Exploring the linkages between agricultural production, environmental degradation and climate change with policy implications for sustainability: Evidence from South Asia

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INTRODUCTION

- Expansion and proliferation of agricultural sector plays a vital role in achieving the Sustainable Development Goals (SDGs) related to ending poverty and hunger.
- Enhanced level of agricultural production also leads to depletion and degradation of environmental resources and generates pollution
- Usage of advanced technologies in agricultural production have been found to have detrimental effects on the environment leading to deforestation, land degradation, soil erosion, water pollution, air pollution, etc. which negatively affects agricultural output.
- Again, environmental degradation is a major factor behind climate change. Climate change in turn inhibits labour and agricultural productivity, which ultimately has a bearing on economic growth and sustainable development,
- Therefore, examining agriculture-environment-climate change nexus is much required and crucial for the development of sustainable agriculture.

OBJECTIVE

To examine the linkages between agricultural production, environmental degradation and climate change and thereby develop a simultaneous equation framework involving economic factors like agricultural production, trade openness; demographic variables such as population growth, urbanisation; ecological depletion indicators like forest area, energy consumption; environmental factors like methane emissions and climate change.

STUDY AREA AND DATA

The present study focuses on five selected Asian countries—Bangladesh, India, Nepal, Pakistan and Sri Lanka—which comprise the South Asian region.

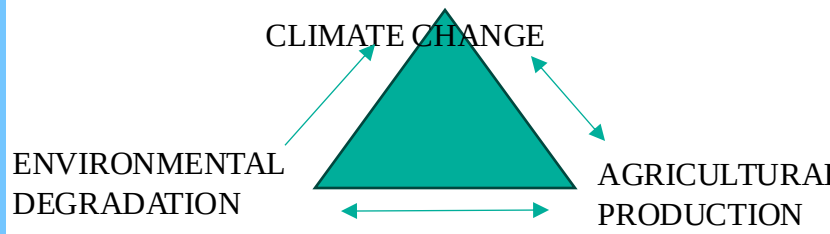
- This study used three endogenous variables such as Agriculture, forestry, and fishing, value added (% of GDP), methane emission (kt of CO2 equivalent) and mean annual temperature (Celsius).
- Data has been collected for 32 years from 1990-2021, from World Development Indicators database, https://databank.worldbank.org.

MODEL SPECIFICATION

- $AVA_t = \beta_0 + \beta_1 EC_t + \beta_2 FA_t + \beta_3 CH_{4t} + \beta_4 TEMP_t + \beta_5 TO_t + U_t$ ----------(1)
- $CH_{4t} = \beta_0 + \beta_1 AVA_t + \beta_2 EC_t + \beta_3 FA_t + \beta_4 URB_t + \beta_5 PGR_t + \beta_6 TO_t + U_t$ ----------(2)
- $TEMP_t = \beta_0 + \beta_1 AVA_t + \beta_2 EC_t + \beta_3 FA_t + \beta_4 CH_{4t} + \beta_5 URB_t + \beta_6 PGR_t + \beta_7 TO_t + U_t$ ----------(3)

Results of Simultaneous Equation Model (FE instrumental variables test)

Variables	Model 1	Model 2	Model 3
AVA	-	2393.141*	-0.0154*
EC	-0.0626*	140.7538*	0.0012**
FA	4.33E-05	1.151533*	-1.25E-05*
URB	-	2158.401*	-0.0065
PGR	-	-15980.22*	-0.0763**
TO	-0.0521***	-60.27179	-0.001752
CH4	9.44E-05*	-	6.58E-06*
TEMP	-9.2112*	-	-
C	228.8588	161,238.	23.2875
R-squared	0.9105	0.9968	0.9995
F-statistic	154.1755	4644.238	26153.72



FINDINGS

- The results indicated that 1 % increase in average temperature, energy consumption and trade openness led to decline in agricultural production by 9.21 %, 0.06% and 0.05% respectively.
- Again, methane emission was found to be positively associated with agricultural production, energy consumption, forest area and urbanisation.
- However, surprisingly population growth had significantly negative impact on emissions.
- Finally, energy consumption and methane emissions had direct positive impact on average temperature while increases in forest area, agricultural production and population growth lowered average annual temperature.
- A 1% increase agricultural production lowered temperature by 0.01 degree celsius.

IMPLICATIONS

- Agricultural production practices were found to be anti-environment and therefore agricultural policies and practices should be revamped in the light of our findings.
- Efforts should be directed towards arresting global warming. The future researchers can consider the role of governance and political ideologies of different countries.