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LIFE ON LAND: ROLE OF FORESTS IN SUSTAINABLE DEVELOPMENT

Vidyashri Teli[1], Dr. Manoj M. Dolli[2]
[1]*Research Scholar, Department of Economics, Karnataka University, Dharwad. Karnataka State.*
[2]*Professor, Department of Economics, Karnataka University, Dharwad Karnataka State.*

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ABSTRACT----------
Forests play a crucial role in sustainable development by simultaneously supporting ecological integrity and economic growth. They are vital for biodiversity conservation, carbon sequestration, and soil stabilisation, and they also provide ecosystem services that regulate water and moderate the climate. In addition to their environmental benefits, forests are an economic powerhouse, supplying raw materials for industries such as timber, paper, construction, and pharmaceuticals. These resources not only drive direct revenue but also support ancillary sectors, such as ecotourism, which generate employment and contribute to rural development.
Economic analysis of forests involves assessing both market and non-market values. Market values arise from direct activities such as timber extraction and agroforestry, directly influencing GDP growth. Non-market values, including ecosystem services, contribute indirectly by reducing costs associated with environmental degradation and disaster recovery. Recent studies have used regression analysis to quantify the relationship between forest area and GDP growth, highlighting how sustainable management practices can yield positive economic outcomes. Autocorrelation analysis further examines the temporal dynamics of this relationship, suggesting that current policies may have lasting impacts on both forest conservation and economic performance.
However, the pressures of deforestation driven by urban expansion and agricultural development pose significant challenges. The loss of forest cover undermines both ecological resilience and economic potential. Integrating sustainable forest management practices such as selective logging, agroforestry, and reforestation into policy frameworks is therefore essential for achieving a balanced approach that fosters long-term economic prosperity while safeguarding the environment.
KEYWORDS: *Economic Perspective, Forest Cover, Balancing Economic Growth, Climate Change, GDP Growth.----------*

INTRODUCTION

In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development, which set out 17 Sustainable Development Goals (SDGs). While SDG 14, "Life Below Water," seeks to safeguard marine environments, SDG 15, "Life on Land," is concerned with the preservation, restoration, and sustainable management of terrestrial ecosystems, including forests. Forest data are closely related to several targets, including 14.2.1, 14.5.2, 15.1.1, 15.1.2, 15.2.1, 15.2.3, 15.3.2, and 15.4.1. The forestry industry is also directly related to SDGs 1 (No Poverty), 2 (Zero Hunger), 3 (Good Health and Well-Being), 6 (Clean Water and Sanitation), and 13 (Climate Action).

Reaching Sustainable Development Goal (SDG) 15 and resolving the current climate crisis: Life on land UN property depends on a sustainable forest. Forests are essential for managing the carbon cycle, preserving biodiversity, and preserving environmental equilibrium. By serving as natural carbon sinks, controlling water cycles, preventing soil erosion, and offering habitat for innumerable species, they lessen the effects of global warming.

However, there are serious risks to human health and the environment from forest destruction. Deforestation and habitat degradation accelerate climate change, reduce biodiversity, and raise the danger of zoonotic illnesses. Rapid GDP growth and urbanization typically not only promote economic growth but also exacerbate environmental degradation and deforestation by allowing industry, infrastructure, and agriculture to grow.

LITERATURE REVIEW

Between 1990 and 2015, there was a 3.16 percent decrease in the amount of forest cover worldwide due to deforestation, or the conversion of wooded regions into non-forested land. Even though India's forest cover

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increased by only 1%, shifting agriculture, rotational felling, and development projects caused losses in many locations (Kumari et al., 2019). adds to the global discussion on forestry and provides a conceptual foundation for sustainable forest development. Although the proposed framework and goals are generally applicable to forests worldwide, implementing sustainable practices requires region-specific silvicultural techniques that are tailored to local ecological and socioeconomic constraints (Maini et al.,1992). Because of their capacity to take in carbon dioxide and expel oxygen, forests are referred to as the "lungs of the Earth" and are essential for controlling the climate and greenhouse gases (Rajasugunasekar et al.,2023). Promote ecosystem conservation, and sustainable forest management, combat desertification, restore degraded land, and protect biodiversity (SDG India Index 2024).

OBJECTIVES

- To examine how forests contribute to sustainable development
- To evaluate how forest degradation is impacted by GDP growth

HYPOTHESIS

H_0: There is no correlation between forest cover area and GDP growth.

METHODOLOGY

Information Collection

Reputable sources, such as government documents, statistical databases, and academic publications, provided the secondary data used in this investigation. The statistic displays India's forest cover data by annual (in km2) and GDP growth rate data, annual ($ in billion), from 1987 to 2023.

Data Analysis

A correlation study was conducted to examine the relationship between GDP growth and forest degradation. The correlation coefficient was used to evaluate the strength and direction of the relationship (r). Additionally, a linear regression model was employed to quantify the impact of changes in forest cover on GDP growth using the following equation.

GDPB^=β0+β1 ·FR+e 0β0 = Intercept 1β1 = Slope Coefficient

Statistics Tests

The correlation coefficient determines how strongly GDP growth and forest cover were related (r).
The p-value was used to assess the statistical significance of the link.

The Adjusted R-squared value is used to measure the model's goodness-of-fit, or how well the forest cover explains changes in GDP growth. By employing the Durbin-Watson (DW) statistic to identify autocorrelation in the residuals, the model's validity was confirmed.

See, in particular, the analysis of India's forest area and GDP growth.

The nation's forest cover is divided into three categories: open forest, moderately dense forest, and very dense forest.

Table 1: Total Forest and GDP Growth Rate by Year in India

Year	Area in km^2	Difference or Annual change(km^2)	India's Total forest %	GDP Growth Rate %
1987	640819	_	19.49%	3.97%
1989	638804	-2015	19.43%	5.95%
1991	639364	-560	19.45%	1.06%
1993	639386	+22	19.46%	4.75%
1995	638879	-507	19.43%	7.57%
1997	633397	-5482	19.27%	4.05%
1999	637293	+3896	19.39%	8.85%
2001	675538	+38245	20.55%	4.82%
2003	678333	+2795	20.64%	7.86%
2005	677088	-1245	20.60%	7.92%
2007	690899	+13811	21.02%	7.66%

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2009	692394	+1495	21.05%	7.86%
2011	692027	-367	21.00%	5.24%
2013	697898	+5871	21.23%	6.39%
2015	701673	+3775	21.34%	8.00%
2017	708273	+6600	21.54%	6.80%
2019	712249	+3976	21.67%	3.87%
2021	713789	+1540	21.71%	9.69%
2023	827356.95	+113567.95	25.17%	7.58%

Data Source: India State of Forest Report and World Bank
The data from 1987 to 2023 in the table above displays the annual forest area and GDP Growth. Negative Correlation in the Early Years: India's GDP grew moderately to significantly between 1987 and 1997 (3.97 to 7.57 percent), yet the country's forest cover decreased by about 7,422 km². Positive Correlation After 2000: Both GDP and forest cover had significant increases starting in 1999. Despite a modest GDP growth rate in 2001, the amount of forest cover grew by 38,245 km² (4.82 percent). Recent Trends (2021-2023): In 2023, forest cover increased by an astounding 113,567.95 km2, which corresponded to a GDP growth rate of 7.58 percent.

RESULT DISCUSSION

^GDPB = -1.27e+04 + 0.0206*FR
(2.13e+03) (0.00309)
GDPB represents the predicted GDP growth.
FR stands for the forest cover (in km²).
The values in parentheses (2,130 for the intercept and 0.00309 for the slope) indicate the standard errors.
The intercept (-12,700) suggests that if forest cover were hypothetically zero, the GDP growth would be extremely negative, though this is not a realistic scenario.

The slope coefficient (0.0206) indicates that for every 1 km² increase in forest cover, GDP growth is predicted to rise by 0.0206 units. This demonstrates a positive relationship between forest cover and GDP growth.

Statistical Analysis
The correlation coefficient (r) is 0.747, representing a strong positive association between forest cover and GDP growth.

The p-value is < 7.55, indicating that the relationship is statistically significant at conventional significance levels. The Adjusted R-squared value of 0.73 suggests that approximately 73% of the variation in GDP growth can be explained by forest cover, implying a good model fit.

Autocorrelation Test
The Durbin-Watson (DW) statistic is 1.03**,** indicating positive autocorrelation in the residuals. This suggests that successive errors in the model are correlated, which is common in time series data.

Model misspecification or the requirement for extra explanatory variables may be indicated by positive autocorrelation. The model is a normal distribution. The model is a strong match for describing the relationship between GDP growth and forest cover because the adjusted R-squared value is fairly high and the relationship is statistically significant. However, additional alterations or model improvements might be required as a result of the positive autocorrelation. Given the importance of the findings, the null hypothesis is disproved, confirming that there is a substantial positive correlation between GDP growth and forest cover.

Table 2: Sort by Rank. The continent's largest forest nations
Approximately 4.06 billion hectares, or 31% of the Earth's land area, are covered by forests worldwide. There are notable differences in the distribution of forest land between nations and continents. The nations with the biggest forest acreage and their corresponding percentages of forest cover are rated below.

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Top 10 Countries with the Biggest Forests (by absolute forest area)

Rank	Country	Continent	Forest Area (Million ha)	% of Land Covered by Forest
1	Russia	Europe/Asia	815	49%
2	Brazil	South America	495	59%
3	Canada	North America	347	38%
4	United States	North America	310	33%
5	China	Asia	220	23%
6	Democratic Republic of Congo	Africa	152	67%
7	Indonesia	Asia	92	49%
8	India	Asia	72	21%
9	Peru	South America	69	53%
10	Suriname	South America	15	98% (Highest % Forest Cover)
Total	World	-	4,060	31%

Source: FAO's Global Forest Resources Assessment (FRA)

Important Takeaways
With 815 million hectares of forest or 49% of its total land area, Russia has the greatest forest acreage in the world.

With 495 million hectares or 59% of its total land area, Brazil comes in second.
There are substantial tracts of forest in both the US and Canada, which make up 33% and 38% of their respective total land areas.

Because of its extensive afforestation efforts, China has 220 million hectares of forest, or 23% of its total land area.

At 67% and 49%, respectively, the Democratic Republic of the Congo and Indonesia have high levels of forest cover.

Suriname is the most forest-dense country in the world, with 98 per cent of its territory covered by forests.
The main reason South America has one of the highest forest coverages

CONTRIBUTION OF THE FOREST

Forests provide significant environmental and economic benefits that support sustainable development. Environmentally, forests help mitigate climate change by absorbing carbon dioxide and reducing global warming. They conserve biodiversity by providing habitat for more than half of the world's terrestrial species. Forests also maintain clean water by filtering pollutants, regulate the water cycle by influencing rainfall patterns, and protect soil from erosion through strong root systems that maintain fertility. Economically, forests generate employment and income through activities such as logging, agriculture, and energy production, supporting over 160 million people worldwide. They also play a crucial role in poverty reduction by sustaining the livelihoods of millions of poor and forest-dependent communities.

SUGGESTION AND CONCLUSION

Sustainable forest management ensures the preservation of plant life and biodiversity, providing a home for forestry and supporting both present and future generations. Forests contribute significantly to human respiration by offering cleaner air, which is essential for the rapidly growing population in our developing country. As of 2024, India ranks as the fifth-largest economy globally by nominal GDP, with an estimated GDP of approximately $3.41 trillion. However, with the country also having the world's largest population, the growth in population directly and indirectly contributes to forest degradation, climate change, loss of greenery, and pollution of air and water resources. Economic growth often leads to the expansion of agricultural land, increased production of goods, and reliance on raw materials, further accelerating forest degradation. To ensure a sustainable future, it is essential for both the current and future generations to commit to environmental responsibility. A simple yet impactful initiative like "One Home, One Tree" can promote greenery and restore ecosystems. Additionally, schools and

colleges should integrate lessons on sustainable forestry and the vital role forests play in human survival. Government-led programs and community participation can foster greater awareness and collective action for forest conservation.

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