



Virtuous Circles: Values, Systems and Sustainability

Andy Jones, Michel Pimbert and Janice Jiggins

EXECUTIVE SUMMARY



Reclaiming
**Diversity &
Citizenship**

Virtuous Circles: Values, Systems and Sustainability

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Executive Summary

In recent years, simultaneous crises in energy costs, the price and availability of food, water supplies, biodiversity loss, the financial system and climate change have all had a major impact on lives and livelihoods across the globe. Energy prices have increased sharply in most countries during the last few years and the price of a barrel of oil reached \$147 during the summer of 2008. The latest surge in food prices has been the most marked of the past century in its magnitude, duration and the number of foodstuffs affected – some food products increased in price by between 50 and 200%. For many households there has not only been a large increase in the cost of food, but also of electricity, fuel, water and other basic needs. These sharp price rises have driven more people into poverty and meant that an additional 100 million people can no longer afford to eat adequately; for the first time since 1970, the number of undernourished people in the world is over one billion.

Indications are that this situation is unlikely to improve. The International Energy Agency (IEA) predicts that global energy demand will increase by 40% by 2030, while at the same time oil and gas production will decline significantly and prices increase sharply. If this demand for energy is met by fossil fuels then average global temperatures could increase by up to 6°C this century—an increase that will have dramatic impacts worldwide. The impacts of climate change on agricultural output and water supplies in particular will exacerbate the situation, and the end result will be a world spiralling ever more rapidly into a vicious cycle of food shortages, climate chaos, famine and disaster.

This book paints a vivid picture of an alternative future: sustainable and fair systems for the provision of food, energy, fibre and textiles, housing and water that are environmentally benign and involve positive interventions in natural cycles. While their environmental impacts are negligible, non-existent or positive, their socio-economic benefits are multiple and significant. The book is an output of a project known as Designing Resilience (Box 1), and documents the initial findings from the first phase of Designing Resilience within the Latin America and Caribbean region.



Craig Mayhew and Robert Simmon, NASA GSFC

Box 1. Designing Resilience

The Designing Resilience project is part of ‘*Designing Resilient Food Systems*’—a collaborative research and communication programme co-ordinated by the International Institute for Environment and Development (IIED) in Africa, China, the Andean region of Latin America and the Caribbean, and parts of Europe. Several concepts and values form the foundations of the Designing Resilience project. These include ecoliteracy, circular systems, food sovereignty, limits, eco-communities, agroecology and permaculture, the carbohydrate economy, the proximity principle, co-operative structures and sustainability. The research approach is based on systems analysis, which encourages a comprehensive, cross-disciplinary and holistic approach. We have chosen this over sectoral analysis—looking at food, water or energy in isolation—which can overlook the root causes and links between problems as well as sustainable solutions. We call our approach ‘joining the dots’ because integrated approaches avoid the problems of looking at systems in a piecemeal, fragmented way. We advocate an approach in which all options for a given need are assessed from a lifecycle perspective: production systems and supply chains are modelled and resource inputs as well as outputs, in the form of pollution and waste are quantified.



Linear thinking and vicious circles

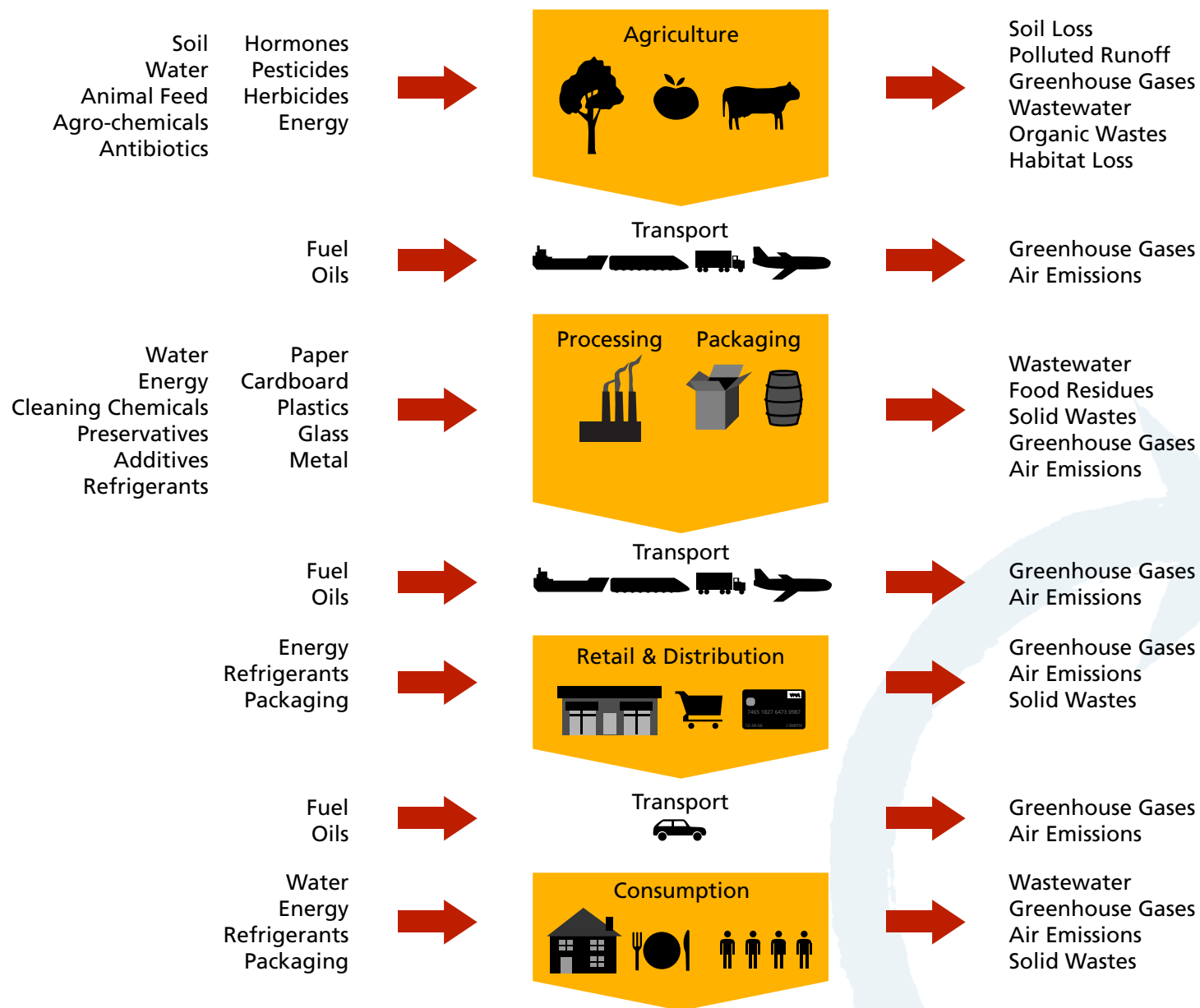
There are two basic reasons underlying the food, energy, water and climatic crises:

- 1) The systems that have evolved to supply us with our basic needs are totally dependent on fossil fuels; the inevitable consequence of this is large amounts of greenhouse gas emissions, as well as solid waste and water and air pollution. It is especially unsustainable given that the era of cheap energy, crude oil and natural gas in particular, is about to end.
- 2) Our current way of providing basic needs – be they food, water, waste management or energy - involves industrialised systems that are linear, centralised and globalised (Figure 1). In the linear approach, it is assumed that at one end of a system there is an unlimited supply of energy and raw materials (which there isn't), while at the other the environment has an infinite capacity to absorb pollution and waste (which it hasn't). The inevitable result is resource shortages on the one hand and solid waste, climate change and air pollution problems on the other.

Unsustainable energy and climate change

Our addiction to fossil fuels means that virtually everything we eat, purchase or do is dependent on crude oil, natural gas and their derivatives. A linear approach to the supply of electricity, in which the combustion of finite resources results directly in carbon dioxide and other polluting emissions, has large and widespread consequences. Globally, the electric power sector is by far the most important source of global anthropogenic CO₂ emissions. Increasing demand for fossil fuels, particularly in OECD and transition countries such as China, Brazil and India, is contributing to higher energy costs. More importantly, prices are increasing due to supply constraints and the peaking of oil production. ‘Peak oil’—the point at which half of the total oil

Figure 1: The Linear Approach to Food



known to exist has been consumed, and beyond which extraction goes into irreversible decline—means that every time demand grows the price of oil (and gas) will rise, and will do so ever more steeply as supply constraints increase.

Unsustainable food production

The causes of the food crisis appear to be complex and multifaceted. These include poor harvests due to unusual weather events; the use of agricultural land to produce biofuels instead of food; market speculation and profit-taking by agribusiness corporations; and rising energy costs pushing up the price of fertilisers, pesticides and the fuel used to power farm machinery and to distribute food. Some commentators see the food crisis as a sign of structural meltdown in the food system, the direct result of industrial agriculture, unsustainable food chains and three decades of neoliberal globalisation. Industrialised farming

consumes 50 times the energy input of traditional agriculture; in the most extreme cases, energy consumption by agriculture has increased 100 fold or more. It has been estimated that 95% of all of all food products in European countries require the use of oil. The manufacture of synthetic fertilisers is also energy-intensive—fertiliser use typically accounts for around one-third of agricultural energy consumption. As energy costs have increased in recent years so have fertiliser prices.

Another key problem is the emergence and increasing market share of multinational corporations. In OECD countries multinational food retailers typically account for 70-80% of food sales. Supermarket expansion in the South has been even more rapid than in the North, with similar consequences. These include a shift to: more industrialised farming systems; larger farms and a decrease in the number of small family farms; food being transported much longer distances; increasing food



imports; more processed and packaged foodstuffs; and increased consumption of fats, sugars and salt resulting in higher levels of diet-related ill-health. As the power of multinational food companies grows, their decisions affect more people and the negative environmental and socio-economic impacts become more widespread and prevalent.

Unsustainable water and waste systems

More than 2.6 billion people worldwide lack access to adequate sanitation services and 1.1 billion must still defecate in the open. In high income countries people turn on a tap to access unlimited supplies of fresh water and go to the toilet where they can flush and forget. Neither of these approaches is sustainable. The 'modern' sanitation systems being introduced in many countries in the South are inadequate because they are based on a linear, industrial world-view in which sewage is disposed, 'somewhere' rather than recycled. The system involves uni-directional flows of food and nutrients from farms in the countryside to the city, which are then converted to sewage and dumped, treated or untreated, into rivers or directly into the sea. The lost nutrients are never returned to the land, and instead, combined with soluble synthetic fertilisers running off agricultural land, result in eutrophication and the formation of toxic algal blooms in freshwater and marine environments.

Joining the dots: highlighting the links between these problems

If we take a closer look behind many of these problems, we can see how interlinked they are and how much our reliance on fossil fuels is fuelling the vicious cycles of unsustainability:

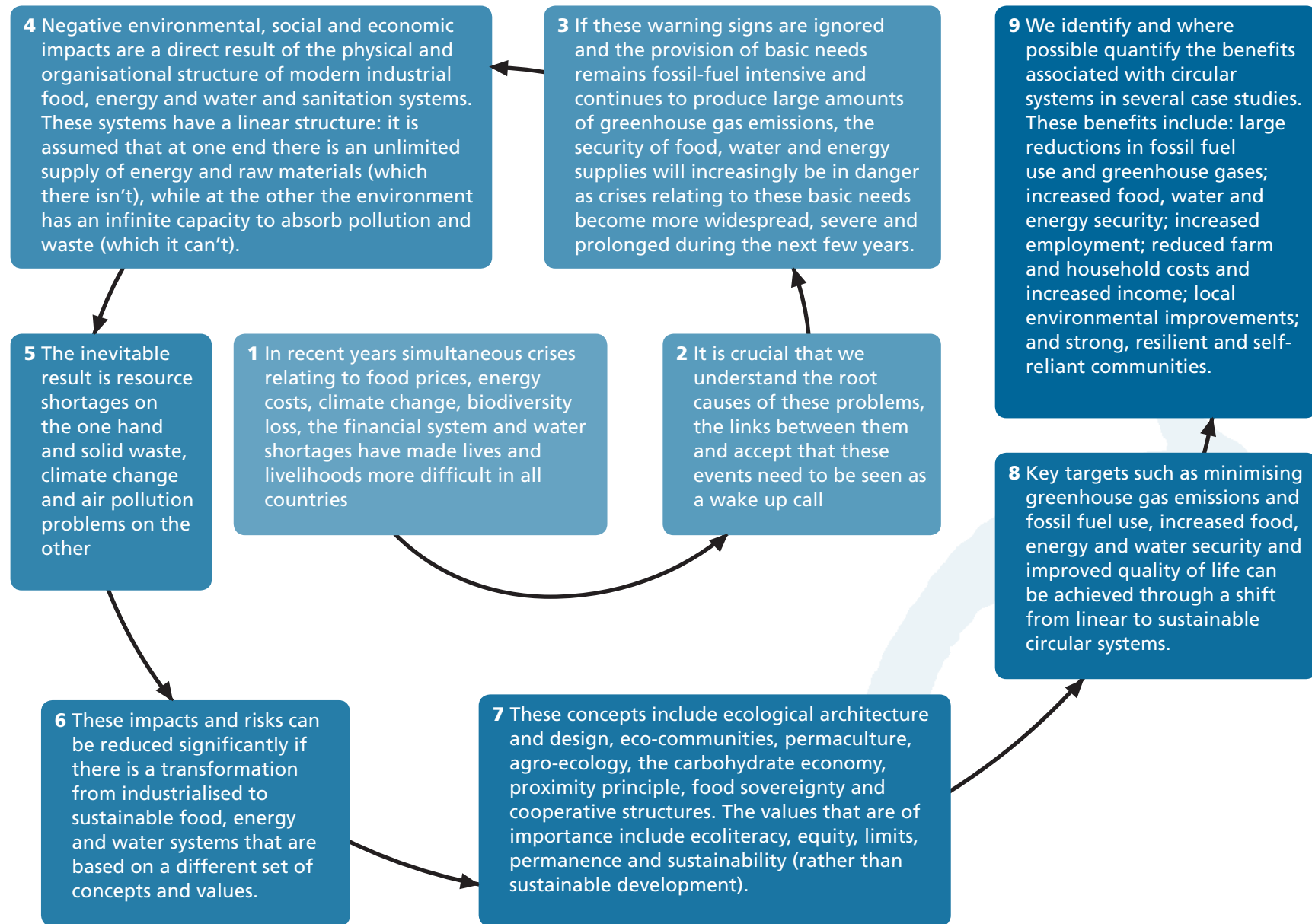
- The shift to biofuels, based on industrially produced crops, is a naive attempt at energy security in a peak oil era—often, replacing fossil fuels with biofuels does not reduce greenhouse

gas emissions, uses more energy than it produces and requires vast amounts of land that should be used to grow food.

- Along with the increasing competition for land between different uses, other constraints are also becoming more critical. These include water supplies and other finite resources, such as phosphorus and soil, which has become increasingly eroded and degraded.
- The water shortages and extreme weather events that have resulted in lower crop yields and crop losses are probably due to climate change; the primary cause of climate change is fossil fuel use.
- Agriculture is a major contributor to climate change due to emissions of methane from livestock, nitrous oxide from synthetic fertilisers, the release of carbon from soils when ploughed, as well as carbon emissions from fuel use on farms and during the manufacture of inputs such as fertiliser. Worldwide, agriculture and land use changes related to agricultural activity alone are responsible for about a third of the world's greenhouse gas emissions.
- Globalised food chains are another major contributor to climate change given the amount of transportation involved.
- In its turn, climate change reduces farm output and the availability of food.
- The production of energy from fossil fuel or industrial biofuels consumes large quantities of water. This is water that could in many cases be used for food production or for drinking....and so it goes on.

All of these factors combine to pose an increasing threat to livelihoods and the provision of basic needs (Figure 2).

Figure 2: Vicious Cycles: The Hypothesis



From vicious cycles to virtuous circles

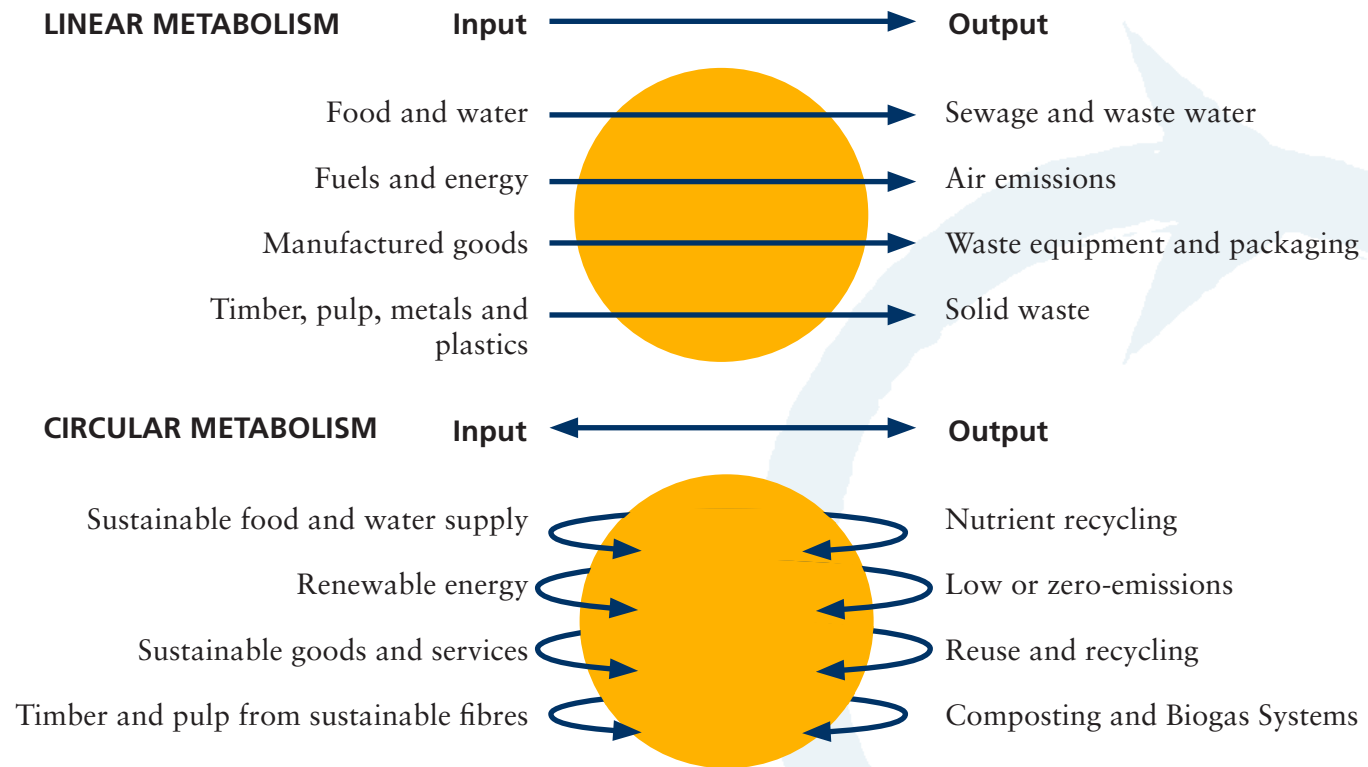
The imperative now is for change. Whether the primary reason for this is increasing energy and fuel costs; the security of food, water and energy supplies; or the need for large cuts in greenhouse gas emissions—or all of these—a fundamentally different approach is required and it will need to begin very soon. So far, national and international policy and decision makers have ignored calls for a fundamental rethink and many questions remain unaddressed. For example can the current systems of food production, processing, packaging, distribution and retail achieve the required cuts in greenhouse gas emissions or will alternative systems need to be developed? How will food, energy and transport systems be powered following the fossil

fuel era? Can renewables meet energy requirements in the current food system? Are supermarket systems compatible with the goals of sustainability or is it now time to contemplate a post-supermarket era?

An alternative to the current linear paradigm is to develop productive systems that minimise external inputs, pollution and waste (as well as risk, dependency and costs) by adopting a circular metabolism. There are two principles here, both reflecting the natural world. The first is that natural systems are based on cycles, for example water, nitrogen and carbon. Secondly, there is very little waste in natural systems. The ‘waste’ from one species is food for another, or is converted into a useful form by natural processes and cycles (Figure 3).

Figure 3.

Settlements with a linear and a circular metabolism



Source: adapted from
Girardet, H (1996) *The Gaia
Atlas of Cities: New Directions
for Sustainable Urban Living*.
Gaia Books Ltd., London



If these principles are applied to human needs we can create systems and settlements that provide food, energy and water; that do not consume large quantities of fossil fuels and other finite resources; and that also maximise the possibilities for recycling and reuse. In the process, greenhouse gas emissions, air pollution, water pollution and solid waste are minimised.

The example in Figure 4 is of a composting and biogas system that can provide food, household and farm energy needs, fertiliser for crops and trees and construction materials. It also avoids many problems associated with current approaches to waste management, sanitation and food and energy supplies.

The aim of the initial stages of the Designing Resilience project has been to identify the key characteristics of these localised, closed loop, low external input systems. These systems vary enormously in terms of their structure, how they function and their geographic and physical scale, as they are adapted

to local conditions, capacities and culture. However, we have identified common themes that contribute to resilient, sustainable and integrated food-energy-waste-water-fibre-housing systems:

- Self reliance and the proximity principle
- Low external input, regenerative systems of food production
- Appropriate scale and technology
- Diversity, multifunctionality and complexity
- Stability, security and safety
- High levels of reuse and recycling so that a large proportion of resources and 'wastes' remain in the system or locality
- Vibrant local organisations to sustain them

[illegible]

Self reliance and the proximity principle

Circular systems for food, energy, water and fabrics can be optimised when they are localised. Local and regional sourcing of food from allotments, community food projects or through home delivery box schemes or independent retailers is environmentally efficient. The products that cannot be supplied by local producers are sourced within the district or province or through fair trade initiatives, using ships rather than air transport.

Low external input, regenerative systems of food production

Highly sustainable agricultural systems aim to make the best use of environmental goods and services whilst not damaging these assets. The key principles for sustainability are:

- Integrating biological and ecological processes such as nutrient cycling, nitrogen fixation, soil regeneration, competition, predation and parasitism into food production processes.
- Minimising inputs which have to be brought in from outside the system or locality. These include synthetic pesticides and fertilisers, animal feed and energy (electricity and fossil fuels).
- Applying the principles of agro-ecology and permaculture to all scales of food production: from growing a few plants in containers in a small city garden to relatively large farm holdings. Manure and other biodegradable material (crop residue, paper and card) from the farm and the local community are composted or passed through a biogas system to provide nutrients, trace elements, minerals and energy.
- Making productive use of the knowledge and skills of farmers, so improving their self-reliance and substituting human capital for costly external inputs.



T.M. Thiagarajan. The System of Rice Intensification.

- Making productive use of people's collective capacities to work together to solve common agricultural and natural resource problems, such as for pest, watershed, irrigation, forest and credit management.
- Applying the principles of food sovereignty—the right of peoples to define their own food, agriculture, livestock and fisheries systems—in contrast to having food largely subject to international market forces.

Appropriate scale and technology

In the contemporary food system, the main driver of change during the last 50 years has been increased economic efficiency through economies of scale. This has led to the application of industrial practices and a culture of 'bigger is better' that permeates every link in the food chain. In circular systems, as farm and energy inputs are sourced and food products distributed locally, a reduced geographic scale is accompanied by the production of a wider range of foodstuffs in urban, peri-

urban and rural areas in gardens, allotments, on farms and in market gardens. Food is processed on the farm or in small local processing units and there is a significant shift away from large-scale, centralised electricity generation to decentralised small-scale renewable energy systems.

Diversity, multifunctionality and complexity

In sustainable food and energy supply chains, specialisation and centralisation are replaced by diverse localised food and energy production. Diverse food production systems, based on permaculture and agro-ecological approaches, minimise pests, maximise economic benefits and minimise risks, as well as ensuring a diverse food supply throughout the year. This will require a shift away from monocultures in which large areas are devoted to the production of a small number of (or perhaps a single) crops or livestock. In the case of energy, diverse, local renewable supplies mean that households, farms and communities can avoid the costs and risks associated with the purchase of imported electricity and fossil fuel supplies.



Stability, security and safety

Security applies to household and farm income as well as employment. It also relates to systems that can ensure food, energy and water security. Economic security for farmers is improved through direct links between themselves and the consumer – locally through direct marketing or internationally through fair trade initiatives. This security allows food producers to diversify and expand their product range which contributes, both directly and indirectly, to local employment and regeneration. This provides a viable and sustainable alternative to dealing with the multiple retailers, exporters and middlemen. Food and energy security are also improved and dependency – on oil, food imports, farm inputs, the whim of supermarket buyers and fluctuating prices on international commodity markets – is minimised.



Reuse and recycling

The predominant systems for the supply of goods and services, because of their linear structure, result in vast amounts of solid waste. Only a very small fraction of this waste is recycled, reused or composted: this applies to OECD countries and countries in the South. In circular systems the aim is to develop zero-waste by reducing external resource inputs, and re-using and recycling materials (organic matter, sewage, animal manure, metals, glass and plastics) that are currently treated as waste. When this is not possible, as is often the case with plastic material, they are replaced by alternative materials. Biogas systems, composting and wormeries can all convert waste into useful energy and nutrients that can be reused in the system.

Local organisations to sustain circular systems

Local organisations have always been important in facilitating collective action and co-ordinated management of food systems and their environments at different spatial scales. Local organisations— individually and collectively—play a key role in:

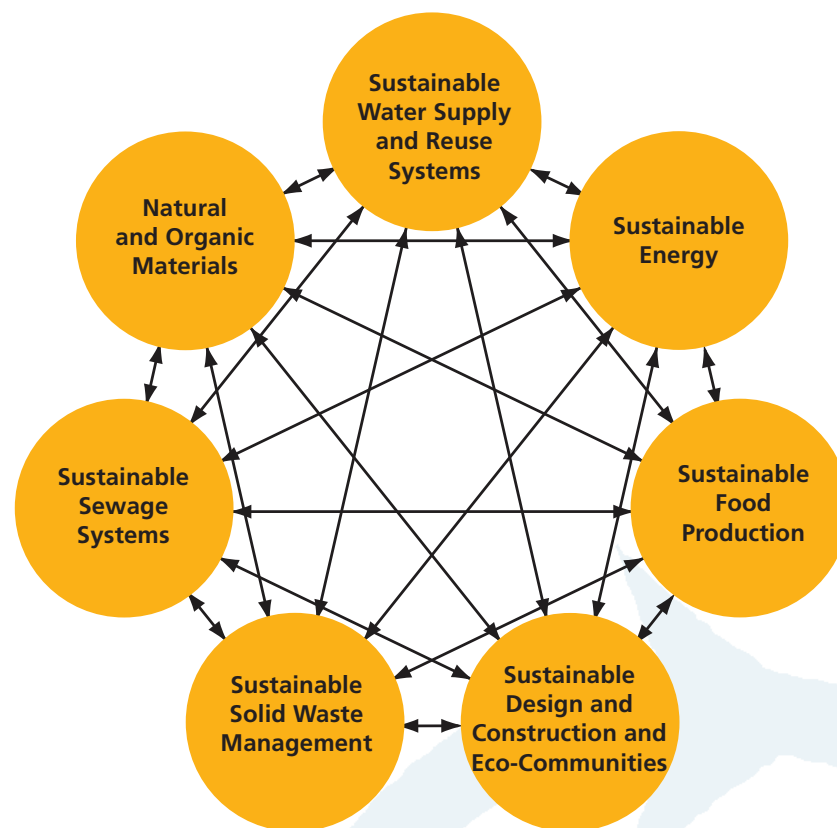
- sustaining the ecological basis of circular systems that combine food and energy production with water and waste management in rural and urban areas;
- co-ordinating human skills, knowledge and labour to generate both use values and exchange values in the economy of these multifunctional circular systems; and
- the local governance of circular systems, including decisions about people's access to food, energy, water, clean air and other resources.

Joining the dots: integrating circular energy, food and water systems

Most sustainable food, water, energy and waste systems have been implemented in isolation. However, greater synergy can be obtained when ecological agriculture, renewable energy systems and sustainable water and waste management systems are all integrated. This can contribute to food, water and energy security and also to financial security and poverty reduction. The aim of Designing Resilience is to highlight the synergy involved when all of these factors are considered from the outset and these systems are integrated and developed simultaneously.

There have been many positive developments in the implementation of sustainable circular systems in recent years. In the main report we highlight the social, economic and environmental benefits of circular systems in several case studies from the Andes, Asia, Cuba and Ecuador. These benefits can be significant and include large reductions in fossil fuel consumption and greenhouse gas emissions and increased food, water and energy security (Table 1). Other benefits that we have identified include:

- Increased local employment that is meaningful, secure and rewarding.
- Increased income from additional output and reduced input purchases
- Energy, food and water security: supplies that are reliable, safe and low cost (or free) once systems have been established.
- Improvements in the local environment – less waste, water and air pollution, vermin and disease.
- Reducing or avoiding the risks, dependency and costs associated with high-external inputs/supplies – for food, fossil



fuels (for energy, transport and machinery), fertiliser (and other farm inputs) and other materials.

- Contributing to the creation of strong, resilient and self-reliant communities, including local and direct links between households and productive systems, which means that supply chains are clearly visible and distancing effects avoided
- Co-operative, fair and equitable systems based on participatory approaches to decision making and planning.



top: Biogas digester, Nepal. bottom: Biogas digester, Vietnam. www.snvworld.org

Table 1. The main household benefits of a biogas plant in the SNV Biogas Support Programme in Nepal

| Benefits to household | Details |
|--|--|
| Reduction of workload (especially for women) | 1,100 hours per year (3 hours per day) |
| Improvement of sanitation and health | No indoor pollution. Introduction of toilets as part of the biogas plant (for 72% of all plants). Improved dung management |
| Reduced firewood use | 2,000kg per year |
| Reduced kerosene use | 32 litres per year |
| Reduction of greenhouse gas emissions | 4,900kg per year (as per 2005 Clean Development Mechanism rules) |
| Increase of agricultural production resulting from improved soil structure and fertility | Availability of agricultural residue (1,000kg per year) and dried manure (500 kg per year) originally used for cooking |
| Savings of chemical fertiliser per year | 39kg nitrogen 19kg phosphates 39kg potash |

Source: Nes, W. et al (2009) Building Viable Domestic Biogas Programmes. SNV; October 2009. At www.snvworld.org/en/Documents/SNV_Building_viable_domestic_biogas_programmes_2009.pdf

There are an increasing number of such practical examples of successful initiatives, some of which involve integrated approaches (Figure 5). However, they remain isolated examples and in most countries food and energy supply is based either on industrial models or unsustainable use of local natural resources. The challenge now is to replicate sustainable projects on a much wider scale.

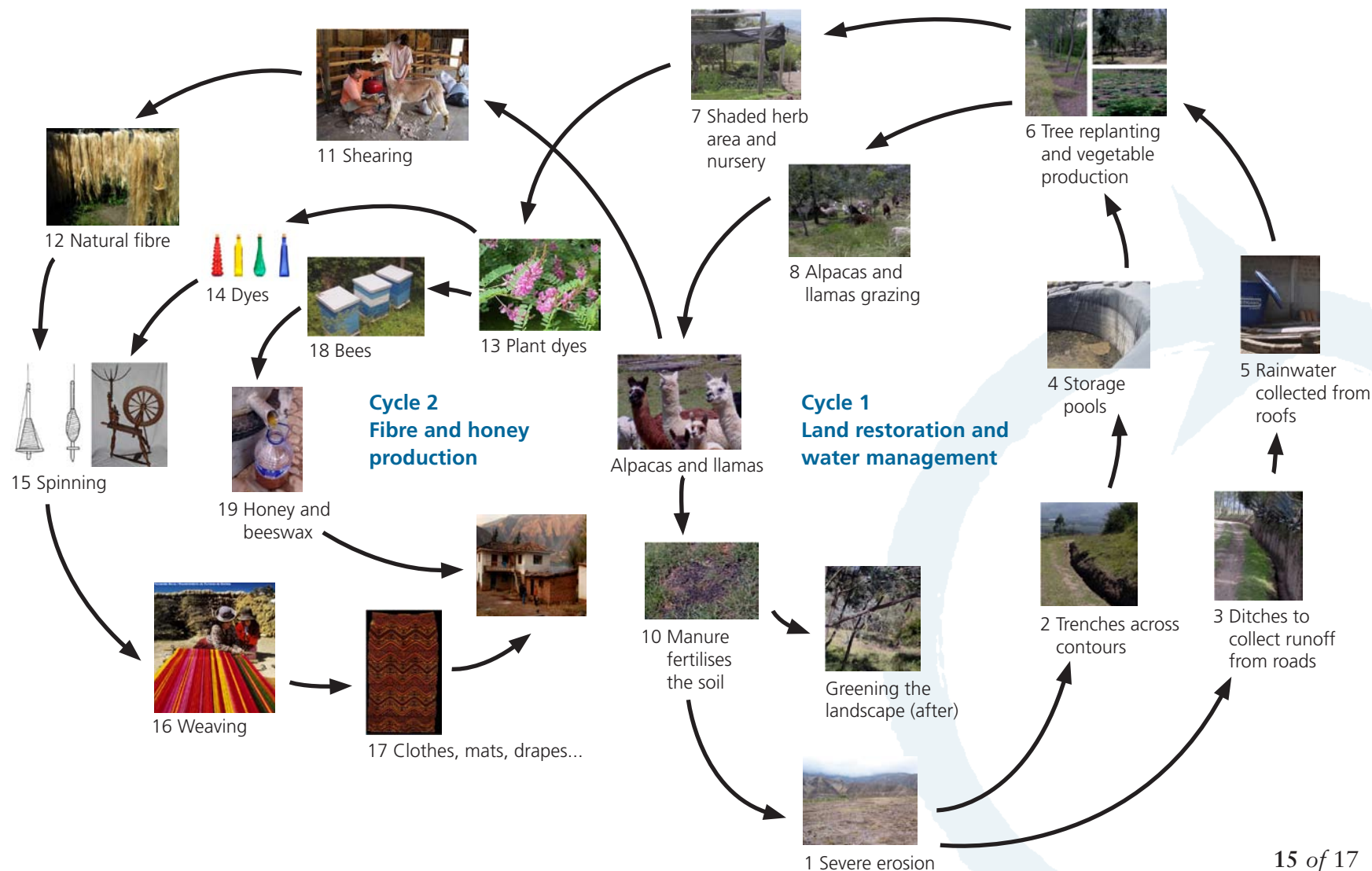
Figure 5. Sustainable water systems, greening the landscape and the production and processing of natural fibres and honey in Ecuador

Notes: Severe erosion caused by over-grazing and the clearance of vegetation to produce charcoal makes livelihoods and food production increasingly difficult. These photographs are from projects on the Ilalo mountain area near Quito in Ecuador. To harvest rainwater, trenches are dug across contours in the landscape (2) as well as ditches to collect runoff from roads (3). These are linked in a network of trenches and storage pools (4). This, together with rainwater collected from roofs (5) provides water to irrigate the trees, plants and grasses that have been reintroduced (6).

Alpaca and llama are now able to graze (8) and there is sufficient water for herb, flower and vegetable beds (7). The animal manure (10) together with green manures, mulch, compost and biogas fertilizer improves soil structure, fertility and water-retention. Alpaca and llama hair comes in many colours, but

can also be dyed using natural plant dyes (13). The fibres are spun (15) and woven (16) into clothes and other fabrics (17). Bees (18) can also be introduced to produce honey and beeswax (19) and to pollinate plants and fruit trees.

In many places rainwater collection, storage and use can be totally based on gravity - where water flows into a series of pools then to areas requiring irrigation. If this is not possible, solar, wind or hand pumps are used. Water can be channelled to where it is required, connected to drip irrigation and sprinkler systems and piped under roads and paths. Settlement tanks are used to reduce blockages and trap valuable nutrients. These are cleared as required and the sediment used as compost on nearby beds.



Recommendations

The current crisis can and should be seen as an opportunity to discuss, design and develop truly sustainable systems to meet the need for food, water and energy. However, this will require a paradigm shift and an acceptance that values, objectives, policies and economies in the North and the South will have to change dramatically and soon. Reversals in policies, legislation and market rules are needed to make the following shifts to sustainability:

- From mining the soil to managing nutrient cycles.
- From managing water use to managing hydrological cycles.
- From proprietary technologies and patents on biodiversity to legal frameworks that recognise farmers' rights and guarantee equitable access to diverse seeds and livestock breeds.
- From investment policies that favour land grabs and displacement of local communities to policies that support equitable access, use and local control over land and territories in both urban and rural contexts.
- From global, uniform standards for food and safety to a diversity of locally evolved food standards that meet food and safety requirements (from seed to plate).
- From support for centralised and capital-intensive energy systems to policies and legislations that promote innovations and internal markets for decentralised, distributed micro-generation of renewable energies (solar, wind, biogas....).

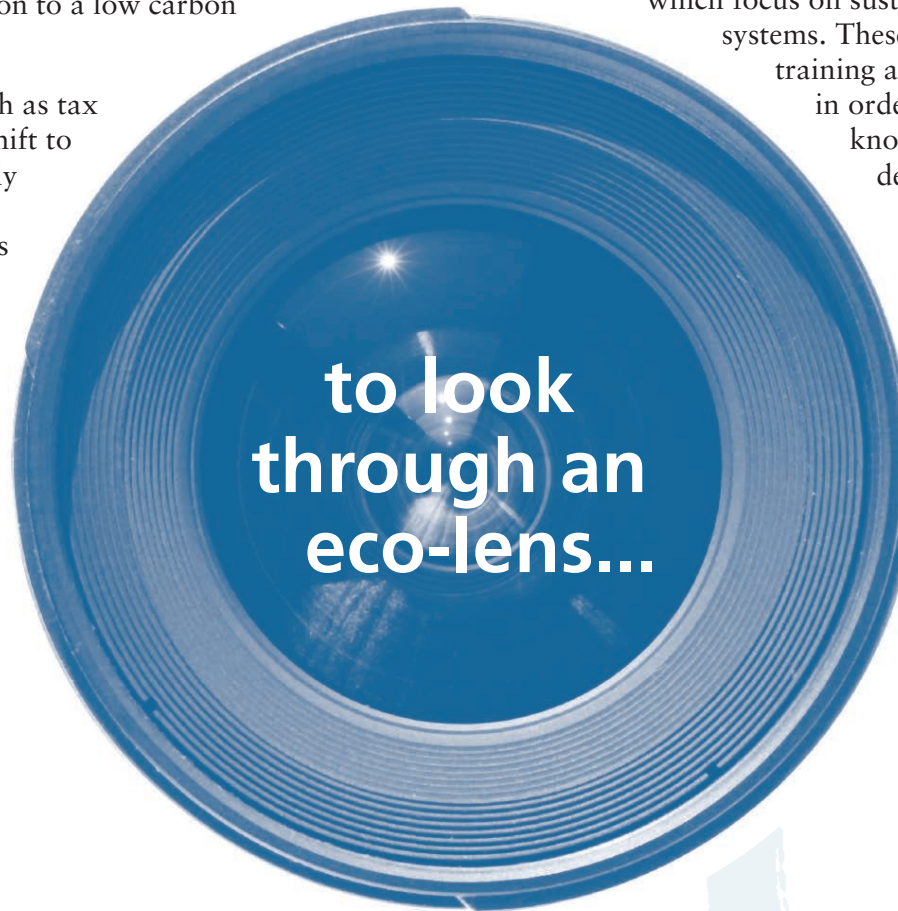
As part of this paradigm shift we suggest the following practical recommendations for individuals, communities, non-governmental organisations (NGOs) and policy makers at the local, national and international level:

- Adopt as a key policy objective the identification and rapid development of sustainable food, energy and water systems based on circular economy models. This process should be based on clear targets including minimising GHG emissions and fossil fuel use and increasing food and energy security and sovereignty at the local level.
- Reformulate agricultural, energy, trade and development policies specifically to promote sustainable food, energy and water systems. This will include designing institutional frameworks and regulatory processes that support and sustain circular systems capable of self-renewal and high production.



http://www.feasta.org/events/foodconf/food_conference.htm

- Introduce stricter measures to internalise the external environmental and social costs of food, energy and transport systems, and use the resulting revenues to support sustainable initiatives. Large corporations involved in the food, agriculture, energy, water and waste management sectors should be the main—but not exclusive—targets of these measures. This policy would act as a driver of change in terms of a shift to sustainability and the transition to a low carbon economy.
- Introduce fiscal measures such as tax incentives to encourage the shift to sustainable systems. Relatively small taxes on financial exchange market speculations (e.g. Tobin tax and similar proposals) —and on other global money transactions—should be introduced through a multilateral agreement. This decision alone will generate immediate and substantial funding for the design and spread of circular systems that regenerate local ecologies and economies for the public good.



- Design and implement a major eco-literacy programme to raise awareness of the hidden environmental and social problems caused by our current linear systems, and the alternative options for supplying food, energy and water that minimise risks and negative impacts.
- Introduce local research, demonstration and training centres which focus on sustainable food, energy and water systems. These centres will provide advice and training and demonstrate best practice in order to develop a new skills and knowledge base. They should be designed so as to strengthen local knowledge systems, organisations and institutions, thereby enhancing capacities for local innovation and their horizontal spread to more people and places.
- Build on farmers and other citizens' proposals for transformation (such as the food sovereignty movement) as part of a larger paradigm shift towards food and energy sovereignty.

**...and remove the filters that conceal
the social and environmental impact of current policy and practice**