The Impact of Rural Poverty on Environment: Evidence from Sundarbans in India

Mr. Chandan Roy

Ph.D Scholar

Department of Economics, Jadavpur University, Kolkata, India

GLOBAL CONFERENCE

on

Prosperity, Equality and Sustainability: Perspectives and Policies for a Better World

1-3 June 2016

India International Centre, New Delhi, India

❑ Motivation

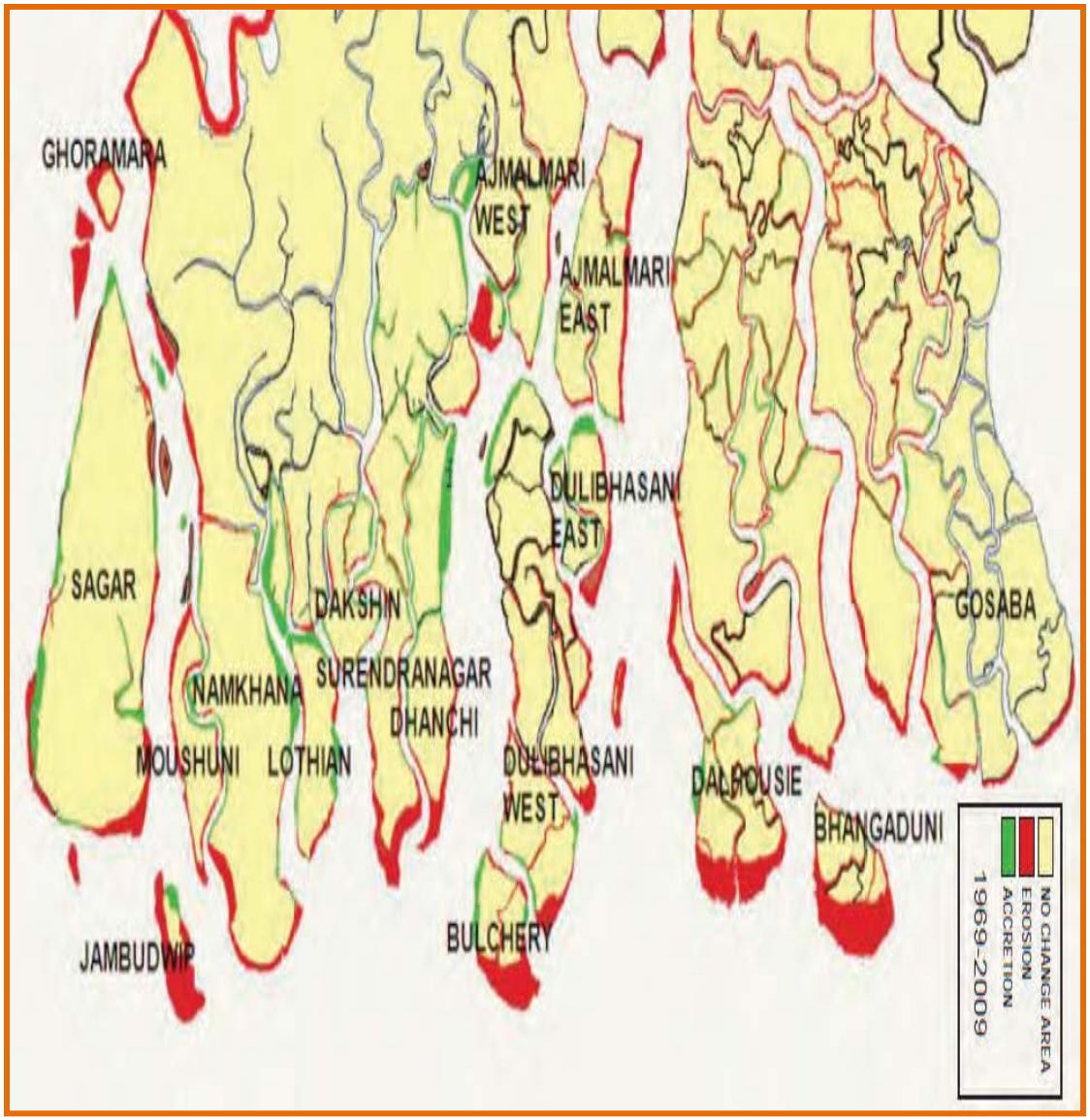
- Eradication of extreme poverty for all people is an important challenge for governments of developing countries all over the world. It is one of the 17 Sustainable Development Goals (SDGs), which world leaders adapted on September 25-27, 2015.
- World Commission on Environment and Development's report in 1987 claims that poverty is a major cause of environmental degradation in rural as well as urban areas.
- Poverty and environmental degradation are imperative problems in many developing countries. Hence, there is a pressing need first to evaluate and analyze the poverty-environmental degradation nexus, and second, to prescribe policy options to mitigate or eradicate these two problems.
- A majority of the total population of a developing country resides in rural areas and the incidence of rural poverty (income poverty) is usually higher than that of urban poverty.
- ***Indian Sundarbans*** is one of the richest areas in the world in terms of natural resources and biodiversity but some of the world's poorest and hungriest people are living in this area.

❑ Objectives

To empirically test the impact of rural poverty on environment in an under-developed country context. This paper also identifies various socio-economic determinants of rural poverty and its impact on ecosystem services.

❑ *Study Area :* Indian Sundarbans

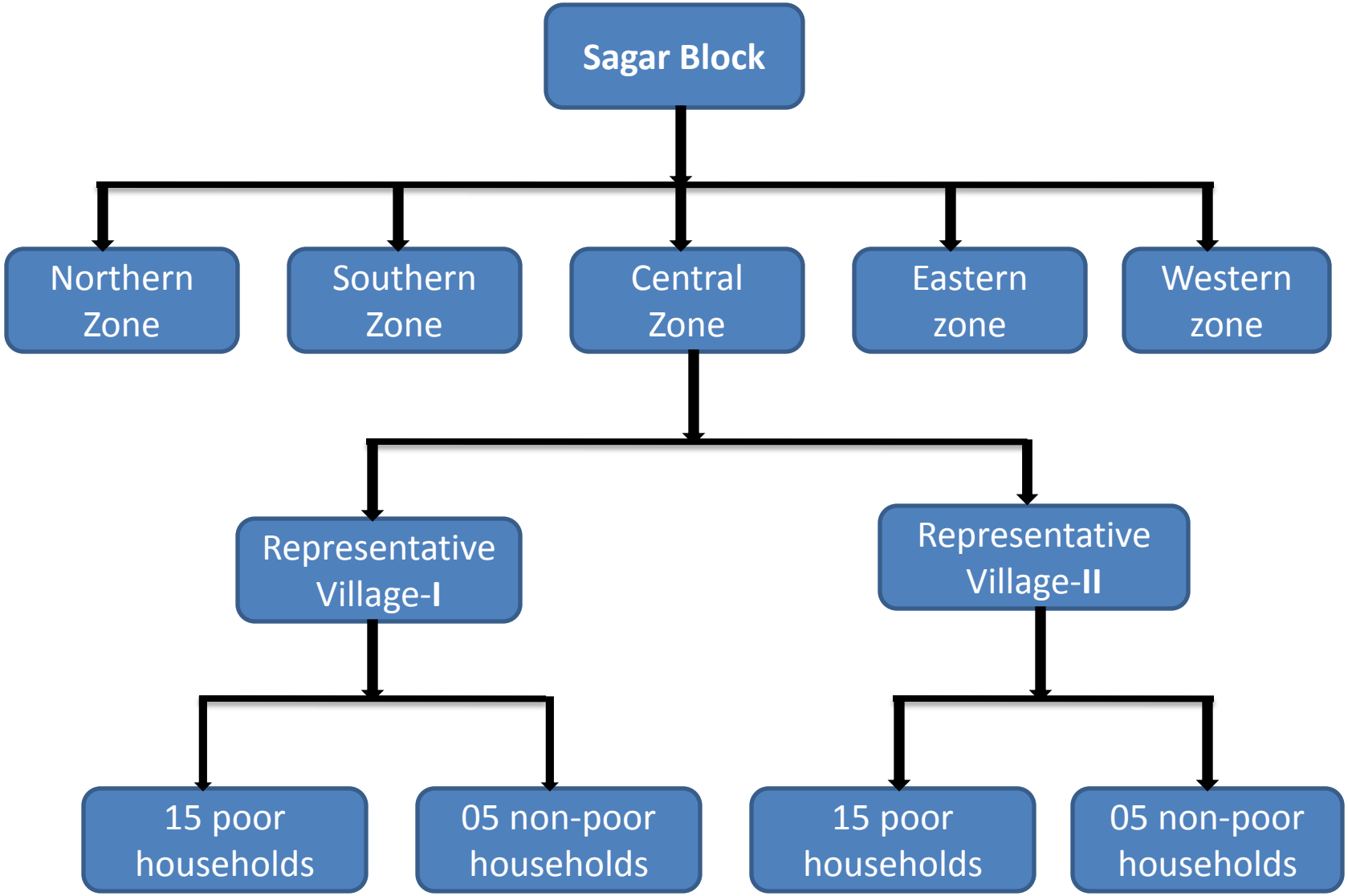
- Sundarbans is the largest mangrove forest in the world and a UNESCO World Heritage site.
- The Sundarbans (Indian part) is located in the North and South 24 Parganas districts of the state of West Bengal with **19** administrative blocks.
- **06** administrative blocks in the district of North 24 Parganas and **13** administrative blocks including **Sagar Block** in South 24 Parganas district.
- Nearly **4.5** million people live in the Sundarbans (Census of Indian, 2011).
- Sagar Island is the largest island in Indian Sundarbans.



Source: School of Oceanographic Studies, Jadavpur University

❑ Sample Design

- We used both qualitative and quantitative data collected from primary and secondary sources.
- The study is conducted in 10 villages of Sagar Block, Indian Sundarbans.
- All the villages in Sagar Block are categorized into **five distinct zones**, namely northern zone, southern zone, eastern zone, western zone and central zone.
- From each zone, **two** representative villages are chosen based on backwardness: the basis of backwardness is based on infrastructure and basic facilities.
- After village selection, all the households in each village are divided into two groups, namely, poor and non-poor family through focus group discussions (FGD).
- Finally, **20** households (3/4 weightage on poor family & 1/4 weightage on non-poor family) from each village are selected.
- Required household data collected from selected households based on predesigned questionnaires.


Sagar Block
Northern Zone
Southern Zone
Central Zone
Eastern zone
Western zone
Representative Village-I
Representative Village-II
15 poor households
05 non-poor households
15 poor households
05 non-poor households

❑ Research Methodology

- To assess the relationship between family income and carbon dioxide (CO_2) emission, first we identified different sources of CO_2 emission of the rural households in Indian Sundarbans.

- The main sources of carbon dioxide (CO_2) emissions of the households in the Indian Sundarbans are ,--

1. Wood & Leaves
2. Cow dung
3. Agricultural residues
4. Kerosene
5. Petrol
6. Liquid petroleum gas (LPG)
7. Electricity

- Gross CO_2 emissions of the households from various pollutants are calculated by multiplying mass of the fuel consumed by the households for cooking, heating, lighting and local transportation with the amount of CO_2 emissions per unit of fuel consumption based on statistical evidences taken from authentic sources (Secondary data: Reports/ journals/ papers/ web-links).

❑ Continued……

Finally, we constructed an equation to calculate total carbon dioxide (CO_2) emissions of the households in this area from different type of fuel consumptions are described below.

$$C_i^f = \sum_{i=1}^{200} (Q_{ij} \times E_j)$$

Where, j = 1, 2, ... , 7

C_i^f = Total amount of CO_2 emission of the i – th family

Q_{ij} = Amount of j – th fuel consumption of the i – th family

E_j = Amount of CO_2 emissions per unit of the j – th fuel consumption

- To assess the impact of socio-economic factors on natural resource based income, we constructed a **log-linear model**.

Where, **dependent variable** Y^{nr} is defined as the share of natural resource based income in total income and

Independent variables are defined to represent the six socio-economic factors which are in three groups-- physical factors, family factors and financial factors.

❑ Continued ……..

Physical Factors

- **(DST^{mmr})** = Distance to nearest motor road is hypothesized to have **positive impact** on share of natural resource based income.
- **SNT** = A dummy is defined to assume value **1** for presence of sanitary service in house and **zero** otherwise. This variable has expected **negative influence** on share of natural resource based income.

Family Factors

- **AGE^{em}** = Age of the earning member is hypothesized to have **positive impact** on share of natural resource based income.
- **DR^r** = Real (effective) dependency ratio is the ratio of the number of economically inactive members in a family to the number of economically active workers in the family,

$$DR^r = \frac{\text{No. of dependants}}{\text{No. of active workers (Economically)}}$$

This variable has expected **negative influence** on share of natural resource based income.

❑ Continued……

- **EDU^{em}** = Level of education is assumed **inversely related** with share of natural resource based income. When number of earning member is more than one we take the median of the education levels (years of schooling) of the various earning members.

Financial Factor

- **CNG^{L}** = Number of family member/s changed their original livelihood over last 10 years is hypothesized to have **negative impact** on share of natural resource based income.

This model shows,

$$Y^{nr} = f(AGE^{em}, DR^{r}, EDU^{em}, DST^{nmr}, CNG^{L}, SNT)$$

Finally, cross-section data are analyzed using log-linear regression model to separate the marginal effect of six socio-economic factors in this area on share of natural resource base income. Technically,

$$Ln(Y_i^{nr}) = \beta_0 + \beta_1 (AGE_i^{em}) + \beta_2 (DR_i^{r}) + \beta_3 (EDU_i^{em}) + \beta_4 (DST_i^{nmr}) + \beta_5 (CNG_i^{L}) + \beta_6 (SNT_i) + \epsilon_i$$

Where, β_0 = Constant term

ϵ_i = Error term, which is normally distributed with mean zero

Finally, we used robust regression methods in our model to control heteroskedasticity

Results

Observed relationship between per capita CO_2 emission and family income

In this paper, we identified two types of Income,--

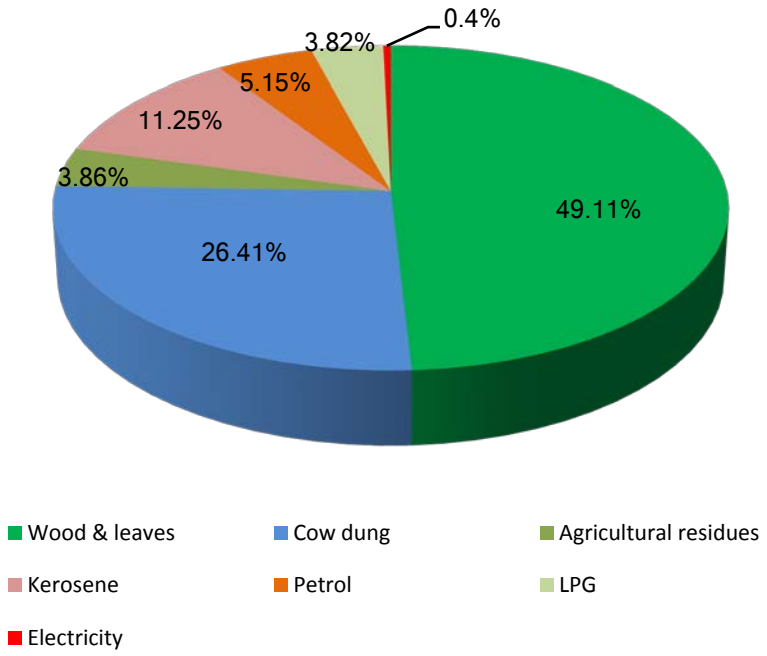
- **Natural resource based income (NRI)** such as that from agriculture, aquaculture, prawn seed collection, pisiculture, livestock, forest etc.
- N***on-natural resource based remunerative income*** such as that from salaried jobs, non-farm skilled and unskilled jobs etc.

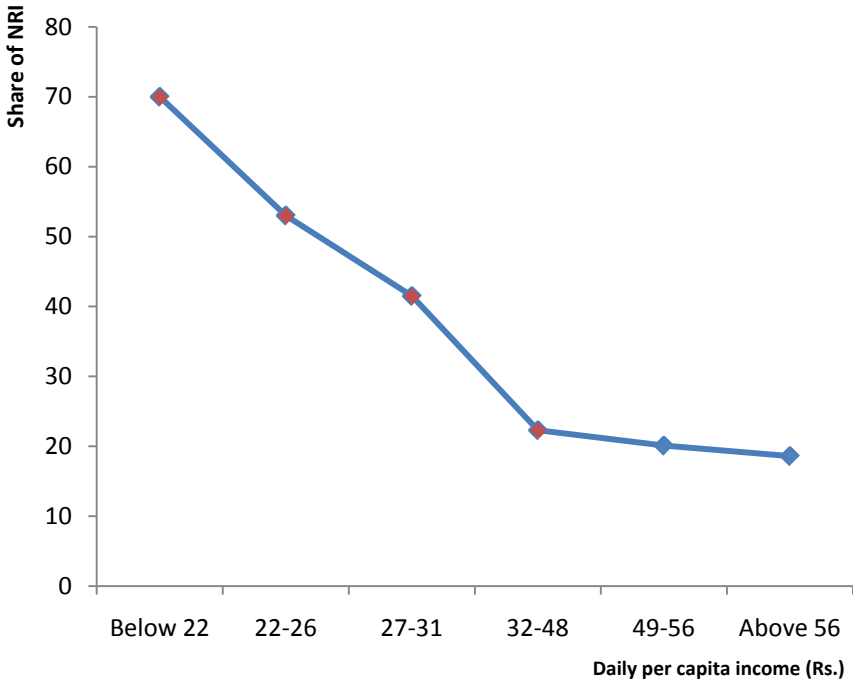
Daily per capita income (Rs.)	Percentage (%) in total households	Per capita CO2 emission per year (in kg)	Share of natural resource based income in total income (in %)
Below 22	3	478	70
22-26	41	346	53
27-31	31.5	330	41.5
32-48	14	328	22.3
49-56	5	251	20.1
Above 56	5.5	244	18.6

- Extremely poor families contribute more than moderately poor families and non-poor families to environmental degradation due to higher dependence on environment and unsustainable patterns of consumption, which emit more CO_2 during their day-to-day survival.

Sources of CO_2 emission

- Most of the emissions (75.52%) arise due to the use of wood and cow-dung in this area.





- Electricity is responsible for 0.40 percent of carbon dioxide emissions.
- Most of the families mainly use electricity for lighting and television: they use limited electronic instruments.

❑ Impact of Socio-Economic Factors on Natural Resource Based Income

- Four variables DST^{nmr}, CNG^{L}, DR^{r} and EDU^{em} are significant with predicted sign out of six independent variables.
- First one is significant at 1% level, 2nd and 3rd variables are significant at 5% level and last one is significant at10% level

Dependent variable: Share of natural resource based income in total income; R-squared: 0.68; F-test: 55.41***	
AGE^{em}	- 0.007 (0.0042)
DR^{r}	- 0.08** (0.0347)
EDU^{em}	- 0.02* (0.27)
DST^{nmr}	0.35*** (0.02)
CNG^{L}	- 0.11** (0.0425)
SNT	- 0.313 (0.057)
Constant , β_0	2.94*** (0.179)

The standard errors are in parenthesis; ***, ** and * indicates significant at 1%, 5%and 10% levels, respectively.

❑ Conclusion

- Extremely poor families' share of natural resource based income in total income is much higher than that of moderately poor families.
- Extremely poor families contribute more than moderately poor families to environmental degradation due to higher dependence on environment and unsustainable patterns of consumption, which emit more CO_2 during their day-to-day survival.
- It is clear that rural poverty has a **negative influence** on environment.
- Distance to nearest motor road has positive influence on poverty and negative influence on environment.
- Level of education of the earning members has negative influence on poverty and positive influence on environment.
- Real dependency ratio has negative influence on poverty and positive influence on environment.
- Change in original livelihood over last 10 years has negative influence on poverty and positive influence on environment.
- More particularly, sustainable pattern of consumption can reduce gross CO_2 emissions of the poor families in this area.
- Therefore, framing of policies and investments should take into account these factors because it may be impossible to improve environment quality without improving the socio-economic status of the poor families.


THANK
YOU