ADDICTED TO RESOURCES

Industrialisation is consuming natural resources at rates that are demonstrably unsustainable in the long term, points out **Helmut Haberl.**

We don't know when exactly the planet saw the arrival of the seven-billionth human during the past few months. Or perhaps that will happen during the coming few months. Humanity has added a billion individuals in only about 13 years after the world's population surpassed six billion, with most growth occurring in the developing world. Although this is a staggering rate, most demographers agree that it will decline – the annual growth rate has been plummeting since the late 1960s – and will eventually grind to a halt as the world population reaches between nine and ten billion people in the next decades.

But stabilisation or even decline of human population will not decrease the world's hunger for resources. According to the Food and Agriculture Organization (FAO), 850 million people – 13 percent of the world population – are at present chronically undernourished. To reduce malnutrition in a growing world population we will need substantial increases in food production, perhaps some 70 percent more than today in the year 2050, according to FAO estimates. Even this surge in agricultural production will not suffice to eradicate malnutrition as long as current levels of inequality in food supply remain. Reducing world hunger depends at least as much on reduced poverty as on increased food production.

Food is only one driver of the growing global resource use.

Food is only one driver of growing global resource use: in fact, during the last century global resource use grew by a factor of 9.5, but biomass use grew by a factor of 3.8 and lagged behind other groups of resources (Figure 1). The yearly use of fossil fuels grew more than 13-fold, ores and industrial minerals 31-fold and construction minerals more than 40-fold.

A major driver behind the trajectory of global resource use displayed in Figure 1 is the global spread of industrialisation; that is, the transition from agrarian subsistence with limited consumption to industrial societies powered by fossil fuels and demanding large amounts of ores and minerals. Industrial society emerged as a historical singularity in England in the 17th and 18th centuries and has since spread across the globe. At present, perhaps a quarter to a third of the world's population has more or less completed the agrarian-industrial transition

The Deepwater Horizon explosion in 2010

Our thirst for resources sometimes comes at a tragic human and environmental cost.

United States Coast Guard Service

and much of the rest is on its way. Some regions are at the initial stages (rural regions in parts of Africa, for example), while others including India and China are moving far more rapidly. Other regions like many urban regions in Latin America and Southeast Asia are almost there (Fischer-Kowalski and Haberl 2007). Such industrialisation is premised on surges in the use of non-renewable resources, which currently account for 70 percent of global resource supply. No matter which side of the heated *peak everything* debate one is on, it is clear that this trajectory cannot be sustainable.

Two additional points need to be made. First, "renewable" doesn't necessarily mean "environmentally benign". 50-70 percent of Earth's land surface is used to produce 20 Gigatons of biomass every year (Erb *et al*. 2007). This puts an array of pressures on ecosystems and is one important driver of biodiversity loss. We cannot increase food supply in the coming decades simply by increasing cultivated area; we also need to intensify land use (Lambin and Meyfroidt 2011). Reaping the benefits of intensification while minimising its substantial adverse effects will be a major challenge. Second, even if resource supply were limitless, the capacity of the biosphere and biogeochemical cycles to absorb the effects of use is not. For example, we need to reduce drastically the accumulation of carbon in the atmosphere to avoid disastrous climate change (Meinshausen *et al*. 2009). And we need to manage the application of fertilisers far more carefully to avoid harming coastal ecosystems.

We need no less than a new development model.

Several nations of the Global South are currently following the same resource-intensive path to industrialisation paved by Europe and North America. This is clearly unsustainable, especially while consumption in the industrialised world shows no sign of abating. We need no less than a new development model that allows improvements in human wellbeing throughout the world without harming the Earth system irrevocably. The contours of such a model, however, remain a huge challenge given the issues such as equity and historical responsibility. The difference between a sustainable society and our current industrial one will probably be almost as large as that between the current industrial society and the agrarian subsistence economies that prevailed in Europe some 200 to 300 years ago (Haberl *et al*. 2011).

Resource efficiency – deriving more income or wellbeing from

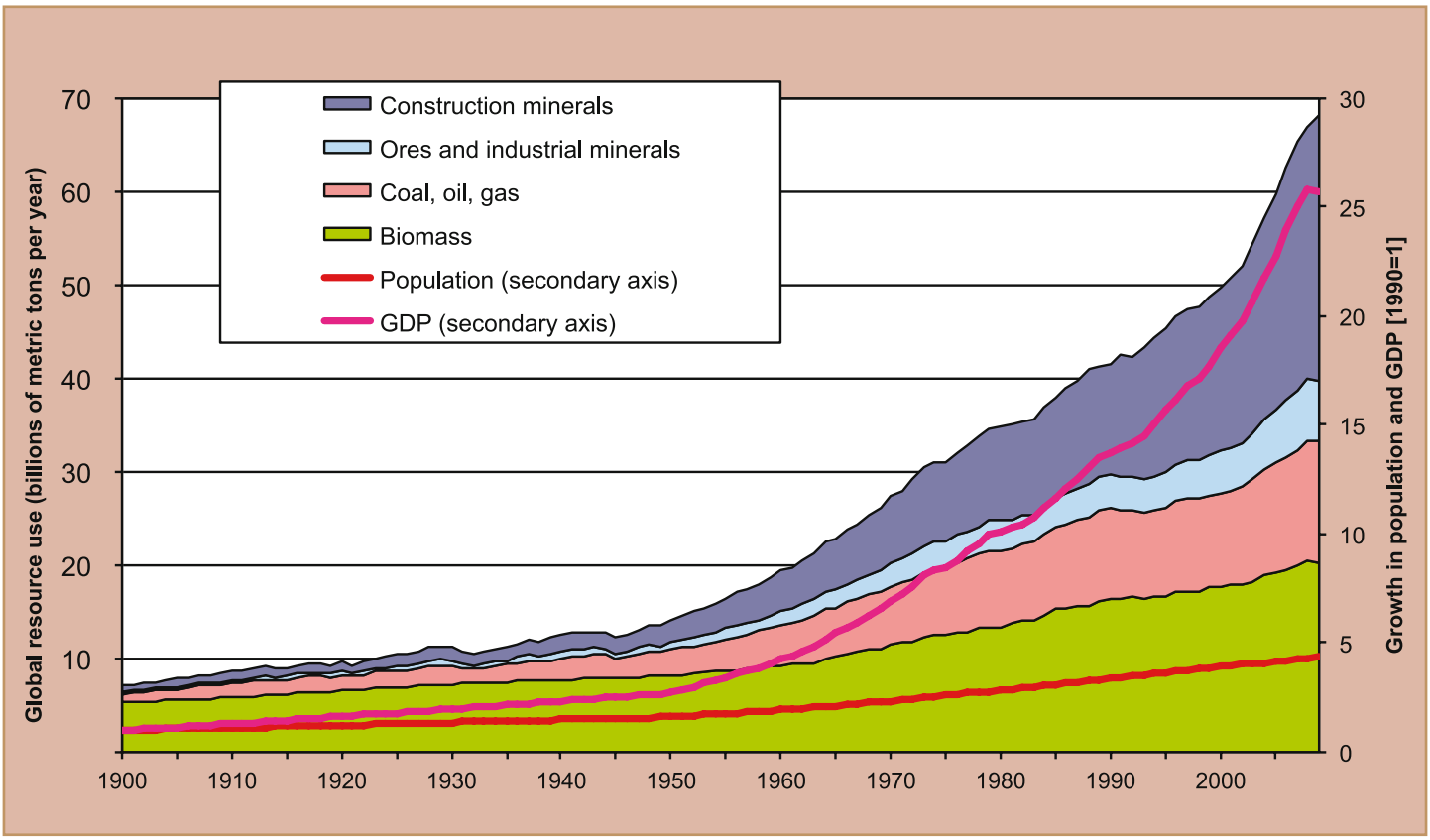

Figure 1. Increasing consumption. The left axis shows global resource use between 1900 and 2009 measured in billions (10^9) of metric tons per year. The right axis (1900=1) shows the growth in population and Gross Domestic Product (GDP) during the same interval. GDP is measured in constant 1990 Geary-Khamis Dollars. Data source: Krausmann *et al*. 2009, updated using data available at http://www.uni-klu.ac.at/socec/inhalt/3133.htm

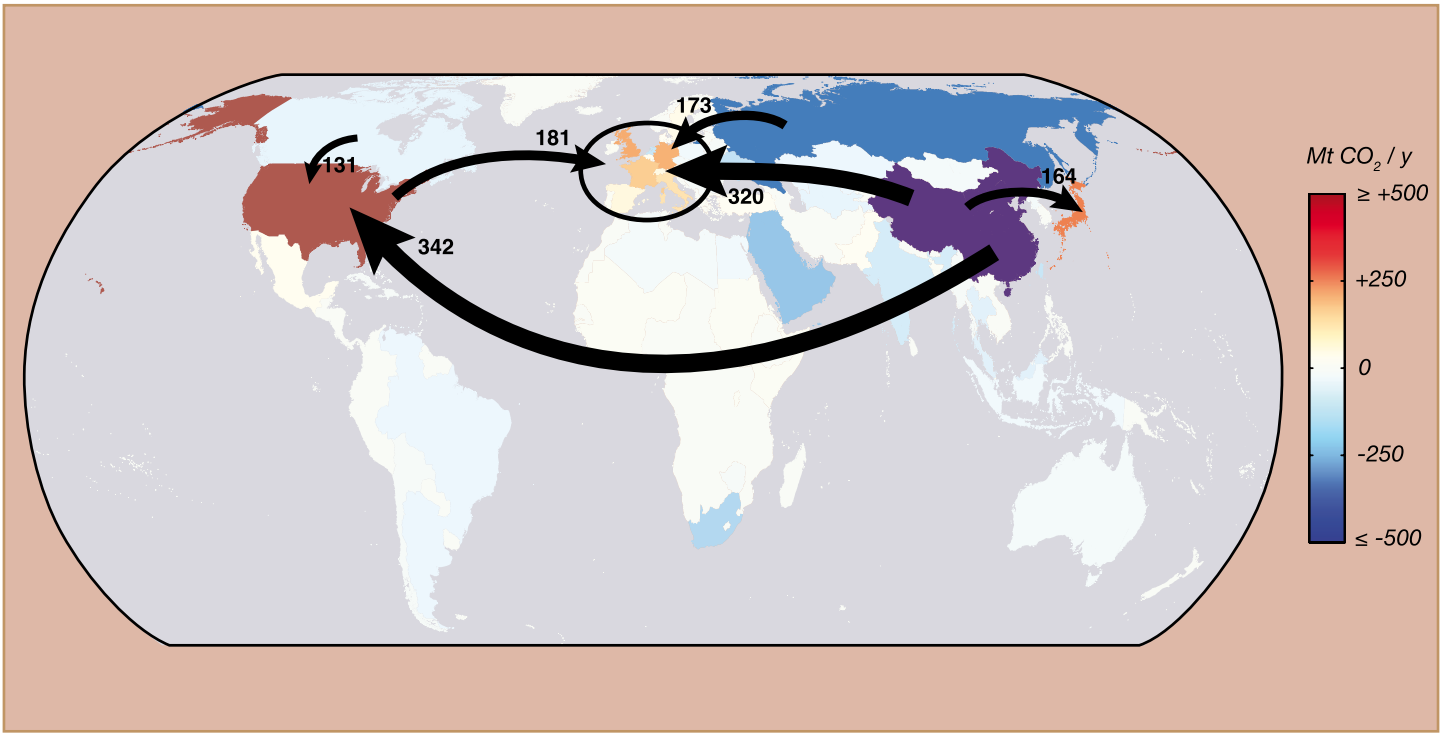

Figure 2. Trade in focus. The net effect of emissions embodied in goods and services based on millions of tons (Mt) of CO_2 trade in 2004. Arrows depict the largest interregional fluxes of emissions (Mt CO_2 / year) from net exporting countries (blue) to net importing countries (red). The threshold for arrows is 100 Mt CO_2 per year. From Davis S J, Peters G P and Caldeira K (2011). *Proceedings of the National Academy of Sciences* 108: 18554-18559.

less resources – is necessary but unlikely to be sufficient to achieve sustainability. After all, between 1900 and 2009, global GDP in constant dollars grew by a factor of 26 – two to three times faster than total resource use or fossil-energy supply (Figure 1). Efficiency gains are business-as-usual and have not so far resulted in stabilisation, let alone reduction, of resource use. Improving wellbeing and incomes have instead triggered an increase in consumption. Also, production and consumption are increasingly globally integrated (Figure 2). For example, the greenhouse-gas emissions (GHG) "embodied" in global trade are growing rapidly, therefore causing increasing carbon leakage from the regions that have agreed to binding emission reductions under the Kyoto Protocol to those that have not (Peters *et al*. 2011).

Although most of us would agree on the need to change current patterns of resource use and consumption, there is no agreement on how to go about doing this. The existing model of improving wellbeing is premised on economic growth fuelled by consumption. Is there a workable alternative whereby we could live well despite reduced resource throughput? What behavioural and institutional changes would this entail and how could we make those happen? The positive news is that our knowledge about resource use and flows is improving by the day. Such information is already informing management decisions at local and regional scales (for example, cities) and remains available to support any steps taken at the international level towards a transition to sustainability. ▮

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Production and consumption are increasingly globally integrated.

REFERENCES

Davis S J, Peters G P and Caldeira K (2011). *Proceedings of the National Academy of Sciences* 108: 18554-18559.

Erb K-H *et al.* (2007) *Journal of Land Use Science* 2, 191-224.

Fischer-Kowalski M and Haberl H, eds (2007) *Socioecological Transitions and Global Change. Trajectories of Social Metabolism and Land Use.* Edward Elgar, Cheltenham and Northampton.

Haberl H *et al.* (2011) *Sustainable Development* 19: 1-14.

Krausmann F *et al.* (2009) *Ecological Economics* 68: 2696-2705.

Lambin E F and Meyfroidt P (2011) *Proceedings of the National Academy of Sciences* 108: 3465-3472.

Meinshausen M *et al.* (2009) *Nature* 458: 1158-1162.

Peters G P *et al.* (2011) *Proceedings of the National Academy of Sciences* 108: 8903-8908.