The human population

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Population numbers are a core component of resource use and waste output whether at the global, national or local level. Resource consumption and waste discharge in any country is a product of the number of residents times the per capita level of resource utilization.

The population factor in this equation is important everywhere. But it is more serious in developed countries because the scale of the ecological footprint of each resident is many times larger than that of persons living in developing countries. This reflects the high material and energy intensity lifestyle of residents of affluent societies. Any increase in population in developed countries (other things being equal) will result in a parallel increase in resource use and waste discharge vastly greater than would be the case in developing countries. One important example is the huge gap in per capita greenhouse gas emissions shown in Table 1 which is attributable to residents of developed countries relative to residents of developing countries.

There are a multitude of factors which influence the level of resource usage and waste discharge in particular countries. Nations vary in the vigor of their conservation policies and in their cleverness in reducing the energy intensity of their economy. But no matter how innovative, if the number of residents in a country grows at the same or greater pace as the decline in per capita resource use or waste discharge, the impact of the extra numbers will negate these environmental efforts.

The world is facing further substantial population growth. The United Nations medium population estimate for the globe is that it will increase from 6.5 billion in 2005 to 9.1 billion in 2050.[i] Most of this growth is projected to take place in developing countries. In the past, the relatively low rates of per capita resource use in developing countries has meant that notwithstanding rapid population growth, the global environmental impact has been less that that of developed countries.

This situation is changing, with the rapid incorporation of India and China into the global capitalist market. Even at current population levels this means the potential engagement of hundreds of millions of low wage workers into the global supply chains feeding the world's consumer markets, as well as even more eager consumers. Since India's population is projected to grow from 1.1 billion in 2005 to 1.6 billion in 2050 and China from 1.3 billion to 1.4 billion over the same period,[ii] this will add several hundred million more workers and consumers. The combination of these numbers, and the inevitable increases in per capita resource use and waste discharge flowing from rapid economic development, means that the environmental impact of economic activities in these countries will rival that of the United States and Europe by 2050. According to the World

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Resources Institute, China's greenhouse gas emissions will substantially exceed those of the United States as early as 2025. [iii]

There is a further less remarked on consequence of population growth in developing countries, at least as it is contributing to the state of the environment in developed countries. This is the increased net flow of migrants to the rich world. The reasons are too complex to elaborate on here, but they include the growing disparity in life style between low income and crowded developing countries and affluent western democracies. The persons successful in making this transition usually rapidly embrace the lifestyles in their country of settlement. In so doing they add to the level of resource use and waste discharge relative to what it was before they arrived, as well as to the overall global burden relative to what it would have been if they had not migrated. This south/north migration is occurring across the developed world but is particularly notable for the United States, Canada and Australia, all of which figure at the top end of the national per capita resource use and waste discharge tables.

The following case study of greenhouse gas emissions illustrates the argument. In contemplating the material it is worth keeping in mind that if global warming is to be contained to around 2 Degrees centigrade by 2050 relative to the pre industrial age, global emissions of greenhouse gases per year will have to be reduced by about 40-45 per cent from 1990 levels.[iv] It will be a mammoth job to achieve cuts in greenhouse gas emission of this scale. The population growth anticipated in both the developing and the developed world will magnify the task.

Population growth and greenhouse gas emissions

The standard way of decomposing greenhouse gas emissions (in this case CO_2 deriving from energy usage) is via the following equation:
CO_2 emissions from energy = Population x GDP per head x energy use per unit of GDP x CO_2 emissions/energy use.[v]

Table 1 shows the World Resources Institute's calculation of each of the components of the above equation for the period 1990 to 2002, by selected countries for CO_2 emissions (excluding changes attributable to land use change and forestry). In the case of the United States, the Table shows that that there was an 18 percent increase in the total emissions (equivalent to 863 million tons (Mt)) over this twelve year period. The decomposition shows that by itself, growth in GDP per capita would have added 23 per cent to CO_2 emissions in the United States, except that over the 1990 to 2002 period there was a 20 percent drop in energy use per unit of GDP and a further one percent drop in the carbon intensity of that energy use. Nevertheless, as the Table shows, CO_2 emissions in the United States actually grew by 18 per cent. This was almost entirely due to the population factor, because during this period the population of the United States increased by 16 percent. Just over half of this population growth was attributable to net overseas migration to the United States.

Table 1: Factors contributing to CO_2 emissions growth 1990-2002

	CO_2 change 1990-2002		Per cent contributions to CO_2 changes			
Country	$MtCO_2$	per cent	GDP per capita (GDP/pop)	Population	Energy intensity (E/GDP)	Fuel mix (CO_2/E)
China	1247	49	122	15	-96	8
United States	863	18	23	16	-20	-1
India	457	70	55	28	-31	19
South Korea	246	97	84	15	12	-15
Iran	178	93	44	26	24	-1
Indonesia	164	97	44	25	2	26
Saudi Arabia	148	91	-7	46	52	0
Brazil	125	57	17	21	7	13
Spain	98	44	31	6	7	-1
Japan	96	9	12	3	0	-7
Mexico	87	28	17	22	-12	1
Canada	87	20	24	13	-18	0
Australia	73	28	31	16	-19	-1
United Kingdom	-36	-6	24	3	-20	-13

Source: World Resources Institute (2005), *Navigating the numbers*, World Resources Institute, Washington DC, p. 15.

By comparison, in developed countries where population growth was low, CO_2 emission growth also tended to be low. For example, in the UK, CO_2 emissions fell by 6 per cent between 1990-2002, despite a 24 percent increase in per capita GDP per capita. In this case the growth in GDP was offset by significant reductions in the units of energy utilized per unit of GDP and in the carbon intensity of the fuel mix. Unlike the United States, population growth in the UK during this period was only 3%, thus not offsetting these reductions. As a result there was a decline of 36 million tons of CO_2 or 6 per cent over the 12 year period.

In the developing countries, as would be expected, the population factor is magnifying the growth in CO_2 emissions. In the case of India, CO_2 emissions increased by 70 percent between 1990 and 2002. The energy intensity of GDP use fell by 31 per cent. But this was offset by the combination of rapid population growth (28 percent), growth in GDP per capita (55 percent) and a higher carbon fuel mix (19 per cent). As Table 2 indicates, in per capita terms, India is a both a low income country and a relatively modest emitter of greenhouse gases by comparison with the United States. Yet because of the recent rapid growth in GDP (even if from a low base) and the country's huge and growing population base, CO_2 emissions grew by 457 million tons between 1990 and 2002. This means that for this period India was the third largest growth point for CO_2 emissions, following China and the United States.

Further rapid growth in emissions from India and China (and some other developing countries) seems inevitable. In the case of China, its relatively modest projected population expansion to 2050 (just 100 million) will mute the population factor (relative

to India). But because the Chinese are already well ahead of India in per capita emission terms (see Table 2) and are expected to sustain rapid economic growth for the foreseeable future, China is expected to be the world's largest single emitter of greenhouse gases well before 2050.

Table 2: CO_2 and GDP per head for selected countries in 2002

Country/grouping	CO_2 per head (tCO_2)	GDP per head ($ppp 2000)
United States	20.4	34430
EU	9.4	23577
United Kingdom	9.6	27176
Japan	9.8	26021
China	3.0	4379
India	1.1	2555
OECD	11.7	24351
Economies in transition	7.7	7123
Non-annex 1 parties	2.2	3870
World	4.0	7649

Source: Nicholas Stern (2007), *The Economics of Climate Change: The Stern Review*, Cambridge University Press, p. 202. PPP is purchasing power parity

From an ethical perspective, it is usually assumed that the burden of greenhouse gas abatement should be shouldered by the developed world, because the constituent nations are responsible for most of the accumulated greenhouse gases currently in the atmosphere and because of their greater financial capacity to reduce their emission levels. If developed nations do decide to take on this obligation, the population outlook for many will deepen the task. In the case of the United States, currently the world's largest greenhouse gas emitter, its government has not yet even acknowledged any responsibility to reduce its emission levels. Meanwhile on the population front, the United States is growing by over one percent a year, mainly due to a net migration intake of more than one million a year. If this continues, as is assumed in the United Nations projections, its population is likely to grow from 300 million in 2005 to 400 million in 2050.

As Table 2 indicates, in 2002, per capita CO_2 emissions in the United States were 20.4 tons. Should this rate be maintained, by 2050 the additional 100 million persons will add 2.04 gigatonnes of CO_2 to the global atmosphere in just that year, relative to what would have been the case with a stable population. This is an immense amount. In the year 2000, total CO_2 emissions in the United States was 5.8 gigatonnes.[vi] A similar outlook (if on a much smaller scale) applies to Canada and Australia. In the case of the United States (and Canada and Australia), most of the migrants are coming from developing societies,

though disproportionately from Mexico in the case of the United States. As can be seen from Table 2, per capita emission levels in these societies are only a small fraction of those for the United States (and Australia and Canada). As a consequence most of the extra CO_2 emitted in the United States over the period to 2050 which is a consequence of population growth can be regarded as a net addition to the global carbon load.

Prospects for population stabilisation

In the developing world there has been a significant reduction in the rate of population growth in recent decades, almost all of which is attributable to a decline in fertility. This is likely to continue. Improvements in child mortality are reducing the motive for families to have large numbers of children. But the main factor thought to be shaping this decline in fertility, at least in the more urbanized Asian societies, is economic growth. Throughout Asia, this circumstance has led to sharp falls in fertility. Basically, this reflects increased opportunities for women in the workforce and consequent higher opportunity costs for women contemplating having children. Economic growth also brings in its wake higher costs of raising children because of the growing skill levels demanded in a more developed economy. In the case of Japan, South Korea, Hong Kong and Singapore fertility levels are now below replacement levels. When countries reach the per capita income levels of these four countries, the energy intensity of GDP tends to decline, and there is increased capacity to implement energy efficient technologies. But by this time their per capita CO_2 emissions are many time those of most developing countries.

India, China, Indonesia, Pakistan and several other populous developing countries have decades to go before they approach the income levels of South Korea or Hong Kong. China's one child policy has already contributed to a sharp decline in fertility. The economic successes of India may lead to a further drop in fertility in that country. But this is a pact with the devil. For greenhouse gas emissions are likely to accelerate with this economic success because of the associated increase in energy consumption.

What about the developed world? With a couple of exceptions, including the United States, all developed countries feature fertility rates are below the long term replacement rate. To the extent that they are growing from natural increase it is because of the momentum derived from relative youthful age distributions. Immigration is now the main source of population growth in developed societies.

Because of the large per capita ecological footprint, population growth in the developed world inevitably adds to environmental stress, not only at the global level (as with greenhouse gases) but also at the national and local level. The accommodation of extra people is energy and material intensive because population growth is the main determinant of the numbers of households and thus of demand for additional dwellings and the accompanying infrastructure. Some conservationists talk bravely about accommodating extra numbers through better planning, or about each of us embracing a 'living with less' ethic, or about the use of 'smart growth' strategies (usually implying the intensification of living arrangements) and so on. In reality, consumer needs usually prevail because residents, as consumers, have purchasing power and they can vote. They

and the corporations supplying their needs have vastly more financial and political influence than do residents speaking for the environment.

The obvious way to limit the environmental damage consequent on population growth in developed societies is to curtail international migration. This has occurred to a degree in Europe, largely because of public concerns about ethnic change associated with north/south migration. Such concerns have been much less influential in Australia, Canada and the United States, where migration is celebrated in some quarters as part of the identity of these nations and where the official adoption of multiculturalism or pluralism has facilitated the accommodation of diverse ethnic communities. Indeed, significant elements of the intelligentsia justify additional migration on the grounds that it will deliver more diversity. Important sections of the environment movements in each of the three countries simply avoid any engagement with the population issue on these grounds. Some, like the Australian Greens, privilege migration over the environment because it fits with their internationalist and humanistic agenda.

Meanwhile the business elite lends its powerful support to continued migration because it promotes market and workforce growth. For property owners extra population is akin to a river of gold because it increases the scarcity value of their land and buildings (especially where they are located in middle to inner city locations).

Conclusion

The population issue illustrates in acute form the difficulties of achieving resource use levels consistent with long term environmental sustainability. All decisions affecting the natural environment are mediated by human institutions and human beings with beliefs, values and aspirations (their accumulated culture). These institutions and this culture are often profoundly at odds with any notion of population stability, especially if it involves low international migration. The position of the Australian Greens is an example. Many more illustrations could be added, including the advocacy of Christian leaders for a generous intake of migrants from oppressive or poor nations. This situation helps explain why the population issue is rarely given the prominence it deserves in environmental policy, even amongst conservation advocates.

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[i] United Nations, *World Population Prospects: the 2006 Revision*
[ii] Ibid
[iii] Kevin Baumer, Timothy Herzog and Jonathan Pershing, Navigating *the Numbers, Greenhouse Gas Data and international Climate Policy,* World Resources Institute, p. 18
[iv] p. 19
[v] Nicholas Stern, *The Economic of Climate Change, The Stern Review*, Cambridge, 2007, p. 203
[vi] Kevin Baumer, et al, op. cit., p. 19