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# Ecosystems

## Things that may interest you

- The biggest programme of conservation, reforestation, cleanup and environmental repair is in China, spending \$1 trillion over the current national five-year plan, more than USA and EU combined - though it is faced with enormous and urgent environmental challenges.
- Unless things change, in 2050 overall human consumption - the global ecological footprint - will be twice the carrying capacity of the Earth. Currently it is 1.5, already in overshoot.
- The economic value of ecosystem services is estimated as twice that of global GDP.
- At current rates, by 2050 there will be the same weight of plastics in the seas as fish.
- Many infectious diseases arise from damming, irrigation, deforestation, hunting, urbanisation and habitat fragmentation. Use of antibiotics in agriculture and dispersal of agrichemicals into the environment also cause many human, animal and plant diseases.
- Biodiversity-rich mature forests are projected to decline by 13% and land-based biodiversity by 10% by 2050. Ten billion trees are already being felled every year.
- In coming decades, loss of biodiversity and ecosystem service benefits will cost \$2-5 trillion per year, affecting economic growth and particularly the poorest people and areas.

In the 21st Century we have to redefine what ‘wild’ means and make the best of whatever we land up with. Even the remotest parts of the world are affected by pervasive human influence – these pools of natural, untamed wilderness, a balancing



factor in the world ecosystem, are dwindling. However, around 10-15% of the Earth’s surface is currently under protection (though underfunded and not without risks). Now in the newly-named *Anthropocene* era, humanity has impacted so much on the planet that it shows up in permanent, irreversible, ecological and geological ways.

We are also in the midst of a great man-made species extinction – 12% of bird species are likely to go extinct in coming decades, thanks to agriculture, logging, habitat and food source loss, invasive species, hunting, climate change, urban growth, fires, pollution, disturbance and overfishing. At current rates, 30% of amphibians and invertebrates, 20% of fish species, mammals and reptiles, 50% of primate species and 70% of plant species risk extinction this century.

The core problem is that *the ecosphere and the human economy mutually contradict and undermine each other*. This conflict started around 1820 in the early industrial revolution, going critical and global around 1970. Growth economics has been a priority for two centuries, leveraged by coal, oil and resource, animal and human exploitation, but precedence must by necessity tip toward the ecosphere in coming decades – and humanity’s cooperation to save the day will matter greatly.

Our economic system functions by evading the full, longterm ecological costs of its extractive and exploitative mode of operation: it depletes resources, ecosystem services and the planet's natural capital, leaving the problem for future generations to sort out, and those future generations are now here, and this is the time, and we are the people they were visualising.

It's all about bulldozers and dynamite: when nature and humans come up against each other, nature has to move over. We're in a long, drawn-out collision of economic and environmental systems, with dangerous consequences for both.

One radical proposal is to turn half of the Earth into protected areas, with an emphasis on placing environmental care responsibilities in the hands of indigenous and local people by reorienting their local economies and supporting new kinds of eco-friendly development. A major international convention is proposed, to replace the current 1992 Convention on Biological Diversity signed by every nation except USA, which ends in 2020. Many of its goals have not been attained or fully funded. The 2010 Aichi Biodiversity Targets, also to be met by 2020, have failed – these were intended to halve habitat loss and deforestation, manage fisheries sustainably, prevent the extinction of known threatened species, and minimise the impact of climate change on coral reefs. To prevent the above-mentioned collision, radical steps are needed, not just to preserve the world's 846 ecoregions but to transform economies to provide the necessary \$100bn per year to fund environmental protection (currently standing at \$4-10bn per year) and also systemically to change many of the economic causes of collision.

Though this plan is ambitious and costly, the price of not doing so is higher, impacting increasingly on the profit margins of corporations and the health of economies, and kicking in further as the decades progress. By 2017 it was found that 10% of the 846 ecoregions were 50% protected, though many of these are the easiest to protect and some of them nevertheless risk encroachment.

How this plays out by 2050 is an issue of historically decisive proportions. International agreements made and *fully implemented* now will make a big difference. A substantial portion of today's problem arises from underfunding and incomplete implementation of existing plans and agreements. Nature is weakened and damaged, a return to pristine former times is not viable and sympathetic human environmental intervention and management are now essential. Ecological issues are becoming economic issues.

## Ecosystem services and the human footprint

Ecosystem services are resources and facilities that nature renders to us, without which we will not survive. They include *support* (habitats, natural processes, air, water, land); *provisioning* (food, fresh water, fuel, medicines, materials, air); *regulation* (of climate, weather, flood, drought and disease, plus air and water purification); and *culture* (psycho-social, ambient, recreational and spiritual benefits). Since the 1970s ecosystem services have been under strain, increasingly drained of their capacity to replenish themselves. Nature is much more than just a resource yet it is treated so, and its fate will be sealed by people in urban offices who make their living imploring us to consume its products. One of the many paradoxes of capitalism is that the rarer a species or resource, the higher its value and the more profitable it becomes to exhaust it.

Access to ecosystem services such as water, timber and fertile land is becoming a critical issue for economic growth and sustainability. In terms of natural capital, some countries, particularly richer ones, are in deficit, dependent on importing the products of ecosystem services from elsewhere – but those regions in surplus are insufficiently so to counterbalance the deficits. Energy and resource issues, climate change, food insecurity, biodiversity loss, depleted soils and fisheries, pollution, soil erosion, water stress and weather events are creating supply-and-demand tensions in the economy.

Humanity's ecological footprint or impact is in overshoot, at 1.6 Earths. The world economy is exhausting many natural resource stocks, reducing bioproductive land area, polluting air and water and creating waste sinks at an accelerating rate. This overshoot will impact more and more on human life as natural limits are crossed. We do not know where those limits truly lie because we have never conducted such a global depletion experiment before, but simple commonsense suggests avoiding even approaching those limits because the outcome can be irreversible.

These impacts affect poorer people and countries more than affluent ones since they have fewer fallbacks, economic resources, technologies and spare capacity to absorb shocks. However, affluent countries are not at all exempt from risk or repercussions, indirect or direct. The greatest tragedy is that we have lacked the will to apply any more than modest remedial measures during a time when we have had the wealth to do it. This remedial window of opportunity is gradually closing.

A 2005 UN-sponsored Millennium Ecosystem Assessment identified four key 'emergent' findings:

1. out of twenty-four ecosystem services examined, 60% were degraded or overexploited, including fresh water sources, fisheries, air and water purification, and natural regional mechanisms regulating climate, natural hazards and pests;
2. the risk of sudden, critical ecosystem changes is increasing, particularly with disease emergence, deteriorating water quality, coastal dead zones, fishery collapse and regional climate change;
3. fragile dry-land ecosystems where biological productivity is low and population growth and poverty are often high are seeing an increase in poverty and inequality, which then acts as a cause of downturn, emigration, conflict and further ecological degradation;

4. together with climate change and habitat loss, nutrient loading is a major driver of ecological change – chemicals, sewage, pharmaceuticals and fertilisers dumped in the soil, rivers and sea.

Work to reverse problems with land degradation, pollution and biodiversity loss in the developed world has been measuredly effective, with admirable achievements and many lessons learned, yet it has been insufficient in scale and scope to outweigh the ecological



and resource damage taking place, and the fundamentals creating such destruction, while having been tweaked, remain in place. The developed world has also shifted some of its problems to the developing world (such as toxic industries, refuse disposal, electronic waste and recycling), meaning that the net global gain from these improvements is less than it appears. The key issue is that it is insufficient simply to make corrective tweaks to human systems and behaviours: to adjust our civilisation to nature and reduce the friction between them, fundamental systemic changes are needed.

Positive eco-supporting interventions need to be prioritised, including widespread investment, policy changes and financial instruments to support environment-friendly practices, elimination of perverse subsidies encouraging energy and food over-consumption and undue exploitation of nature, and regulation of harmful technological, waste disposal, farming and land-use practices. Global fossil fuel subsidies amount to around \$460bn per year: if this were invested in ecological support and remediation,

much would change in the environment and with human impacts on it.

Such interventions need to involve root-and-branch behavioural and technical changes to reduce consumption, waste, toxicity and pollution; comprehensive adaptation of economic, industrial, transport and urban systems; and investment in public services such as education and health to help change public behaviour. In addition we need to reduce socio-economic inequalities and poverty to help ordinary people, small farmers and communities develop ecologically sound methods, manage local ecosystems and increase their and the world's overall resilience to environmental and climatic change. Above all we need to deal with environmental stresses *before* they become urgent. If the world fails to get serious about such issues, then it's heading for a train-crash. This possibility has been visible for some decades – these questions needed tackling earlier.

There are barriers to favourable change. Governments, institutions, financial markets, banks, investors, media, lobbyists, marketers and vested interests all variously obstruct change or they 'greenwash' the issues while carrying on with symbolic and cosmetic changes. Corruption, weak regulation, perverse taxes, lack of transparency, subsidies and tax evasion all undermine the application of environmental policies. The people most affected by environmental issues – the poor, small farmers, rural dwellers, women, minorities and indigenous groups – lack political and economic influence. Overall, a culture of avoidance, denial, unawareness and suppression continues to prevail in the public domain. So large-scale environmental damage continues.

Partial and profitable environmental solutions such as electric cars, 'clean' nuclear power stations and eco-tourism tend to be prioritised over whole-systems and alternative solutions. There is also wilful ignorance over the effects of electromagnetic and pharmaceutical pollution, pervasive ambient toxins, habitant

destruction and fragmentation, and also inadvertent geoengineering – environmental damage with fundamental global-scale effects. At ground level and amongst academics, politicians and business leaders there is insufficient knowledge about ecosystem services and their importance.

## Mitigation and adaptation

On average, 75% of world GDP is spent on consumption and 25% goes on investment. In coming decades remedial investment will need to rise to 30-35% of global GDP to fund many remedial and adaptation projects. However, part of this investment can be funded by investment switching. These projects include: substitutes for fossil fuels and agricultural phosphates; cutting emissions; regeneration of ecosystem services; cleanup of nuclear stations, toxic and sewage treatment sites and waste sinks; restoration of habitats, species and natural capital; infrastructural adaptations to buildings, roads, rivers and coastlines; disaster-related expenses; and facilities to protect resources and deal with displaced people, migrants, emergencies and contingencies.

Some investment will yield small or slow direct returns but, if such investments are *not* made, the future socio-economic and environmental costs will be considerably higher. The true returns are bigger, wider and longer term than customary short-timescale financial planning encompasses – and this too needs to change. At a time when global economic growth is likely to slow, investment needs to rise, and low direct returns will probably further slow the world economy. Such investment needed to start fifty years ago, and some did, but it was stopped in the 1980s deregulation frenzy.

Environmental problems most impact ordinary people and the poor. They drive small farmers and the bottom billion downwards economically as a result of floods, droughts, failed harvests and resource and habitat loss. To feed everyone, the UN estimates that by 2050 a 70% rise in food production is needed (though this is

questionable) just at a time when crop yields are declining and environmental conditions are deteriorating. This contradiction implies shortages to come, rising food prices, price spikes and competition for scarce food stocks, in bad years leading to possible famines. These can be mitigated by lifestyle, dietary and consumption changes, elimination of food waste and reduction of meat and dairy intake, but changing society's habits takes time.

As natural capital becomes scarcer than financial capital, the effectiveness of the world economy to deliver decent lives for people will depend on proper ecological and resource accounting and proactive mitigation policies – otherwise social and political stresses are likely. Recent wars in Syria, the Sahel and Yemen, and criminal violence in central America, all had ecological causes, for example. Progress has been made in nature conservation but we have landed up with islands of good news amidst an ocean of bad news, and environmental concerns have customarily been treated as a political side-issue. A fundamental rethink and reorientation is needed, leading toward systemic change to prioritise environmental measures, improve natural capital, defragment habitats, reduce food and resource demand and grapple with the many environmental imperatives before us.

This reorientation might work better in authoritarian-ruled countries than in democracies, since centralised power generally thinks longer term, with a greater capacity to implement measures that, if truth be known, need to be draconian. Democracies need to be more resolute, thinking longer-term, if ecological problems are to be properly addressed – that's politically difficult. Systems change needs to move toward a circular, recycling, sharing economy, as mentioned in this report's economics chapter. The footprints of affluent people and countries need to diminish by at least 50% – this might sound extreme, even punitive, but the price of omitting to do so could be higher and better-off people would, in effect, be committing murder by default.

Most environmental remedies will be implemented in the world's fields, rivers, forests and villages, but the offices of power are where a critical difference will be made. Individuals, civil society, NGOs and scientists have pushed the environmental agenda forward, and consumer and public pressure do work, but the powers-that-be in governments, banks and corporations constitute both the biggest blockage to and also the biggest potential source of global-scale breakthrough.

Recent experience in disaster relief shows that the possibilities for spontaneous, improvised local initiative and action are high – first responders are usually individuals, volunteers and local bodies – and the same might apply in future environmental crises. Currently the prospects for ground-level, eco-friendly social change and remedial action are quite promising. Bottom-up community initiatives have a future, even if top-down measures fail to achieve sufficient results.

If the world makes large-scale changes of policy and practice, implementation will take *decades*: growing a biodiversity-rich forest, cleaning up toxic waste and pollution, reconstructing and adapting infrastructure and cities, changing public habits and developing innovations all take time. The world will go through decades of uncertainty, at times anxiety, and this could exacerbate public insecurity and political instability. Competing ecological and anthropocentric priorities could be a cause of political polarisation, within and between states.

## The environmental age

The environmental age began around 1962 with Rachel Carson's seminal book *Silent Spring*, about pesticide and chemical pollution in modern farming. Building up impetus in environmental work has taken a long time and this tardiness charges its price. Sustainability is not only a matter for governments and corporations: it engages all of society and, while reducing consumption habits is a major

step, much more than this is needed, including social engagement and mass mobilisation.

A time when environmental and economic priorities begin to converge is coming into view. It will arrive when it is perceived to be more profitable to put environmental priorities first. The benefits to the economy, during a time of transition to a circular economy, will eventually be significant due to improved efficiency and reduced waste and excess. Transition could be difficult economically but the payoffs will be enormous in terms of creating systemic and social efficiencies.

Today we burn up so much time and energy running hard to produce, consume and pay for things we don't actually need, or which could be enjoyed more efficiently and economically. Much economic activity is burned up servicing debt, which itself fuels overconsumption and feeds inequality. Our individualised lives are fundamentally inefficient – cars, for example, are unused for 90% of the time. Savings will be immense and life will in some respects become easier. The way we utilise resources and ecosystem services, generate energy, feed the population and sustain ourselves can improve longterm, and this will have significant payoffs. But the next 30-50 years are critical and hazardous. Everything that is unsustainable must go.

We are peppered with news of the latest environmental issue or disaster and the media perpetuate the problem by reporting a steady barrage of daunting single-issue environmental news, with the effect of disempowering the public, giving the impression that the problem is too vast to address. So people shrug shoulders, worry and get on with their busy lives. Treated as single issues without connecting up the dots makes remedial work – such as the establishment of protected marine conservation areas to help propagate endangered ocean species – more difficult. Remediation is only partially successful if the normalised practice of over-exploitation continues. The problem needs to be addressed totally,

at all levels, and the consumptive and polluting causes of most environmental problems need tackling comprehensively.

The solution to swarms of pests or fungal outbreaks in food crops is not to spray affected areas but to rebuild ecosystems and farming methods such that natural balances are improved. Monoculture in industrial farming might give high yields and low food prices in the short term but, longterm, it adds costs and complexities as consequent problems arise from monoculture. The solution lies in scaling down agriculture to create a more biodiverse system run by smaller farmers, with education, rural support, renewed market systems, fair trade and social development schemes attached. Narrow accounting does not show the benefits of an all-round approach, but wider, whole-systems cost-benefit accounting does. This is an example of eco-favourable systemic change. It needs applying at both the production and the consumption ends, and not just materially but also with love.

Something big needs to shift in the way of attitudes, priorities and perceptions, for this to happen. In terms of worldview, we need to recognise Earth as a *being*, with needs, operating rules, priorities, rights, sensitivities and even a heart and consciousness. It is bigger than we, it gives us life and we are dependent on it. When and how we achieve lift-off with the global environmental project is the biggest question of all. Yet *necessity is the mother of invention* and, by the end of the 21st Century, if we have failed to make the necessary systemic changes, humanity's chances of a decent future life are likely to be pretty slim. It all rests on what we do, or omit to do, in the years up to 2050.

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