

DP ESS IA

Why does the correlation between economic growth and ecological footprint have an impact on our future and how humankind will develop it?

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Research Question:

Why does the correlation between economic growth and ecological footprint have an impact on our future and how humankind will develop it?

Background Information:

Since the creation of the first machine; humans have been doing everything to progress and make their lives better even if it destroys the world and its ecosystems. This has escalated from the beginning of the industrial revolution which introduced the first automated machine. With this human's creativeness has increased exponentially which in turn has increased their destructiveness. In the present humankind has destroyed a lot of this earth in the pursuit of their self-gain and comfortability by removing forests and wildlife for their cities, food, and other assorted things. Can this continue or will humankind run out of resources, land, and other stuff that keeps it afloat?

Hypothesis:

Humankind will eventually destroy their planet by pollution, destroying the land, and overpopulating if they don't do anything to help it.

Experimental Variables	Named Variables	Procedure/ Method to measure the variables
Independent Variable	<ul style="list-style-type: none">• The rate of how much land humankind has	<ul style="list-style-type: none">• The total count of how many cities and towns

	<p>already destroyed with the production of cities, houses, and other things</p> <ul style="list-style-type: none"> • The growth rate of humankind over the years • The amount of pollution that is made each year 	<p>were made in the last hundred years</p> <ul style="list-style-type: none"> • The growth of humans during the last hundred years • The growth and measurement of pollution during the last hundred years
Dependent Variable	<ul style="list-style-type: none"> • How long humankind can continue to live on earth before it becomes too much destroyed 	<ul style="list-style-type: none"> • Estimated growth of humans based on the data already found
Controlled Variables	<ul style="list-style-type: none"> • How much resources earth already has • Earth 	<ul style="list-style-type: none"> • The total amount of resources humankind have used already with growth estimation of which

		they will use in the future
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Materials used to collect data/Website Sources

- Internet
- Google
- <https://ourworldindata.org>
- <https://www.theworldcounts.com>
- <https://www.theguardian.com/environment/blog/2011/oct/31/six-natural-resources-population>

Method

1. Urbanization

- Look at the starting rate of urbanization during the last 100 hundred years beginning in 1900's
- Look at the current rate of urbanization in the present 2000's
- Use the formula $\text{Rate} = y/x \text{ divide by } 100$
- Calculate the future exponential growth rate with the formula $A(t) = (1 + r)^t$
- Use America's urbanization rate as an example for the formula

2. Population

- Look at the starting rate of the population during the last 100 hundred years beginning in 1900
- Look at the current state of the population in the present 2019
- Use the formula $\text{Rate} = y/x$ divide by 100
- Calculate the future exponential growth rate with the formula $A(t) = (1 + r)^t$

3. Pollutants

- Look at the starting rate of pollution during the last 100 hundred years beginning in 1900
- Look at the current state of pollution in the present 2019
- Use the formula $\text{Rate} = y/x$ divide by 100
- Calculate the future exponential negative growth rate with the formula $A(t) = (1 + r)^t$

Data Collection and Processing:

Topic 1:

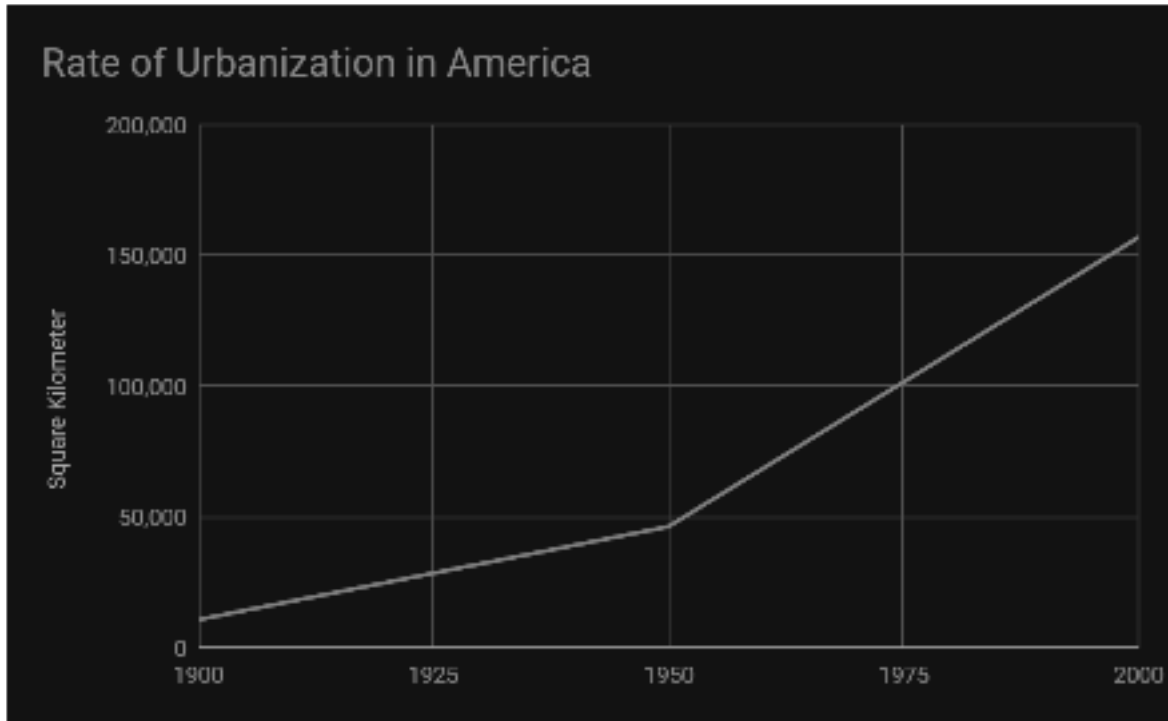
Topic	Past	Present
Urbanization	10,766	156,919

Growth percentage from 1900 to 2000:

$156,919/10,766$ divided by 100 = $14.575 * 100 = 1457\%$

Future Growth rate:

$156,919(1 + 14.575)^{100} = 2.7 * 100 = 270\%$ increase in the next century and 2.7% increase every year



Topic 2

Years	Population
1900	1.65 Billion
1928	2 Billion
1960	3 Billion
1975	4 Billion
1987	5 Billion
1999	6 Billion
2011	7 Billion
2019	7.7 Billion

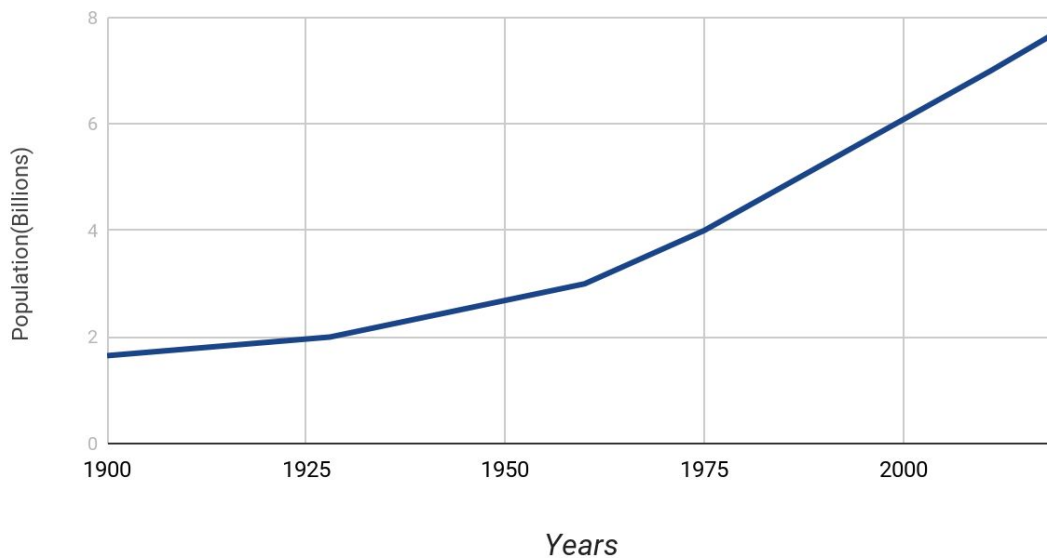
Growth percentage from 1900 to 2019:

$7,700,000 / 1,650,000$ divided by 100 = $0.039 * 100 = 3.9 * 100 = 390\%$

Future Growth rate:

$7,700,000(1 + 3.9)^{100} = 8.1 * 100 = 810\%$ increase in the next century and 8.1% increase every year not definite because of free will

Population Growth on Earth



Topic 3:

	Ammonia	PM _{2.5}	VOCs	NO _x	PM ₁₀	SO ₂
1970	0	0	100	100	100	100
1980	0	0	89.75	100.74	50.57	83.05
1990	100	100	69.56	94.96	26.41	73.92
2000	99.70	111.74	50.53	84.07	25.43	53.36
2010	99.40	79.63	51.46	55.23	22.54	24.77
2016	99.14	74.65	45.74	39.02	21.66	8.68

Negative Growth Percentage Rates:

Ammonia: - .86%

PM_{2.5}: -26.35%

VOCs: -54.26

NO_x: -60.98

PM₁₀: -78.34%

SO₂: -91.32

Negative Future Rate:

$100(1 - .0086)^{100} = 42.16$ ending rate of ammonia in the next century

$100(1 - .2635)^{100} = 5.21$ ending rate of PM_{2.5} in the next century

$100(1 - .5426)^{100} = 1.07$ ending rate of VOCs in the next century

$100(1 - .6098)^{100} = 1.34$ ending rate of NO_x in the next century

$100(1 - .7834)^{100} = 3.68$ ending rate of PM_{10} in the next century

$100(1 - .9132)^{100} = 7.11$ ending rate of SO_2 in the next century

Topic 4:

<https://www.theguardian.com/environment/blog/2011/oct/31/six-natural-resources-population>

Trends Indicated by the data:

- The rate of urbanization has increased exponentially in the last century
- The population amount has gone up by 390% since the beginning of the 19th century
- In table 3 the percent of pollution in the air has decreased exponentially depending on the type

Evaluation and Analysis:

In my investigation into whether our economic growth and ecological footprint have an impact on our future and how humankind will develop it. At the beginning of my investigation when researching the rate of urbanization in America I noticed an exponential climb from the beginning of 1900 to 2000 and you will notice that it has increased by a factor of 1457%. This is relevant since when urbanizing you have to take account that you have to destroy the land and that ruins the ecosystem which destroys the natural system in place. Next, I researched the rate of growth in the population that can be accounted for in the world. Starting in 1900 when the total population was 1.6 billion to now in 2019 when it is 7.7 billion this is a growth of 390% in the

last century and with my calculation; the growth rate will increase by a factor of 8.1% every year. With this data you can see how in the near future you will not have just passed the carrying capacity of the earth humankind will have overshoot it by an enormous amount. But this data is not entirely correct because of free will since my calculation uses the rule that it grows at a constant which is not true. Then, I researched the rate of pollution that has affected America. And in each type of pollution ranging from Ammonia to SOS I have noticed that even though there is still a large amount of pollution that is still on earth, you can see that it has decreased in the last 50 years. Depending on the type of pollution you can see that it has decreased from a little to a lot. This is amazing since pollution is a big reason for a lot of the environmental problems on earth like the destruction of forests, and the destruction of the ozone layer which protects us from harmful radiation but this data is not entirely correct since it doesn't cover all types of pollution. The final result of the research of data shows how the resources humankind can use are not that much and by some time in the future, they will run out. Since the amount of water can use is only 2.5% of the total amount of water on earth and there is the ever-decreasing pool of oil that is available to us which is only enough for only 46.2 years which is calculated in a constant which would only give you an estimation because of free will. This is only just some examples of the decreasing natural resource humankind has at hand to use.

Conclusion:

The earth is dying and humankind is 100% responsible for it from our overpopulating to our urbanization of the land which creates pollution and to the use of the limited natural resources that decrease exponentially. Humankind has been making strides to counteract the strain they have put on the earth but they are coming up short since all data points to the earth running out of resources that sustain them in the next century. Solutions that could help with this problem would be the regulation of urbanization, populating, and use of natural resources but this is not a very viable solution since people don't like being prohibited from doing something. So humankind would have to start finding replacements for the natural resources that can be used like new energy sources I.E. Sun, wind, water. It is important to know that it is humankind's responsibility to fix what they are breaking since they are the reason for the earth becoming unlivable.