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Over Consumption of Natural Resources:-A Case Study of Cropland

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ABSTRACT: *In this paper, we look into how India's ecological footprint and biocapacity of cropland is affected by trade links with the rest of the world. We also take into account the Population, GDP and HDI of India and see the effect on ecological footprint and biocapacity of cropland thus we can assess ecological footprint as an indicator of sustainable development. We can also understand ecological footprint as an economics indicator also. We also compare the ecological footprint with the biocapacity and understand if there is an ecological deficit(EF>BC) or ecological surplus(BC>EF), thereby understanding the condition of over-consumption of natural resources in India. The countries are divided into developed, developing and underdeveloped inorder to make a comparison between three divisions. We used panel regression: - both fixed effects and random effects model. The Hausman test was conducted inorder to know the optimal model for the analysis. From the results of the fixed effects and the random effects models, it was found that the imports, exports, population, GDP and HDI has significant impact on India's ecological footprint and biocapacity of cropland but imports and exports have insignificant impact when others variable are included. It can be concluded that the there is an ecological overshoot (EF>BC) condition. Among the categories of countries, developed countries is causing the highest impact followed by developing and underdeveloped countries for cropland.*
KEYWORDS: *-Ecological Footprint, Biocapacity, Ecological overshoot, Ecological deficit, Fixed Effect, Random Effect, Hausman test*

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I. INTRODUCTION

In the current era of dwindling natural resources and widespread environmental degradation (Brown, 2011), driven by global population growth, rapid industrialization of emerging countries and humanity's increasing level of consumption (Royal Society, 2012), it has become paramount to determine the biophysical bases of nations (Adriaanse et al., 1997; Behrenset al., 2007; Global Footprint Network, 2010; Matthews et al.,2000). As societies grow wealthier, they demand more and more materials and energy to sustain their economic activities and standard of living. From 1900 to 2005, total material extraction of biomass, ores and industrial minerals, construction minerals, and fossil fuels increased eight-fold globally (Krausmann et al., 2009). Not only has global resource consumption expanded, but also there are huge geographical imbalances on how natural resources are used. Advanced economies benefit from major natural capital transfers originating mainly in poorer parts of the world where most material extraction takes place and energy ivorous and highly polluting industries are found (Sustainable Europe Research Institute, GLOBAL 2000, 2009; UNEP, 2011a; Wiedmannet al., 2013). This fact, coupled with rapid population increase in developing countries and growing consumption in emerging economies, has caused the global metabolic rate – the quantity of materials and energy used per capita per year – to start rising again during the last decade (UNEP, 2011b). This metric, in fact, which had been rising since the beginning of the previous century, had reached a fairly stable level between the oil crisis of the 70s and the beginning of the current century. At present, emerging nations display a metabolic rate similar to that of industrial countries in the 1950s and 60s (UNEP, 2011b).

According to the data provided from the Global Footprint Network (GFN), current global consumption is 50% beyond the Earth's biological capacity (World Wildlife Fund for Nature, 2012). Moreover, among the199 countries reported, only 60 countries have higher biological capacity than their ecological footprint as of 2008. That means 139countries ran biological deficits that can only be covered by either importing biological capacity and/or depleting their biological stock, which are not environmentally sustainable ways given the available stocks and their limited regenerative capacity. Moreover, in today's globalized world, locations of production and consumption have been changing rapidly. This necessitates the measurement of environmental degradation and natural resource exploitation not only in the location where consumption takes place but also in the production location given the fact that international trade and capital flows make it possible to import rather than produce domestically the goods which are ecologically destructive (Peters et al., 2011; Weinzettel et al., 2013). According to the Global Footprint Network (GFN, 2012), the current overshoot (EF minus biocapacity) is around 50 per cent, in other words we use 1.5 times more ecological "budget" than is available. In reality the situation is even worse, while this is an anthropocentric indicator, not counting with the biocapacity need of the estimated 4.5 million species other than mankind. The Earth Overshoot Day – the approximate date humanity's annual demand on nature exceeds what Earth can renew in a year, was celebrated on August 20, in 2013 (GFN, 2013). Some years ago the first EF deficit year was 1986. As the methodology develops, it shifts back to 1970.

The Ecological Footprint methodology as it is currently implemented considers crops – and cropland activity – in particular to be sustained by the capacity of the ecosystem. The consumption of natural resources due to farming activity (and embodied as a Footprint in products) is exactly equal to the biocapacity of cropland measured by crop production and embodied in the crops themselves, in the absence of trade. This assumption produces some confusion in the Ecological Footprint analysis results, and suggests that there is never overexploitation in cropland production and farming activity. This link between pressure to increase yield and the requirements of long term sustainability is one of the main challenges for the agricultural systems (Harris, 1996).

In this chapter, we look into how India's ecological footprint and biocapacity of cropland is affected by trade links with the rest of the world. We also take into account the Population, GDP and HDI of India and see the effect on ecological footprint and biocapacity of cropland, thus we can assess ecological footprint as an indicator of sustainable development. We can also understand ecological footprint as an economic indicator also. We also compare the ecological footprint with the biocapacity and understand if there is an ecological deficit(EF>BC) or ecological surplus(BC>EF), thereby understanding the condition of over-consumption of natural resources in India.

I.1 BACKGROUND

Ecological Footprint (EF) methodology allows for the assessment of the impact that human beings have on the environment in terms of the ecologically productive area which is necessary to sustain their lives and their activities (Wackernagel and Rees, 2008). Introduced by Rees (1992) and developed by Rees and Wackernagel (1994), the Ecological Footprint is a synthetic indicator used to estimate population's impact on the environment due to its consumption patterns; it quantifies the total area of the terrestrial and aquatic ecosystems necessary to supply all resources, and to absorb emissions produced. While the Ecological Footprint shows the demand on nature, the biocapacity (BC) tracks the supply side of the equation, and is therefore defined as the rate of resource supply and waste disposal that can be sustained in a given territory under prevailing technology and management schemes.

The first, regarding the consumption of natural resources, the Ecological Footprint of production (EFp), is accounted as follows:

$$EFp=A^{*}\ Yn/Yw^{*}EQF \qquad (1.1)$$

where A (area) is the land used for crop cultivation; Yn (national yield) is the average national yield for a single crop. Yn = P/A, where P is national production of a single crop product and A is area devoted to that crop's cultivation. Yw (world yield) is the average yield for world production a single crop (Galli et al., 2007). (Yn)/Yw = YF (yield factor) is a scaling factor used to convert from local to average bioproductive land requirements (Monfreda et al.,2004; Wackernagel and Rees, 1996). EQF (equivalence factor) is a scaling factor needed to convert a specific land-use type into a universal unit of biologically productive area (the global hectare)
(Monfreda et al., 2004; Wackernagel and Rees, 1996).

On the other side of GFN methodology the equation for biocapacity is:

$$BC=A^{*}Yn/Yw^{*}EQF \qquad (1.2)$$

From the perspective of the production system, assuming that there is no variation in EQF or in Yw and that there is no trade (import and export), the quantity produced is assumed to be the

only parameter for evaluating both the EF and the BC. All the crops by definition are sustained by the ecosystem's capacity, because EF and BC are both based on the same flow accounting calculation (Mozner et al., 2012). The consequence is that there is no possibility of a result measuring overexploitation of natural resources for cropland production. This limitation has been raised by some authors.

II. LITERATURE REVIEW

Alessandro et al (2015), explained the rationale behind Ecological Footprint Accounting (EFA) and help ensure that Ecological Footprint and biocapacity results are properly interpreted and effectively used in evaluating risks and developing policy recommendations. The conclusion of the paper is that the main value added of Ecological Footprint Accounting is highlighting trade-offs between human activities by providing both a final aggregate indicator and an accounting framework that shed light on the relationships between many of the anthropogenic drivers that contribute to ecological overshoot.

Jixi et (2015), indicated that China's consumption footprint surpassed its biocapacity in 1983, leading to an ecological deficit, and the production footprint surpassed its biocapacity in1986, leading to an ecological over-shoot, as the over-consumption of natural resources grew. By 2010,3.6 times the current area of bioproductive land was needed to provide sufficient resources to meet the consumption. China has been encouraging the development of exporting enterprises by implementing a series of financial and tax incentives, which have stimulated the economy in the short-term but have gradually increased the ecological trade deficit since 2000.

Daniel et al (2015), it has been estimated that one third of biodiversity threats are driven by consumer demand from outside the country in which the threat occurs. This occurs when the production of export goods exerts pressure on vulnerable populations. The paper investigates the suitability of multi-region input–output (MRIO) analysis for tracing out links between particular species threats, directly implicated industries, and the countries and consumer goods sectors ultimately driving these industries. The study was conducted using the Eora global input–output database that documents greater than 5 billion global supply chains. MRIO analysis, can be useful for outlining supply chains and identifying which consumption sectors and trade and transformation steps can be subjected to closer analysis in order to enable remedial action.

Usama et al (2014), investigates the environmental Kuznets curve (EKC) hypothesis using a country's ecological footprint as an indicator of environmental degradation. Ninety-three countries were examined, categorized by income. The fixed effects and the generalized method of moment's results clearly showed an inverted U-shaped relationship between the ecological footprint and GDP growth, which represents the EKC hypothesis in upper middle- and high-income countries but not in low- and lower middle income countries.

Energy consumption, urbanization, and trade openness increase environmental damage through their positive effect on the ecological footprint of most countries across all income groups. However, financial development reduces environmental degradation in lower middle-, upper middle- and high-income countries.

Ahmet et al (2015), paper is to investigate whether countries tend to relocate their ecological footprint as they grow richer. The analysis is carried out for a panel of 116 countries by employing the production and import components of the ecological footprint data of the Global Footprint Network for the period 2004–2008. Controlling for the effects of openness to trade, biological capacity, population density, industry share and energy per capita as well as stringency of environmental regulation and environmental regulation enforcement, we detect an EKC-type relation-ship only between per capita income and footprint of domestic production. Within the income range, import footprint is found to be monotonically increasing with income. Moreover, we find that domes-tic environmental regulations do not influence country decisions to import environmentally harmful products from abroad; but they do affect domestic production characteristics.

Niccoulucci et al (2011), Observed the temporal trends for most of the world's nations between 1961 and 2007, in order to appraise the different development paths of Biocapacity and Footprint. The analysis identified four main dynamic typologies: parallel, scissor, wedge and descent. The main features of each type are explained on the basis of population trends and jointly with other indicators. In this analysis the Ecological Footprint is the leading biophysical accounting tool for comparing present aggregate human demand on the biosphere with the ecological capacity to sustain life. Biocapacity may be regarded as a new type of ecological wealth, it will be of strategic importance in geopolitics, playing a fundamental role in competitiveness and relationships between nations, as well as in the quality of life of their communities.

Gazi et al (2016), Examined the effects of real income, financial development and trade openness on the ecological footprint (EF) of consumption using a panel data of leading world EF contributors during the period1991–2012.A number of panel unit root tests confirm that the data are first-difference stationary. Results indicate a positive and significant association between ecological footprint (EF) and real income, and a negative and insignificant impact of trade openness on EF. Financial development is also observed to reduce EF.

Wafaa et al (2016), A macro level indication of the overall resource demands by Mediterranean cities, their drivers and leverage point. The main Footprint drivers are food consumption, transportation and consumption of manufactured goods. Differences among cities' Ecological Footprint values are most likely driven by socio-economic factors, such as disposable income, infrastructure, and cultural habits. City level Footprint findings can be used to help design sustainability policies and positively reinforce collective public achievements.

Passeri et al (2012), The Ecological Footprint methodology assumes that all cropland activities are sustained by the capacity of the ecosystem, basing both demand and capacity calculations on the exact same flow accounting. The paper proposes a solution to this duality caused by the current methodological assumption about croplands, and investigates the influence of different farming techniques on Ecological Footprint results. Starting from the concept of an embodied footprint in production, it proposes a new approach for the evaluation of farming performance. This approach permits an estimation of the impact of farming activity, linked to the farmers' technique, and a calculation of the crop Footprint in reference to the production capacity of the natural system.

III. DATA AND METHODOLOGY

In this study we analyze the ecological footprint and biocapacity of India using the 176 developed, developing and underdeveloped countries (62-developed ,86-developing and 28-undedeveloped) covering the period 1970-2012.The list of developed, developing and underdeveloped countries are displayed in Table A1 in appendix. Ecological footprint and biocapacity data are taken from the Global Footprint Network's 2012 Dataset (GFN, 2012), which contains data from1970 to 2012 and is expressed in terms of Total GHA (Global hectares). Summary statistics of the variables are displayed in Figure1 and Figure 2.

The positive effects unleashed by increasing income in developed countries could help to clean up the domestic environment; but this does not guarantee an overall reduction in environmental degradation globally, if not an increase. There are several ways of importing environmental burden of consumption in developed countries that can be understood in the context of "unequal ecological exchange" among countries (Andersson and Lindroth, 2001). One explanation is that developing and underdeveloped countries extract natural resources and export them to more developed ones so that the latter externalize pollution and environmental costs by means of importing resource-intensive goods or energy materials. Schütz et al. (2004). So we make a distinction of countries into developed, developing and underdeveloped.

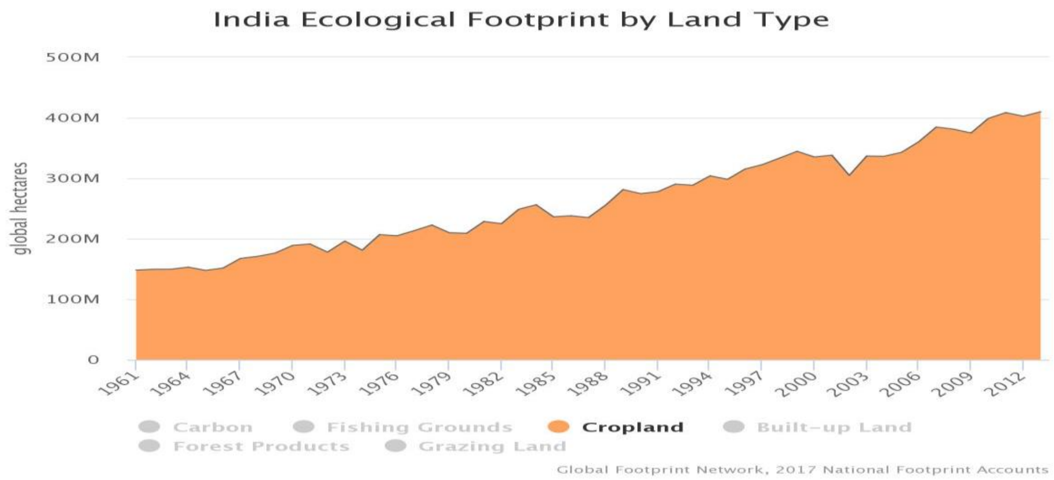

Figure 1:India Cropland Ecological Footprint

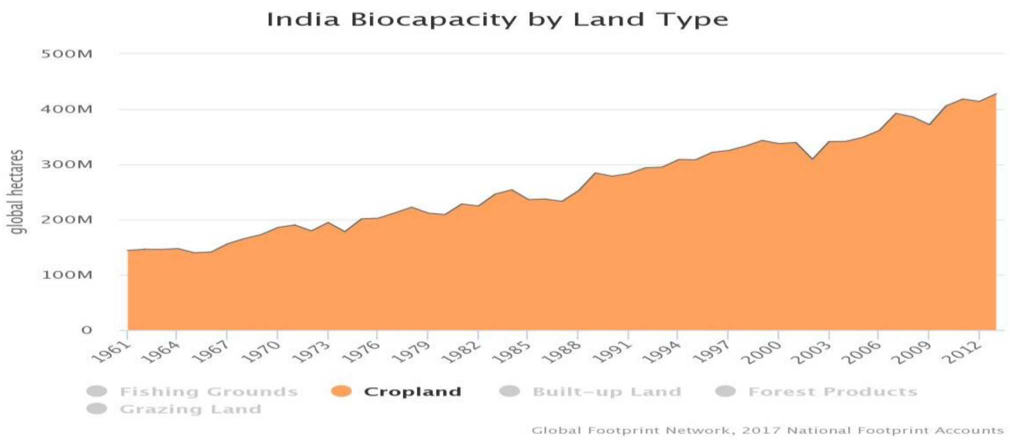

Figure 2:India Cropland Biocapacity

The independent variables are Imports, Exports, GDP, HDI and Population. The data for Imports and Exports are extracted from the EORA MRIO database, which contains data from1970-2012. Andersson and Lindroth (2001) lists four different ways of how trade may affect ecological footprint: positive allocative effect, which reduces ecological footprint as trade enables specialization of countries on products which are produced with a higher yield, negative income effect, which increases ecological footprint as trade helps countries raise their income, and thereby, consumption, negative rich-country-illusion effect, which highlights the false impression in rich countries that their lifestyle is sustainable which might be formed thanks to the possibility of importing bio-and sink-capacity from poorer countries, and negative terms-of-trade distortion effect, which hints to the tendency of poorer countries to exploit natural resources beyond sustainable scales to protect themselves from falling terms-of-trade during boost periods in world demand.

Population, GDP and HDI data are extracted from the Global Footprint Network(GFN,2012), which contains data from1991-2012Many leading scientists from Malthus (1798) to Lorenz (1989) have looked only at the first column of the table above and concluded that we have a problem with too many people. Two pieces of scientific literature have made this way of thinking immensely influential in scientific circles: (Lloyd, 1833; Hardin, 1968) and The IPAT Equation by Ehrlich and Holdren (1971). The overpopulation fears reached their peak in the 1970–1980s, but they still contribute a popular view both in public opinion and in the scientific community. However, experts project “The end of population growth” since the late 1990s (O’Neill et al., 1999; Lutz et al., 2001), which is also confirmed by the Moscow Demographic Summit (2011). So we take the population variable into account. The summary statistics of the independent variable (GDP, HDI, Population) are presented in TableA2 in appendix.

In this study we use two dependent variables: -

i. Ecological Footprint(EF)
ii. Biocapacity(BC)

In this paper panel data analysis is performed for all categories of countries from 1970-1990 and 1991-2012.We are dividing the years in order to analyse the effect of including Population, GDP and HDI data on ecological footprint and biocapacity.

III.1 ECONOMETRIC MODEL

There are two classes of panel estimator approaches that can be employed in this study namely the fixed and the random (RE and FE) effects models. The fixed and random effects models are two well-known models used in modeling panel data. The fixed effects model portions of specifications are controlled using orthogonal forecasts. These forecasts of projections remove the specific means from the cross-sections and the period from the dependent variables and the exogenous regressors and then utilize the quantified regression using the demeaned data (Baltagi, 2009). The important benefit of the fixed effects model is that it can eliminate the bias problems arising from the omitted variables that do not change over time. Meanwhile, the random effects model assumes that the equivalent effects of the cross-section effect vectors and the time period effect vectors are essentially uncorrelated. In other words, the random effects model accepts that the effects are uncorrelated with the residuals. To determine the optimal model, the Hausman (1978) test was used, as the test compares the random and fixed effects estimates of coefficients. The Hausman test is based on Chi-square statistics; if the Chi-square statistic is significant, the random effects model is not reliable, and the fixed effects model should be utilized.

The relationship between Ecological Footprint, Imports, Exports, Population, GDP and HDI,
FE model can be specified as follows: -

$$EF_{it} = \beta_{1i} + \beta_2 IM + \beta_3 EX + \beta_4 PO + \beta_5 GDP + \beta_6 HDI + u_{it} \quad 3.1$$

RE model can be specified as follows: -

$$EF_{it} = \beta_1 + \beta_{2t} IM + \beta_{3t} EX + \beta_{4t} PO + \beta_{5t} GDP + \beta_{6t} HDI + €_{it} + u_{it} \quad 3.2$$

The relationship between Biocapacity, Imports, Exports, Population, GDP and HDI,
FE model can be specified as follows: -

$$BC_{it} = \beta_{1i} + \beta_{2t} IM + \beta_{3t} EX + \beta_{4t} PO + \beta_{5t} GDP + \beta_{6t} HDI + u_{it} \quad 3.3$$

RE model can be specifies as follows: -

$$BC_{it} = \beta_1 + \beta_{2t} IM + \beta_{3t} EX + \beta_{4t} PO + \beta_{5t} GDP + \beta_{6t} HDI + €_{it} + u_{it} \quad 3.4$$

where t represents the time period (1970-2012) and i is the cross section(86-developing,62-developed and 28-undedeveloped countries). β_{1i} ,β_{6t} represent the slope coefficients, β_1 is the constant, and u_{it} is the error term.IM represents imports ,EX represents exports and PO represents Population.

IV. RESULTS AND DISCUSSION

IV.1 Developed Countries

VARIABLES	(1) Corplandef (RE)	(2) Corplandef (FE)	(3) Croplandbc (RE)	(4) Croplandbc (FE)
Imports	3.919*	3.927*	8.134***	17.81***
	(2.270)	(2.272)	(2.704)	(4.139)
Exports	1.448	1.488	5.655***	13.75***
	(1.015)	(1.016)	(1.198)	(1.851)
Constant	6.904e+07***	6.903e+07***	2.298e+08***	2.256e+08***
	(1.268e+07)	(510,036)	(878,612)	(929,224)
Observations	1,323	1,323	1,323	1,323
R-squared		0.014		0.158
Number of Country_num	63	63	63	63

Table 1:Panel regression results from 1970-1990

VARIABLES	(1) Croplandef (RE)	(2) Croplandef (FE)	(3) Croplandbc (RE)	(4) Croplandbc (FE)
Imports	1.541***	2.488***	1.614***	2.619***
	(0.301)	(0.432)	(0.306)	(0.438)
Exports	0.553***	1.995***	0.565***	2.047***
	(0.141)	(0.230)	(0.143)	(0.234)
Constant	3.500e+08***	3.429e+08***	3.547e+08***	3.473e+08***
	(1.120e+06)	(1.191e+06)	(1.138e+06)	(1.207e+06)
Observations	1,386	1,386	1,386	1,386
R-squared		0.200		0.208
Number of Country_num	63	63	63	63

Table 2:-Panel regression results from 1991-2012 without GDP,HDI and Population

VARIABLES	(1) Croplandef(RE)	(2) Croplandef(FE)	(3) Croplandbc(RE)	(4) Croplandbc(FE)
Imports	-0.0168	-0.0401	-0.00761	-0.0227
	(0.0889)	(0.138)	(0.0835)	(0.129)
Exports	0.00790	0.0227	0.0115	0.0374
	(0.0414)	(0.0742)	(0.0389)	(0.0697)
Population	-0.125***	-0.125***	-0.206***	-0.206***
	(0.0291)	(0.0298)	(0.0274)	(0.0280)
Gdp	60,878***	60,881***	79,510***	79,334***
	(6,297)	(6,473)	(5,915)	(6,080)
HDI	6.888e+08***	6.890e+08***	7.819e+08***	7.818e+08***
	(8.570e+07)	(8.770e+07)	(8.050e+07)	(8.237e+07)
Constant	8.346e+07***	8.352e+07***	1.123e+08***	1.124e+08***
	(1.284e+07)	(1.314e+07)	(1.206e+07)	(1.234e+07)
Observations	1,386	1,386	1,386	1,386
R-squared		0.922		0.934
Number of Country_num	63	63	63	63

Table3:-Panel regression results from 1991-2012

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1 reviews the results of the panel regressions for the developed countries from 1970-1990. The Hausman test was performed to confirm whether the fixed effects or the random effects model is the optimal model for our panel regression. Because the Chi-square is insignificant at the 1% level for countries, the random effects model is the optimal model for analysis. Table 2 reviews the results of the panel regressions for the developed countries from 1991-2012 without GDP, HDI and Population. Because the Chi-square is significant at the 1% level for countries, the fixed effects model is the optimal model for analysis. Table 3 reviews the results of the panel regressions for the developed countries from 1991-2012 with GDP, HDI and Population. Because the Chi-square is insignificant at the 1% level for countries, the random effects model is the optimal model for analysis.

The random effects results for the developed countries of Table 1 show that the coefficients for IM and EX are both positive and significant , which indicates an upper trend relationship with the ecological footprint and biocapacity during 1970-1990.The fixed effect results of Table 2 show that the coefficients for IM and EX are both positive and significant , which indicates an upper trend relationship with the ecological footprint and biocapacity during 1991-2012.The random effects results of Table 3 shows that the coefficient of imports and exports are insignificant and coefficient of imports is negative. The coefficients of GDP, HDI and Population are significant and positive for GDP and HDI and negative for population. This indicates that imports have negative and insignificant impact and exports have positive and insignificant impact on ecological footprint and biocapacity when adding the population, GDP and HDI variables to the analysis during 1991-2012.GDP and HDI had significant results because in developed countries both variables are very high so it shows an upper trend relationship with ecological footprint and biocapacity. Population is having a negative effect because the population is low in developed countries when compared to other countries.

IV.2 Developing Countries

VARIABLES	(1) Corplandef(RE)	(2) Corplandef(FE)	(3) Croplandbc(RE)	(4) Croplandbc(FE)
Import	-2.932	-3.009	-13.69***	-18.07***
	(2.448)	(2.449)	(3.334)	(5.292)
Exports	26.90***	26.88***	40.79***	60.52***
	(3.005)	(3.006)	(4.971)	(6.495)
Constant	5.928e+07***	5.928e+07***	2.310e+08***	2.299e+08***
	(1.027e+07)	(361,596)	(754,346)	(781,309)
Observations	1,743	1,743	1,743	1,743
R-squared		0.087		0.068
Number of Country_num	83	83	83	83

Table 4:Panel regression result from 1970-1990

VARIABLES	(1) Croplandef(RE)	(2) Croplandef(FE)	(3) Croplandbc(RE)	(4) Croplandbc(FE)
Imports	0.587**	0.945***	0.609**	0.980***
	(0.244)	(0.336)	(0.248)	(0.341)
Exports	1.795***	3.675***	1.873***	3.835***
	(0.323)	(0.462)	(0.329)	(0.469)
Constant	3.528e+08***	3.510e+08***	3.575e+08***	3.557e+08***
	(927,107)	(955,131)	(942,902)	(970,461)
Observations	1,914	1,914	1,914	1,914
R-squared		0.074		0.077
Number of Country_num	87	87	87	87

Table 5:- Panel regression results from 1991-2012 without GDP,HDI and Population

VARIABLES	(1) Croplandef(RE)	(2) Croplandef(FE)	(3) Croplandbc(RE)	(4) Croplandbc(FE)
Imports	-0.00316	-0.00599	-0.00366	-0.00798
	(0.0696)	(0.0977)	(0.0653)	(0.0918)
Exports	0.00303	0.00608	0.0235	0.0491
	(0.0929)	(0.137)	(0.0873)	(0.128)
Population	-0.124***	-0.124***	-0.206***	-0.206***
	(0.0248)	(0.0254)	(0.0233)	(0.0238)
Gdp	60,847***	60,847***	79,493***	79,398***
	(5,352)	(5,490)	(5,027)	(5,157)
HDI	6.887e+08***	6.887e+08***	7.821e+08***	7.822e+08***
	(7.289e+07)	(7.459e+07)	(6.846e+07)	(7.006e+07)
Constant	8.342e+07***	8.342e+07***	1.122e+08***	1.122e+08***
	(1.092e+07)	(1.118e+07)	(1.026e+07)	(1.050e+07)
Observations	1,914	1,914	1,914	1,914
R-squared		0.922		0.934
Number of Country_num	87	87	87	87

Table 6:-Panel regression results from 1991-2012

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 reviews the results of the panel regressions for the developing countries from 1970-1990. The Hausman test was performed to confirm whether the fixed effects or the random effects model is the optimal model for our panel regression. Because the Chi-square is significant at the 1% level for countries, the fixed effects model is the optimal model for analysis. Table 5 reviews the results of the panel regressions for the developing countries from 1991-2012 without GDP, HDI and Population. Because the Chi-square is significant at the 1% level for countries, the fixed effects model is the optimal model for analysis. Table 6 reviews the results of the panel regressions for the developing countries from 1991-2012 with GDP, HDI and Population. . Because the Chi-square is insignificant at the 1% level for countries, the random effects model is the optimal model for analysis.

The fixed effects results for the developed countries of Table 4 show that the coefficients for IM is negative and insignificant impact on ecological footprint and negative and significant impact on biocapacity .EX is having positive and significant impact, which indicates an upper trend relationship with the ecological footprint and biocapacity during 1970-1990.The fixed effect results of Table 5 show that the coefficients for IM and EX are both positive and significant , which indicates an upper trend relationship with the ecological footprint and biocapacity during 1991-2012.The random effects results of Table 6 shows that the coefficient of imports and exports are insignificant and coefficient of imports is negative. The coefficients of GDP, HDI and Population are significant and positive for GDP and HDI and negative for population. This indicates that imports have negative and insignificant impact and exports have positive and insignificant impact on ecological footprint and biocapacity when adding the population, GDP and HDI variables to the analysis during 1991-2012.GDP and HDI had significant results because in developing countries both variables are very high so it shows an upper trend relationship with ecological footprint and biocapacity. Population is having a negative effect thus we can conclude that population growth is not affecting the ecological footprint and biocapacity but it's their consumption patterns as discussed in the literature review.

IV.3 Underdeveloped Countries

VARIABLES	(1) CorplandEF(RE)	(2) CorplandEF(FE)	(3) CroplandBC(RE)	(4) CroplandBC(FE)
Import	-136.7	-131.0	479.4***	197.4
	(113.4)	(113.5)	(156.8)	(192.8)
Exports	1,109***	1,100***	553.8***	2,637***
	(147.0)	(147.3)	(122.6)	(253.1)
Constant	6.497e+07***	6.506e+07***	2.198e+08***	1.887e+08***
	(1.985e+07)	(2.303e+06)	(2.488e+06)	(3.943e+06)
Observations	588	588	567	567
R-squared		0.096		0.205
Number of country_num	28	28	27	27

Table 7:-Panel regression results from 1970-1990

VARIABLES	(1) CroplandEF(RE)	(2) CroplandEF(FE)	(3) CroplandBC(RE)	(4) CroplandBC(FE)
Imports	186.8***	532.4***	193.2***	551.0***
	(34.26)	(53.02)	(34.83)	(53.74)
Exports	-76.73**	-243.7***	-78.34**	-250.4***
	(37.29)	(51.72)	(37.91)	(52.41)
Constant	3.514e+08***	3.462e+08***	3.561e+08***	3.507e+08***
	(1.751e+06)	(1.852e+06)	(1.780e+06)	(1.877e+06)
Observations	616	616	616	616
R-squared		0.185		0.192
Number of Country_num	28	28	28	28

Table 8:- Panel regression results from 1991-2012 without GDP,HDI and Population

VARIABLES	(1) CroplandEF(RE)	(2) CroplandEF(FE)	(3) CroplandBC(RE)	(4) CroplandBC(FE)
Imports	-6.005	-17.36	-5.308	-14.28
	(10.21)	(18.08)	(9.593)	(16.98)
Exports	5.849	14.31	6.477	14.61
	(10.86)	(16.43)	(10.20)	(15.43)
Population	-0.126***	-0.128***	-0.207***	-0.209***

	(0.0439)	(0.0449)	(0.0412)	(0.0422)
Gdp	60,880***	61,158***	79,505***	79,606***
	(9,458)	(9,696)	(8,883)	(9,108)
HDI	6.924e+08***	6.984e+08***	7.856e+08***	7.909e+08***
	(1.290e+08)	(1.321e+08)	(1.212e+08)	(1.241e+08)
Constant	8.287e+07***	8.206e+07***	1.117e+08***	1.109e+08***
	(1.934e+07)	(1.980e+07)	(1.816e+07)	(1.860e+07)
Observations	616	616	616	616
R-squared		0.922		0.934
Number of Country_num	28	28	28	28

Table 9:-Panel regression results from 1991-2012

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 reviews the results of the panel regressions for the underdeveloped countries from 1970-1990. The Hausman test was performed to confirm whether the fixed effects or the random effects model is the optimal model for our panel regression. Because the Chi-square is insignificant at the 1% level for countries, the random effects model is the optimal model for analysis. Table 8 reviews the results of the panel regressions for the developing countries from 1991-2012 without GDP, HDI and Population. Because the Chi-square is insignificant at the 1% level for countries, the random effects model is the optimal model for analysis. Table 9 reviews the results of the panel regressions for the developing countries from 1991-2012 with GDP, HDI and Population. Because the Chi-square is insignificant at the 1% level for countries, the random effects model is the optimal model for analysis.

The random effects results for the developed countries of Table 7 show that the coefficients for IM has negative and insignificant impact on ecological footprint and negative and significant impact on biocapacity .EX is having positive and significant impact, which indicates an upper trend relationship with the ecological footprint and biocapacity during 1970-1990.The random effect results of Table 8 show that the coefficients for IM are both positive and significant , which indicates an upper trend relationship with the ecological footprint and biocapacity during 1991-2012 and EX has negative and insignificant impact on ecological footprint and biocapacity. The random effects result of Table 9 shows that the coefficient of imports and exports are insignificant and coefficient of imports is negative. The coefficients of GDP, HDI and Population are significant and positive for GDP and HDI and negative for population. This indicates that imports have negative and insignificant impact and exports have positive and insignificant impact on ecological footprint and biocapacity when adding the population, GDP and HDI variables to the analysis during 1991-2012.GDP and HDI had significant results because in underdeveloped countries both variables are slowly increasing so it shows an upper trend relationship with ecological footprint and biocapacity. Population is having a negative effect, thus we can conclude that population growth is not affecting the ecological footprint and biocapacity but it's their consumption patterns as discussed the literature review.

V. CONCLUSION

In the last two decades' average wealth accumulation leveraged population growth less, and luxury consumption of developed nations more. Other research also supports that population growth is not the primary factor of the increasing ecological footprint any more (Galli et al.,2012). Man has always made irreversible changes in nature (Diamond, 2005; Hetesi, 2009; Takács-Sánta, 2004). These have changed the face of local ecosystems and whole parts of continents forever. However, the total degree of change had never been globally critical, till we reached the level of Earth saturation, in the 1970s.c. Until the point of ecological overshoot (or 100 per cent Earth Fullness as we call), which is in the early 1970s, ecologically sustainable societies balanced out the over-consumption ones. The EF has started to decrease, or at least shows a stagnation since reaching the point of Earth Fullness. However, this beneficial effect has been not only levelled off but overridden by growing number of people and growing consumption. Once again: out of these two factors growing consumption is more-and-more influential, and it shows no tendency to change. Maybe we should be more relaxed about one digit GDP growth figures in developed countries and concentrate more on developing ones. HDI is also important variable affecting ecological footprint and biocapacity.

The major weakness of the previous literatures is that it has not looked the over consumption of natural resources from the viewpoint of the different categories of ecological footprint and biocapacity. Therefore, the main objective of the paper is to investigate the overconsumption of natural resources in India by examining the ecological footprint and biocapacity of cropland. To realize the aims of this research, a panel model was constructed using a country's ecological footprint and biocapacity of cropland as the dependent variable. The ecological footprint can provide a more complete perspective of environmental damage. From the results of the fixed effects and the random effects models, it was found that the imports, exports, population, GDP and HDI has significant impact on India's ecological footprint and biocapacity of cropland but imports and exports have insignificant impact when others variable are included. This is because after 1990 LPG (Liberalization, Privatization and Globalization) had been introduced. The trade liberalization had led to an increase in GDP.As economy grows its HDI will improve. Thus the effect of imports and exports was reflected in the GDP and HDI figures. Population is having a negative effect, thus we can conclude that population growth is not affecting the ecological footprint and biocapacity but it's their consumption patterns as discussed the literature review. It can be concluded that the there is an ecological deficit(EF>BC) condition. Among the categories of countries, developed countries is causing the highest impact followed by developing and underdeveloped countries. This is because the developed countries will import raw materials from developing and underdeveloped countries. They only import those finished goods, if produced by them will degrade their environment.

The diverging economic, environmental and political characteristics of countries, economic growth in itself is not sufficient to mitigate negative environmental externalities. The significantly changed income turning points show the importance of environmental regulation and its enforcement along with economic growth. The finding that countries replace domestic production of environmentally damaging goods by imports as they get developed confirms that they export the ecological cost of their consumption to developing and underdeveloped economies. Hence it is concluded that income growth relocates ecological footprint. Increasing volume of trade, in the absence of proper institutional framework, would aggravate the situation under the business-as-usual scenario. The policy suggestions are strict trade restrictions should be introduced by the government. Ecological agriculture should be promoted and enhanced through technical innovation of agricultural equipment, scientific land management, highly efficient breeding techniques, and effective irrigation systems.

The Scope for further studies are, a country wise study can be conducted. A study can also be conducted such that it takes the resource base of both the trading countries and make a comparison study.

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Appendix
Table A

Developed Countries	Andorra
	Antigua
	Aruba
	Australia
	Austria
	Bahamas
	Bahrain
	Barbados
	Belgium
	Bermuda
	British Virgin Islands
	Canada
	Cayman Islands
	Chile
	Croatia
	Cyprus
	Czech Republic
	Denmark
	Estonia
	Finland
	France
	French Polynesia
	Germany
	Greece
	Greenland
	Hong Kong
	Hungary
	Iceland
	Ireland
	Israel
	Italy
	Japan
	Kuwait
	Latvia
	Liechtenstein
	Lithuania
	Luxembourg
	Macao SAR
	Malta
	Monaco
	Netherlands
	New Caledonia
	New Zealand
	North Korea
	Norway
	Oman
	Poland
	Portugal
	Qatar

	San Marino Saudi Arabia Seychelles Singapore Slovenia South Korea Spain Sweden Switzerland Taiwan Trinidad and Tobago UAE UK USA
Developing Countries	Albania Algeria Angola Argentina Armenia Azerbaijan Bangladesh Belarus Belize Bhutan Bolivia Bosnia and Herzegovina Botswana Brazil Bulgaria Cambodia Cameroon China Colombia Costa Rica Cote dIvoire Cuba Djibouti Dominican Republic Ecuador Egypt El Salvador Fiji Gabon Georgia Ghana Guatemala Guyana Honduras

	India Indonesia Iran Iraq Jamaica Jordan Kazakhstan Kenya Lebanon Lesotho Libya Malaysia Maldives Mauritania Mauritius Mexico Moldova Mongolia Montenegro Morocco Myanmar Namibia Nicaragua Nigeria Pakistan Panama Papua New Guinea Paraguay Peru Philippines Romania Russia Samoa Sao Tome and Principe Serbia South Africa Sri Lanka Sudan Suriname Swaziland Syria Tajikistan Thailand Tunisia Turkey Turkmenistan Ukraine Uzbekistan

	Vanuatu Venezuela Viet Nam Yemen Zambia
Underdeveloped Countries	Afghanistan Benin Burkina Faso Burundi Central African Republic Chad Congo Eritrea Ethiopia Gambia Guinea Haiti Liberia Madagascar Malawi Mali Mozambique Nepal Niger Rwanda Senegal Sierra Leone Somalia South Sudan Tanzania Togo Uganda Zimbabwe

Table B

Country Name	year	record	value	record	value	record	value
India	1991	HDI	0.43	Population	8.89E+08	GDP	536.43
India	1992	HDI	0.44	Population	9.06E+08	GDP	554.64
India	1993	HDI	0.44	Population	9.24E+08	GDP	569.67
India	1994	HDI	0.45	Population	9.43E+08	GDP	595.91
India	1995	HDI	0.46	Population	9.61E+08	GDP	628.86
India	1996	HDI	0.47	Population	9.79E+08	GDP	663.62
India	1997	HDI	0.47	Population	9.98E+08	GDP	677.68
India	1998	HDI	0.48	Population	1.02E+09	GDP	706.43
India	1999	HDI	0.49	Population	1.03E+09	GDP	755.12
India	2000	HDI	0.49	Population	1.05E+09	GDP	770.35
India	2001	HDI	0.5	Population	1.07E+09	GDP	793.64
India	2002	HDI	0.5	Population	1.09E+09	GDP	810
India	2003	HDI	0.52	Population	1.11E+09	GDP	859.34
India	2004	HDI	0.53	Population	1.13E+09	GDP	912.56
India	2005	HDI	0.54	Population	1.14E+09	GDP	981.69
India	2006	HDI	0.55	Population	1.16E+09	GDP	1056.24
India	2007	HDI	0.56	Population	1.18E+09	GDP	1130.05
India	2008	HDI	0.56	Population	1.2E+09	GDP	1156.97
India	2009	HDI	0.57	Population	1.21E+09	GDP	1237.39
India	2010	HDI	0.58	Population	1.23E+09	GDP	1345.72
India	2011	HDI	0.59	Population	1.25E+09	GDP	1416.12
India	2012	HDI	0.6	Population	1.26E+09	GDP	1476.57