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Ecological footprint and the wealth of people from a socio-ecological point of view

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ABSTRACT

With time it is getting more difficult to solve environmental issues as several people are unaware of the current environmental concerns. Using the ecological footprint analysis, people can know their daily use of natural resources. Therefore, this study aims to determine the ecological footprint of people in Solo, Indonesia. We applied the Ecological Footprint Test to the 152 respondents that consist of students, academicians and ordinary people. Through survey and questionnaire, this study found the relationship between different statuses of occupation and determined which category was more eco-friendly. Furthermore, this study hypothesized about the effects of education level on the use of natural resources and explained that educational level does affect the use of natural resources. Regression analysis was used to examine the determinant of ecological footprint score of the Solo people. The result showed that the estimated parameter of education has positively significant to the ecological footprint of the people of Solo. The higher the education, the higher the ecological footprint score of the Solo people. This is indirectly related to mobility and the goal of earning more income for those with higher education. Therefore, their consumption of natural resources is higher than that of ordinary people. The economic improvement is directly proportional to increases in income and natural resources

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INTRODUCTION

Population growth has long been considered an environmental issue, leading to a higher demand for natural resources, threatening people with an environmental scarcity, and unbalancing natural resources. The concern gets further complicated due to people's lack of knowledge about this environmental issue (Danish & SU-Din, 2019).

Wackernagel and Rees (1996) developed a powerful tool to access human carrying capacity in 1992. They inverted the standard carrying capacity ratio and extended the concept of this ecological footprint, hence, this tool could be used to measure how much "nature" is available for specific populations and how much natural resources are consumed by the population based on their lifestyle, income, and technology. They defined that ecological footprint is inversely related to the attempts to measure human carrying capacity in terms of waste and natural resource consumption. Ecological footprint became one of the indicators to measure sustainable

development due to its ability to measure human impact on the biosphere (Wackernagel, 1994). Hence, the ecological footprint analysis is a successful indicator of ecological overshoot in measuring human consumption of natural resources and has been widely used in sustainability analyses (Venetoulis & Talberth, 2007).

Moran et al. (2008) found a way to measure the sustainable development of nations using the ecological footprint analysis. However, the development of a nation enlarges its ecological footprint, and only a few low-income countries successfully develop without enlarging their ecological footprint score. Nonetheless, high-income countries have exhibited the opposite trend. According to studies, economic development pushes industrialization, thus, increasing natural resource extractions (Ahmed et al., 2022; Collins et al., 2017; Danish & SU-Din, 2019; Lin et al., 2018; Majeed & Mazhar, 2019; Nathaniel et al., 2020; Usman et al., 2022; Wiedmann & Barrett, 2010). Large amounts of natural resource consumption, through agriculture, industrialization, deforestation, and mining, can adversely affect the environment, leading to a larger ecological footprint. These findings are supported by Jorgenson & Clark (2011) and prove that "urbanized nations are more consumptive based on their environmental impacts" and lead to a larger ecological footprint of a country (Figge et al., 2016). To work with the ecological footprint tool, six fundamental assumptions from Wackernagel et al. (2002) should be understood.

The ecological footprint represents the area required for resource production and waste assimilation. The area unit in ecological footprint is defined as "global hectare" (gha), and the biocapacity is divided into five usage categories – grazing land, cultivated land, forest, fishing areas, and built-up land. Most countries run a biocapacity deficit because nature cannot meet the demands born of human over-consumption, which automatically leads to scarcity. However, some countries, usually found in the tropics and boreal latitudes, still have abundant natural resources. Indonesia is one of the countries facing a natural resource deficiency. The footprint in Indonesia is more significant than the biocapacity, indicating that Indonesians are over-consuming natural resources (Network, 2018).

Education plays an essential role in the development of a country. If a country does not have proper education, it will be left behind by other countries that support education. To eliminate poverty, famine, or environmental energy problems, the solutions will always include education. Education is critical in environment conservation to provide learners with the opportunity to gain awareness and sensitivity toward the environment, knowledge, and experience in facing environmental problems. These will bring a positive attitude toward the environment, the skills required to identify and solve environmental problems, and the motivation and ability to participate (Jacobson et al., 2006). However, several studies say that gender difference impacts environmental concerns and behaviors and state that females tend to be more environmentally concerned than males (Hunter et al., 2004; Kawgan-Kagan, 2020; Lee, 2009). However, it is difficult to determine if females have better education than males. Several factors affect the education system of a country, such as culture, technology, and economic matters.

Solo City, Indonesia, located in Central Java, is known for its culture, art, and healthy manner of society. It is on its way to developing an "Eco-Cultural City," followed by four components – tangible cultural heritage, self-sufficient local economies, good quality public spaces enhanced by a clean environment, and adequate infrastructure (Kota Kita, 2019). However, it is unclear whether Solo is aware of the environmental changes and how they balance economic and environmental status. This study examined whether the education level relates to natural resource usage.

RESEARCH METHOD

Solo, or Surakarta City in Central Java Province, Indonesia, has a population of around 550,000 people (Indonesia Access, 2018). Solo was chosen as the study location to collect data by surveying the respondents as it has a fascinating culture toward the environment.

To gather data on the ecological footprint of the respondents, a questionnaire based on the "Ecological Footprint Test" was distributed among the participants. This survey aimed to assess and quantify their ecological footprints, providing insights into their environmental impact, based on various lifestyle factors and consumption patterns.

This study uses the descriptive approach, an effective method for collecting and analyzing data. Surveys and interviews involved personal interaction between the researcher and the participants to collect

the necessary information. The researcher used a descriptive sampling method. All close-ended questions were asked to define respondents' characteristics. The sample size was 152 respondents. Purposive sampling was used to find out how the ecological footprint is viewed from the perspective of students, academics, and ordinary people. The number of people per group is based on a minimum sample of 30, hence, the more samples, the better it can describe the actual situation (Sugiyono, 2016). The participants were chosen using a direct selection method according to three layers or strata.

This study involved a diverse group of participants, with 50 respondents being students. These individuals were selected from colleges, representing various academic disciplines. By including students, the study aimed to capture insights into the ecological footprints of the younger generation, shedding light on their lifestyle choices and behaviors and their contribution to the environment.

Another subset of respondents comprised 52 academicians from scientific fields. This group included teachers, lecturers, and researchers who are actively engaged in academic pursuits. The inclusion of academicians examined the ecological footprints of individuals with a strong academic background, exploring how their professional activities and knowledge in scientific areas influence their environmental behaviors.

This study incorporated the perspectives of 50 ordinary people, representing various occupations, such as vendors, drivers, farmers, and workers. This diverse group of respondents from different walks of life provided valuable insights into the ecological footprints of individuals who may not have a direct connection to academia. Understanding the environmental impact of ordinary people was crucial for obtaining a comprehensive view of the broader community and the varied factors influencing ecological footprints across different societal roles.

Data and Variable

The questionnaire was translated to Bahasa Indonesia for better understanding. The questionnaire was divided into four sections.

It investigates phenomena, such as the ecological consequences of dietary habits, emphasizing the role of meat consumption and the ecological benefits associated with plant-based diets. The socio-ecological viewpoint scrutinizes how food choices intertwine with broader societal patterns, influencing individual well-being and the overall ecological health of the communities.

This study delves into phenomena associated with housing, exploring the ecological implications of different materials, energy-efficient technologies, and sustainable architectural trends. This examination extends beyond the environmental impact, considering the socio-economic dimensions of housing choices, community planning, and their collective influence on the ecological footprint of individuals and societies.

This study investigates phenomena related to commuting habits, examining the carbon footprint associated with various transportation modes. It sheds light on the adoption of sustainable alternatives, such as electric vehicles, and scrutinizes the socio-ecological dimensions of public transportation systems. The discussion emphasizes the interconnectedness of accessibility, affordability, and social equity in shaping transportation choices and their subsequent impact on ecological footprints.

It explores varied phenomena, ranging from the environmental consequences of consumer behavior to the nuanced connections between mental well-being and sustainable lifestyles. This study investigates the role of conscious consumerism in mitigating ecological footprints and highlights how lifestyle choices intersect with cultural, economic, and social dimensions. Through this holistic perspective, the article seeks to uncover the intricate ways in which individual lifestyle choices contribute to the broader socio-ecological fabric and presents valuable insights into the intricate relationships between individual choices and the broader well-being of both the environment and society.

Data Analysis

The data were analyzed using the qualitative analysis method by using the descriptive method to explain the data of ecological footprint score and the quantitative analysis method by using multiple regression linear methods to estimate the significant relationship between the dependent and independent variables (Wooldridge, 2013).

Regression analysis was chosen to understand the dependence of one variable on one or more variables. With those variables, this study could estimate and predict the (population) mean or average value of the former in terms of the knowledge or fixed (in repeated

sampling) values of the latter. The best linear unbiased estimator (BLUE) should be understood. The variable average or expected value should be equal to the actual value. An unbiased estimator with a minor variance is known as an efficient estimator (Gujarati, 2003). The following test became a part of the analysis.

The scoring guide (Table 1) is provided with the questionnaire. This ecological footprint (EF) test is available on the internet (www.footprint.wwf.org.uk). It is divided into four sections, depending on the question classification. Each choice in the questionnaire has corresponding points.

Table 1. Scoring Guide

Section	Questions	Score
Diet and Food Choices	#1 to 5	A = 1 Point
		B = 2 Points
		C = 3 Points
		D = 4 Points
		E = 5 Points
Shelter/Home Life	#6 to 8	A = 1 Point
		B = 2 Points
		C = 3 Points
		D = 4 Points
		E = 5 Points
	#9 to 10	A = 1 point
		B = 5 Points
Transportation	#11 to 15	A = 1 Point
		B = 2 Points
		C = 3 Points
		D = 4 Points
		E = 5 Points
Lifestyle Choices	#16 to 17	A = 1 point
		B = 5 Points
	#18 to 20	A = 1 point
		B = 3 Points
		C = 5 Points

This study manually calculated the total points following the score guide. The score was divided into three ranges, each describing how the respondents behaved toward the environment based on their total points. The lower the score, the more ecologically friendly they are. The higher the score, the less eco-friendly and less sustainable the lifestyle.

The analysis of the collected data involved the utilization of the PAST software. This software enabled the examination of trends and patterns within each respondent group. By employing statistical tools and algorithms, PAST facilitated a comprehensive exploration of the ecological footprints of each respondent group, allowing for a nuanced understanding of their environmental behaviors.

For further insights and a detailed data examination, STATA software was employed. STATA, a powerful statistical software, was utilized to describe the data by comparing different respondent groups. The goal was to identify any statistically significant differences in the ecological footprint scores among these groups. This rigorous analysis unveiled patterns or correlations for a deeper understanding of the factors influencing ecological footprints within the surveyed population.

RESULT AND DISCUSSION

Characteristics of Respondents

From the total sample, 52.7% of the respondents were females and 47.2% were males (Table 2). The high percentage of females may be attributed to the fact that women are involved in ecological footprint in more areas than men, such as diet and food choices, home life, transportation, and lifestyle choices. Regarding age, 66.4% of the respondents were 21–40 years old, followed by 41–60 years old (22.3%), and below 20 years old (6.5%).

Table 2. Characteristics of Respondents

Item	Frequency	Proportion
	people	%
Age		
≤ 20 years	10	6.5
21 – 40 years	101	66.4
41 – 60 years	34	22.3
61 – 80 years	7	4,8
Education level		
Diploma	44	28.9
Bachelor's Degree	56	36.8
Master Degree	27	17.7
Doctoral Degree	25	16.6
Average (years)	15.9	
Sex		
Male	72	47.3
Female	80	52.7
Status		
Student	50	32.8
Academics	52	34.4
Ordinary people	50	32.8

The other categories were the least represented (4.8%). This implies that the respondents did not have an awareness of ecological footprint. About 36.8% of the respondents were at the bachelor's degree level, followed by a diploma (28.9%), master's degree (17.7%), and doctoral degree (16.6%).

Furthermore, 34.4% of respondents were from academics, and 32.8% were students and ordinary people. Hence, the respondents had basic knowledge of environmental issues.

The minimum ecological footprint score was 38 and the maximum score was 82 (Table 3). The age range was from 18–70 years. The shortest education duration was 12 years and the longest was 21 years of education. It calculated the mean of the data and the standard deviation and successfully compared each category. All the data was positively significant.

Table 3. Statistics Data

Variable	Mean	Standard Deviation	Min	Max
Ecologycal Footprint Score	55.1513	7.7943	38	82
Age	31.5263	12.2544	18	70
Education	15.9144	3.0097	12	21

Ecological Footprint Score

Each respondent had a different score based on their occupation status and their answers to the questionnaire. Through these scores, the researcher was able to determine whether the respondent was eco-friendly or not. The lower the score, the more eco-friendly the respondent. Furthermore, the score was divided into three ranges (20–44, 45–75, and 76–100), and each range had a score description.

Respondents scoring between 20 and 44 demonstrated commendable environment-conscious behavior. They exhibited a careful and considerate approach to resource utilization, essentially "tip-toeing on earth in bare feet." Their ability to use natural resources wisely suggested a heightened awareness of ecological sustainability and a commitment to minimizing their environmental impact. Individuals scoring between 45 and 75 were progressing toward becoming eco-friendly, global citizens. They showed positive inclinations toward adopting sustainable practices and reducing their ecological footprint. The scores indicated a growing awareness and effort to align their lifestyles with environmentally responsible choices. Respondents scoring between 76 and 100 were categorized as "destroyers." They demonstrated a concerning trend of using natural resources with a disregard for their finite nature. The categorization – "destroyers" – signifies the need for heightened awareness and a shift toward more sustainable practices to mitigate their impact on the environment. Understanding their behavior is crucial for implementing targeted interventions aimed at promoting sustainable and responsible resource consumption.

Table 4 shows that there were five males and seven females in the 20–44 score range, and were eco-friendly citizens. Most others were in the middle range. However, there were only two females in the 76–100 score range, and need to change their behavior toward the environment. The differences between both genders are almost the same.

Table 4. Ecological Footprint Score based on the Sex

Sex	Ecological Footprint Score		
	20-44	45-75	76-100
Male (72)	5	67	0
Female (80)	7	71	2
Total (152)	12	138	2

This study categorized the data based on the education of the respondents (Table 5). Approximately 36.84% of the survey data was dominated by bachelor's degrees and six were in the 20–44 score range, indicating that they were eco-friendly. However, the two "destroyers" had higher education levels.

Table 5. Ecological Footprint Score Based on the Education

Education	Ecological Footprint Score		
	20-44	45-75	76-100
Diploma (44)	4	40	0
Bachelor's Degree (56)	6	50	0
Master Degree (27)	1	25	1
Doctoral Degree (25)	1	23	1
Total (152)	12	138	2

Table 6. Ecological Footprint Based on the Status of Occupation

Status of Occupation	Ecological Footprint Score		
	20-44	45-74	75-100
Students (50)	3	47	0
Academicians (52)	2	48	2
Ordinary People (50)	7	43	0
Total (152)	12	138	2

Table 6 compares the total points of the respondents from different groups based on their status of occupation. A total of 90.78% of people were in the 45–74 score range, hence, they were on their way to being eco-friendly, global citizens. However, 12

people were eco-friendly global citizens, and only two respondents, both academicians, were classified as "destroyers."

The results based on sex and education are presented in Figures 1 and 2. An interesting trend emerged in the Figure 1 graph based on gender. The data revealed that males were closer to the 45–75 range. This suggests that, on average, men exhibit behaviors of becoming more eco-friendly, global citizens. Understanding gender-specific patterns in ecological footprints can contribute to targeted strategies for environmental education and awareness campaigns. In contrast, the ecological footprint of females showed a different pattern. Women aligned more closely with the 20–44 range and were notably distant from the 76–100 range. However, both genders demonstrated a similar inclination toward the 45–75 range. This shared tendency highlights a common ground where efforts for promoting eco-friendly behaviors can be effectively directed, bridging the gender gap in ecological footprint ranges. A notable observation across both genders is that they are collectively distant from the 76–100 range. This uniformity suggests a shared awareness and avoidance of environmentally destructive behaviors. Recognizing this commonality provides an opportunity for targeted interventions and educational initiatives to emphasize sustainable practices and encourage the avoidance of resource-depleting behaviors.

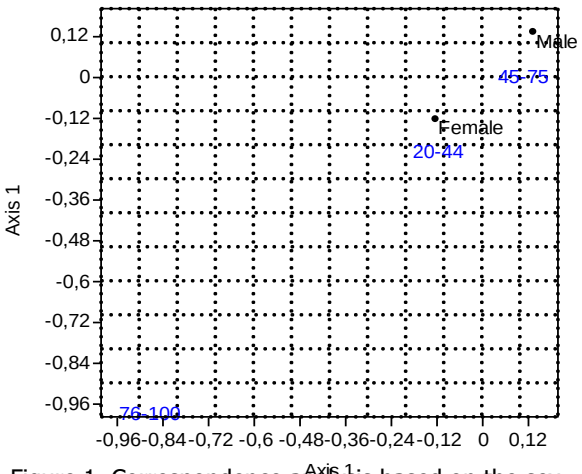

Figure 1. Correspondence analysis based on the sex

Figure 2 provides valuable insights into the relationship between education levels and ecological footprint tendencies. Notably, individuals with a diploma degree exhibited a tendency closer to the 20–44 range. This suggests that, on average, individuals with a diploma degree displayed behaviors aligned with an environmentally conscious lifestyle, showcasing a heightened awareness of resource utilization. Examining the ecological footprint tendencies based on education levels, those with a bachelor's degree displayed a unique pattern. They fell between the 20–44 and 45–75 ranges, placing them in the middle ground. This indicates a balanced approach where individuals with a bachelor's degree are progressing toward eco-friendly behaviors without fully reaching the higher ecological footprint range.

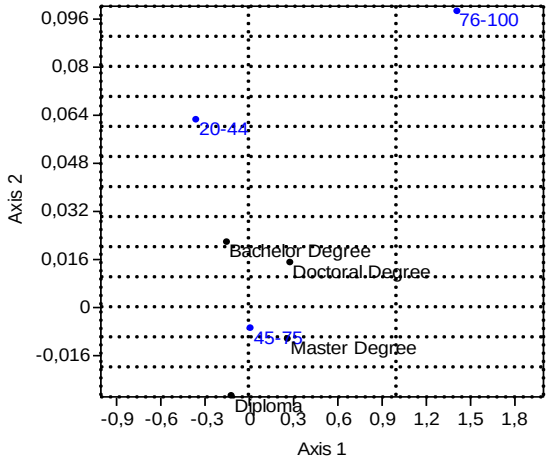

Figure 2. Correspondence analysis based on the education

The analysis further revealed intriguing trends among individuals with higher academic qualifications. Those with a master's and doctoral degree displayed tendencies closer to the 45–75 range. In addition, these groups were closer to the 76–100 range as compared to other educational categories. This suggests that individuals with advanced degrees may need targeted interventions to reinforce sustainable practices and mitigate the potential for higher ecological footprints. Understanding these educational dynamics can inform tailored strategies for environmental education and awareness campaigns.

Figure 3 presents the correspondence analysis based on the status of occupation. The PAST software was used to determine the tendencies of each respondent category. Upon analyzing the results, distinct ecological footprint tendencies emerged among different respondent categories. Notably, the ecological footprint tendency of students was identified as closer to the 45–75 range. This indicates

that students, on average, exhibit behaviors that align more closely with becoming eco-friendly, global citizens. Moreover, their tendencies were notably distant from both the 20–44 and 76–100 ranges.

In contrast, the ecological footprint tendencies of ordinary people were closer to the 20–44 range compared to academicians. Both categories, however, positioned themselves in the middle ground, between 20–44 and 45–75. This suggests that, on average, ordinary people demonstrate a more eco-friendly behavior compared to academicians.

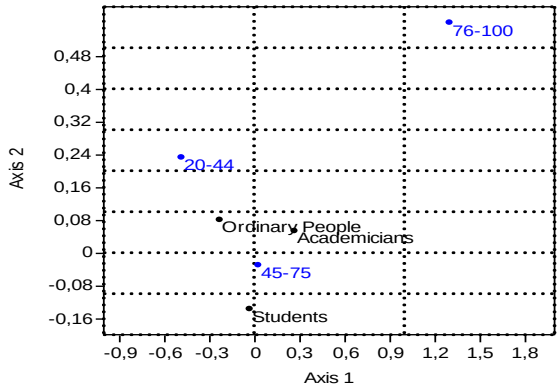

Figure 3. Correspondence analysis based on the status of occupation

Analyzing the ecological footprint tendencies of academicians revealed a unique pattern. Their tendencies were closer to the 45–75 range; however, they exhibited proximity to the 20–44 range as well. Despite being far from the 76–100 range, academicians were one step closer to the higher ranges than the other categories. This implies that targeted efforts may be needed to address and mitigate potential higher ecological footprints among academicians, even though all the categories were collectively distant from the 76–100 range. Understanding these distinctions is crucial for tailoring interventions to specific respondent categories and fostering broader adoption of eco-friendly practices.

The respondents showed scattered results. The hypothesis that education affects the ecological footprint score of each respondent was not completely supported by the results. Education does affect ecological footprint scores since academicians did not reach the 76–100 range; however, the result of the academicians was higher than the other categories and two academicians reached the 76–100 range. This indicates that the higher education level would automatically increase academicians' standard of living and lead to a higher ecological footprint on the environment.

Table 7 indicates that the estimated education parameter is positively significant to the ecological footprint score at a 99% confidence level. While the variables of age and sex did not significantly affect the ecological footprint score, higher education leads to an increased score. This result is consistent with the result from PAST software, which indicates that the higher the education level, the higher the consumption of natural resources.

Table 7. Factors that Affect Ecological Footprint Score

Variable	Coefficient	Standard Error	t-value
Age	-0.0617	0.0550	-1.12
Education	0.8789	0.2414	3.64***
Sex	-0.4902	1.3272	-0.37
Constant`	43.341	3.7733	11.49
F-stat	5.91***		
R-squared	0.107		
Number of obs	152		

*** denotes significant level at 0.01

Thus, we may conclude that the variables of age and sex do not influence the ecological footprint scores. This means that young and older adults, irrespective of sex, have the same behavior toward the environment, which is distinguished by their standard of living. This finding is in contrast with previous research findings that men have higher carbon emissions because men drive more than women, which leads to a higher ecological footprint (Medina & Toledo-Bruno, 2016), and women are more social compared to men, thus, more socially responsible and more concerned about the environmental (Zelezny et al., 2000).

This study hypothesized that education aligns with the use of natural resources. Several people assume that education does not correlate with the ecological footprint. According to Jacobson et al. (2006), education is important in environment conservation to provide learners with the opportunity to gain awareness or sensitivity, knowledge, and experience of facing environmental problems. Furthermore, it brings a positive attitude toward the environment, the skills required to identify and solve environmental problems, and the motivation and ability to participate. However, the analyzed data demonstrates that education is the only one that has a significant

role in human's ecological footprint. Furthermore, some believe that men are worse than women in treating the environment, whereas the data shows that both are the same regarding the use of natural resources.

Research Implication

As education is not the main factor, but rather the variables related to it, such as income and occupation, based on the study result, academicians have higher education levels, leading to higher income and standard of living. Hence, academicians can easily access natural resources (Danish & SU-Din, 2019; Jacobson et al., 2006; Dogan & Taspinar, 2019). The financial sector has the potential to support global efforts toward environmental protection (Majeed & Mazhar, 2019).

The culture in Solo or the culture of people in Java plays an essential role in environmental behavior, their dress, and their food. Hence, the "students" group does not reach the highest range, indicating a good attitude toward the environment.

Human consumption patterns will increase along with economic growth. This consumption pattern is influenced by the desire to fulfill basic human needs. There is an increase in consuming various types. Excessive demand will have an impact on environmental imbalance. This is because increasing consumption behavior will also increase activity production of various types of needs. This study conducted in Solo City and used ecological footprints to analyze natural resource consumption and waste decomposition. Carbon Footprint is the amount of carbon or greenhouse gases produced from various human activities over a certain period of time.

Education is the main factor that contributes to the condition and quality of the living environment. Good knowledge causes good attitudes and participation towards the environment. The results also confirm that the higher education of people lead the higher their level of knowledge about the environment, so that concern for the quality of the environment and motivation to participate in responsible environmental behavior will also be higher. Therefore, the research results provide the implication that the government needs to improve the level of public education and implement an environmental education curriculum from early childhood education. It is hoped that environmental education and awareness, which can ultimately change lifestyles, can be a solution in reducing carbon footprints. So that people will implement behaviors as an effort to reduce their carbon footprint, such as reducing consumption of animal products, not wasting food and having a zero waste spirit, traveling by foot or bicycle if possible using public transportation, reducing wasteful energy usage habits, planting trees and others. In addition, the people can also be educated and given socialization on calculating the carbon footprint resulting from daily activities through a carbon footprint calculator which can be accessed via the internet. By knowing the carbon footprint produced every day, people can become wiser and more motivated to reduce their carbon footprint.

Reducing the carbon footprint in people's daily lives is a shared responsibility as Indonesians. Moreover, with the existence of Pancasila values, Indonesian people must strengthen efforts to protect and protect the environment so that a sustainable heritage is maintained for future generations. Through these concrete actions, especially with the spirit of mutual cooperation that exists in the lives of Indonesian people, we can further increase efforts to protect the earth and achieve sustainable development in Indonesia.

CONCLUSION AND SUGGESTION

Most people in Solo are eco-friendly, as evidenced by their ecological footprint score. This indicates that the people in Solo know how to treat the environment. The biocapacity in Indonesia is decreasing dramatically, which, according to "The Ecological and Biocapacity of Central Java," is the only component still in "reserve" in the forest. Thus, society should be aware of this condition, especially in Solo. The determinant that influences the ecological footprint of the people of Solo is education, whereas age and gender do not have a significant effect. The higher the education, the higher the ecological footprint score of the Solo people. This is indirectly related to mobility and the goal of earning more income for those with higher education. Hence, they have a higher consumption of natural resources than ordinary people.

The results imply that an increase in the economy is directly proportional to an increase in income and natural resources. Economic development drives natural resource exploitation. From an economic perspective, this will increase GDP by increasing

people's income. However, it will damage the earth, if done continuously. Ecological footprint awareness remains minimal, even at the academic level. Several things can be done to reduce ecological footprint and increase awareness. Increasing literacy about ecological footprint through campaigns, seminars, advertisements, and an environment-friendly lifestyle with renewable resources can increase the importance of conservation. With rising income, a higher budget should be allocated to innovations in renewable energy projects.

Income, coupled with strict environmental measures, can control pollution and ensure sustainable use of natural resources. The policymakers should increase the literature on ecological footprint and renewable energy as a choice from natural resources. The goal of renewable energy is to manage natural resources efficiently and control their urbanization pattern and current implications to establish a sustainable future. Hence, people and policymakers should contribute to better sustainability for future generations. For further research, it is recommended to conduct another survey to measure awareness progression, and whether people's perspectives have changed (for better or worse) over time. Further research can also be expanded to a national scale and more detailed observational indicators. So we can also find out how the comparison between people living on Java Island and outside Java Island is.

REFERENCES

Ahmed, Z., Hussain, N., Ahmad, M., Rjoub, H., & Kalugina, O. A. (2022). Economic growth, renewable energy consumption, and ecological footprint : Exploring the role of environmental regulations and democracy in sustainable development. Sustainable Development, 30(4), 595–605. https://doi.org/10.1002/sd.2251

Collins, A., Cooper, C., & Collins, A. (2017). Measuring and managing the environmental impact of festivals : the contribution of the Ecological Footprint. Journal of Sustainable Tourism, 25(1), 148–162. https://doi.org/10.1080/09669582.2016.1189922

Danish, U. R., & SU-Din, K. (2019). Determinants of the ecological footprint: Role of renewable energy, natural resources, and urbanization. Sustainable Cities and Society, 101996. https://doi.org/10.1016/j.scs.2019.101996

Dogan, E., & Taspinar, N. (2019). Determinants of ecological footprint in MINT countries. Energy and Environment, 0(0), 1–22. https://doi.org/10.1177/0958305X19834279

Figge, L., Oebels, K., & Offermans, A. (2016). The effects of globalization on Ecological Footprints: an empirical analysis. Environment, Development and Sustainability, (3), 863–876. https://doi.org/10.1007/s10668-016-9769-8

Gujarati. (2003). Basic Econometrics (4th ed.). New York: McGraw-Hill Book Company.

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-national gender variation in environmental behaviors. Social Science Quarterly, 3, 677–694. https://doi.org/10.1111/j.0038-4941.2004.00239

Indonesia Access. (2018). Solo.

Jacobson, S. K., McDuff, M. D., & Monroe, M. C. (2006). Conservation Education and Outreach Techniques. Oxford University Press. https://doi.org/ 10.1093/acprof:oso/9780198567714.001.0001

Jorgenson, A. K., & Clark, B. (2011). Societies consuming nature: A panel study of the ecological footprints of nations, 1960–2003. Social Science Research, 1, 226–244. https://doi.org/ 10.1016/j.ssresearch.2010.09.004

Kawgan-Kagan, I. (2020). Are women greener than men? A preference analysis of women and men from major German cities over sustainable urban mobility. Transportation Research Interdisciplinary Perspectives, 100236. https://doi.org/https://doi.org/10.1016/j.trip.2020.100236

Kota Kita. (2019). Solo City Vision Profile. Retrieved from https://kotakita.org

Lee, K. (2009). Gender differences in Hong Kong adolescent consumers' green purchasing behavior. Journal of Consumer Marketing, 2, 87–96. https://doi.org/10.1108/07363760910940456

Lin, D., Hanscom, L., Murthy, A., Galli, A., Evans, M., Neill, E., … Huang, S. (2018). Ecological footprint accounting for countries : Updates and results of the national footprint. Resources, 7(58), 1–22. https://doi.org/10.3390/resources7030058

Majeed, M. T., & Mazhar, M. (2019). Financial development and ecological footprint : A global panel data analysis A Global Panel Data Analysis. Pakistan Journal of Commerce and Social Sciences (PJCSS), 13(2), 487–514.

Medina, M. A. P., & Toledo-Bruno, A. G. (2016). Ecological footprint of university students: Does

gender matter? Global Journal of Environmental Science and Management, 4. https://doi.org/10.22034/gjesm.2016.02.04.003

Moran, D. D., Wackernagel, M., Kitzes, J. A., Goldfinger, S. H., & Boutaud, A. (2008). Measuring sustainable development — Nation by nation. Ecological Economics, 3, 470–474. https://doi.org/10.1016/j.ecolecon.2007.08.017

Nathaniel, S. P., Adeleye, N., & Adedoyin, F. F. (2020). Natural resource abundance, renewable energy, and ecological footprint linkage in mena countries. Studies of Applied Economics, 39, 1–31.

Network, G. F. (2018). Ecological Deficit dan Reserves. Retrieved from https://data.footprintnetwork.org

Sugiyono. (2016). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: PT.Alfabet.

Usman, M., Jahanger, A., Sohail, M., Makhdum, A., Radulescu, M., Balsalobre-lorente, D., & Jianu, E. (2022). An empirical investigation of ecological footprint using direct investment. Energies, 15(6442), 1–26.

Venetoulis, J., & Talberth, J. (2007). Refining the ecological footprint. Environment, Development and Sustainability, 4, 441–469. https://doi.org/10.1007/s10668-006-9074-z

Wackernagel, M., & Rees, W. E. (1996). Our Ecological Footprint: Reducing human impact on the earth. Gabriola Island, BC; Philadelphia, PA: New Society Publishers.

Wackernagel, M. (1994). Ecological footprint and appropriated carrying capacity : a tool for planning toward sustainability (T). University of British Columbia. Retrieved from https://open.library.ubc.ca/collections/ubctheses/831/items/1.0088048

Wackernagel, M., Schulz, N. B., Deumling, D., Linares, A. C., Jenkins, M., Kapos, V., & Randers, J. (2002). Tracking the ecological overshoot of the human economy. Proceedings of the National Academy of Sciences, 9266–9271. https://doi.org/10.1073/pnas.142033699

Wiedmann, T., & Barrett, J. (2010). A review of the ecological footprint indicator—Perceptions and methods. Sustainability (Switzerland), 2, 1645–1693. https://doi.org/10.3390/su2061645

Wooldridge, J. (2013). Introductory Econometrics: A Modern Approach. Fifth Edition (5th editio). Michigan, USA: Michigan State University.

Zelezny, L. C., Chua, P.-P., & Aldrich, C. (2000). New ways of thinking about environmentalism: elaborating on gender differences in environmentalism. Journal of Social Issues, 3, 443–457. https://doi.org/10.1111/0022-4537.00177