Sagar Chawla, Student Participant
Central Academy
Des Moines, IA

# India: Food Security and the Implementation of Biofuels

A free and democratic world can only exist if its comprising states exercise self-government. Likewise, a free and democratic state cannot exit unless its citizens are able to determine their own actions. Thus, the major hurdle to the ideal world society is not rogue nations or terrorism: these are merely consequences of a deep-seated social condition. Humanitarians have realized that the best way to do such is to ensure food security through poverty eradication. Yet lasting food security is not a terminal objective but a condition that must be sought and maintained to engender a freer and more prosperous tomorrow. The Food and Agriculture Organization of the United Nations ("The State of Food Insecurity 2006") reported in 2001-03, 854 million people were undernourished in the world. Even more disquieting is that a great majority reside in developing countries, whose governments are unable or unwilling to provide the necessary services or enact the policies that may alleviate the status quo. At the dawn of the twentieth century the cure to these global ailments may be biofuels.

"Projections indicate that bioenergy produced through agricultural could meet up to 25 percent of global energy demand by 2050." Energy that can be grown has many advantages. It can replace the diminishing fossil fuel supply, open new economic opportunities, and is carbon neutral, which may help mitigate the climate change associated with fossil fuels. The current energy services do not provide for nearly 2.4 billion people, mostly rural poor, who still rely on biomass, or biodegradable waste products such as wood and dung, for daily energy needs. The shifting of resources from food to fuel must be orchestrated with respect to each nation's respective conditions. It is critical to consider the implications on national ecology, food security, and food, labor, land prices when considering biofuel production implementation ("Agriculture and Environment: Time to Act Globally"). Currently one-fifth of India's population is labeled undernourished making it the nation with the greatest number of underfed, most of whom live in rural areas. India has not only to check its exponential population growth, but also the effects of low levels of literacy in rural areas, social equity, and rapid urbanization among others ("Rural Poverty in India"). Yet agriculture still contributes to nearly 33 percent of India's Gross Domestic Product (GDP) and a third of its people depend on agriculture for their livelihood (Embassy of India).

Each of India's states has its own spoken tongue and unique culture. Thus defining a typical subsistence family farm is difficult. In the eastern states of Jharkhand and Bihar food insecurity is the most pressing; these states are followed by Uttar Pradesh, Uttarakhand, Orissa, Chhattisgarh, and Madhya Pradesh, Rajasthan, and Gujarat as the next most insecure (Food Insecurity Map - Rural India"). The average rural family size ranges from 4.99 (Bihar) to 5.11 (Madhya Pradesh). In states considered more secure, average family size is between 4.16 (Andhra Pradesh) and 5.55 (Haryana). Female-headed households tend to be smaller and the average ages of the family older, as there are usually fewer children (Meenakshi and Ray). The primary rural diet is wheat in the west and rice in the east and south; cereals compose 73 percent of total calorie intake in rural areas (Kumar, Rosegrant, and Hazell). The average daily calorie intake per capita is lowest in rural Kerla, 1389, and averages to about 1800 in the rest of the nation. Furthermore, richer states such as Punjab and Haryana have a cereal share (percent of household income spent on food) of about 15 percent, whereas in poorer states such as Bihar and Manipur the cereal share is around 40 percent (Sen).

The literacy rate of India is 61 percent with a breakdown of 73 percent males and 54 percent females (United States of America). A majority of the illiterate live in the rural areas with little or no access to formal education as 20 percent of children age six to fourteen do not attend school ("India: Education"). The average income in rural India averages 42 dollars per month. In richer states such as

Punjab, the average is higher, 200 dollars a month, an income bracket of the Indian lower middle class. Although the average farmer would not consider buying household appliances such as a refrigerator, those of Punjab are looking to buy televisions and other modern commodities ("Rural India, Have a Coke"). The average farm size in Bihar and Orissa is about 0.70 ha, whereas it is 1.25 ha in Punjab and 1.41 ha in Haryana. Furthermore, there is an inverse relationship between the poverty rate and the size of land holdings (Meenakshi and Ray). The overall average holding is under 2.0 ha, often fragmented by legal and family disputes. The main crops grown on these farms are rice, bajra, jowar, and maize followed by ragi and small millets. Alternative crops include groundnut, sugarcane, and pulses ("Cropping Patterns"). To improve agricultural productivity and farm income, barriers such as irrigation technology, primary education, social equity, market access, available land, and the use of inefficient and outdated farming practices. The most pressing to food security are gender disparity, urbanization, and population growth.

Although the family is often considered a single entity with members having common interests, it is necessary to consider the balance of powers within a household and each member's respective tasks if one is to understand the link between gender disparity and food security. A woman's productive, reproductive, and caring functions are critical to the food security of poorer families. In fact, women in India tend to invest a greater portion of their income, usually between 25 to 50 percent of the total family income, on family nutrition and health; studies show a positive correlation between the mother's upkeep of home garden or subsistence farm and child nourishment (Ramachandran). "An often-quoted study estimated that a specific project focus on gender increased agricultural productivity and output by more than 20 percent," ("Food Security, Poverty and Women"). Thus, the alleviation of chronic food insecurity lies in empowering women; if they have the economic leverage necessary to sustain a steady income, then they can support the nutritional needs of their family. However, women are still economically immobile due to social biases and public policies. South Asia's farming culture prohibits women from acquiring a tenure for land and thus gaining right of ownership to land. In the Hindu system, women only inherit property from their family in the absence of a male heir for four generations. A woman cannot pass down any property she receives to her daughter. The Hindu Succession Act of 1956 attempted to mandate the equal sharing of property between daughters and sons; however, agricultural land was excluded from the purview of the law. Under Islamic code a daughter receives only half as much property left by her father, as does the son. The Muslim Personal Law *Shariat* Act of 1937 also excluded agricultural land from its purview (Ramachandran). This is a key problem as 86 percent of agricultural land is held privately in India. In the future, it will be essential for women to hold ownership of land as their male counterparts go to urban areas, attracted by higher wages and greater economic mobility. There is a growing number of female-headed households surviving without access to credit, technology, or extension services. Without legal ownership of land, they do not have the necessary collateral to acquire credit or social status to deal with extension workers. As Ramachandran concludes, ownership of land will allow women to have a greater contribution to the food security of their families by controlling crop output, availability of fodder, fuel, trees, and garden.

Four indicators measure the gender disparity: ratios of girls to boys in primary, secondary and tertiary education; ratio of literate women to men among 15-24 year-olds; share of women in wage employment in the non-agricultural sector; and proportion of seats held by women in national parliament ("Women as Agents of Change"). India's ratio of girls to boys in primary, secondary, and tertiary education increased by more than four percent from 2001 to 2004, one of the greatest changes in the educational gender gap in the developing world ("South Asia"). Currently, 54 percent of females are literate, a 15 percentage point increase from 1991 ("Census of India, 2001"). The share of women in wage employment and the proportion of seats held by women in the national parliament show a similar trend. The steady piecemeal progress of women in India may yield the alleviation of the gender disparity in rural in the near future.

Rapid urbanization and population growth are another set factor linked to the agricultural productivity and food security of India's farmers. Urbanization is the primary issue that rural farmers must face; rapid population growth only intensifies the problem. The population of urban Asia has increased twofold in the last thirty years due to the shifting of people from rural areas to urban areas in search of economic opportunities. Furthermore, most of the population growth in India in the coming century will happen in dense urban areas, transforming India from a nation that lives in villages to one that lives in bustling metropolitans. One study from the IFPRI confirms that as the exodus from agricultural communities continues, the demand for food in urban areas is swelling (Kim, Popkin, and Horton). The demand, however, is not for the staple foodstuff of rural diets but for a more mixed food basket of fruits, vegetables, eggs, meat, milk, highly refined grains, and sugars (Tontisirin). As this transition occurs, the growth of global demand for all types of agricultural products will drop from an average of 2.2 percent in the last thirty years to 1.5 percent for the next thirty years ("Global and Regional Food Consumption Patterns"). The general trend away from cereals other protective foods has been evident for decades. In India, rice consumption has decreased from 1987-88 with 5.26 kg/month/per capita to 5.10 kg/month/per capita in 1999-2000. The consumption of wheat has slowed, growing from 4.37 kg/month/per capita to 4.44 kg/month/per capita, an increase of 0.07 kg/month/per capita, from 1987-88 to 1993-94 respectively to only a 0.01kg/month/per capita increase from 1993-94 to 1999-2000. The consumption of jaggery/sugar, cookies, salted refreshments, and prepared sweets have shown marked increases, the consumption of prepared sweets increasing nearly fourfold, from 0.11kg/month/per capita in 1987-88 to 0.40 kg/month/per capita in 1999-2000 (Gopalan and Bhushan). By 2025 the rapid population growth, mainly in urban areas, will cause high value commodity food demands to grow between 80 to 112 percent, while only 28 percent for grains ("Toward High-Value Agriculture and Vertical Coordination").

Currently few public policy initiatives check the changing demand from urbanization and population growth. Because of the market diversification and shift in demand, farmers in India are looking to market-oriented production in hope of greater returns on land and labor. Cash crops are preferred as the demand for most other traditional agricultural products is declining. They are becoming the best alternative for poor farmers, traditionally the ones dependent on their subsistence farming for food and any profit. As more farmers switch production from cereals and staple products to strictly cash crops, the availability of these products in India declines, increasing prices. The other problem is that market-oriented production is a high-risk activity as it involves mono cropping. If the one crop fails for that year, the family will have no money with which to buy food. Even if the family has a good harvest, the majority of the money from the sale of crops often goes to moneylenders and intermediaries due to lack of market access in rural areas. Over the last five years, 28 percent of rural households were more dependent on the market for cereals and 43.5 percent were more dependent on the market for foodstuffs in general ("Food Security, Poverty and Women"). This trend will continue and possibly accelerate with increasing urban populations.

Urbanization in India shows a positive trend and will continue in the coming decades. In the 1981 Census, 159.46 million people, or 23.34 percent of the total population, lived in urban areas in India. The next decade showed a continual when 217.17 million lived in cities, and in 2000, nearly 30 percent of the billion-person population lived in metropolitan areas. Entering the twenty first century, India had an urban decennial population growth rate of a staggering 31.50 percent (Bhagat). The estimated 2007 overall population growth rate is 1.606 percent (United States of America). As these trends remain, the coming decades will observe greater market diversification in the food sector and market oriented agricultural activities as both are inherent to urbanization and population growth at this scale. The effects of urbanization and population growth in India are intrinsic to India's development. They are conditions that should be taken advantage of for the sake of smallholders, farmers with little land holdings, and the rural poor. The current problem is that most rural poor own small pieces of land that prevent them from transitioning to high-value agriculture. The problems in the shift include poor market access, lack of

credit available, access to information, technologies, transaction costs, production risks, and high safety standards set for high-value agriculture. If these external problems can be ameliorated then the farmers would have the necessary tools to thrive in the increasingly integrated and urban-dependent agricultural climate (Joshi, Gulati, and Cummings).

Biofuels have great potential in areas where it is cost prohibitive to build electricity lines or ship fuels. By growing green energy in their fields, the rural poor would be able to save income on fuel necessary to transport their agricultural products to markets. The opportunities extend much farther; most of the current energy demand is from developed countries often lacking the climate required to grow high yield biodiesels and biofuels (Laney). These and other far-reaching effects of biofuel production in India will undoubtedly influence the current conditions of gender disparity and contribute to the factors caused by urbanization and population growth.

The crop grown for the purpose of biofuel production would become a cash crop; it would be worth more if sold than it would be as part of the family's diet. In India, the men tend to the commercial crops. In a study in Andhra Pradesh, a state of India, it was found that increased cash crop production directly affected the amount of food the family grew for itself. This is especially harmful if the family already has limited land holding, possibly less than 0.70 ha in some areas. The decreased production of the subsistence family farm leads to the decreased control of women over the family finances and food supply. The men, who obtained greater control over the finances, often squandered the money on alcohol, cigarettes, or other vices instead of buying food. Cash crop production lead to a dramatic increase in the prevalence of alcoholism in the state of Andhra Pradesh. Due to the decreased food supply, women cut their intake of food while working harder to earn a larger income ("India - Impact of Market-Oriented Production on Household Food Security"). Thus if biofuel production is implemented in India under the current conditions, it is likely to exacerbate the gender disparity while leading to greater food insecurity. In Brazil, sugarcane production for biofuels has created numerous unskilled jobs in rural areas. Furthermore, most of the production of biofuels has been handed to small farmers who now produce 30 percent of all the sugarcane designated for biofuels (Hazell and Pachauri). With such widespread availability of jobs, men would not be forced to migrate to urban areas in search of jobs. By removing a primary impetus for rural exodus and rapid urbanization, the rate of urbanization in India could be decelerated to a degree. Furthermore, rural jobs could translate into a supplementary income for rural families. Such income could buffer against lean months or provide security from market oriented mono cropping practices.

The production of biofuels has already began in India, however many implementation problems remain and current plans do not necessarily benefit the rural poor. In 2003, nine states and four union territories were mandated by the Government of India to sell a 5 percent blend of ethanol and gasoline called gasohol. Currently, most ethanol in India is made from molasses after the sugar has been extracted from the sugarcane (Canadian Press). However, since the passage of the 2003 law, India has had to import sugar products and ethanol to cover the domestic demand. This past year, there was a great surplus of sugarcane, correlating in an increased amount of molasses and ethanol production, totaling 500.00 $m^3$ ethanol designated for fuel purposes (Pelkmans and Papageorgiou). Such annual flux yields a volatile market for biofuels, causing smallholders to shy away from investing in biofuel crops. Furthermore, since most ethanol is produced from sugarcane, the biofuel industry only benefits those farmers already growing sugarcane.

India's pilot projects in biofuels are yielding results, however for mass biofuel production to be effective and beneficial to smallholders, the crop of choice must be *jatropha carcus*. Not only can jatropha grow in variable weather conditions, little water and poor soil, but a barrel of ethanol can be produced for around 43 USD. This is cheaper than the corn based ethanol, 83 USD/barrel and India's sugarcane ethanol at 45 USD/barrel (Mongabay). Jatropha's flexibility means that poor farmers will be

more willing to adopt it as part of their crop rotation. The Indian federal government should further encourage smallholders to adopt jatropha by mandating a higher degree blend (E15 or E20) in all fuel in the states and union territories with greatest demand for fuel. The federal government can further encourage the risk-averse smallholders by establishing a minimum price contract for the crop. In the initial years of production, the poor farmers must be guaranteed this certain rate of return. This will also protect the rural poor that have already begun risky market-oriented production. India's rapid population and urbanization is a quickly growing market for fuel and will only expand in the decades to come. To solve the problems related to gender disparity the government of India should ensure that this emerging cash crop industry is not male centered. Once the creation of unskilled and minimally skilled jobs in rural areas in the biofuel industry begins, it will become imperative that a percentage of these jobs are allocated for women and that women are guaranteed equal wages to those of men. If women are the key determiners of family food security for the rural poor then it is necessary that they have employment opportunities. To accomplish this, the federal government of India must guarantee and encourage companies that invest in India's future biofuel market to do likewise.

India is at the forefront of developing nations, yet it is still plagued with issues faced by other such states: gender disparity, rapid urbanization, and population growth. The mass implementation of biofuels may be the impetus that India needs to propel itself to the status of a prosperous economic superpower. It is evident that as the population of India grows and it urbanizes, its thirst for fuel will not be quenched by the world supply of crude oil. Thus, the sooner India begins to grow its own energy supply, the better its future will be both economically and in the area of food security. However, the current pilot projects in biofuel indicate that an adjustment is needed in the crop of choice: jatropha, a stable dependent crop, not the volatile sugarcane should be used. If implementation is successful and the guidelines delineated above are followed, not only will the jarring conditions of gender disparity, urbanization, and population growth be ameliorated, but also the overall food security of the rural poor of India may become a non-issue.

After the first green revolution, India transformed from a nation dependent on others for basic food needs for its people to one that is self-sufficient. In this second green revolution, India has the opportunity to step up from a fuel-importing nation to one that provides the rest of the world with energy. Being a leader of developing nations, it is necessary for India to succeed and inspire those countries that missed the first green revolution, and aid them ending the global pandemic of hunger.

A free and democratic world cannot exist until its member states exercise self-determination, yet such cannot happen as long as its comprising citizens are enslaved to poverty. In this global effort, one must realize that the first step is ensuring food security through the eradication of poverty. Doing so means that families can provide for their own basic needs and not be dependent on periodic aid from their developed neighbors or fall victim to corrupt demagogues. Doing so will mean that the countless efforts of humanitarians around the world will bear fruit: a world of lasting peace and security.

Bibliography

"Agriculture and Environment: Time to Act Globally." Agriculture 21. Apr. 2007. 2 Aug. 2007 <http://www.fao.org/AG/magazine/0704sp1.htm>.

Bhagat, R B. Urbanisation in India: a Demographic Reppraisal. International Union for Scientific Study of Population. 2003. 1-17. 4 Aug. 2007 <http://www.iussp.org/Brazil2001/s80/S83_03_Bhagat.pdf>.

"Census of India, 2001." Chart. 2001 Census Results Mixed for India's Women and Girls. Population Reference Bureau. 15 July 2007 <http://www.prb.org/Articles/2001/2001CensusResultsMixedforIndiasWomenandGirls.aspx>.

"Cropping Patterns." KrishiWorld. 18 July 2007 <http://www.krishiworld.com/html/crop_pattern3.html>.

"Food Insecurity Map - Rural India." Map. Food Insecurity Atlas of Rural India. M.S. Swaminathan Research Foundation. 15 July 2007 <http://www.mssrf.org/fs/atlas/rural.htm>.

"Food Security, Poverty and Women: Lessons From Rural Asia." Rural Poverty Portal. 15 Mar. 2007. International Fund for Agricultural Development. 9 Sept. 2007 <http://www.ifad.org/gender/thematic/rural/rural_4.htm>.

Global and Regional Food Consumption Patterns. World Health Organization. 13-29. 18 Aug. 2007 <http://www.who.int/dietphysicalactivity/publications/trs916/en/gsfao_global.pdf>.

Gopalan, Sarath, and Sakshi Bhushan. Nutrition in Disease Management. Centre for Research on Nutrition Support Systems. New Delhi-110 016: Media Workshop India Pvt Lmtd, 2006. 3-18. 30 Aug. 2007 <http://crnssindia.res.in/update_oct_06.pdf>.

Hazell, Peter, and R. K. Pachauri. Bioenergy and Agriculture: Promises and Challenges. International Food Policy Research Institute. Washington, D.C.: International Food Policy Research Institute, 2006. 2-28. 14 Sept. 2007 <http://www.ifpri.org/2020/focus/focus14/focus14.pdf>.

"India - Impact of Market-Oriented Production on Household Food Security." International Food Policy Research Institute. IFAD. 9 Aug. 2007 <http://www.ifad.org/hfs/learning/in_3.htm>.

"India: Education." UNICEF. United Nations. 29 July 2007 <http://www.unicef.org/india/children_2359.htm>.

India. Embassy of India. Agriculture and Rural Developments. 15 Aug. 2007 <http://www.indianembassy.org/dydemo/agriculture.htm>.

"India Plans to Double Ethanol Blend in Gasoline, Lift Curbs on Biofuel." The Canadian Press 19 Sept. 2007. 22 Sept. 2007 <http://canadianpress.google.com/article/ALeqM5ibxiAkeThezg8D_J_qQThv7rwmnA>.

Joshi, P K., Ashok Gulati, and Ralph Cummings. Agricultural Diversification and Smallholders in South Asia. New Delhi: Academic Foundation, 2007. Agricultural Diversification and Smallholders in South Asia. 3 Aug. 2007 <http://www.ifpri.org/pubs/otherpubs/agdiversesach01.pdf>.

Kim, Soowon, Barry M. Popkin, and Sue Horton. The Nutritional Transition and Diet-Related Chronic Diseases in Asia: Implications for Prevention. International Food Policy Research Institute. Washington, D.C.:

International Food Policy Research Institute, 2001. 1-102. 19 July 2007 <http://www.ifpri.org/divs/fcnd/dp/papers/fcndp105.pdf>.

Kumar, Praduman, Mark Rosegrant, and Peter Hazell. Cereals Prospects in India to 2020: Implications for Policy. International Food Policy Research Institute. 1995. 30 July 2007 <http://www.ifpri.org/2020/briefs/number23.htm>.

Laney, Kara. Biofuels: Promises and Constraints. International Food and Agriculture Trade Policy Council. International Food & Agricultural Trade Policy Council Layout and Design, 2006. 3-18. 14 Aug. 2007 <http://www.agritrade.org/Publications/DiscussionPapers/IPC_Biofuels_Promises%20and%20Constraints.pdf>.

Meenakshi, J V., and Ranjan Ray, comps. Impact of Household Size and Family Composition. Vers. 2. July 2000. Research School of Pacific and Asian Studies. 7 Aug. 2007 <http://rspas.anu.edu.au/papers/asarc/meenakshi.pdf>.

Pelkmans, Luc, and Andreas Papageorgiou. Biofuels in India. Permia. Permia, 2005. 5-29. 14 Aug. 2007 <http://www.premia-eu.org/public_files/D2c_biofuels_India_Dec2005.pdf>.

Ramachandran, Nira. Women and Food Security in South Asia: Current Issues and Emerging Concerns. United Nations University - World Institute for Development Economics Research. 00160 Helsinki, Finland: UNU-WIDER, 2006. 1-16. 5 Aug. 2007 <http://www.wider.unu.edu/publications/rps/rps2006/rp2006-131.pdf>.

"Rural India, Have a Coke." BusinessWeek 27 May 2007. 3 Aug. 2007 <http://www.businessweek.com/magazine/content/02_21/b3784134.htm>.

"Rural Poverty in India." Rural Poverty Portal. 2 Apr. 2007. International Fund for Agricultural Development. 18 Aug. 2007 <http://www.ruralpovertyportal.org/english/regions/asia/ind/index.htm>.

Sen, Pronab. Poverty-Undernutrition Linkages. Nutrition Foundation of India. CSI, 2005. 23 July 2007 <http://nutritionfoundationofindia.res.in/archives.asp?archiveid=210&back=bydate.asp>.

"South Asia." Chart. Ratio of Girls to Boys in Primary and Secondary Education (%). World Bank. 4 Aug. 2007 <http://devdata.worldbank.org/gmis/ida14qa/indicators/girls_schooling.htm>.

The State of Food Insecurity 2006. United Nations. Food Agriculture Organization, 2006. 1-40. 12 Aug. 2007 <ftp://ftp.fao.org/docrep/fao/009/a0750e/a0750e00.pdf>.

Tontisirin, Kraisid. Impact of Globalization. Food and Agricultural Organization. 00100 Rome, Italy: Publishing Management Service, Information Division, FAO, 2004. 1-22. 18 July 2007 <ftp://ftp.fao.org/docrep/fao/007/y5736e/y5736e00.pdf>.

Toward High-Value Agriculture and Vertical Coordination: Implications for Agribusiness and Smallholders. New Delhi Symposium, 7 Mar. 2005, International Food Policy Research Institute. 9 Sept. 2007 <http://www.ifpri.org/pubs/books/oc47/oc47ch04Delhi.pdf>.

United States of America. Central Intelligence Agency. India. 20 Sept. 2007. 12 June 2007 <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>.

"With Corn Ethanol More Costly Than Oil, is Jatropha a Better Biofuel?" Mongabay.Com. 24 Aug. 2007. 6 Sept. 2007 <http://news.mongabay.com/2007/0824-biofuels.html>.

Women as Agents of Change. International Fund for Agricultural Development. 00142 Rome, Italy: Via Del Serafico, 107, 2003. 3-17. 29 Aug. 2007 <http://www.ifad.org/gbdocs/gc/26/e/women.pdf>.