official forest cover while significantly reducing ecological integrity and biodiversity (World Resources Institute, n.d.). Such localized threats may contribute to an explanation of why EG ranks as the country with the highest relative plant species threat among the countries studied. Therefore, the stability suggested by FAO and CAFI data may overlook significant localized threats, emphasizing the importance of detailed assessments to fully understand the drivers of EG's biodiversity challenges.

As specified in the methods section (3.6), small island nations were excluded due to their often unique ecosystems and limited land areas, often resulting in outlier values for metrics calculated per square kilometer. Islands also often have a high proportion of endemic species with limited ranges, making them particularly vulnerable to habitat loss and other threats (Burca, 2024). Therefore, this raises the question of whether EG, as a country with both mainland and island components, should have been included in the study. While the mainland portion shares characteristics with its neighboring countries, Bioko Island's distinct ecology may influence results by amplifying species threat metrics. Future studies could consider separating data for mainland and islands to better account for these differences and ensure comparability across countries.

While this thesis focuses on species threat densities, understanding the absolute number of threatened species adds insight into biodiversity pressures (Appendix figures 3-8). In EG cartilaginous fishes (Chondrichthyes) is the class that has the highest number of threatened species (within the Animalia kingdom). However, including marine species would not have been relevant to this analysis, as they do not directly interact with land-based human population density.

To summarize, EG's high relative STD, despite its relatively low population density, shows how threats concentrated in biodiversity hotspots may influence overall STD. Localized habitat fragmentation, bushmeat trade on Bioko Island, and infrastructure development linked to the oil industry, are likely further contributing factors. The case of EG highlights how population pressures, even in less densely populated regions, can affect threats to wildlife and underscores the importance of including population dynamics in conservation strategies.

5.2 The Gambia & Comparison to Lower Threat Countries Uganda and Nigeria

The Gambia has one of the third highest population density of the included Sub-Saharan African countries (261 people/km^2), which could reasonably be expected to contribute to an increase in human-wildlife conflicts (HWCs). While there isn't an abundance of cited literature on specific species threats in the Gambia, one article suggests that HWCs are

prevalent, particularly in areas where agricultural expansion and urban areas increasingly overlap with natural habitats (Yengoh, 2024). One such area is the Central River Region (CRR) in the Gambia, a biodiversity hotspot where people rely heavily on e.g., agriculture, fishing, and forestry, placing strain on wildlife habitats and contributing to conflicts with wildlife. Grain-eating bids are most often reported being part of HWC in this region (Yengoh, 2024). They are also known to damage and consume important crops for the locals, putting economic strain on local agricultural livelihoods. Supporting this observation, Zwarts et al. (2023) highlight broader trends in the Sahel where grain-eating bird populations are declining. Agricultural expansion, particularly livestock grazing, favors vegetation which seeds are difficult for the birds to consume (Zwarts et al, 2023). Widespread cashew plantations in the Sahel have also impacted bird populations, as they offer little to no food or suitable habitats, replacing woody vegetation that previously supported a rich variety of bird species (Zwarts et al, 2023). This information can contribute to explaining the Gambia's position as an outlier in fig. 7 (Bird threat density).

The IUCN Red List also provides the information that many bird species, including several vulture species, are endangered and critically endangered. Vultures are not directly reported having a large role in HWCs, due to them not directly competing with humans for resources or posing a threat to their safety. Instead, their decline is likely driven by more indirect human actions such as poisoning (intentional as well as unintentional), habitat loss due to land being converted to farmland, and poaching for trade and traditional medicines (IUCN redlist, 2021). These examples highlight the dual pressures on avian species: some are directly implicated in HWCs, while others face significant conservation challenges due to anthropogenic impacts associated with population density.

Interestingly, Nigeria and Uganda are two countries with similar population density as the Gambia, but with lower relative STD in figures 1,3,5,6, and 7. Although the reasons for this discrepancy are likely multifaceted, and exploring all possible causes would fall outside the scope of this thesis, the following may be contributing. Firstly, the measure of human population density does not account for urbanization and the distribution of the population. The larger countries could, for example, have a larger part of the population clustered in some areas, leaving more space for wildlife in others. In contrast, Gambia's population could be more evenly distributed around the country, putting pressure on wildlife habitats in the whole region. It is also a very small country. In other words, wildlife habitats are more likely to be in closer proximity to human activities such as roads, agriculture, or even villages and cities. Therefore, even if countries have similar population densities, a smaller total land area increases the likelihood of these effects where the boundaries of habitats are degraded, reducing the quality for wildlife. This, of course, applies to all species, not just birds.

Differences in species threat between the Gambia, Nigeria, and Uganda may also arise from differences in conservation efforts and policies. Based on literature I found, all three countries have established conservation initiatives e.g., protected areas or community-based programs. For instance, Uganda focuses on ecotourism and community involvement in conservation, with examples like Bwindi Impenetrable National Park generating revenue to support biodiversity protection (UNESCO, n.d). Uganda also

benefits from funding from, for example, the U.S. Agency for International Development (USAID), which is a significant financial supporter of conservation efforts in sub-Saharan Africa. For instance, USAID funds the Uganda Biodiversity Fund, a conservation trust involved in protecting the country's biodiversity (Uganda Biodiversity Fund, n.d.). In Nigeria, USAID supports conservation through initiatives such as the Watershed Protection program, which enhances water security and ecosystem resilience in key regions, and mangrove restoration efforts in the Niger Delta, addressing biodiversity loss and climate change (Guardian, n.d.; SDN, n.d.) Although USAID also offers some funding to the Gambia, its main objective is to support democracy and human rights instead of conservation efforts (USAID, 2022).

These differences in funding priorities may influence the challenges and successes each country faces in conservation. Nigeria has a larger network of protected areas, such as the Cross River National Park, but faces challenges with illegal logging, poaching, livestock encroachment and grazing, and overharvesting of non-timber forest products (NTFPs) such as berries, fruits or certain plants (Adetola et al, 2022). the Gambia also emphasizes community engagement in conservation through initiatives like the Tanji Bird Reserve, but resource constraints may limit the enforcement of these efforts (Wicander, 2015).

For threats to plants (fig. 4), the Gambia stands out as having relatively low plant threat density compared to the other countries. However, this does not necessarily translate into low absolute threat values, as the country’s position in the graph could be due to the threat density being higher in other countries. If more time had been available for this study, it would have been interesting to discuss drivers of plant threat in the Gambia in more detail.

In summary, the Gambia deviating from the trend in fig. 7, with high relative STD for birds, but following the trend for e.g., plants highlights the complex relationship between population density and species threat in the Gambia. Potential contributors to the Gambia’s deviation from the trend could be limitations of the measure population density, and possibly differences in conservation efforts.

As mentioned in 5.1. (Equatorial Guinea) the absolute number of threatened species may belong to a different taxonomic group that those in the STD calculation. Similarly to EG, cartilaginous fishes (Chondrichthyes) is also the class that has the highest number of threatened species (within the Animalia kingdom) in the Gambia (Graph of population density vs. absolute number of threatened species are found in appendix, fig 3-8).

5.3. Survey- Differences Across Respondents

5.3.1 Gender

Considering that high population growth in African and other high-fertility countries is not widely discussed in media, surprisingly many people listed it as their top priority for foreign aid (161 people, 12.1%). Interestingly, FP was prioritized almost equally by men (85) and women (74), despite its strong association with women’s health, reproductive rights, and

empowerment- issues mostly tied to women's experiences and perspectives. The distribution between genders was very even- 664 women and 662 men. Therefore, it seems like family planning and population related issues resonate equally with both men and women in the context of foreign aid, at least among those that gave it top priority in this survey. It may reflect a growing awareness of FP's broader societal benefits, beyond its associations with women's reproductive health and rights. For example, its impact on economic stability, the environment, and public health.

Sweden ranks first in the EU's gender equality index, indicating a strong commitment to equality (European Institute for Gender Equality, 2023). Sweden exemplifies a society where gender roles are balanced, and shared responsibilities in family and societal matters are emphasized. Generous parental leave and affordable childcare mirror these values. It enables both parents to participate equally in the workforce and at home, possibly contributing to the equal prioritizations observed in the survey.

5.3.2 Age

As more respondents belonged to the age groups 30-49, 50-64, and 65+, compared to 18-29, conclusions regarding the youngest age group need to be drawn with caution, the smaller sample size of young people may not fully capture their preferences.

Many people from older generations have lived through decades of population growth, media information, and campaigns promoting FP. For instance, Manon Parry mentions in her book "*Broadcasting Birth Control: Mass Media and Family Planning*" that the mid-20th century used multiple media outlets like radio and TV to promote FP on a global scale (Parry, 2013). While these campaigns may not always have been successful in changing behaviors (Parry, 2013), they probably still contributed to making family planning a prominent topic in public discourse.

A survey from Bangladesh shows how mass media exposure can influence FP behaviors. Radio and television played an important role in spreading FP information, and exposure to these media was associated with an increase in contraceptive use (Mazharul Islam & Saidul Hasan, 2000). This highlights the potential of mass media as a valuable tool for raising awareness and disseminating information.

Despite the stronger focus on FP during the mid-20th century, this study found no significant difference in FP prioritization across age groups (<65 and 65+). While respondents aged 65+ ranked FP as the top priority slightly less often (10.1%) than younger age groups, the overall similarity in rankings suggests that exposure to FP messaging during the mid-20th century does not strongly influence current attitudes. Alternatively, it may reflect changes in priorities among older generations or a broader societal understanding of FP's importance across all ages. The non-significant chi-square test ($p = 0.878$) further reinforced that age alone does not appear to be a major determinant of FP prioritization in this sample.

5.3.3 Education

Lithander & Götmark (2024) found that higher educated individuals' perspective on domestic population growth in Sweden tends to be more positive than those with lower education. This may be tied to economic considerations, assuming that a growing population benefits the economy. Higher-educated individuals may be more inclined toward this way of thinking, as academic and professional settings often emphasize ideas that prioritize economic growth. In contrast, less-educated respondents may have a more pragmatic perspective, associating population growth with tangible challenges like immigration to Sweden, unemployment, or financial strain. These firsthand experiences could make FP resonate more strongly, as they may connect its benefits to addressing socioeconomic pressures.

5.3.4. Geographic Region

The results indicate no statistically significant difference in prioritization of aid alternatives between respondents from countryside/suburban areas (12.6%) and city regions (12.0%), confirmed by a chi-square test ($p = 0.16$). This suggests that geographical location alone may not strongly influence attitudes toward FP in this sample. With that being said, only 318 respondents resided in countryside/suburban areas while 864 respondents lived in urban areas. Therefore, the sample for suburban respondents may not fully reflect their attitudes, and results may be somewhat skewed.

However, when looking at existing literature, swedes in countryside/suburban areas tend to be more skeptical of immigration and population growth and also show greater support for e.g., the Sweden Democrats (SD). In 2016, 24% of suburban residents supported the Sweden Democrats (SD), compared to only 12% of urban residents (Roden, 2016). My data did not fully support this, as almost 34% of countryside/suburban respondents identified with right-winged politics, compared to almost 37% of urban respondents (Table 7), but with a larger sample size the results may have been different.

Additionally, lower levels of education are more common in countryside/suburban areas which have been associated with stronger support for FP. Urban residents, who tend to have higher education, may view family planning as a less important issue and more as one of many developmental priorities, reflecting a broader focus on economic growth and technological solutions to global challenges.

6. Limitations

Several limitations should be noted. Firstly, the IUCN Redlist assessments may differ in their coverage/scope i.e., the amount of research conducted for different countries. Therefore, underrepresentation of species or other taxonomic groups may skew the results. Secondly, while correlation analyses have indicated that population density and STD have a positive relationship, it has not confirmed causation leaving other variables unaccounted for. Secondly, STD may make smaller countries or biodiversity hotspots appear as outliers, possibly exaggerating their relative species threat, although this needs further research.

Although countries were used as statistically independent units in this thesis, some researchers would find this problematic. It can be misleading, as neighboring nations often share cultural, economic, or political traits, and even distant countries may have similarities through international ties. Country borders are also shaped by historical events rather than natural divisions, leading to clusters that undermine statistical independence.

In the survey, a key limitation is that I cannot know the underlying reasons behind the respondents' choices. It is unclear how much the introductory text influenced ranking.

7. Conclusion and Future Research

In conclusion, the original hypothesis that a high human population density is associated with high STD in Sub-Saharan African countries was supported, although the threat levels varied among the countries. Based on the correlation analyses, there are positive relationships between the two variables across all taxonomic groups in the study. This shows that higher population densities are *associated* with higher species threat, but to determine causation more complex mathematical models that control for other variables would have to be used, alternatively longitudinal studies of how population growth has impacted species threat over time.

Despite population growth in Africa and its related issues being underrepresented in public discourse, a notable proportion of respondents of the survey (12.1%) ranked FP as their top priority for foreign aid. No significant differences could be found in ranking between genders, age groups, geographical region, but different education levels influence the respondents ranking. The Swedish public shows little support for the government's new direction in aid policy and currently seem to support family planning in many developing countries (e.g., Africa) to a higher degree. In future surveys, it would be interesting to include a control group where respondents do not receive an introductory text before answering the survey question, to determine if the text influenced rankings.

8. Acknowledgments

I would like to express my gratitude to Frank Götmark for supporting me throughout this process. Your passion for the subject has not only deepened my understanding but also motivated me to remain on this path. Your insights and support have been invaluable in shaping this work, and I am truly grateful for the opportunity to learn under your mentorship.

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Appendix 1: Popular Science Summary

Sub-Saharan Africa's Population Crisis: Wildlife Threats and Swedish Aid Perspectives

Did you know that Africa's population is set to almost triple by the end of this century? From today's 1.4 billion, it's projected to grow to 3.8 billion by 2100. This rapid increase is not just about numbers—it's reshaping the continent's wildlife and ecosystems in profound ways.

As human populations increase, the demand for resources and land intensifies. Wildlife habitats are converted into farmland and cities, leaving less room for wildlife. Activities like agricultural expansion, urban development, and resource exploitation are encroaching on wildlife habitats, pushing many species toward endangerment or extinction. Understanding the relationship between population growth and threat to wild species is key to tackling these challenges.

Measuring the Impact on Wildlife

To get an accurate view on wildlife threat in countries of different sizes, my study used a metric called *species threat density* (STD)—the number of threatened species per square kilometer. The International Union for Conservation of Nature's Red List of Threatened Species (IUCN) was a valuable source, as it categorizes all assessed species into different risk levels, from "Least Concern" to "Critically endangered". For this study I used the categories "Critically Endangered" (CR), "Endangered" (EN), and "Vulnerable" (VU) for the species threat measurement. Correlation analyses were performed for different organism groups: all assessed species, animals, plants, primates and birds together, as well as primates and birds separately. Why these groups? Because primates and birds often are so called indicator species which means that they reflect the overall health of the ecosystems they live in. Primates and birds' relatively well-documented status may also reduce biases that could arise from incomplete data on less-studied taxa.

The results showed a trend: countries with higher population densities are associated with higher STD. For example, densely populated Rwanda and Burundi experience relatively high STD, which highlights the pressures that can occur in densely populated areas. But not all countries align with the trend.

Surprising Outliers

Equatorial Guinea, with a relatively low population density, had the highest STD when testing for all assessed species, as well as for primates and plants alone. Reasons behind this high threat level is likely multifaceted, but Bioko Island (outside of Equatorial Guinea's coast) being a biodiversity hotspot likely contributes. A high number of species in a small area inherently increases the risk of a higher STD. The concentration of species in a small space also makes them extra vulnerable to local pressures,

such as logging and hunting, possibly leading to disproportionate STD.

Similarly, the Gambia, though moderately populated, faces a relatively high STD. Literature for this country is sparce, but human-wildlife conflicts have been reported in the Central River Region (CRR). The CRR is a biodiversity hotspot where people rely heavily on e.g., agriculture, fishing, and forestry, placing strain on wildlife habitats and contributing to conflicts with wildlife. the Gambia has similar population density to Uganda and Nigeria but experiences higher STD. What could be the reason for this? Firstly, the measure of population density perhaps doesn't tell the whole story, it doesn't account for how people are spread across a country. In larger countries, populations could be more clustered, leaving more space for wildlife. In smaller countries like the Gambia, people are possibly more evenly distributed, putting pressure on habitats everywhere. With less space, wildlife is closer to human activities like farming and roads. Differences in conservation efforts and policies may also explain variations in STD between the countries.

What Do Swedes Think About These Challenges?

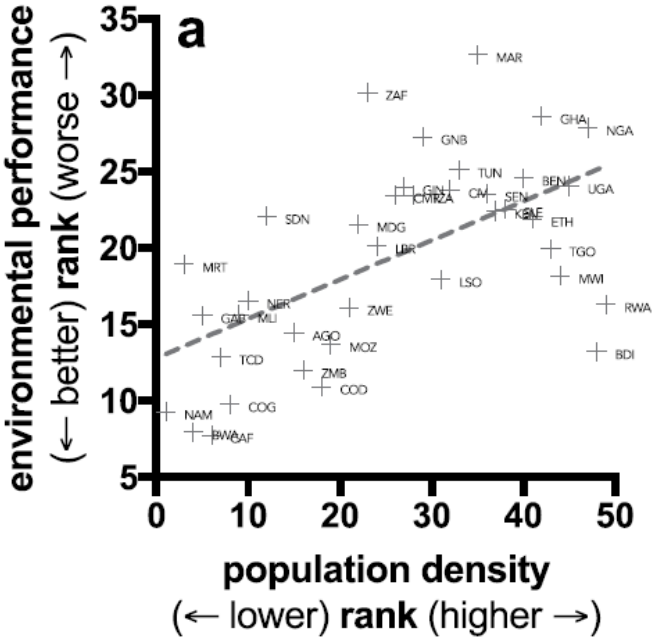
To complement the literature review, I surveyed the Swedish public about their development aid priorities in Africa. Of the 1333 respondents, almost 42% prioritized democracy and human rights, almost 41% humanitarian aid, 5.5% trade and business, and 12% lower population growth through e.g. family planning. Interestingly, respondents with lower levels of education were more likely to prioritize family planning than those with higher education. This was the only category that provided statistically significant differences in ranking. Similar comparisons were made between family planning and age, gender and region, but no significant differences could be determined. However, respondents identifying with right-wing politics were much more likely to prioritize family planning compared to those identifying with left-wing or neither left now right-wing politics.

Why This Matters

Africa's unique ecosystems are home to countless species found nowhere else on Earth. But as human populations grow, these habitats shrink, and the pressures on wildlife intensify. Addressing this issue is long overdue. Integrating family planning into developmental aid would be a win-win: slowing biodiversity loss while improving quality of life in rapidly growing regions. By understanding the link between population growth and threat to wild species, we can develop strategies that protect both people and nature.

Although this study is focusing on Sub-Saharan Africa, the issues are not limited to this area. Population related issues are more widespread and it's important to look at it through a global lens.

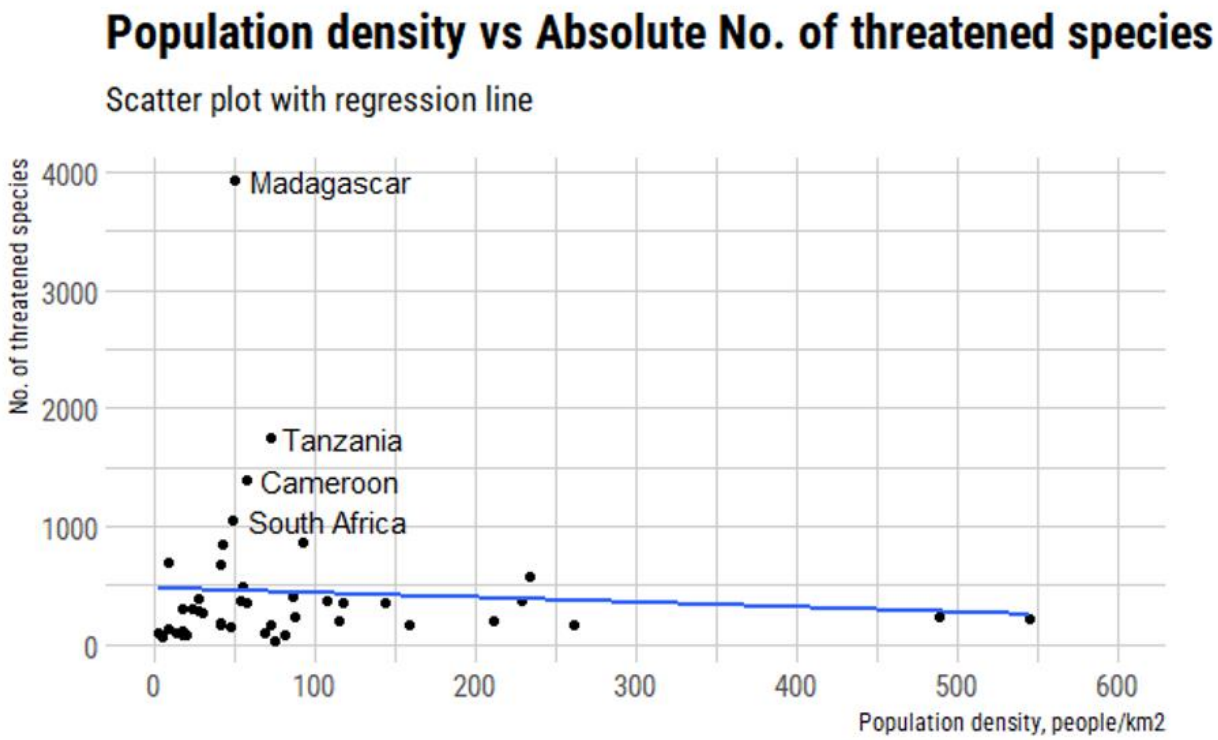
Appendix 2: Supplementary Graphs and Figures



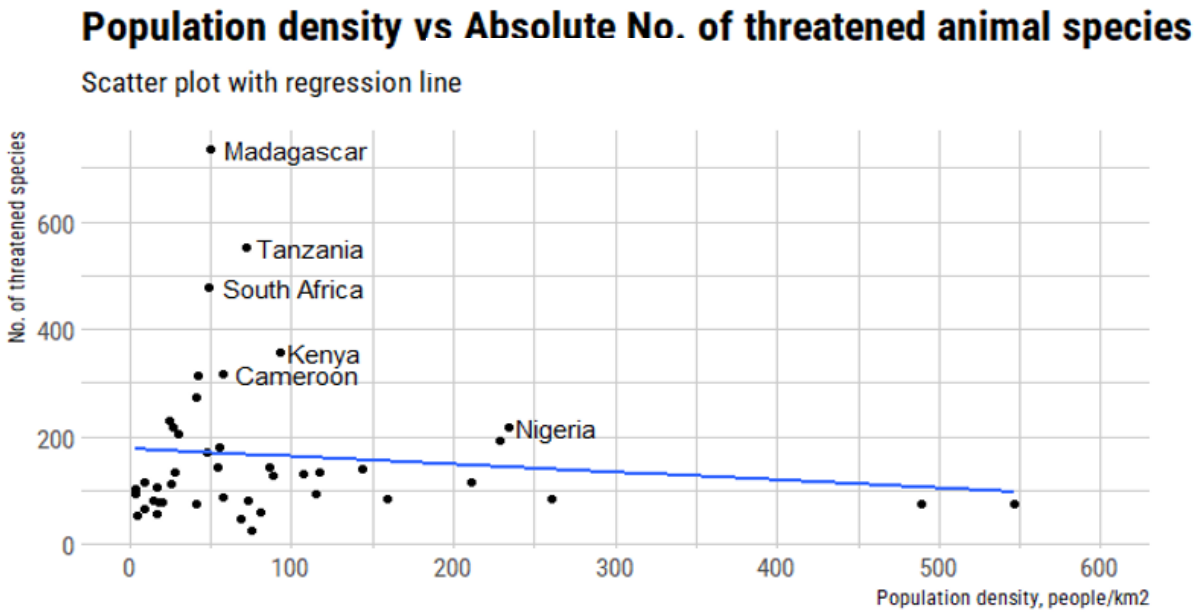
Appendix Figure 1: Fig 3a from Bradshaw, C. J. A., & di Minin, E. (2019). Socio-economic predictors of environmental performance among African nations. https://doi.org/10.1038/s41598-019-45762-3

Country	ISO	environmental component variable ranks								ENV_{gm}
		EF	MCI	THR	FWR	FRL	LVS	CPL	EMI	
Cent Afr Rep	CAF	18	5	1	2	25	44	11	6	7.754
Botswana	BWA	44	1	4	31	10	7	1	42	7.955
Namibia	NAM	NA	2	18	24	12	5	3	38	9.276
Congo	COG	20	20	9	1	27	2	14	31	9.790
Dem Rep Congo	COD	3	33	23	5	43	10	21	2	10.943
Eritrea	ERI	1	34	45	37	4	27	4	NA	11.363
Zambia	ZMB	8	6	8	18	39	11	7	21	12.020
Chad	TCD	31	23	11	26	19	13	5	3	12.876
Burundi	BDI	2	22	22	21	24	43	45	1	13.240
Mozambique	MOZ	5	10	38	12	46	4	20	15	13.724
Angola	AGO	6	17	12	10	38	7	15	39	14.454
Gabon	GAB	NA	30	17	6	23	3	24	44	15.581
Mali	MLI	30	29	5	34	16	30	10	5	15.623
Zimbabwe	ZWE	17	4	6	39	29	17	16	36	16.102
Rwanda	RWA	7	7	21	16	22	47	42	7	16.309
Niger	NER	32	26	15	38	6	24.5	9	9	16.557
Somalia	SOM	24	44	40	43	11	20	6	4	17.690
Lesotho	LSO	34	32	16	11	4	32	12	37	17.972
Malawi	MWI	4	9	37	32	33	35.5	30	8	18.190
Eq Guinea	GNQ	NA	28	20	4	34	7	32	46	18.650
Mauritania	MRT	42	46	27	46	7	15	2	33	18.950
Togo	TGO	13	12	10	15	35	33	36	26	19.970
Liberia	LBR	16	41	33	3	48	14	31	20	20.139
Burkina Faso	BFA	21	18	7	30	26	45	19	16	20.246
Madagascar	MDG	10	NA	50	25	41	12	27	13	21.550
Ethiopia	ETH	11	21	29	35	17	46	29	10	21.913
Sudan	SDN	28	31	35	47	9	NA	8	25	22.094
Kenya	KEN	12	8	41	36	20	38	26	23	22.444
Sierra Leone	SLE	23	25	30	7	44	21	33	18	22.525
Gambia	GMB	9	38	14	22	32	41.5	23	22	22.711
Swaziland	SWZ	39	27	3	42	28	26	25	35	23.220
Tanzania	TZA	27	3	48	28	42	31	34	19	23.454
Cameroon	CMR	15	16	39	9	30	40	38	24	23.474
Senegal	SEN	19	13	26	33	21	37	18	32	23.557
Côte d'Ivoire	CIV	22	14	32	19	49	9	46	27	23.789
Guinea	GIN	29	36	34	8	36	18	35	17	23.984
Uganda	UGA	26	11	31	17	37	39	43	12	24.058
Benin	BEN	25	15	13	14	47	35.5	39	30	24.580
Tunisia	TUN	40	37	42	45	1	28	47	43	25.115
Djibouti	DJI	43	45	47	29	4	24.5	NA	34	26.336
Guinea Bissau	GNB	33	43	19	13	45	34	41	14	27.292
Libya	LBY	46	47	36	48	8	19	13	47	27.704
Nigeria	NGA	14	24	28	27	31	41.5	40	28	27.889
Egypt	EGY	38	42	46	49	2	48	28	41	28.169
Ghana	GHA	37	19	25	23	40	22	44	29	28.650
South Africa	ZAF	45	40	49	40	15	16	17	48	30.195
Algeria	DZA	41	39	44	44	13	23	22	45	31.279
Morocco	MAR	35	35	43	41	14	29	37	40	32.670

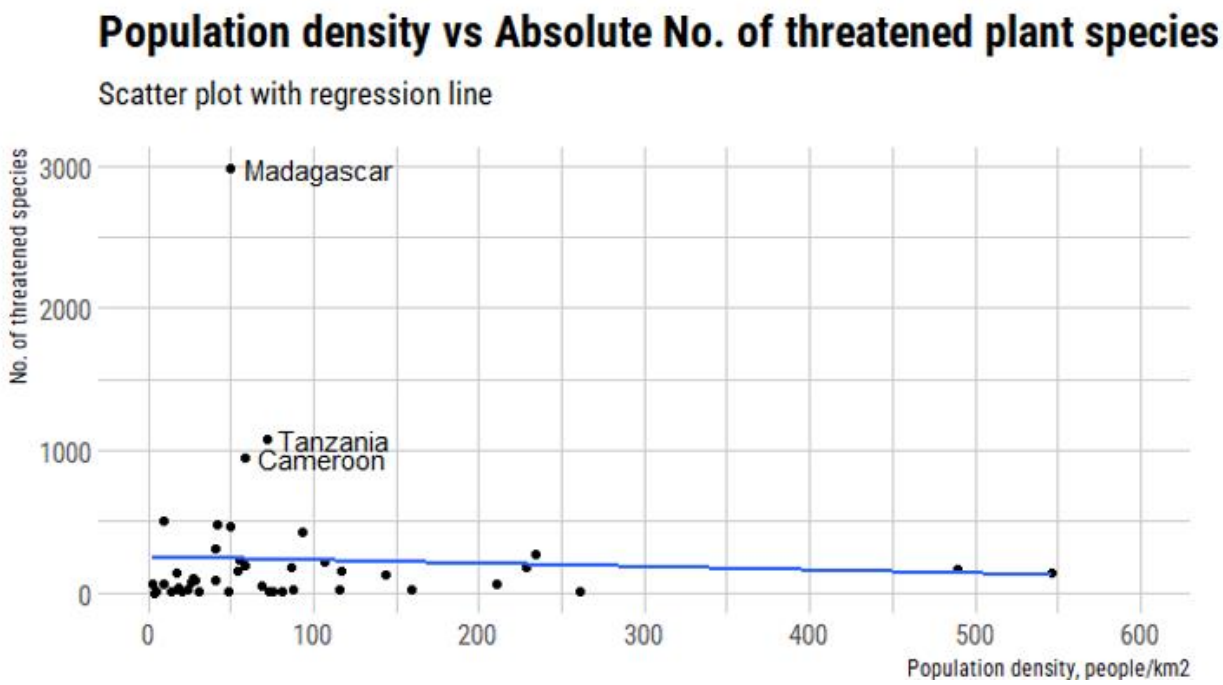
Appendix Figure 2: Table 2 from Bradshaw, C. J. A., & di Minin, E. (2019). Socio-economic predictors of environmental performance among African nations. https://doi.org/10.1038/s41598-019-45762-3



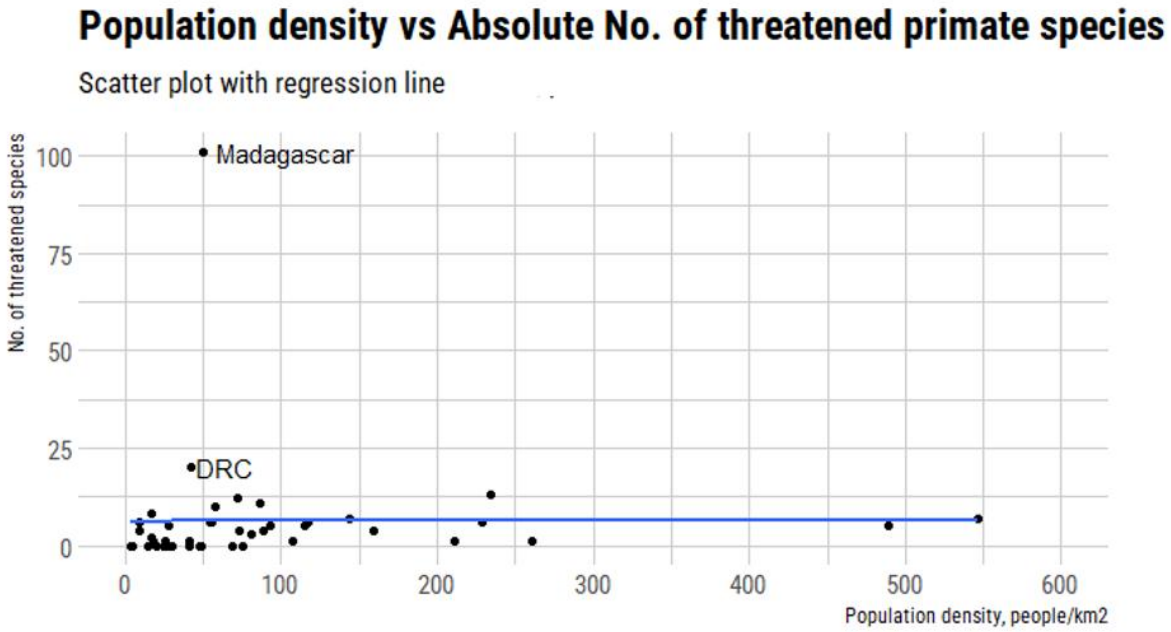
Appendix Figure 3: Graph for population density vs. absolute number of threatened species (including all assessed vu, en, cr species)



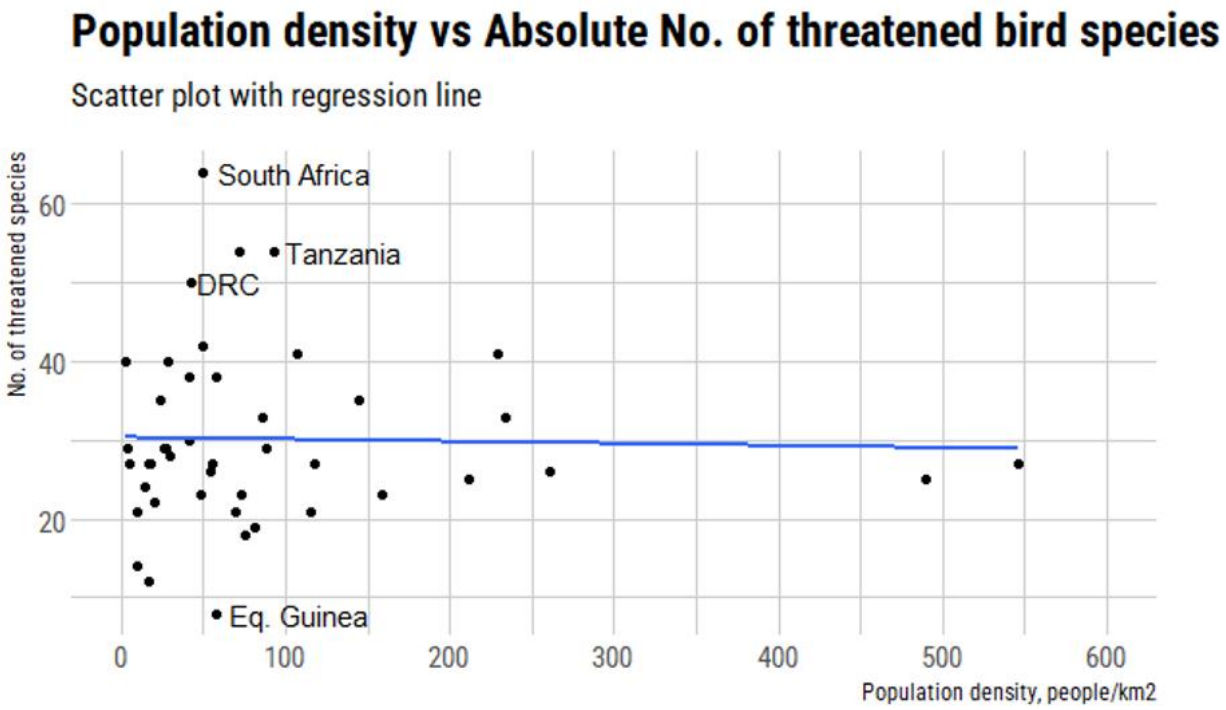
Appendix Figure 4: Graph for population density vs. absolute number of threatened animal species (including all assessed vu, en, cr species)



Appendix Figure 5: Graph for population density vs. absolute number of threatened plant species



Appendix Figure 6: Graph for population density vs. absolute number of threatened primate species



Appendix Figure 7: Graph for population density vs. absolute number of threatened bird species