INDIA'S ECOLOGICAL FOOTPRINT

A BUSINESS PERSPECTIVE

Global Footprint Network
Advancing the Science of Sustainability

CII
Confederation of Indian Industry

CONTENTS

FOREWORD

As today's pressing issues of climate change, food scarcity and spiking prices for basic goods make clear, India's long-term economic success is dependent on the health of its own natural capital as well as that of other nations. India's current rapid industrialization and advancing technology are bringing it unprecedented economic prosperity, with gross national income per capita almost doubling since 2000. But this rapid economic growth comes at an ecological cost. India must work to manage natural capital in a way that allows maintenance of a strong economy while improving the well-being of its population.

This report examines the balance between India's demand on and supply of natural capital. It shows that India is depleting its ecological assets in supporting its current economic boom and the growth of its population. This suggests that business and government intervention are needed to reverse this risky trend, and ensure a sustainable future in which India remains economically competitive and its people can live satisfying lives. The report also illustrates ways in which Indian industry can continue to operate successfully in the face of growing local and global resource constraints.

The Confederation of Indian Industry (CII) works to maintain the positive growth of the Indian economy through consensus building between Business and Government. CII has launched an initiative called 'Mission on Sustainable Growth' (MSG), with an objective "to promote and champion conservation of natural resources in Indian Industry without compromising on high and accelerated growth". As part of this effort, CII has worked with the Global Footprint Network and World Wide Fund for Nature-India (WWF-India) to produce this report on ecological footprint of India. I am confident that this report will create awareness and accelerate action towards ecologically sustainable growth in the country.

Jamshyd N Godrej
Chairman, CII – Sohrabji Godrej Green Business Centre

EXECUTIVE SUMMARY

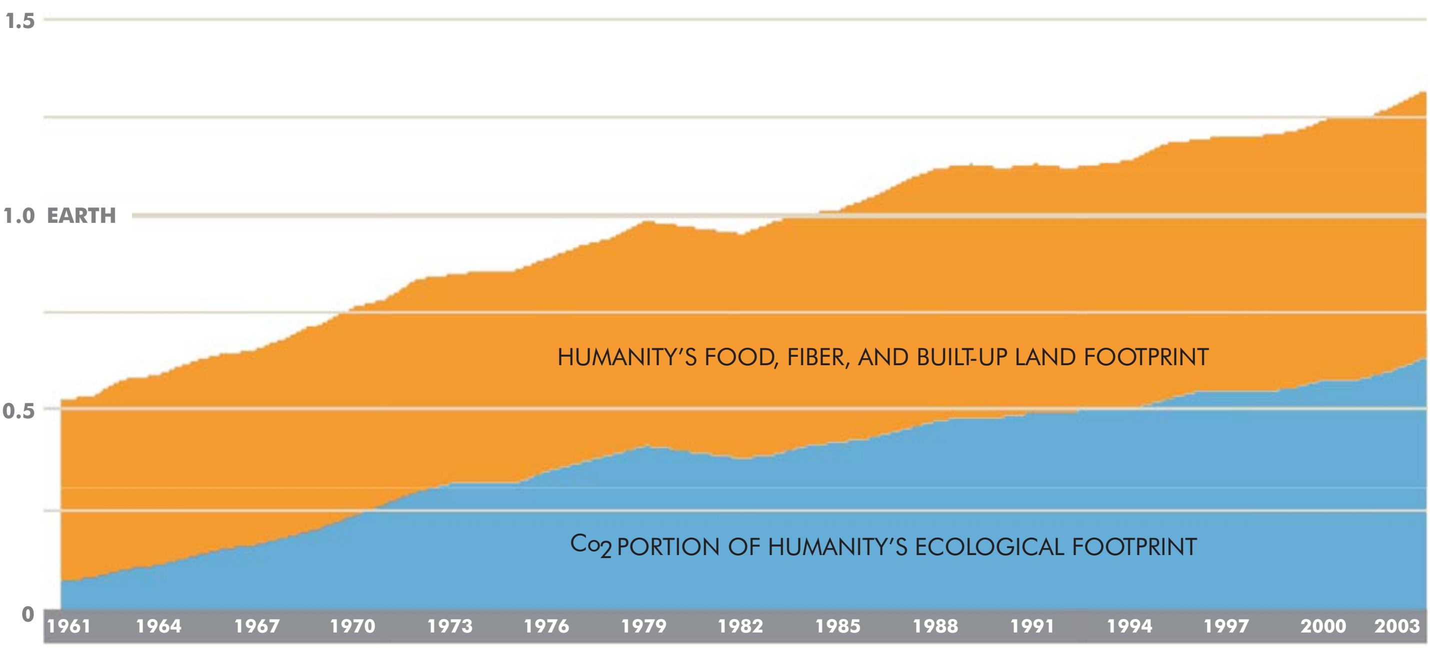


FIGURE 1: Ecological Footprint by component (1961 – 2003)

In 2003, humanity's Ecological Footprint (its demand on nature) exceeded global biocapacity (nature's ability to meet this demand) by 25 percent (Fig. 1). This indicates that the current global level of consumption is not sustainable. While the Ecological Footprint of an average Indian citizen is low compared to that in many other countries, India's total demand on biocapacity is exceeded only by that of the United States and China. Indian industries will play a key role in determining both India's future well-being and that of the rest of the world.

This report focuses on India's Ecological Footprint and biocapacity, and the implications of current and future trends for Indian industry. It also examines water consumption and human development concerns, and concludes with case studies suggesting opportunities for addressing India's Ecological Footprint.

The report finds that:

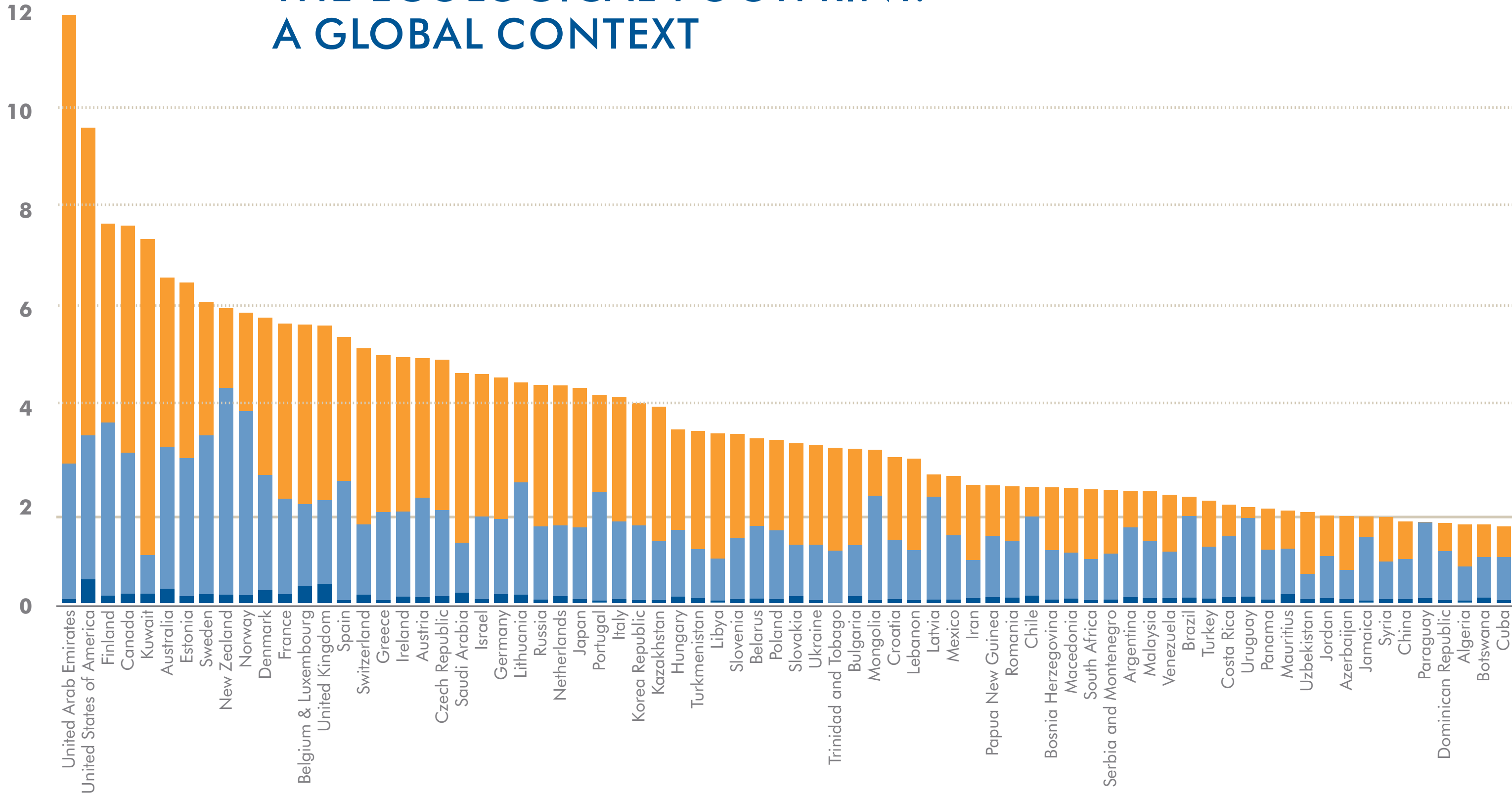
India represents approximately 6 percent of the world's Ecological Footprint, 4 percent of the world's biocapacity, and 17 percent of the world's population. Focusing on individual consumption, India's Ecological Footprint in 2003 was 0.8 global hectares per person, significantly lower than the world average of 2.2 global hectares, and ranking India 125th among 152 countries. At the same time, because of population growth India's total national Footprint has doubled since 1961, contributing to the degradation of its natural capital.

India's Human development Index score increased from 0.4 to 0.6 over the past 30 years (0.8 is the threshold for high development according to the united Nations), but a growing ecological deficit and the highest total water use of any nation puts this improvement at risk. and while India's overall wealth as measured by GDP has grown, its per capita Ecological Footprint has shrunk, suggesting that while the standard of living has improved for some, the majority are making due with less.

Since 1991, when its economy was opened to foreign investment and competition, India's industry has grown rapidly. The United Nations projects that India's population will reach 1.7 billion by 2050; if this is the case, India will require increased imports from other countries as it cannot support a population that size on domestic bio-capacity alone. To maintain a robust economy and a decent standard of living in the face of this demand, Indian businesses and government will need to invest in low-Footprint manufacturing, renewable sources of energy, and resource-efficient urban infrastructure.

CII is already working with Indian businesses to help reduce India's Footprint and demand on its biocapacity. The Indian industry has been taking up several steps towards sustainable development by adopting the green building concepts, energy efficiency and utilizing renewable energy for industrial and commercial applications.

THE ECOLOGICAL FOOTPRINT: A GLOBAL CONTEXT



The Ecological Footprint measures human demand on the biosphere in terms of the land and sea area required to provide the resources we use and to absorb the waste we generate. this includes all the cropland, grazing land, forest and fishing grounds used to produce food, fibre and timber, to absorb the carbon emitted in burning fossil fuels, and to provide space for infrastructure. People consume resources and ecological services from all over the world; their Footprint is the sum of these areas, wherever they are located on the planet.

Humanity's Footprint first grew larger than global biocapacity, the total amount of productive area available, in the mid-1980s (Figure 1). This "ecological overshoot" has been increasing every year since. In 2003 the global Ecological Footprint was 14.1 billion global hectares, or 2.2 global hectares per person. (a global hectare is a hectare with world average ability to produce resources and absorb wastes). Total biocapacity was 11.2 global hectares, or 1.8 global hectares per person. With demand exceeding supply by about 25 per cent in 2003, it took the Earth approximately a year and three months to regenerate the ecological resources humanity used that year.

Consumption differs considerably by country (Figure 2 and Figure 3). India's Ecological Footprint in 2003 was on average 0.8 global hectares per person, ranking it 125th of 152 nations measured. Most people in India consumed less than this average, while others consumed far more.

Despite this low average consumption per person, because of its large population, India has the third largest total Footprint, exceeded only by the United States and China (Figure 3).

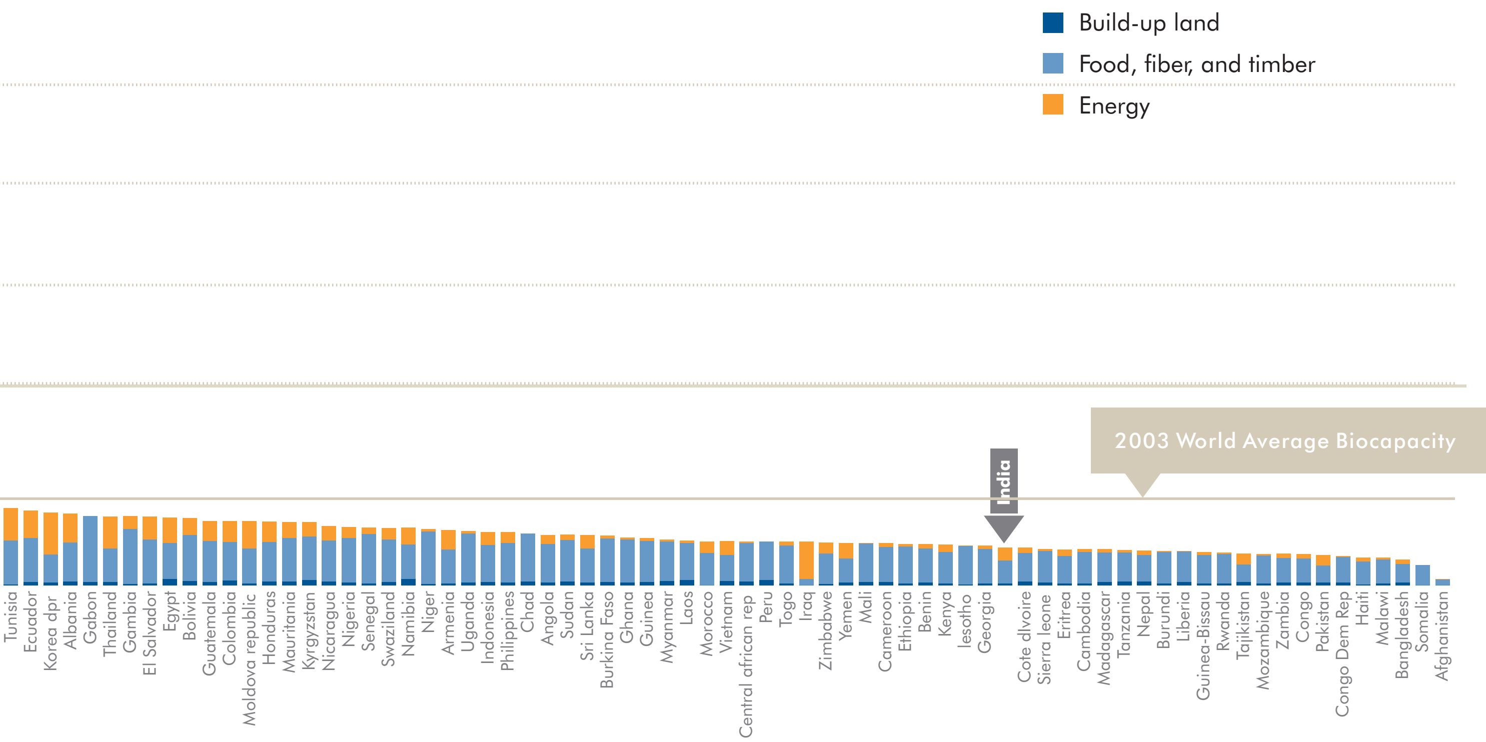


FIGURE 2: Ecological Footprint per person, by country (2003). This includes all countries with populations greater than 1 million for which complete data are available.

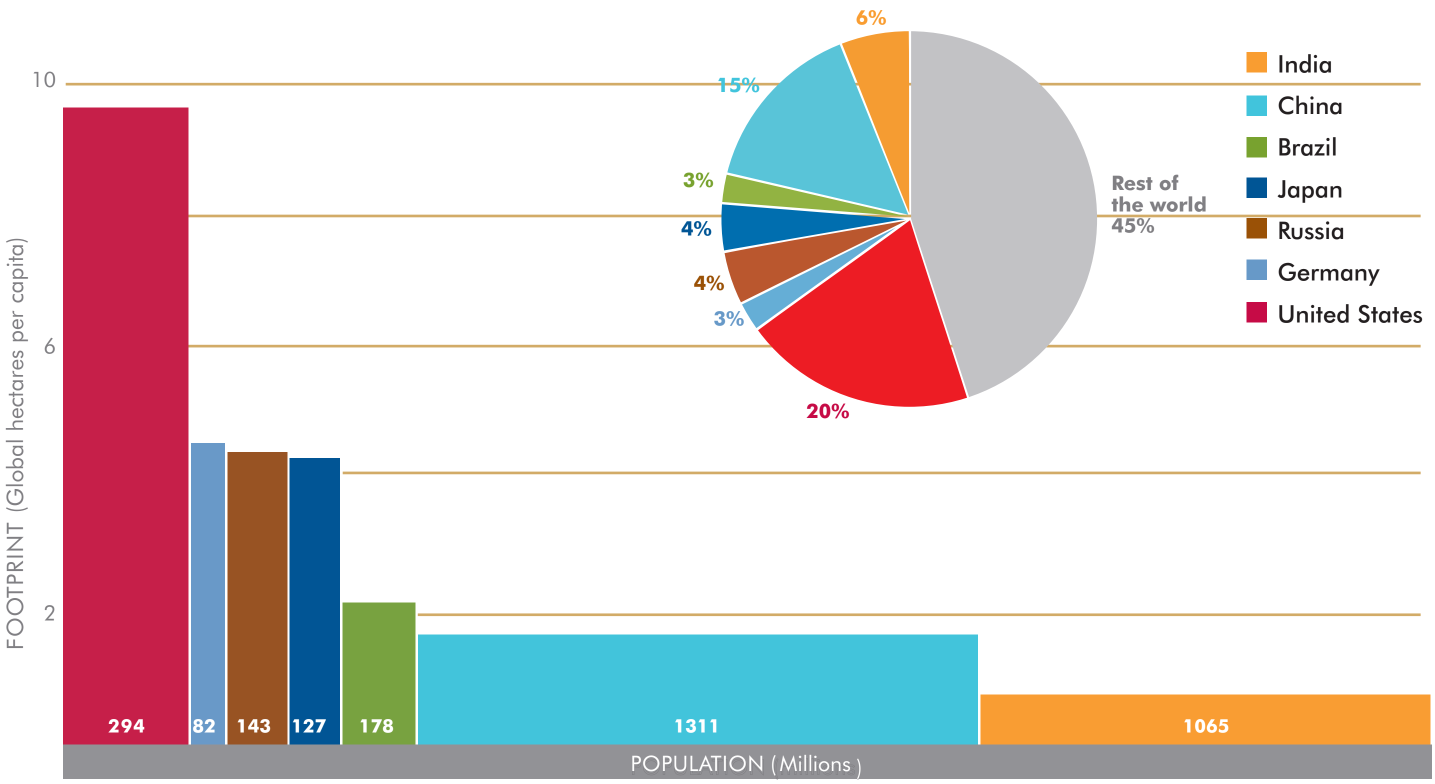


FIGURE 3: Ecological Footprint for selected nations, with population (2003)

INDIA AND ECOLOGICAL DEBT

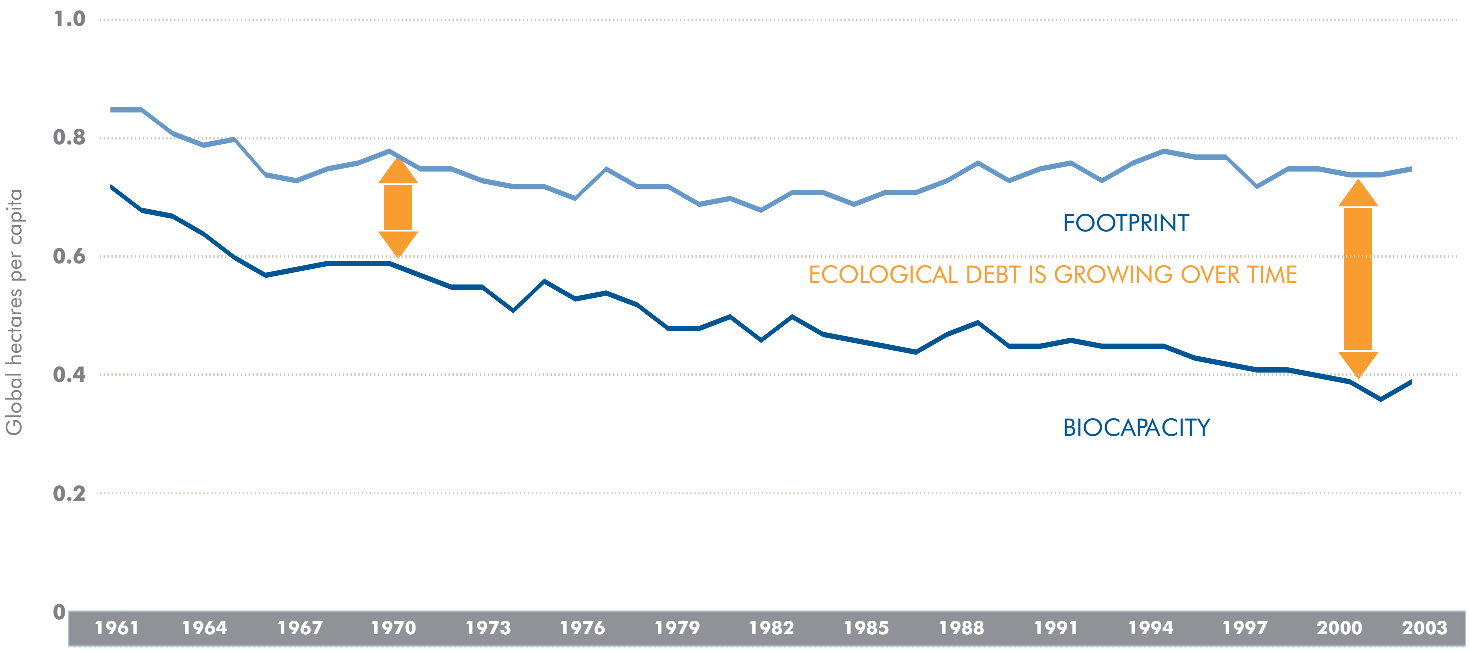


FIGURE 4: India's growing Ecological debt (1961 – 2003)

Countries with ecological deficits consume more than the ecosystems within their borders can provide. With a per person Footprint of 0.75 global hectares and per person biocapacity of 0.4 global hectares, India is running an ecological deficit of approximately 100 percent.

There are only three ways in which it is possible for India and other ecological debtor countries to consume more than the ecosystems within their borders can provide. They can import ecological resources from other nations, liquidate domestic ecological assets, or utilize the atmosphere, a globally shared commons, as a dumping ground for carbon dioxide emissions.

While India's Footprint is higher than its biocapacity, rapid population growth has caused India's per capita Footprint to decrease over the past half-century (Figure 4); in essence, this means that there are many more people today in India living on limited available resources.

Figure 5 shows that as India industrializes, its carbon Footprint continues to grow rapidly due to an increasing per capita consumption of fossil fuels.

India's ecological debt also results from a decrease in India's per capita biocapacity (Figure 6). From 1961 to 2003, India's per person biocapacity dropped 46 percent, from just over 0.7 global hectares per person in 1961 to 0.4 global hectares in 2003. India has been successful in the past with increasing the productivity of its cropland. However, this increase has been outpaced by a doubling of population over the same period. As a result, more and more people are sharing a limited amount of biocapacity.

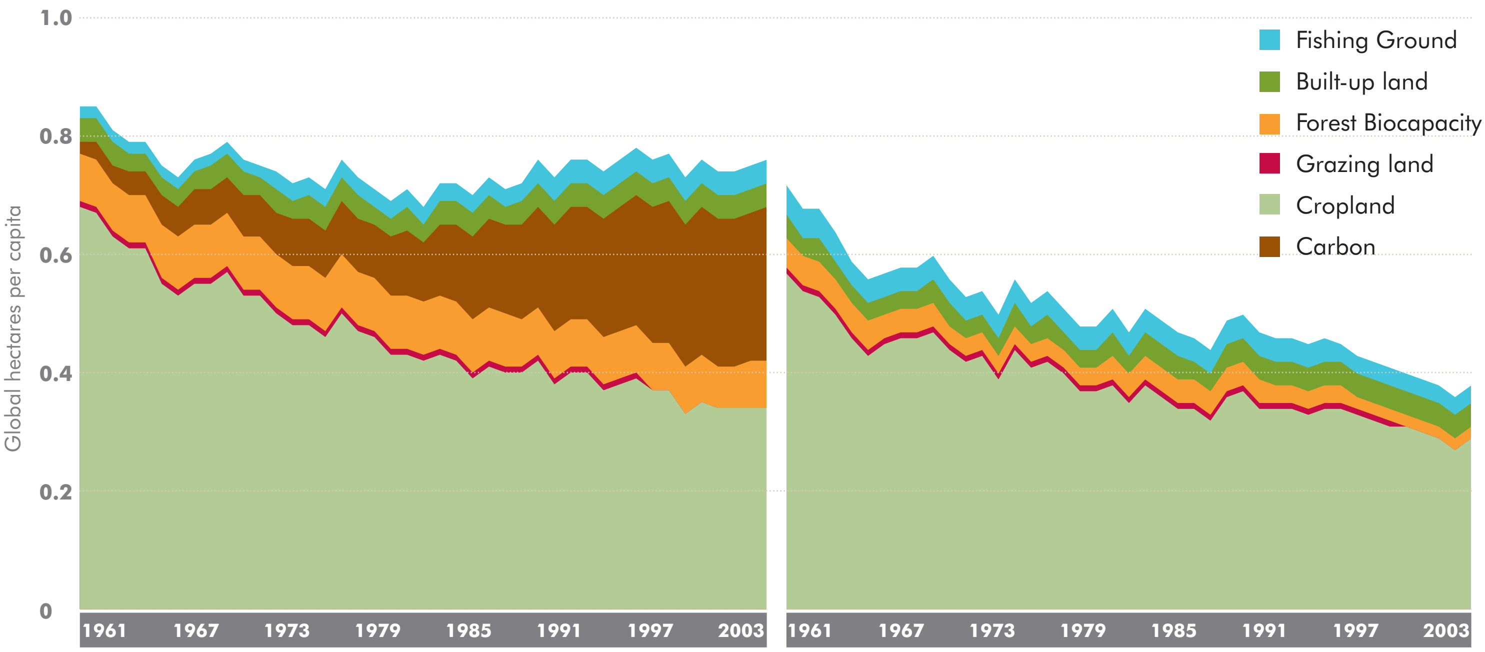


FIGURE 5: India's Ecological Footprint per person, by component (1961 – 2003)

FIGURE 6: India's Biocapacity per person, by component (1961 – 2003)

The majority of India's biocapacity is cropland. Other land types, such as forest and grazing land, while used by humans also serve as the habitat for a variety of endangered species, such as the Bengal tiger. As the need to feed more people grows, pressure will increase to convert forest to cropland. This competition for biocapacity could be devastating to the remaining forest species. In addition to loss of habitat for wild species, conversion will also reduce the capacity of forests to provide ecological services such as Co_2 sequestration, freshwater collection, and erosion control in mountainous regions.

People living at lower-income levels are likely to be more affected by the growing ecological deficit than those at higher income levels. While wealthier individuals are more likely to have sufficient income to purchase imported food and goods to meet their needs, poorer communities often depend more directly on local biocapacity, and thus are more impacted by the health and productivity of these ecosystems.

Climate change is an example of ecological debt on a global scale that affects India directly. Already, warming temperatures are causing glaciers to melt in the Indian Himalayas, altering the flow rates of many of India's most important rivers, causing increased landslides and flooding such as that which displaced one million people in the northern state of Bihar. In addition, global warming can produce shifts in the growing seasons for major crops such as rice, production of which could fall by as much as 40%. The Indira Gandhi Institute of Development Research has projected that future climate-related factors could cause India's GDP to decline by upto 9%.

India's growing ecological debt is the result of both increasing population and increasing per capita consumption of resources, particularly of non-renewable energy.

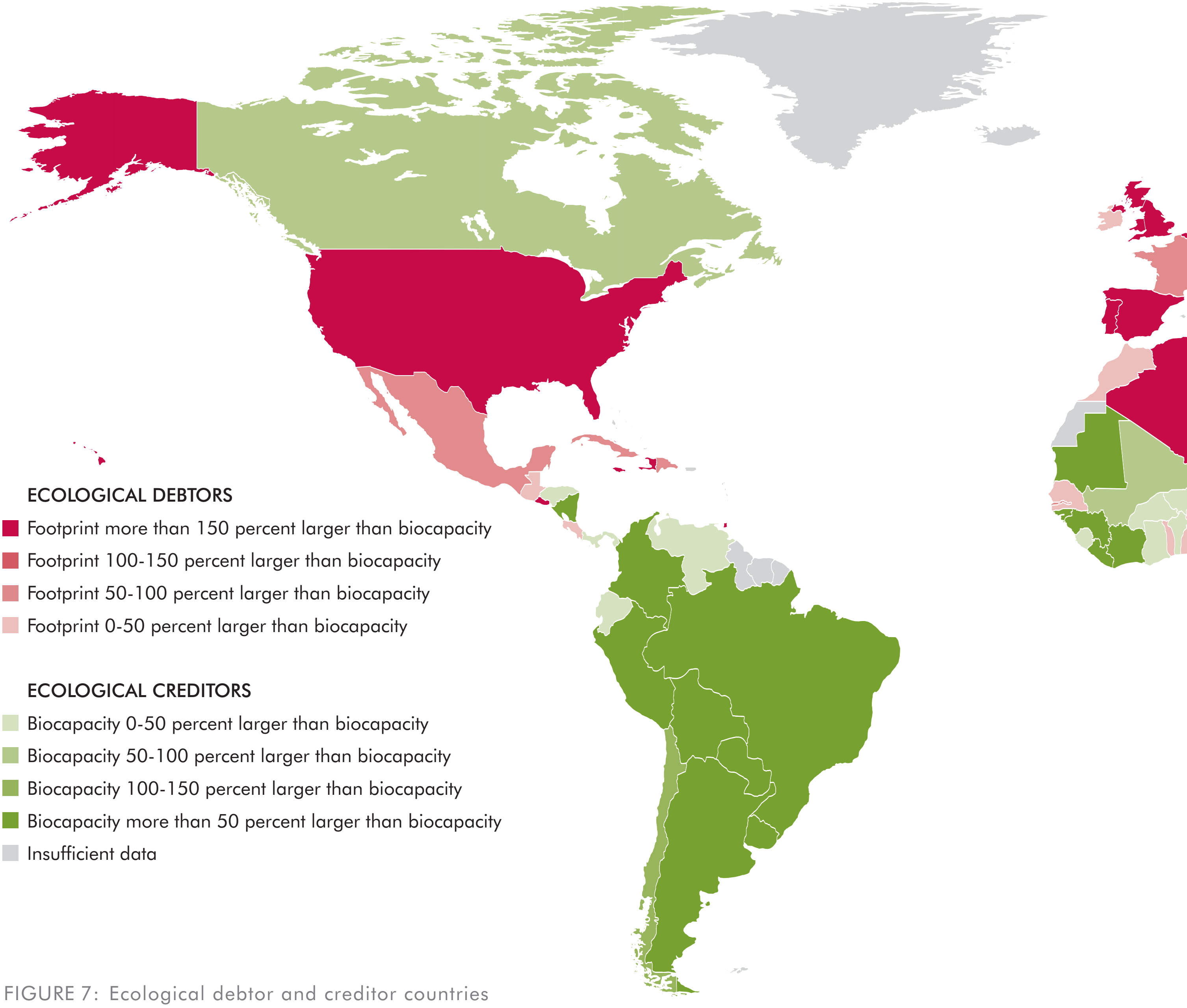
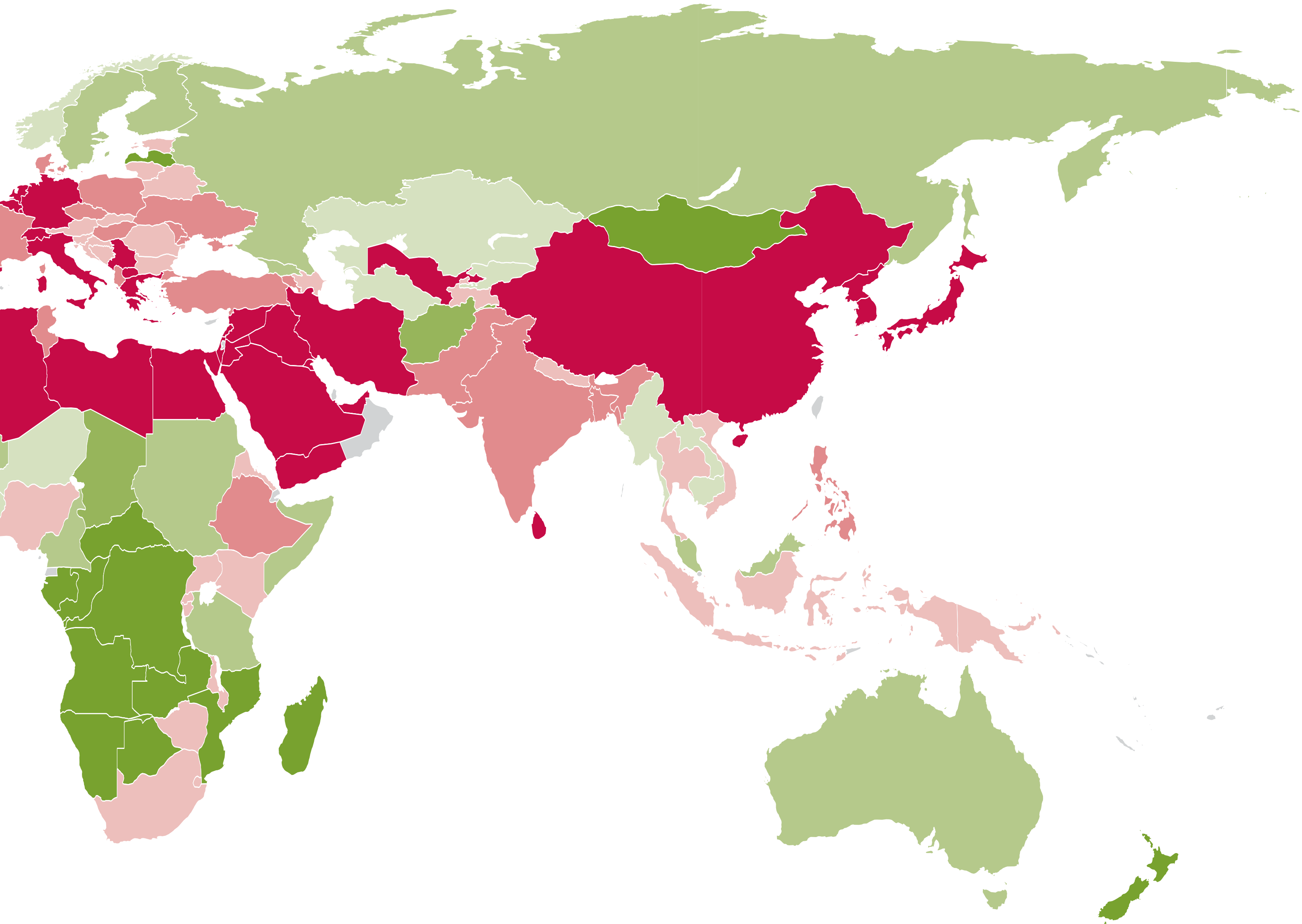


FIGURE 7: Ecological debtor and creditor countries (2003). Illustrates national Ecological Footprint relative to nationally available biocapacity. Red countries are ecological debtors; Green countries are ecological creditors.



Many Asian nations beside India have less biocapacity per capita available within their borders than they consume (Figure 7). China, for example, has an average Footprint of 1.6 global hectares per person, while only half that amount of biocapacity. And it is not just the Asian nations that are running ecological deficits —the U.S. and the EU, for example, are also using roughly twice their domestic biocapacity. As resources become less available and more costly, ecological debtor countries will find themselves in an increasingly precarious economic position.

At the same time, ecological creditor countries, those with biological capacity that exceeds their own consumption, may gain greater leverage in the global economy.

Will India have sufficient economic reserves to compete for the biocapacity needed to support its population in the future? The costs to the Indian economy may grow when the laws of supply and demand put a higher value on the biocapacity available in nations that have an ecological reserve.

WATER FOOTPRINT

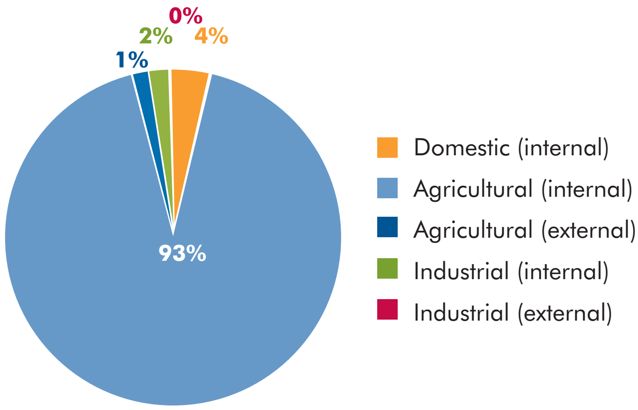


FIGURE 8: Water footprint of India (1997 – 2001), by internal or external use (Hoekstra and Chapagain 2008)

Clean water is needed for the most vital of human activities: drinking and cooking, washing and maintaining hygiene, raising domestic animals and supporting industrial and agricultural activities. Along with land area, nutrients and energy, freshwater is also critical to ecosystem health and productivity.

Hence, both human activity and the health of local ecosystems are influenced and potentially limited by the availability of water to meet these competing needs.

Unlike energy use, which has global impact in the form of Co_2 emissions, the ecological impact of water tends to be largely local. The impact of each litre of freshwater use varies by geography and season. In wet areas, for example, when crops need little or no irrigation, water withdrawals have minimal impact on yields or biodiversity. But in dry areas, each litre of water used for households, industries or agriculture puts further stress on local ecosystems. Since insufficient data are available to measure this demand on freshwater in terms of its impact on biocapacity, and since demand on water affects ecosystems in ways not accounted for by the Ecological Footprint, water use is tracked here with a parallel measure called the Water Footprint, a tool originally developed by Arjen Hoekstra et al.

Whereas the Ecological Footprint refers to the area (in global hectares) used by an individual or group of people, the Water Footprint indicates the volume of water used (measured in cubic meters per year). Water Footprint analysis differs from the Ecological Footprint, however, in that it provides a local analysis of the water demand since very little water is traded across watersheds.

A nation's Water Footprint has two components: the internal and the external Water Footprint (Figure 8). The internal Water Footprint is defined as the volume of domestic resources used to produce goods and services consumed by inhabitants of the country. The external Water Footprint is defined as the annual volume of water resources used in other countries to produce goods and services consumed by a population. Both internal and external Water Footprint include the consumptive use of blue water (originating from ground and surface water), the consumptive use of green water (infiltrated or harvest rainwater), and the production of gray water (polluted ground and surface water) (Hoekstra and Chapagain 2008).

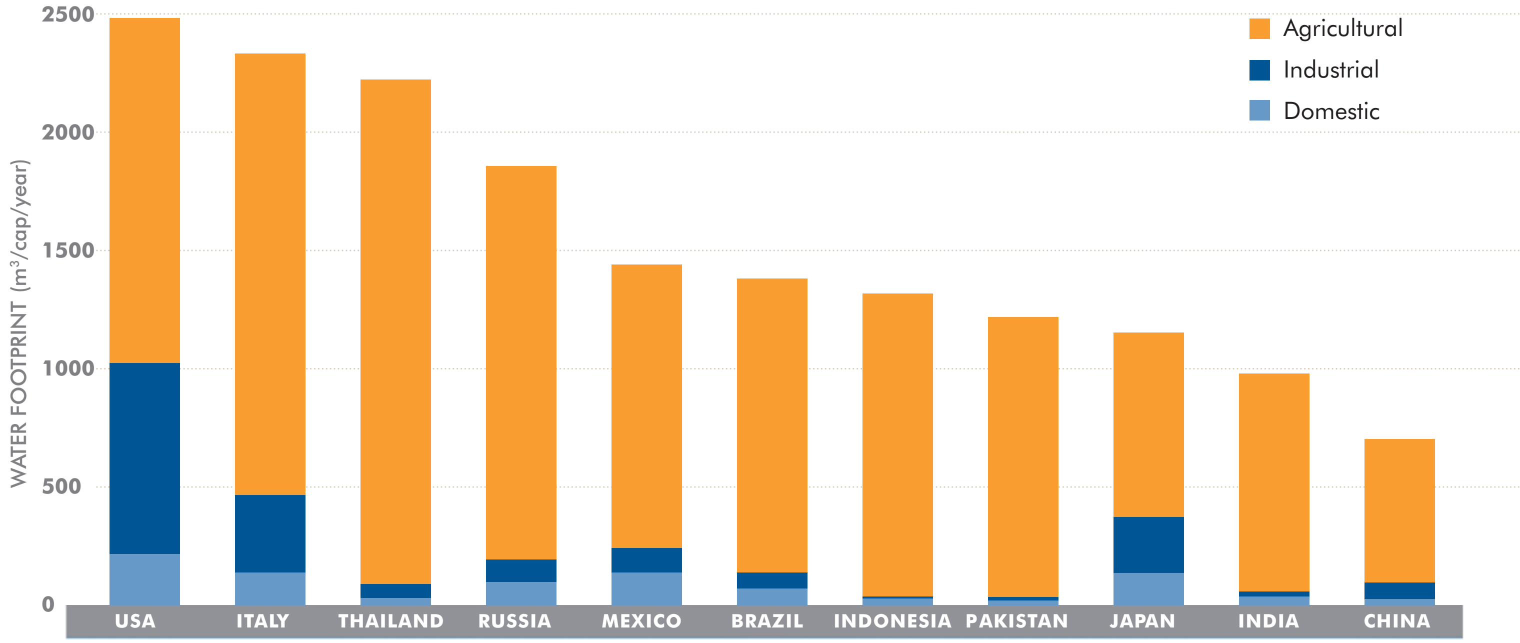


FIGURE 9: National water footprints for selected countries, by contribution of different consumption categories (Hoekstra and Chapagain, 2008)

India has the largest total Water Footprint of any country in the world, adding up to 987 billion m^3/year. Yet at the same time, its water use per capita is less than in many countries with similar or higher per capita income (Figure 9). While India contributes 17 percent to the global population, Indian people contribute only 13 percent to the global Water Footprint. Between 1997 and 2001, the global Water Footprint was 7,450 billion m^3/year or 1,240 m^3 per person. Figure 9 shows that India's per capita Water Footprint is 980 m^3/year, lower than that of many other countries.

Compared to industrialized nations, lower-income nations typically use a higher percentage of water for agricultural purposes, and India is no exception. India ranks second only to the U.S. in terms of available arable land, and its industrial innovation is well recognized. However when it comes to agriculture, the nation's cropland output (yield factor) and efficient use of water, as measured by the Water Footprint, lags far behind the technical potential (NFA 2006, Hoekstra and Chapagain 2008). In addition, forty years after the Green revolution, many experts argue that India's population is growing faster than its ability to produce staples such as wheat and rice (Sengupta 2008).

Some attribute the lag to the fact that the Indian Government has not expanded irrigation or agricultural research since the 1980s, but groundwater has also been depleted at alarming rates. In Punjab for example, more than 75 percent of districts extract more groundwater than is replenished by nature.

If another Green revolution were to occur, it is likely that an even greater demand would be put on the shared water resources within the country, unless water use efficiency improves dramatically.

What does this mean for India's industrial sector? If competition for scarce amounts of water becomes more prominent for Indian industries in years to come, they will need to develop and rely on aggressive water-saving technologies to remain competitive. India is not alone in its need for these technologies, and could become a leading exporter of water-efficient technologies to the rest of the World.

BIOLOGICAL CAPITAL AND HUMAN WELL-BEING

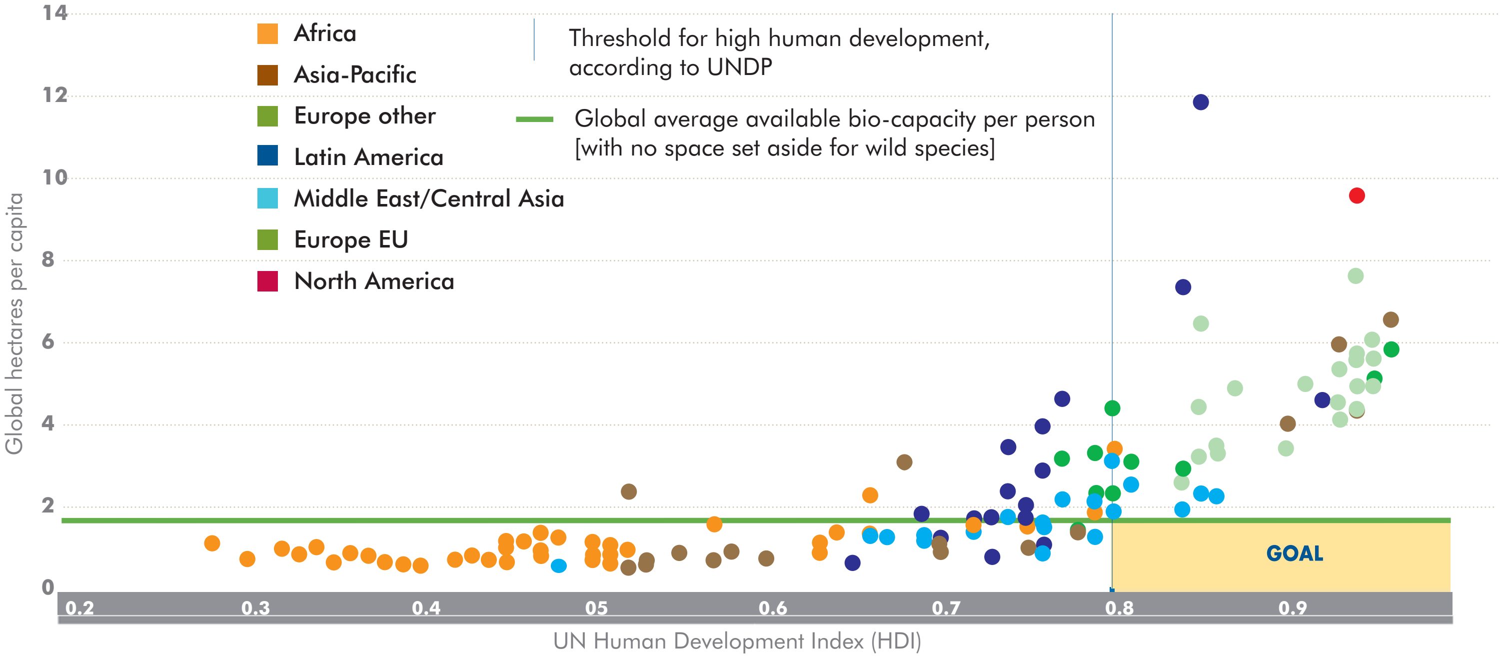


FIGURE 10: UNDP Human Development Index and Ecological Footprint, selected nations (2003)

A sustainable society lives within the biological limits of the planet while securing people's basic human needs. There is growing recognition that existing economic indicators such as Gross Domestic Product (GDP) are unable to capture improvements in human well-being and development. There is, however, broad consensus on the minimum conditions essential for a healthy society. These include basic security of food and shelter, longevity, and access to education. Recognizing this, theUnited Nations Development Programme created the Human Development Index (HDI), an index that goes beyond the GDP in reflecting the extent to which these three conditions have been achieved in a given nation.

Combining the Ecological Footprint, an indicator of human demand on the biosphere, with the UNDP's Human Development Index gives clear minimum conditions for sustainable human development.

The United Nations considers an HDI of 0.8 to be the threshold for "high human development." Additionally, an Ecological Footprint of less than 1.8 global hectares per person (the average per capita amount of biocapacity available worldwide) makes an individual's resource demand globally replicable. Despite increasing adoption of sustainable development as an explicit policy goal, most countries do not meet both minimum requirements.

Using the two criteria of HDI (to measure development) and Footprint (to measure resource demand), we can divide the plot into four quadrants (Figure 10). Countries located in the lower right quadrant meet the minimum requirements for sustainability: This quadrant represents a high level of human development and a lifestyle that could be replicated globally without exceeding available resources. Nations need to start "thinking inside the box" to reach this goal.

The health and well-being of human society is intricately linked to the health of the biological capital on which it depends. Recognizing and accounting for biological capacity available to a society can help identify opportunities and chal - lenges in meeting human development goals.

India's trajectory has shown a steady increase in human development. India's HDI increased from 0.4 to 0.6 over the last 30 years without growth in per capita demand on natural resources. Over the same time period, however, biocapacity dropped from 0.55 to 0.39 global hectares per person. Even with an increase in HDI, many Indians continue to have a low standard of living; poverty and infant mortality remain significant challenges. Indeed, to improve human development, the Ecological Footprint of many Indians may need to increase to allow for increases in food calories, shelter, electricity, sanitary infrastructure, medicine and material goods that are not currently accessible to the entire population. The ultimate challenge in the context of growing global overshoot is: How can Indians make their development success last, and improve their well-being without liquidating their resource base?

The health and well-being of human society is intricately linked to the health of the biological capital on which it depends. recognizing and accounting for biological capacity available to and used by a society can help identify opportunities and challenges in meeting human development goals.

INDIA'S ECOLOGICAL FOOTPRINT

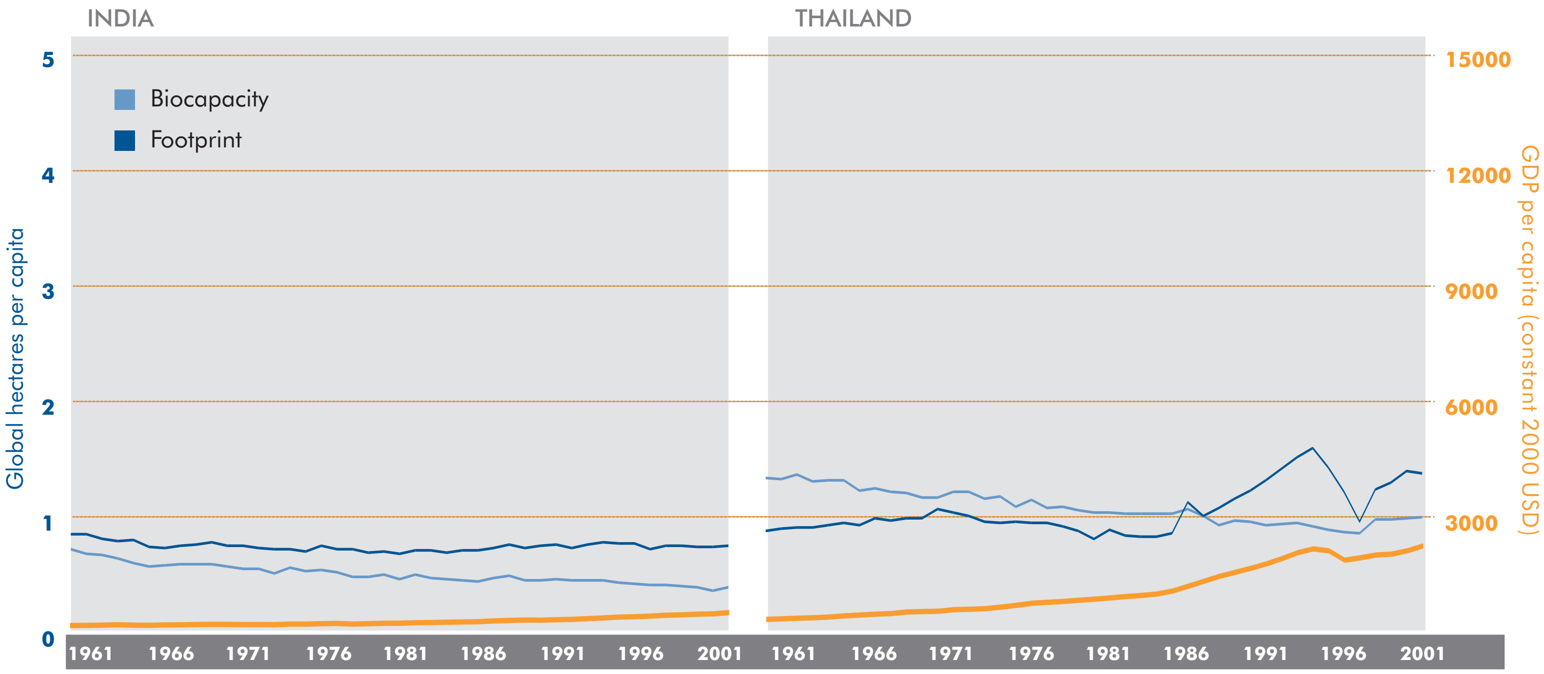


FIGURE 11: India's Ecological Footprint, Biocapacity and GDP (1961 – 2003)

FIGURE 12: Thailand's Ecological Footprint, Biocapacity and GDP (1961 – 2003)

Looking at a plot of India's Footprint and GDP growth provides some perspective on the past. Since 1961, India's GDP per capita (in constant USD) has nearly tripled, going from $177 per person to $512. Over that same period, Footprint per capita has actually gone down by 12 percent, from 0.85 to 0.75 global hectares per person, likely due in large part to a dramatic population increase of 135 percent. Bio-capacity has had a more precipitous drop, falling from 0.72 global hectares to 0.39 global hectares, a decrease of over 45 percent.

There is in no clear indication that a higher Footprint is required for an increase in GDP; however, there is some evidence to suggest that per capita Footprints can be limited by available bio-capacity, as appears to be the case in India. While Figures 12-14 illustrate how Thailand's, China's and Korea Republic's per capita Footprints continued to grow alongside GDP despite their decreasing bio-capacity, India shows a marked contrast, with a Footprint decreasing along with its bio-capacity. Interestingly, population has increased dramatically in all four of these countries, albeit with the greatest increase in India.

PER CAPITA PERCENT CHANGE 1961 To 2003

	GDP	FOOTPRINT	BIOCAPACITY	% POPULATION CHANGE
India	190%	-12%	-46%	135%
Thailand	569%	56%	-25%	129%
China	1458%	100%	-22%	95%
Korea Republic	985%	363%	-54%	85%

CHINA

KOREA

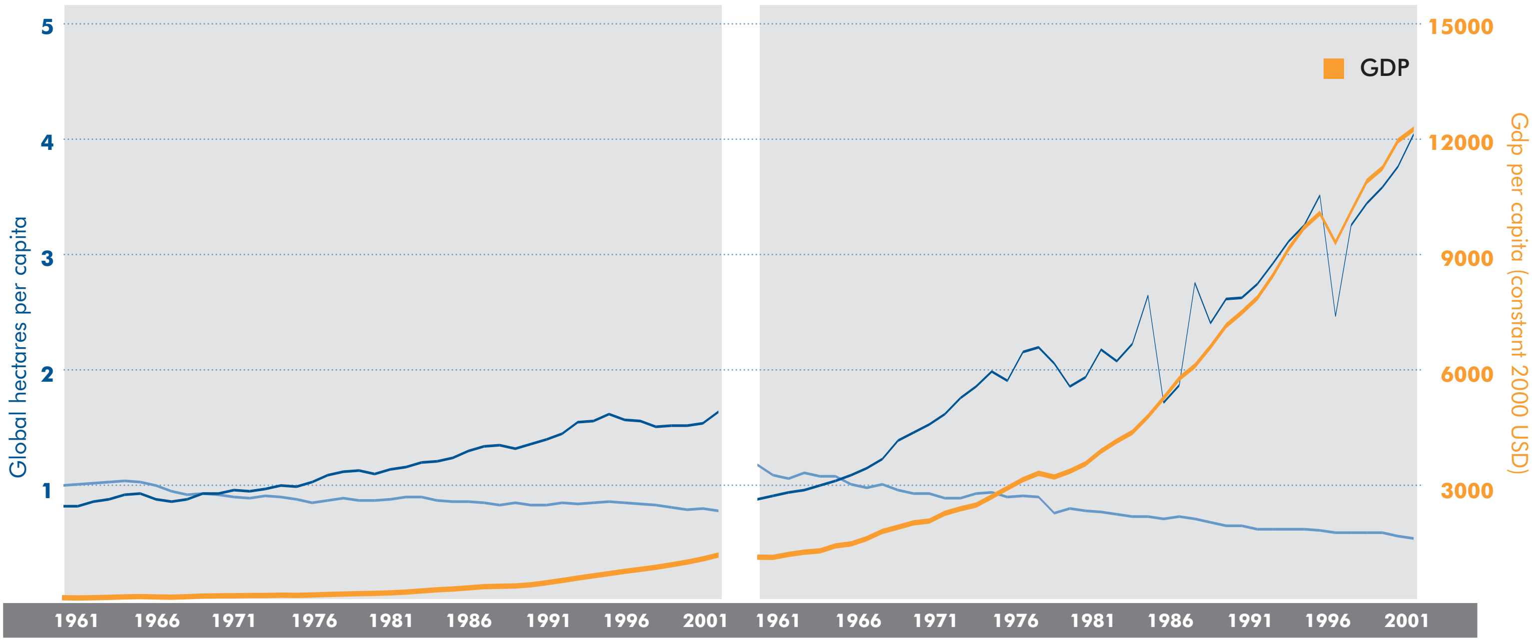


FIGURE 13: China's Ecological Footprint, Biocapacity and GDP (1961 – 2003)

FIGURE 14: Korea's Ecological Footprint, Biocapacity and GDP (1961 – 2003)

The critical question is, how can India ensure both continued economic growth and a globally replicable quality of life for its citizens? If bio-capacity is a limiting factor, how can India safeguard its remaining bio-capacity while meeting the Footprint demands of a growing population? By looking at the five factors that influence Footprint and bio-capacity we can begin to see how business and policy decisions can contribute to both the prosperity and risk India faces in managing its biological assets.

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BUSINESS, INDUSTRY AND THE ECOLOGICAL FOOTPRINT

Indian industry has undergone a transformation since 1991, the year the economy was opened to foreign investment and competition. This economic growth, coupled with increasing demand for Indian industrial goods, has prompted some industry experts, government agencies and researchers to focus much more intently on the efficiency and sustainability of Indian industrial processes and technology.

While selected Indian industrial sectors have been shown to display very high efficiency, approaching world best-practices, the average Footprint and energy intensity lags behind optimal levels. Research suggests that several Indian industrial sectors use energy more intensively than comparable sectors in other industrializing counties. CII and Global Footprint Network plan additional research to look more closely into the Footprint of India's industrial sectors.

While it is true that improvements in energy efficiency have created energy savings since 1991, there is considerable opportunity for improvement by a number of industrial sectors. Some examples are discussed in the case studies that follow in the latter part of this report. Potential improvement can be made not only in terms of intensity of resource use and waste creation in the production process, but also in the other four areas that contribute to India's ecological deficit (Figure 15).

In total, five factors influence the size of a nation's ecological deficit. Three of these factors shape the Ecological Footprint, or demand on biocapacity: population size, the average consumption per person in that population, and the average Footprint intensity per unit of consumption.

The five factors described here not only determine a nation's ecological deficit, but also predict the extent of global overshoot. If industries in an ecological debtor nation like India are to continue to compete in a global economy, it is critical that they consider ecological limits, and the impact global overshoot will have on the economy and their competitiveness.

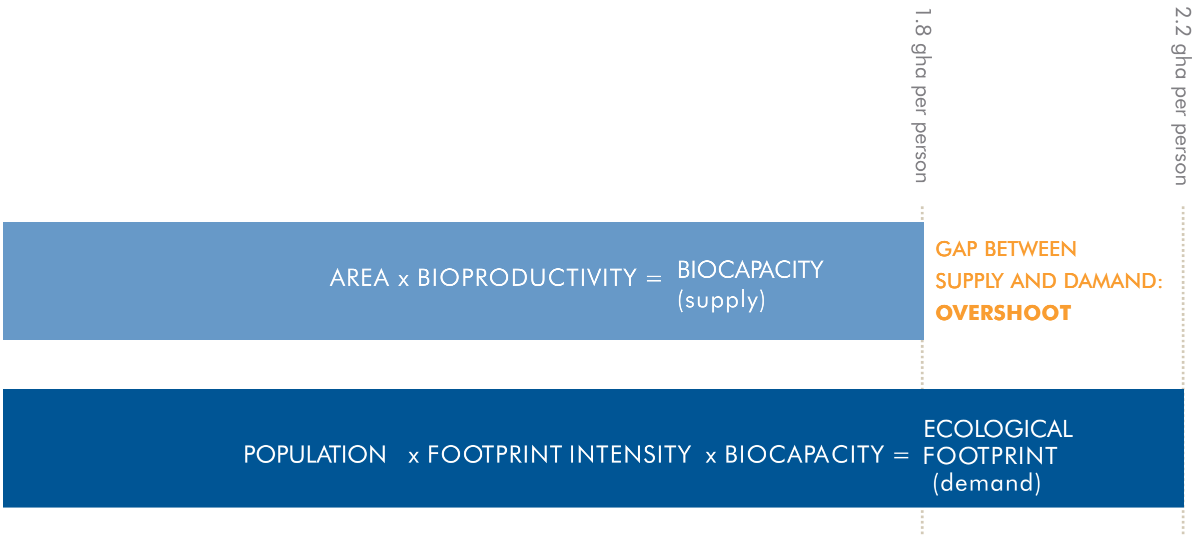


FIGURE 15: Five factors influencing ecological overshoot.

1. POPULATION Increase in population can be slowed and eventually reversed by supporting families in choosing to have fewer children. Offering women access to better education, economic opportunities, family planning and health care are proven approaches to achieving this. These investments also enhance the health and educational outcomes of those families' children.

2. CONSUMPTION OF GOODS AND SERVICES PER PERSON The potential for reducing consumption depends in part on an individual's economic situation. While people living at or below subsistence level may need to increase their consumption to move out of poverty, more affluent people can reduce consumption and still improve their quality of life, particularly by making cities compact and resource-efficient.

3. FOOTPRINT INTENSITY The amount of resources used in the production of goods and services can be significantly reduced. this can take many forms, such as increasing energy efficiency in manufacturing and in the home, minimizing waste and increasing recycling and reuse, using fuel-efficient cars, and reducing the distance goods are transported. Business and industry do react to government policies that promote resource efficiency and technical innovation – where such policies are clear and long-term – as well as to consumer pressure. The remaining two factors determine bio-capacity, or supply: the amount of biologically productive area available and the productivity or yield of that area.

4. BIOPRODUCTIVE AREA Can be extended, and degraded lands can be reclaimed through careful management. Terracing has had historical success, and irrigation can make marginal lands more productive, though the gains may not persist. Above all, good land management must ensure that bioproductive areas are not lost, for example, to urbanization, salinization, or desertification.

5. BIOPRODUCTIVITY Depends both on the type of eco - system and the way it is managed. agricultural technologies can boost productivity but can also diminish bio-diversity. Energy-intensive agriculture and heavy reliance on fertilizer may increase yields, but at the cost of a larger Footprint associated with increased inputs, and may so impoverish soil that yields ultimately begin to fall. Bio-capacity can be preserved by protecting soil from erosion and other forms of degradation; safeguarding river basins, wetlands, and watersheds to secure freshwater supplies; and maintaining healthy forests and fisheries. Preventing or mitigating the impacts of climate change can also help maintain yields, as can eliminating the use of toxic chemicals that can degrade ecosystems.

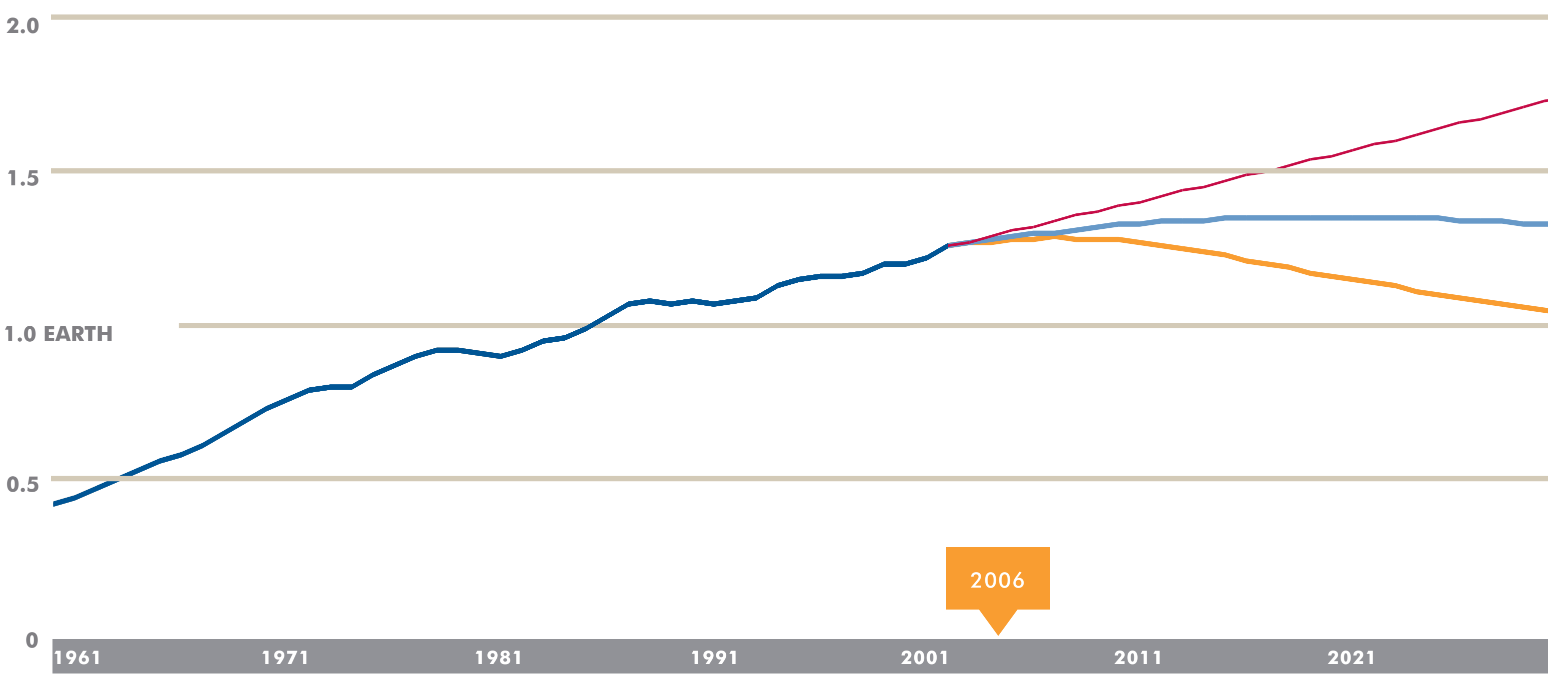


FIGURE 16: Ending global overshoot: three scenarios (1961-2100)

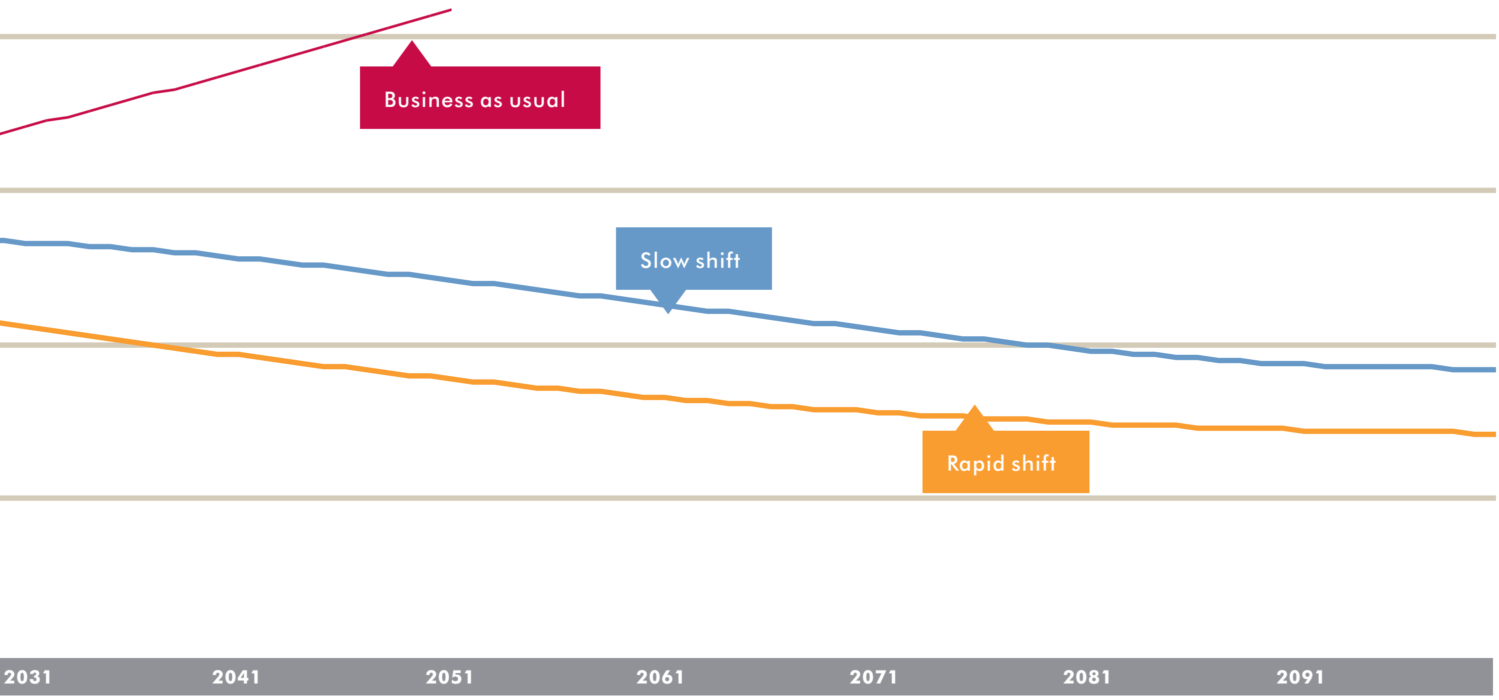
If we continue on our current trajectory, even optimistic United Nations projections, with moderate increases in population, food and fibre consumption, and Co_2 emissions, suggest that by 2050 humanity will demand resources at double the rate at which the Earth can regenerate them (Figure 16).

Reaching this level of consumption may be impossible, however, as the natural capital being used to enable this overshoot may well be depleted before mid-century. Efforts to avoid ecosystem collapse must take into account the slow response times of human populations and infrastructure. Even after birth rates fall below replacement levels, populations continue to expand for many years. Life expectancy has more than doubled in the 20th century alone – a child born today will, on average, consume resources for the next 65 years. Human-made infrastructure, too, can last many decades.

Figure 17 compares typical lifespans for some human and physical assets. Together, the people born and the infrastructure built today will shape resource consumption for much of the rest of the century.

Some business choices have a more far-reaching effect than others. An office building has a projected life span of 50 to 100 years. The cost and amount of energy required to build an energy-efficient office building is comparable to building a traditionally designed structure, but there is a significant difference in operating costs. a comprehensive study by the U.S. Green Building Council found that an average 2 percent increase in the construction cost of an energy-efficient building typically yields operating savings of over ten times the initial investment. The overall cost savings results from an average 30 percent decrease in energy use as well as decreases in other waste, emissions and worker health-related costs. Because the energy demands of a society's buildings constitute a significant percentage of its total energy use, energy-efficient buildings can play an important role in moving from a business-as-usual scenario to one in which overshoot begins to be meaning-fully addressed.

Similarly to buildings, power plants have a have a long life span, often up to 75 years. a coal-fired plant will typically generate more than a tonne of global warming-causing carbon dioxide for each MWh produced. An average car's carbon Footprint occupies about one global hectare, with limited opportunities available for retrofitting to lessen these impacts.



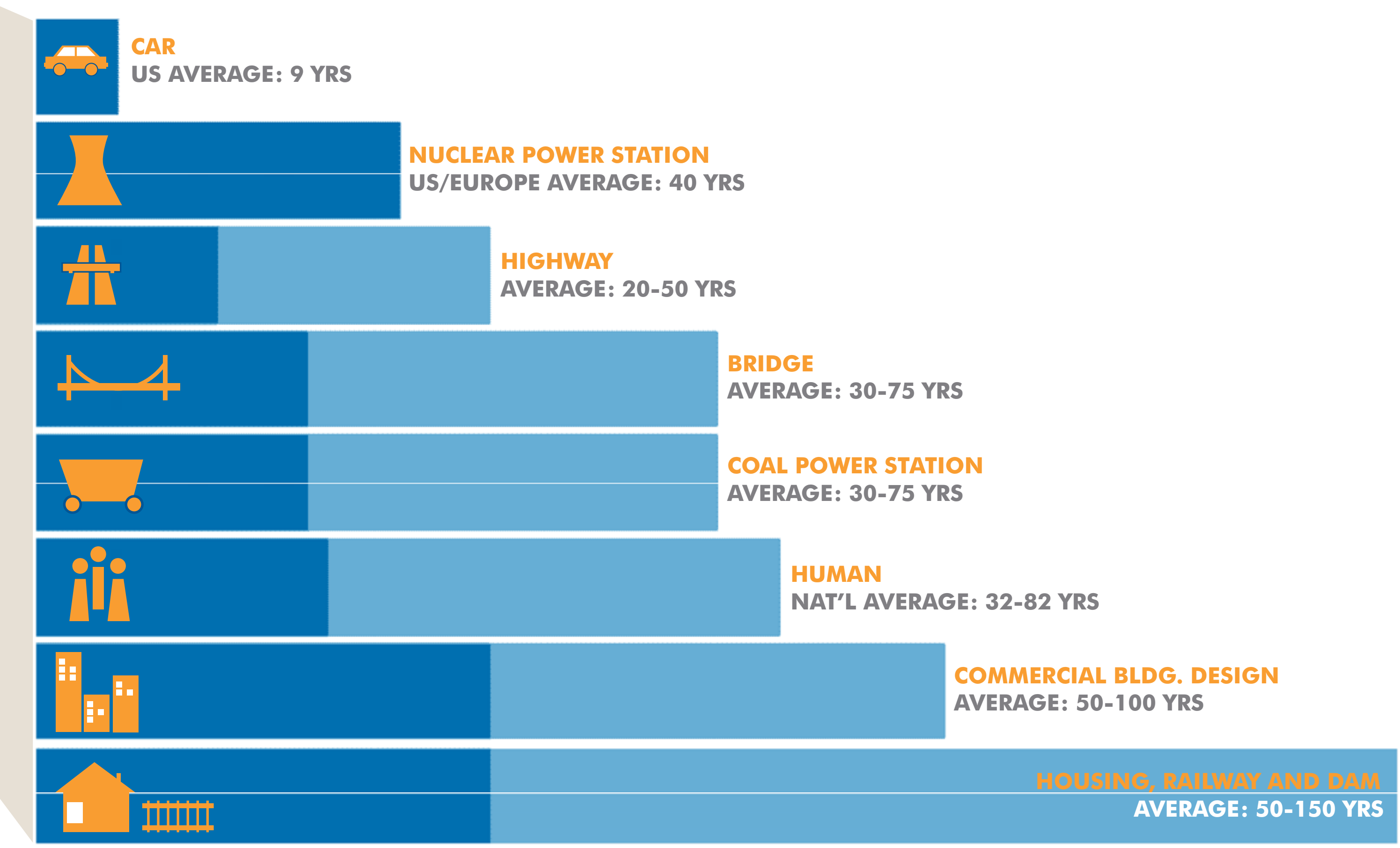


FIGURE 17: Life spans of people, assets, and infrastructure

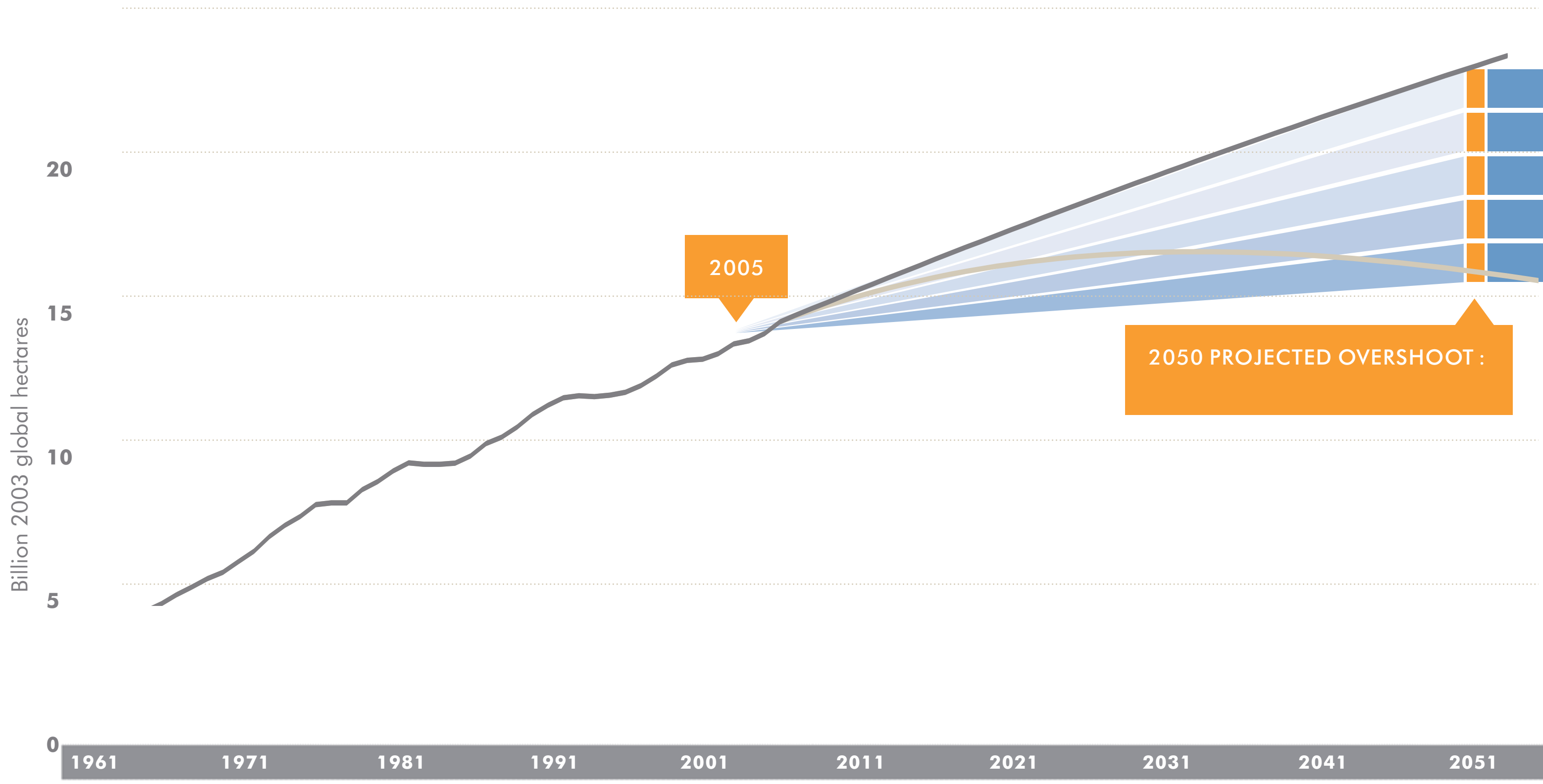
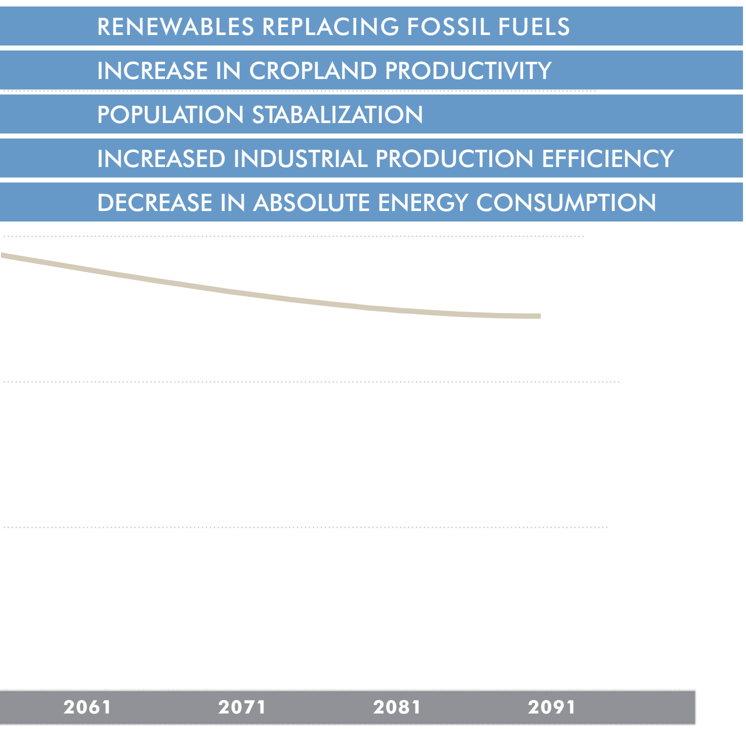


FIGURE 18: A suite of sustainability wedges could help bring the world out of overshoot by 2050

AN OPPORTUNITY FOR BUSINESS

What are the options for reducing a country's ecological deficit? a useful way to address the overall gap is to break it down into a number of "wedges". Wedges are groupings of activities that represent reductions in a portion of a country's overall demand. Rather than looking for a single solution to reduce humanity's foreseeable 12.2 billion global hectare gap by 2050, we can think about the need for a suite of wedges that, together, form a large change. The question is whether we can create a sufficient number of wedges to end overshoot (Figure 18).

From a business perspective, wedges represent growing market opportunities with significant potential rewards for market leaders. These opportunities can be focused on serving growing local markets where India's environmental issues are having an influence on customers' buying decisions. Wedges are also an avenue for Indian business and industry to become established in export markets currently dominated by companies maintaining business-as-usual market positions. For example, the Indian automobile industry has an opportunity to redefine the market space through the use of new materials, new construction principles, and other ways to boost vehicles' fuel economy by a factor of four or more over today's best practices. However, to avoid the rebound effect in which increased fuel economy leads to more expendable income for travel, thereby negating overall Footprint savings, other governmental policies must be put into place to promote social behavior changes.



While the previously mentioned wedges are especially suited to market-based solutions, other wedges will require efforts that include government promotion and community engagement. Increasing cropland productivity is an example of such a wedge, as is investing in women, and creating distributed village energy systems.

Government can play an important role in the process by speeding the adoption of new practices. Extensive information-exchange networks will need to be established to promote innovative approaches and allow communities to learn from each others' successes.

A focus on wedges helps create discrete Footprint reduction initiatives that can be tracked at national and sub-national levels. Goals can be identified and championed. Tracking progress becomes more manageable with discrete initiatives compared to the common alternative: a large set of potential solutions with no sense of cohesion.

WHAT IS A WEDGE?

A wedge is a strategy that can reduce a country's or the world's demand on the biosphere by reducing the area of bioproductive land (global hectares) used to meet the demands of a given population. Examples of wedges include energy efficiency, low-carbon fuels, efficient mobility solutions, decreased population growth, increased cropland productivity, industrial production efficiency, cradle-to-cradle design, and increased food systems productivity.

FOOTPRINT INTENSITY
- Resource efficiency
- Infrastructure

PER CAPITA CONSUMPTION
- Product design

BIOPRODUCTIVE HECTARES
- Yield

POPULATION
- Women's education
- Reproductive health

PRODUCTIVITY PER HECTARE
- Yield

CASE STUDY: GREEN BUILDINGS IN INDIA

Construction is one of India's largest industries and is growing at an average annual rate of 9.5 percent, nearly twice the global rate. With this growth there has been increasing awareness in the construction and green building industries of the consequences of processes and products on the planet and local environments.

The Indian Green Building Council (IGBC) was formed in 2001 to provide a common platform for carrying forward green building activities in the country and promoting sustainable building practices and materials. The IGBC is represented by architects, developers, product manufacturers and institutions, as well as corporate, government and nodal agencies.

Green building brings together a vast array of practices and techniques to reduce the impacts of buildings on the environment relative to the impact of to traditional building practices. For instance, buildings rated as green by LEED (Leadership in Energy and Environmental Design) standard consume at least 40 to 50 percent less energy and 20 to 30 percent less water than a conventional building. other less tangible benefits of green buildings can include improved health for occupants, safety benefits and a positive image of corporate citizenship. Several corporations are also seeing Green Building rating as a tool to enhance marketability.

Today, 30 buildings in India have been awarded the LEED rating, seven of which have earned the prestigious platinum rating. Over 300 green building projects in the country are under way, amounting to more than 230 million square feet of space and representing construction that is significantly less resource-intensive than traditional construction.

The Indian Green Building Council has set the goal of achieving one billion square feet of green building space by 2012.

Reducing and reversing overshoot will require conscious decisions on the part of Indian government, society and business to ensure we are not building a destructive legacy that will undermine our social and physical well-being. Wise choices made today can prevent the negative long-term impacts caused by future-unfriendly infrastructure and technologies. While LEED certified buildings promote more environmentally friendly construction, we need to continue to promote overall resource efficiency to reduce our Footprint.

Key strategies to increase green building in India:

- Add 1 billion sq. ft of green-certified building space by 2012
- Tap Rs.15000 Cr of the green building materials market by 2010
- Facilitate capacity-building in green building services
- Develop different rating programs to include all types of buildings, includung integrated townships, residential buildings, individual homes, etc.
- Spread awareness and recruit more stakeholders to the green building movement

INNOVATION IN CONSTRUCTION: FAL-G BRICKS

Approximately four million tonnes of fly ash, a by-product of coal combustion, are released into the atmosphere annually in India. T he thick clouds that result directly affect the well-being of the large populations living in urban areas, and contain trace amounts of carcino-genic heavy metals. For every 200 Mt of coal burned, 80 Mt end up as fly ash (as residue sent through chimneys) or bottom ash (residue at the bottom of the furnace).

Once thought of as a waste product, fly ash can now be trapped and used to make bricks using "FAL-G" technology. This technology provides an alternative to traditional clay bricks which can be damaging to fertile soil. Not only do these bricks use what would otherwise be released as waste, they also require minimal energy in the process, which in turn leads to a decrease in greenhouse gas emissions. The invention of the FAL-G fly ash brick has prompted the Indian government to commit to banning new construction using clay bricks in urban centres and has been promoted within India's construction sector as the preferred alternative.

CASE STUDY: SUSTAINABLE MOBILITY

ELECTRIC VEHICLES

Electric scooters made in India are becoming an increasingly popular mode of transport for city dwellers worldwide. The vehicles' popularity is in large part due to the increasing cost of gasoline and the growing of air quality problems in major cities. More than 3.5 million electric scooters were sold in China in 2006.

To accommodate electric vehicle drivers, some manufacturers, like Eko-vehicles from Bangalore, have started "Charge and Chai" kiosks across Bangalore and Kerala, featuring a rapid-charger facility. These roadside kiosks sell refreshments and feature a two-pin plug that can charge an electric scooter in less than 12 minutes.

BETTER BIOFUELS

Switching from oil-based to plant-based fuels may be an option that can help address global climate change. But if the right crops aren't used, plant-based fuels can be a cure that is worse than the disease. It is critical that industry and policy makers promote only the most efficient biofuels. Corn-based ethanol for example, has been promoted in the U.S. as a possible alternative to oil-based fuel. However, while corn ethanol can have a positive energy balance (generating slightly more energy than it takes to farm and produce), and generates fewer greenhouse gas over its emissions life cycle than gasoline does, the efficiency of corn-based ethanol becomes more problematic when looked at from a Footprint perspective. This is due to the fact that, while it may reduce pressure on resources due to carbon emissions, it also requires considerable land area.

In India, there is much interest in generating biodiesel from Jatropha (an oil-producing succulent native to India) grown on marginal lands. Is this a sustainable use of India's biocapacity? More research is required to come to a conclusion about this crop, but it shows some potential to be a good fuel alternative. Getting out of overshoot will, however, require going beyond these crops. As more and more people in the world begin to own cars, developing truly low-Footprint mobility is essential. This will require not only lower-Footprint alternative fuels and ultra-efficient vehicle technologies, but also a focus on city infrastructure that supports extensive mass transit. In order to decrease the overall amount of driving and its associated Footprint, it is important to combine better fuel economy with measures to reduce overall social demand for driving.

Switching from oil-based to plant-based fuels may be an option that can help us address global climate change. But if the right crops aren't used, plant-based fuels can be a cure that is worse than the disease.

CASE STUDY: INNOVATIONS IN ENERGY AND ENERGY EFFICIENCY

PROMOTION OF RENEWABLE ENERGY IN INDIAN INDUSTRIES

Overall, about 61 percent of India's green-house gas emissions come from energy generation, and this amount is expected to grow along with future demand. The solution to emissions reductions in the power sector must come from a planned transition to a low-carbon economy through an emphasis on renewable power generation.

Renewable sources of energy currently constitute only 8 percent of total installed capacity nationwide, and 2 percent in terms of energy operation. However, India is bestowed with abundant renewable energy sources, with a total estimated potential of 122,000 MW of grid-interactive power (without considering solar energy potential). This translates into an investment potential of Rs 610,000 Crores (USD 135 billion), in addition to the current annual turnover of 8 to 10 Thousand Crore Rupees in the renewable energy sector.

Today India is in a position to play a major role in large-scale commercialization of renewable energy technologies, and can offer technology transfer to other developing countries and support in building capacity.

In spite of the huge opportunities for growth in the renewable energy sector in India, it is still lacking large scale commercialization.

To catalyze more corporate investments and enhance penetration of renewable energy systems for industrial and commercial applications, CII-Godrej GBC has formed a Council on Renewable Energy to facilitate more private sector participation in tapping the huge potential in the RE sector in India. The Council addresses policy issues at the State and Central level, supports technology transfer, and facilitates innovative financing mechanisms by bringing all stakeholders together.

Today India is in a position to play a major role in large-scale commercialization of renewable energy technologies, and can offer technology transfer to other developing countries and support in building capacity. The country has already achieved installation of over 10,000 MW of renewable-based capacity, and stands at fourth position worldwide in terms of wind power installed capacity. It is notable that more than 95 percent of the total investments in renewable energy in India have come from the private sector.

INNOVATIONS IN HOME ENERGY

Gasification represents a new innovation in the energy sector, allowing the conversion of carbonaceous matter such as rice husks into carbon monoxide and hydrogen through use of heat, pressure, and steam. The products of gasification include syngas (or hydrocarbon gases), hydrocarbon oils, and char (carbon ash by-product). The resulting syngas product is more energy dense than the original biomass, and is thus a more energy-efficient fuel.

Gasification has changed life in Baharbari, an isolated village in the state of Bihar that is not connected to the electricity or telephone grid and is cut off from the outside world during monsoon season. In 2002, for the first time, villagers harvested 25 acres of irrigated summer wheat for the creation of biofuels. A small rice husking industry has grown so that it competes with a monopolistic business set up by a powerful family some years ago. Several members of lower castes and a disabled woman have full-time salaried jobs; some have bought land for the first time.

What happened? With skills and technical assistance from desipower, a self-formed co-operative has succeeded in transforming the village in the past years by installing a village power plant run by a biomass gasifier. Fuelled by rice husk and dhaincha, a weed commonly grown in India to restore nitrogen to depleted soils, the power plant runs agro-processing machines, irrigation pumps, and a battery charging station. It doesn't take much – just 25 kilowatts – to power these village industries on clean, renewable, local energy.

WORLD CLASS ENERGY EFFICIENCY IN THE CEMENT INDUSTRY

India is the second-largest cement producer in the world, with an installed capacity of 166 million tonnes. India's projected GDP growth rate of 8 percent, coupled with a booming construction industry, has spurred the cement sector to start gearing up for the high demand.

As the cement industry grows, attention must be paid to the associated environmental impact. The cement industry is highly energy-intensive, the cost of energy within some plants reaching as high as 55 percent of manufacturing costs. Because it powers its clinker production with carbon-intensive coal fuel, the global cement industry is responsible for contributing about 4 percent of global Co_2 emissions.

The Indian cement industry has become a forerunner in energy-efficient cement manufacturing, with some of its plants operating at among the lowest specific energy consumption levels in the world. Due to increases in overall production, this energy efficiency may not reduce the overall Footprint. Neverless, it is important to note that Indian manufacturers are making steps to decrease their demand on Indian biocapacity.

The cement industry brings together a vast array of practices and techniques to reduce its impact on the environment. A significant effort in this direction was the "World Class Energy Efficiency" initiative in Indian cement plants.

Major initiatives taken up by the cement industry towards minimizing the industry's Ecological Footprint include:

- Adoption of energy-efficient technologies
- Use of alternative fuels
- Installation of waste heat recovery system

As part of the initiative, major cement companies shared their best practices and experiences with respect to the efficient utilization of energy resources. With a focus on the impact of waste products and the importance of low specific energy consumption per tonne of cement produced, the initiative was able to significantly reduce the cement industry's environmental impact.

The average electrical energy consumption for the cement industry in 2005-06 was 82 kilowatt hours per tonne of cement (kWh/t), and thermal energy consumption was 725 kilocalories per kilogram (kcal/kg). It is expected that the average electrical energy consumption will decrease to 78 kWh/t of cement, and thermal energy consumption to 710 kcal/kg by the end of 2012. this improvement can be made possible by new options in retrofitting and the adoption of energy-efficient equipment, better operations and process control of instrumentation facilities.

ECOLOGICAL FOOTPRINT: FREQUENTLY ASKED QUESTIONS

How is the Ecological Footprint calculated?

The Ecological Footprint measures the amount of biologically productive land and water area required to produce the resources an individual, population or activity consumes and to absorb its waste, given prevailing technology and resource management. This area is expressed in global hectares, hectares with world-average biological productivity. Footprint calculations use yield factors to take into account national differences in biological productivity (e.g., tonnes of wheat per U.K. hectare versus per Argentina hectare) and equivalence factors to take into account differences in world average productivity among land types (e.g., world average forest versus world average cropland).

Footprint and bio-capacity results for nations are calculated annually by Global Footprint Network. The continuing methodological development of these National Footprint accounts is overseen by a formal review committee (www.footprintstandards.org). A detailed method paper and copies of sample calculation sheets can be obtained at no charge: see www.footprintnetwork.org.

What is included in the Ecological Footprint? What is excluded?

To avoid exaggerating human demand on nature, the Ecological Footprint includes only those aspects of resource consumption and waste production for which the Earth has regenerative capacity, and where data exist that allow this demand to be expressed in terms of productive area. For example, freshwater withdrawal is not included in the Footprint, although the energy used to pump or treat it is.

Ecological Footprint accounts provide snapshots of past resource demand and availability.
They do not predict the future. Thus, while the Footprint does not estimate future losses caused by present degradation of ecosystems, this degradation, if persistent, will likely be reflected in future accounts as a loss of bio-capacity.

Footprint accounts also do not indicate the intensity with which a biologically productive area is being used, nor do they pinpoint specific biodiversity pressures. Finally, the Ecological Footprint is a biophysical measure; it does not evaluate the essential social and economic dimensions of sustainability.

How does the Ecological Footprint account for the use of fossil fuels?

Fossil fuels such as coal, oil, and natural gas are extracted from the Earth's crust rather than produced by ecosystems. When this fuel is burned, carbon dioxide is produced. In order to avoid carbon accumulation in the atmosphere, the goal of the U.N. Framework Convention on Climate Change, two options exist: a) human technological sequestration, such as deep well injection; or b) natural sequestration.

Natural sequestration corresponds to the biocapacity required to absorb and store the Co_2 not sequestered by humans, less the amount absorbed by the oceans. This is the Footprint for fossil fuel. Currently, negligible amounts of Co_2 are sequestered through human technological processes.

The sequestration rate used in Ecological Footprint calculations is based on an estimate of how much carbon the world's forests can remove from the atmosphere and retain. One 2003 global hectare can absorb the Co_2 released by burning approximately 1450 litres of gasoline per year.

The fossil fuel Footprint does not suggest that carbon sequestration is the key to resolving global warming. rather the opposite: it shows that the biosphere does not have sufficient capacity to cope with current levels of Co_2 emissions. As forests mature, their Co_2 sequestration rate approaches zero, the Footprint per tonne of Co_2 sequestration increases, and eventually, forests may even become net emitters of carbon.

How is international trade taken into account?

The National Ecological Footprint accounts calculate each country's net consumption by adding its imports to its production and subtracting its exports. This means that the resources used for producing a car that is manufactured in Japan, but sold and used in India, will contribute to the Indian, not the Japanese consumption Footprint.

The resulting national consumption Footprints can be distorted, since the resources used and waste generated in making products for export is not fully documented. This affects the Footprints of countries whose trade flows are large relative to their overall economies. these misallocations, however, do not affect the total global Ecological Footprint.

Does the Ecological Footprint take into account other species?

The Ecological Footprint describes human demand on nature. Currently, there are 1.8 global hectares of biocapacity available per person on planet Earth, less if some of this biologically productive area is set aside for use by wild species. The value society places on biodiversity will determine how much of a biodiversity buffer to set aside. Efforts to increase biocapacity, such as monocropping and application of pesticides, may also increase pressure on biodiversity; this can increase the size of the biodiversity buffer required to achieve the same conservation results.

Does the Ecological Footprint say what is a "fair" or "equitable" use of resources?

The Footprint documents what has happened in the past. It can quantitatively describe the ecological resources used by an individual or a population, but it does not prescribe what they should be using. resource allocation is a policy issue, based on societal beliefs about what is or is not equitable. Thus, while Footprint accounting can determine the average bio-capacity that is available per person, it can not stipulate how that bio-capacity should be allocated among individuals or nations. However, it provides a context for such discussions.

How do I calculate the Ecological Footprint of a city or region?

While the calculations for global and national Ecological Footprints have been standardized within the National Footprint accounts, there are a variety of ways used to calculate the Footprint of a city or region. The family of "process-based" approaches use production recipes and supplementary statistics to allocate the national per capita Footprint to consumption categories (e.g., food, shelter, mobility, goods and services). regional or municipal average per capita Footprints are calculated by scaling these national results up or down based on differences between national and local consumption patterns. The family of input-output approaches use monetary, physical or hybrid input-output tables for allocating overall demand to consumption categories.

There is growing recognition of the need to standardize sub-national Footprint application methods in order to increase their comparability across studies and over time. In response to this need, methods and approaches for calculating the Footprint of cities and regions are currently being aligned through the global Ecological Footprint standards initiative. For more information on current Footprint standards and ongoing standardization debates, see: www.footprintstandards.org.

For additional information about Footprint methodology, data sources, assumptions and definitions please visit: www.footprintnetwork.org/2006technotes

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Additional references can be found at:
www.footprintnetwork.org/2006references

ABOUT GLOBAL FOOTPRINT NETWORK

Global Footprint Network
Advancing the Science of Sustainability

Global Footprint Network promotes a sustainable economy by advancing the Ecological Footprint, a tool that makes sustainability measurable. Together with its partners, the Network coordinates research, develops methodological standards, and provides decision makers with robust resource accounts to help the human economy operate within the Earth's ecological limits.

ABOUT CII

CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the growth of industry in India, partnering with industry and government alike through advisory and consultative processes.

CII is a non-government, not-for-profit, industry led and industry managed organisation, playing a proactive role in India's development process. Founded over 113 years ago, it is India's premier business association, with a direct membership of over 7500 organisations from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 83,000 companies from around 380 national and regional sectoral associations.

CII catalyses change by working closely with government on policy issues, enhancing efficiency, competitiveness and expanding business opportunities for industry through a range of specialised services and global linkages. It also provides a platform for sectoral consensus building and networking. Major emphasis is laid on projecting a positive image of business, assisting industry to identify and execute corporate citizenship programmes. partnerships with over 120 NGOs across the country carry forward our initiatives in integrated and inclusive development, which include health, education, livelihood, diversity management, skill development and water, to name a few.

Complementing this vision, CII's theme "India@75: The Emerging Agenda", reflects its aspirational role to facilitate the acceleration in India's transformation into an economically vital, technologically innovative, socially and ethically vibrant global leader by year 2022.

With 63 offices in India, 8 overseas in Australia, Austria, China, France, Japan, Singapore, UK, USA and institutional partnerships with 271 counterpart organisations in 100 countries, CII serves as a reference point for Indian industry and the international business community.

ABOUT CII-GODREJ GBC

CII – Sohrabji Godrej Green Business Centre (CII – Godrej GBC), a division of CII, is India's premier developmental institution, offering advisory services to the industry on environmental aspects and works in the areas of green buildings, energy efficiency, water management, renewable energy, product incubation and climate change activities. The centre sensitises key stakeholders to embrace green practices and facilitate market transformation, paving way for India to become one of the global leaders in green businesses by 2015.

The centre is housed in a green building which received the coveted LEED (Leadership in Energy and Environmental Design) Platinum rating in 2003. This was the first platinum rated Green Building outside of the U.S. and also the first in India. The Centre was inaugurated by H.E Shri A P J Abdul Kalam, the then President of India, on July 14, 2004.

ABOUT WWF INDIA

World Wide Fund for Nature-India (WWF-India) is one of country's largest non-governmental organizations working towards the conservation of biodiversity and natural habitats. It engages with multiple stakeholders including local communities, teachers, students, state and central governments, industry and civil society organizations, so as to ensure a living planet for future generations. WWF-India works through a network of 15 state, 22 field and 8 divisional offices with approximately 300 staff working across the country to implement its mission and work. The secretariat is based in New Delhi and the organization is a part of the WWF International network, with its headquarters located in Gland, switzerland.

WWF-India has several programme divisions that work on specific areas of conservation and sustainable development. These include:

- Climate Change and Energy
- Forest Conservation
- Freshwater and Wetlands
- Marine
- Species Conservation
- Sustainable Livelihoods Programme
- Centre for Environmental Law
- Environment Education Programme
- Indira Gandhi Conservation Monitoring Centre (IGCMC)
- Living Ganga Program

Besides these initiatives WWF-India will be part of two large global programmes that will commence in 2008, namely the Tiger Initiative and the Living Himalayas Initiative.

All these programs do cross cutting work on landscapes that have been identified as fragile and important due to the critical role they play to ensure that sub continental biodiversity of flora and fauna in thrives. These landscapes are:

- Khangchendzonga
- Satpuda- Maikal
- North Bank
- Kaziranga-Karbilong
- Terrai-Arc
- Sundarbhans
- Nilgiri and Eastern Ghats

WWf-India's field staff works tirelessly to ensure that nature conservation is conducted in a scientific manner so as to ensure gradual reduction in man induced degradation of the environment and also to ensure that sustainable development practices are adopted.

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ABOUT USAID

USAID is an independent federal government agency that receives overall foreign policy guidance from the Secretary of State of the United States of America. USAID works in agri culture, democracy & governance, economic growth, the environment, education, health, global partnerships, and humanitarian assistance in more than 100 countries to provide a better future for all.

ABOUT ICICI BANK

ICICI Bank is India's second-largest bank, and second amongst all the companies listed on the Indian stock exchanges in terms of free float market capitalization. The Bank has a network of about 1,308 branches and 3,950 ATM's in India and presence in 18 countries. The Bank currently has subsidiaries in the United Kingdom, Russia and Canada, branches in United States, Singapore, Bahrain, Hong Kong, Sri Lanka, Qatar and Dubai International Finance Centre and representative offices in United Arab Emirates, China, South Africa, Bangladesh, Thailand, Malaysia and Indonesia.

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DR REDDY'S LABORATORIES

Dr. Reddy's is committed to providing affordable and innovative medicines for healthier lives. Dr Reddy's is a global, vertically integrated pharmaceutical company with a presence across the value chain through its various businesses, including Pharmaceutical Services & Active Ingredients (PSAI), Global Generics and Innovation. The company's products are marketed in over 100 countries with an emphasis on North America, Europe, India, Russia and other emerging markets. Dr Reddy's conducts NCE drug discovery research in the areas of metabolic disorders, cardiovascular indications and cancer at its research facilities in Atlanta (USA) and Hyderabad (India). Through its PSAI business, Dr Reddy's provides drug substance and drug product development and manufacturing services.

Dr Reddy's is among the leading pharmaceutical companies from India and has a global workforce of 9,500 employees. It has been consistently recognized for its HR practices and has ranked among the Best Places to Work in India in the pharmaceutical sector.

Dr Reddy's is guided by the Triple Bottom Line approach that ensures its care and concern for the environment, resource conservation, socially responsible engagement of employees and economically sustainable relationships with customers, suppliers, business partners and shareholders. Through Dr Reddy's Foundation, a non-profit organization set up by Dr Reddy's in 1996, the organization has pioneered innovative programs in education and sustainable livelihoods.

ABOUT ONGC

ONGC pioneered the nation's petroleum quest and is now present over the entire hydrocarbon value chain. As India's only company to feature in Fortune's Most admired Companies list, it has taken a giant leap forward for promoting sustainable growth and development by harnessing nature's clean alternatives like wind power and solar energy. ONGC intends to be carbon neutral and has invested substantially towards renewable energy research.

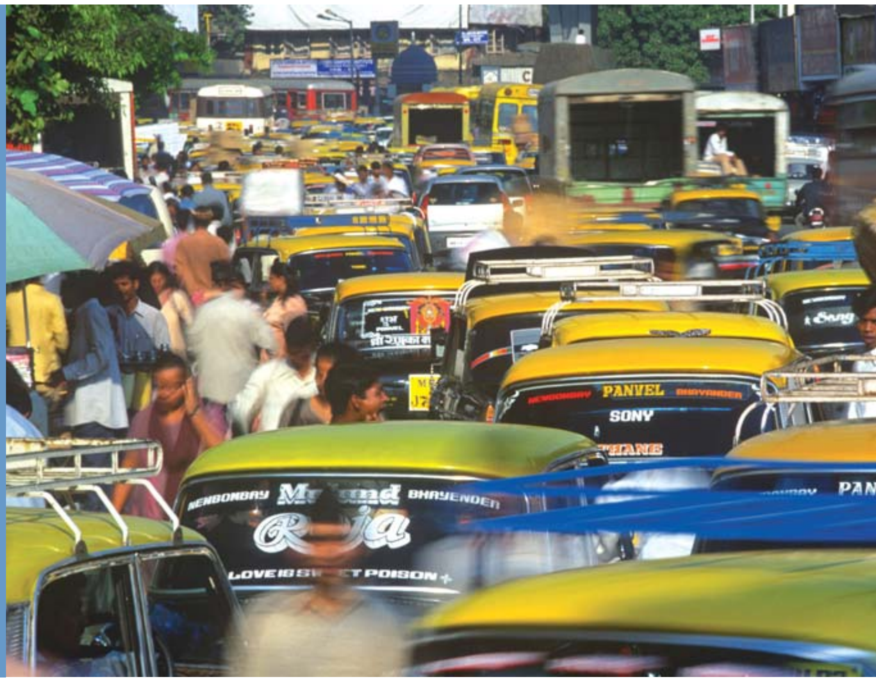
ABOUT TATA POWER

Tata Power is India's largest integrated private power company with consolidated revenues of Rs. 10,890.86 Crores for the fiscal year ended March 31, 2008. Inspired by a powerful vision, the founders of Tata Power pioneered the generation of electricity in India with the commissioning of India's first large hydro-electric project in 1915. Today, Tata Power has an installed generating capacity of over 2300 MW and a presence across the entire value chain in generation (thermal, hydro, solar and wind) transmission, trading and distribution. The Company has emerged as a pioneer in the Indian power sector, with a track record of performance, and a frontrunner in introducing state-of-the-art power technologies.

Among its achievements, the Company has to its credit the installation of India's first 500 MW unit at Trombay, the first 150 MW pumped storage unit at Bhira, and a Flue Gas De-sulphurization plant for pollution control at Trombay. Having served Mumbai's consumers for over nine decades the Company has since spread its footprint across the country and abroad. Outside Mumbai, the Company now has generation capacities in the States of Jharkhand and Karnataka and a distribution Company in Delhi. The thermal power stations of the Company are located at Trombay in Mumbai, Jojobera in Jharkhand and Belgaum in Karnataka. The hydro stations are located in the Western Ghats of Maharashtra and the wind farm in Ahmednagar. An optimum mix of hydel and thermal capacity enables the company to supply power at competitive tariffs to its customers. At 2.25% the Company's transmission & distribution losses are among the lowest in the country. Also, at the core of reliable power supply to the city is the unique 'Islanding' system pioneered by Tata Power, due to which the city of Mumbai has the advantage of assured uninterrupted reliable supply of power. In case of a grid failure, an "Islanding system" ensures power supply within the city limits.

The Company has successful public-private partnerships in generation, transmission and distribution- North Delhi Power Limited with Delhi Vidyut Board for distribution in North Delhi, 'Powerlinks Transmission Ltd.' with Power Grid Corporation of India Ltd. for evacuation of Power from Tala hydro project in Bhutan to Delhi and 'Maithon Power Ltd.' with Damodar Valley Corporation for a 1000 MW Mega Power Project.

For more information visit www.tatapower.com



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"The report on India's Ecological Footprint – a Business Perspective" was supported in part by a grant from the Government of India pursuant to the agreement between India and United States of America for the trade in Environment Services and Technologies (Clean technology Initiative) (EST/CTI). The views and information contained herein are those of the Global Footprint Network & CII – Godrej GBC and not necessarily those of Government of India or ICICI Bank or USAID or the corporate sponsors of the report. The Government of India or USAID or ICICI Bank or the corporate sponsors assumes no liability for the contents of this manual by virtue of the support given.

Published by Confederation of Indian Industry, CII – Sohrabji Godrej Green Business Centre, Survey No 64, Kothaguda post, Near Hitech City, R.R. Dist, Hyderabad – 500032