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Modern Lifestyle, Non Veg Food and its Impact on Environmental Aspects

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Materials and methods: Data from U.S Department of Agriculture, Foreign Agriculture Service, 2010 is used for meat consumption analysis. Global data of 1965-2005 obtained from the U.N. Food and Agricultural Organization FAOSTAT livestock database is used for projection.

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Results: Modern lifestyle has affected the meat consumption pattern. With increase in per capita income the consumption rate of meat products has dramatically increased through out the world. The projected population for 2050 will demand 624,530000 metric tons of meat and per capita meat consumption will rise from 41.0 kg to 68.8 from 2005 to 2050. The projected data shows that there in increase in per capita meat consumption with increase in per capita GDP. India having, low per capita GDP in comparison to USA has low meat consumption rate. Australia, North and South America and some parts of Europe have very high meat consumption rate .The total land used for meat production (excluding pasture land) was 2526347 Km2 in 2002 whereas it is estimated to be more than double by 2050 i.e. 6594227 Km2 and The CO_2E released from livestock farming was 982108000 metric tons in 2002 where as it is going to be almost triple of it (2753452000 metric tons) by 2050. Besides, the water required for meat production was around 2000000000 thousand kilo liters in 1965 whereas it is estimated to be around six times more i.e. 12000000000 thousand kilo liters by 2050. The rain forest and biodiversity are also adversely affected by meat production/ consumption.

Conclusion: Meat consumption is not economically and ecologically sustainable for Earth. Radical changes in food consumption pattern, emphasizing on vegetarian food is a must for sustainability of our mother Earth.

Keywords : Meat Consumption, Environmental Impacts, Modern life style, Non veg food, Climate change.

I. Introduction

There is changing trend that is occurring globally in how people eat. As the economic status of people changes, the food consumption pattern changes as well. Communication technology and bombarded advertisements and modern lifestyle have made the best tools for forcing people to shift from vegetarian to non vegetarian. There is a substantial social science literature that examines the factors that influence the meat consumption behavior of individuals (Dietz et al., 1995). Agricultural economists have examined the factors that influence demand for different types of food at the aggregate (Rosegrant et al., 2001). Economic analyses have led to sophisticated models used to project future demand for various food types, including meat. They find that population growth, changing lifestyle due to economic growth, and urbanizations are the key factors influencing global food consumption trends (Rosegrant et al., 2001).

Attraction towards non veg food is high in modern era. The tendency of eating non veg, fast food in hotels, restaurants and at home has become a fashion which has boost up the global market of non veg food. The study of Popkin BM (2001) has suggested that rapid changes in diets resulting from modernization (i.e. improved standards of living and continued development) and market globalization have had a significant impact on lifespan of people. In the present modern life style we do not take care of our eating habits, only when we land into trouble we realize the consequences of the modern life style. The modernization perspective identifies economic development and connection to global markets as key influences on production and consumption processes. The modernization perspective generally assumes that meat consumption are determined by the economic means of a society to acquire these ''superior goods''—i.e. it is assumed that as national affluence rises, meat and fish consumption will also rise since they are

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desirable, although expensive, food sources (Brown, 1995; Rosegrant et al., 2001). The modern life style with high Per capita Purchasing Power (PPP) has increased the meat production and consumption. The consumption and production of non veg food is rising enormously in developing countries since the per capita income is growing. In fact, in 2007 at least 60 percent of meat was produced in developing nations (Henning S, Pius C. 2007).

Food consumption patterns, particularly meat and fish consumption, have serious consequences for environmental Sustainability (Gerbens-Leenes and Nonhebel, 2002; Goodland, 1997; White, 2000). Meat production is resource intensive and of growing concern in environmental circles. Up to 10 times the quantity of resources (land, energy, and water) is needed to produce meat relative to equivalent amounts of vegetarian food (Durning and Brough, 1991; Dutilh and Kramer, 2000). Beef production in particular has serious environmental consequences, contributing to deforestation, desertification, and global warming (Durning and Brough, 1991). In 2007, meat production remained steady at an estimated 275 million tons; in 2008, output is expected to top 280 million tons. (FAO, 2008) And by 2050 nearly twice as much meat will be produced as today (FAO, Livestock's Long Shadow, 2007).

So far, systematic studies analyzing the meat consumption pattern of world and its consequences on environmental resource have not been carried out. This analysis tends to fill this gap by examining the nexus between meat consumption and environmental degradation. The study estimates population growth, per capita income and per capita meat consumption for 2050 and finds association between per capita income and meat consumption and focuses on exploring the impacts of meat consumption on various environmental aspects.

Overall objective of this study is to identify relation between modern lifestyle and meat consumption, estimate per capita meat consumption by 2050, find its correlation with per capita income and to examine whether meat consumption has any sorts of environmental impacts, in particular, on water, land use, climate change, rain forest and biodiversity and if there is, to what extent?

II. Materials and Methods

The Study is based on secondary source of data. Data from U.S Department of Agriculture, Foreign Agriculture Service, 2010 is used for meat consumption analysis. Global meat production data for 1965-2005 were obtained from the U.N. Food and Agricultural Organization FAOSTAT livestock database. The total production numbers were divided by the U.N. population estimates to obtain per capita meat production. To project population growth by 2050 the following model was used

The equation used was:

$$Pop = A + B(Year) + C(Year^2) + D(Year^3)$$

Using least squares regression the resulting estimate was: Pop = 46,660,628,985 - 70,374,538 (Year) + 35,343.4(Year2) + 5.910(Year3) $R^2 = .99994$

And to project GDP from 2005 to 2050 the available data for 1965 through 2005 were regressed on Year. The equation was estimated in logarithms, and regression gives average annual growth rate of GDP. The regression result was : Per Capita GDP = 2995.3*e0.0154 $R^2 = 0.98$

The global per capita meat production was estimated by using following model:

Per Capita Meat Production = A + B (Per Capita GDP)

Both variables were converted to logarithms before the regression was run. The resulting estimated equation for 1965-2005 was Per Capita Meat Production = -2.842 + 0.758313(Per Capita GDP) R2= 0.976 .

The models developed by Gerbens-Leenes , Nonhebel, and Susan Subak are used for estimation of land required for production of (Beef, Pork, and Broiler) per m2and estimation of CO2 emission per kg meat.

Both descriptive and analytical method of data analysis is applied in this study. Data is presented in tabulated as well as graphical forms for in-depth analysis.

III. Discussion

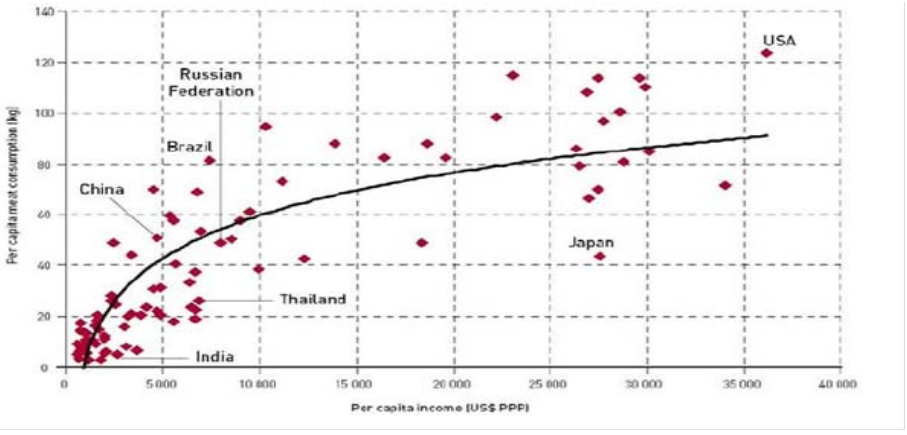
The demand of non veg food (beef, pork, and broiler) is growing higher since they are regarded as the chief source of protein. It is essential to find, why non veg food consumption is growing with growth in modernization? Table 1 indicates the reasons for it.

Table 1 : Per Capita and Total Meat Production 2006-2050 Projected.

Year	Per Capita GDP $2000	Population	GDP $2000	Total Meat/ 000 Metric Tons	Per Capita Meat in kg
1965	$2,825	3,337,974	$9,429,556	84,437	25.3
1970	$3,299	3,696,588	$12,194,430	100,624	27.2
1975	$3,581	4,073,740	$14,587,570	115,765	28.4
1980	$3,966	4,442,295	$17,616,910	136,682	30.8
1985	$4,136	4,843,947	$20,032,840	154,421	31.9
1990	$4,535	5,279,519	$23,944,060	179,958	34.1
1995	$4,727	5,692,353	$26,910,310	206,755	36.3
2000	$5,217	6,085,572	$31,745,760	235,121	38.6
2005	$5,654	6,464,750	$36,554,731	265,236	41.0
2010	$6,103	6,842,923	$41,765,656	296,199	43.3
2015	$6,588	7,219,431	$47,562,691	331,138	45.9
2020	$7,111	7,577,889	$53,888,672	368,316	48.6
2025	$7,676	7,905,239	$60,680,624	407,148	51.5
2030	$8,286	8,199,104	$67,934,006	447,475	54.6
2035	$8,943	8,463,265	$75,691,056	489,447	57.8
2040	$9,654	8,701,319	$83,999,657	533,234	61.3
2045	$10,420	8,907,417	$92,817,529	578,429	64.9
2050	$11,248	9,075,903	$102,083,102	624,530	68.8
1965-2005 Increase	100.2%		93.7%	287.7%	214.1%	62.2%
2005-2050 Increase	98.9%		40.4%	179.3%	135.5%	67.7%

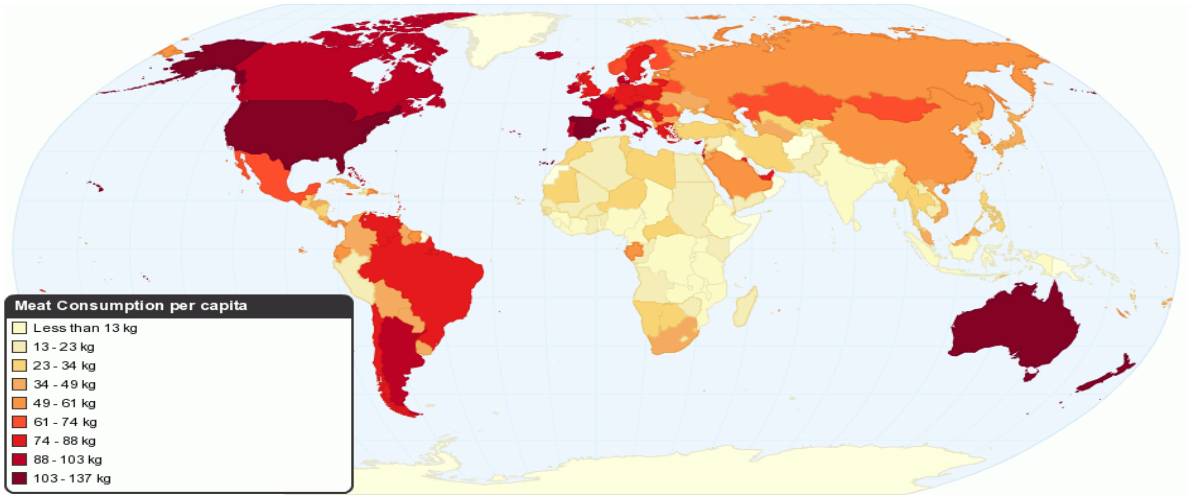
Modern life style is by and large associated with per capita income. Higher the per capita income, better the life style. Over the time, the Per capita Purchasing Power (PPP) of people have increased with increase in Per capita GDP so the per capita meat consumption has also increased as indicated in table 1 (25.3Kg meat/ person in 1965 to 68.8 kg meat /person in 2050). The increase in income has brought change in the food consumption pattern. People have attracted towards non veg food (meat) and this situation is going to be more serious in days to come (Galloway et al.). By 2050, the demand of meat will be 624,530000 metric tons. Production of such amount of meat by live stocks will certainly hamper the environment.

Figure 1 : The relationship between meat consumption and per capita income 2005.



The projected data shows that there in increase in per capita meat consumption with increase in per capita GDP. India having, low per capita GDP in comparison to USA has low meat consumption rate. USA, Japan, Russia and Brazil has very high consumption rate of meat products (fig.1) .

Figure 2 : Meat consumption per capital by country, 2010.



Source : U.S Department of Agriculture, Foreign Agriculture Service, Livestock and Poultry: World Markets and trades, annual 2010.

Fig (2) indicates high per capita meat consumption in Australia, North and South America and some parts of Europe. The per capita meat consumption is less in Africa and South Asia. This also indicates association of meat consumption with Per capita GDP.

With no more, and perhaps less, productive farmland available over the next 50 years this projected growth in meat production represents a major challenge to both farmers and the environment. More meat means more feed and forage will need to be produced, and more land will be required for housing the additional animals that will be on farms. In addition, more production of all crops will be needed, including those used for direct human consumption and for industrial uses.

To support the higher animal product with reference to production level of 2050. It is required that feed crop yields will need to more than double if we are to increase meat production in line with increases in GDP and changing life style. Failure to substantially increase crop yields in line with the meat production projections , will result in increased pressure to push crop production onto more of the world's fragile lands that are not being farmed today. If feed crops production is pushed onto marginal land the result will be a degraded environment, increased soil erosion, increase water pollution, reduced wildlife habitat, and increased use of chemical and fertilizer inputs.

IV. Impacts of Meat Production/ Consumption in Environment

The findings of Gerbens-Leenes , Nonhebel and Susan Subak has developed a model to measure the CO_2 e / kg(carbon dioxide equivalent per kg) and land required(m2)for production of 1 kg meat production .

Table 2 : Environmental impact of 1 kg of a given commodity.

Impact type	Beef	Chicken	Pig
CO_2 equivalent (kg)	14.8	0.	0.9
Land requirement (m^2)	20.9	2	7.3
		8.	

a) Diminishing Availability of Land for Food Production

According to the United Nations, raising animals for food (including land used for grazing and land used to grow feed crops) now uses a staggering 30 percent of the Earth's land mass. Soybean cultivated in many countries is mostly used for live stock farming rather than human use, causing hunger and starvation in some parts of the world. Soybean production covers around half of Argentina's cultivated land and expansion is spreading into the heavily forested northern states such as Salta and Santiago del Estero – around 415,000 hectares of forest were cleared in Salta between 2002 and 2006(Fuel destruction in Latin America, 2008). According to government figures a total of 250,000 hectares of forest are cleared annually, with 80 per cent of this making way for soy and cattle farming in the Chaco. Brazil is the second largest global producer of soybeans after the United States, followed by Argentina which is mostly used for live stock farming (United Soya republic, 2010). It is obvious that live stock farming has excessive pressure on land. Huge amount of arable land is used for live stock farming and growing crops for live stocks. It eventually affects the human life causing food insecurity as increased livestock farm will reduce the supply of soybean, wheat, maize and other crops to people since these products are used for

livestock rearing. The model developed by Gerbens-Leenes and Nonhebel is used here to estimate the land used for meat production. This estimates the amount of land needed for feed and other inputs and does not include land usage for pasture and production facilities.

Table 3 : Global Land Requirement for Meat Production.

In 2002	Beef	Pork	Poultry	Total
Land usage (km^2)	1252849	657692	615806	2526347
In 2020				
Land usage (km^2)	2144609	936180	1017447	4098236
In 2050				
Land usage (km^2)	3604887	1324532	1664808	6594227

One of the problems with meat production is the amount of land required. To produce 1 kg of beef, pork and broiler in the Netherlands requires 20.9, 8.9, 7.3 m2 of land respectively. (Gerbens-Leenes and Nonhebel 2002). If same model is followed, the total land used for meat production was 2526347 Km2 in 2002 whereas it is estimated to be more than double by 2050 i.e. 6594227 Km2 (table 3).

b) Green House Emission and Climate Change

Livestock buildings are a major anthropogenic [caused by human activity] source of atmospheric pollutants, such as ammonia, nitrous oxide, methane and carbon dioxide, which contributes to soil acidification and global warming(CM Wathes et al, 1997).Methane and nitrous oxide are the principal outputs of livestock systems that impact on GHG. Emissions arise "directly" and "indirectly". Direct emissions refer to those directly produced by the animal from enteric fermentation of fiber by ruminants, manure and urine excretion. Indirect emissions include those from feed crops used for animal feed, emissions from manure application, CO_2 emissions from fertilizer production for feed and CO_2 emissions from processing and transportation of refrigerated livestock products (IPCC,1997). The greenhouse gas emissions associated with different stages in the animal food chain production cycle are shown in Table4.

Table 4 : Livestock Life Cycle Stage and Associated Emissions (Garnett, 2007).

Life Cycle Stage	Process Creating Emissions	Type Of Emissions
Production Of Animal	Production Of Nitrogenous And Other Fertilizers, Agricultural Machinery, Pesticides Etc	N_2o Emissions From Grazing Land, Fertilizer Production; Co_2 From Fertilizer Production
Housing, Maintenance, Machinery	Heating, Lighting Etc	Co_2
Digestion (Ruminants)	Enteric Fermentation	Ch_4
Waste Products	Manure And Urine	Ch_4 And N_2o
Slaughtering, Processing, Waste Treatment	Machinery, Cooking, Cooling, Chilling, Lighting, Leather And Wool Production, Rendering And Incineration	Co_2 And Refrigerant Emissions
Transport. Storage, Packaging	Transport, Chilling, Lighting, Packaging Materials	Co_2 And Refrigerant Emissions
Domestic Consumption	Refrigeration And Cooking	Co_2 And Refrigerant Emissions
Waste Disposal	Transport, Composting, Anaerobic Digestion And Incineration	Co_2, Ch_4 And N_2o

Susan Subak (1999) calculated the environmental effects of methane and CO_2 emissions of cattle. In total, to produce one kg of meat (beef) requires the equivalent of 14.8 kg of CO_2. As a comparison, one gallon of gasoline emits approximately 2.4 kg of CO_2 (EPA 2005). Consuming one kg of meat thus has a similar impact on the environment as 6.2 gallons of gasoline, or driving 160 highway miles in the average American mid-size car. The following table shows meat consumption and emission of CO_2 in environment.

Table 5 : Meat Consumption and Emission of CO_2 by 2050.

In 2002	Beef	Pork	Poultry	Total
CO_2 equivalent (1000's mt)	887185	81085	13838	982108
In 2020				
CO_2 equivalent (1000's mt)	1518671	115419	22863	1656953
In 2050				
CO_2 equivalent (1000's mt)	2552743	163298	37411	2753452

It is obvious from the table (5) that the meat consumption has adverse effect in global warming and climate change. As the demand of meat will grow in future the production of Co_2 Equivalent responsible for climate change will also increase. The CO_2E produced from livestock and poultry farming was 982108000 metric tons in 2002 whereas it is going to be almost triple of it (2753452000 metric tons) by 2050. Such a huge amount of CO_2 Equivalent emission certainly affects the climate change. Methane is 23 times more responsible of global warming than CO_2 and the number one source of methane worldwide is animal agriculture. Methane emission from livestock contribute around 6 percent of global green house gas.(World Agriculture Towards 2015) .Cow , Sheep and Goat emit methane through the digestive process(enteric fermentation), while manure is also high in methane(Table 4). As meat and diary consumption increases, methane emission is predicted to raise by up to 60 percent by 2030.(Livestock's long shadow 2006) which is going to be a burning environmental issues in near future.

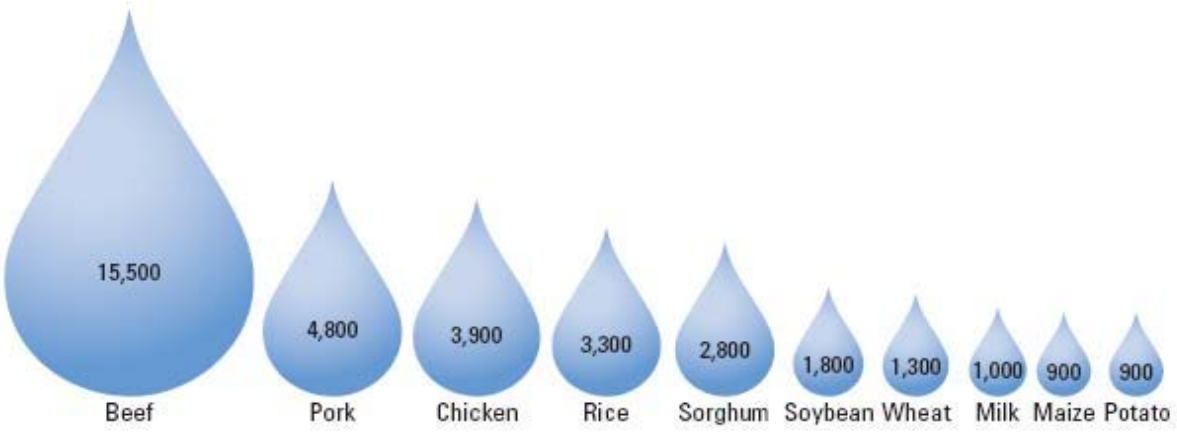
c) Global Water Crisis and Meat Production

Probably even more crucial than the inefficient feed conversion ratios for animal products is their drain on the world's water resources. For there is now widespread acceptance that water scarcity will become at least as important a constraint on future food production as lack of available land. Demand has tripled in the past two decades and is expected to accelerate further in the next two - considerably more so if predictions for growth in the livestock population prove accurate. Water from dwindling supplies will have to serve both a growing human population and an explosion in the number of livestock.

Between watering the crops that farmed animals eat, providing drinking water for billions of animals each year, and cleaning away the filth in factory farms, transport trucks, and slaughterhouses, the farmed animal industry places a serious strain on our water supply. Recent projections by the International Food Policy Research Centre (IFPRI) indicate that if current trends in water management continue, we can expect a combined rise of 62 per cent in consumption for domestic, industrial and livestock use in the period 1995-2025. Figures for livestock production, while lower than for industry and domestic use, are predicted to rise by 71 per cent in the same period - 19 per cent in the developed world and more than double in developing nations.(Mark W. et al, 2002) . In India, the pumping of underground water is estimated to be double the rate of aquifer recharge from rainfall.(Janice Cox & Sari Varpama,,2000) . A potentially catastrophic crisis is looming for a country whose human population is already greater than 1 billion in such case wattage of huge amount of water is worthless.

One indication of the relative water requirement per unit of product is provided in Figure (3). The high value attributed to beef is notable. The production of 1 kg potato requires merely 900 liters of water where as 1 kg beef production requires 15500 liters of water Excessive water used for meat production has lead to. scarcity of water for agricultural land causing less production. Low food productivity is causing malnutrition and untimely death of many children. Less production of meat using more water is irrational, it could be resolved if consumption of meat is stopped.

Figure 3 : Water Use for Agricultural Products (liters per kg).

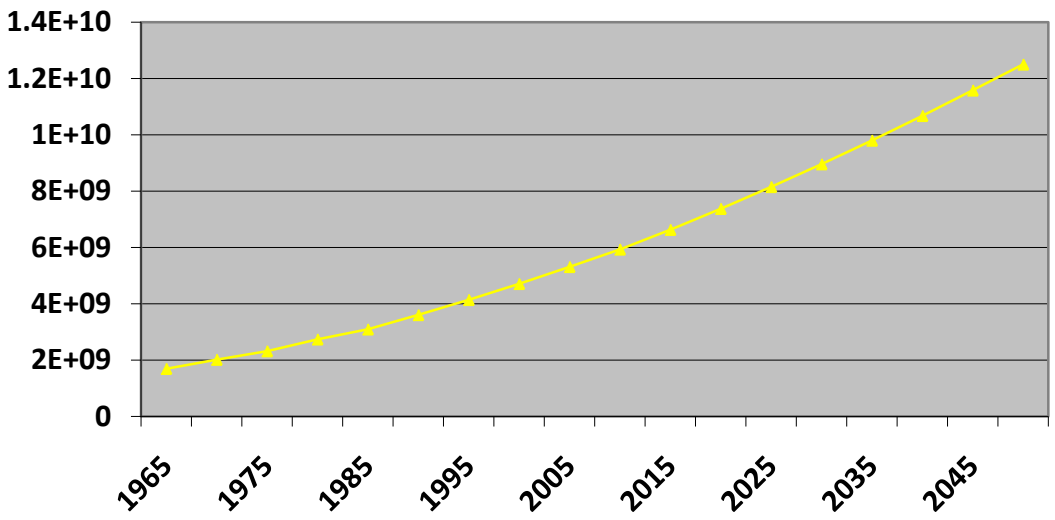


Source: Waterfootprint (https://www.waterfootprint.org), accessed May 15, 2009; Gleick 2008.

Note: Figure shows liters of water needed to produce one kilogram of product (or one liter for milk). Water use for beef production only characterizes intensive production systems.

Nearly half of all the water used in the United States goes to raising animals for food. In 2008, John Anthony Allan, a professor at King's College London and the winner of the prestigious Stockholm Water Prize, urged people worldwide to go vegetarian because of the tremendous waste of water involved with eating animals. Livestock operations are major water users and polluters. The irrigation of feed crops for cattle accounts for nearly 8 percent of global human water use (ibid). It takes more than 2,400 gallons of water to produce 1 pound of meat, while growing 1 pound of wheat only requires 25 gallons. You save more water by not eating a pound of meat than you do by not showering for six months! A totally vegan diet requires only 300 gallons of water per day, while a typical meat-eating diet requires more than 4,000 gallons of water per day.

Figure 4 : Water Required for Meat Production in 1000 kilo liters.



As population was less during 1965 and the meat consumption rate was also low. Modernization had not much influenced the human life, the per capita GDP was low thus meat consumption rate had not gone very high in late 20th century but now scenario is different. Water demand for meat production is going on increasing with high demand of meat world wide. The water required for meat production was around 2,000,000,000 thousand kilo liters in 1965 where as it is estimated to be around six times more i.e. 12,000,000,000 thousand kilo liters by 2050(fig4).

d) Food Insecurity and Livestock Farming

In spite of the enthusiasm among poorer countries to enter the international trade in animal products, it defies all logic for them to import grain to feed animals which they then export to richer nations. This situation is leading them towards food insecurity with in the country. Intensively produced meat cannot

possibly feed the world's poor. Poor nations are unable to provide even the basic foodstuffs (grains) to sustain their poorest people, how can they utilize land to grow grains for animals feeding and sell such animal meat in lower price than the food grains to people? Given that the hungry are hungry because they cannot even grow or afford to buy enough low-priced grain for sustenance. It is far-fetched to suppose that they will suddenly be able to afford relatively high priced mutton, pork and chicken.

Indian broiler industry is one of many that exemplify the problem. It has grown phenomenally from 31 million birds slaughtered per annum in 1981 to 300 million in 1992 and roughly 800 million by the turn of the century. (B. S. Bhattu, 2002). Consumption has tripled in the past decade. Yet as the industry itself acknowledges, this has had no impact upon human hunger. Anuradha Desai, Indian Branch President of the World Poultry Science Association, states that the target audience for the Indian broiler market is 'the fast growing middle class of over 250 million potential customers'. (Dr. M A Ibrahim, 1997). Increase in live stock farming is causing excessive increase in price of food grains since much of the food grains of agricultural countries is exported for livestock farming. Such situation has created food scarcity and increment in food price causing poor people die with starvation. According to very conservative estimates, a 50 per cent reduction in meat eating in developed nations could save 3.6 million children from malnutrition.

e) Poisoning the Environmental Resources

Land and water pollution is extremely high with live stock farming. The improper management of manure and over use of insecticide and pesticide on land for production of grains for live stock is poisoning the land and water. Waste from CAFOs is emerging as a leading cause of water pollution in China(Xiayon, 2005). It is estimated that around 90% of industrial farm of China lack adequate pollution control, and that only 5% of waste is actually treated- the remainder ending up in water system.

f) Deforestation and loss of biodiversity

As consumer's demand for meat increases, more land is needed. Hundreds of miles of the South American rainforest is burned and cut annually and converted to crop and grazing land (ibid, 2009). The New York Times reported that 1,250 miles of Brazilian rain forest were lost for feed and livestock production in just 5 months.

The Amazon rain forest is on of the world's largest tropical forest which is the habitat of many rare and endangered flora and fauna. Such a valuable forest is being converted in to farm land for cattle rearing. According to Greenpeace, all the wild animals and trees in more than 2.9 million acres of the Amazon rain forest in Brazil were destroyed in the 2004-2005 in order to grow crops that are used to feed chickens and other animals in factory farms. By 2005 over 6 million hector had been converted to soy with in legal boundaries of Cerrado (Eating up the Amazon, 2006). It is estimated that a further 9.6 million hectors of Amazon forest could be lost to soy expansion by 2020.(The impact of Soy production , 2008).Such a massive deforestation in resulting into excessive destruction of biodiversity.

V. Conclusion

It is clear that the current model of livestock production is no longer affordable in environmental or social terms. The climate, water systems, soil and wildlife cannot sustain the damage that is being caused. Impacts of meat consumption on environmental resources are not a small issue, both today and especially in the future. The way the system is currently setup is not sustainable, and so a range of issues must be dealt with by the governments of the world sooner rather than later.

Action to replace livestock products not only can achieve quick reductions in atmospheric GHGs, but can also reverse the ongoing world food and water crises so organizations should consider making advocating vegetarianism a major part of their "Save the Earth" campaigns. At a minimum, environmental advocates should mention vegetarianism in any information about actions individuals can take to address meat consumption and global warming. An alternative could be, food companies producing and marketing such products that are alternatives to livestock products but taste similar, are healthier and easier to cook and made up of grains.

There should be change in Government's food procurement policies, special emphasize should be given to encourage vegetarian diets. Possible mechanisms include an environmental tax on meat, a shift in farm subsidies to encourage plant agriculture over animal agriculture, or an increased emphasis on vegetarian foods in government-run programs like school lunch program.

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