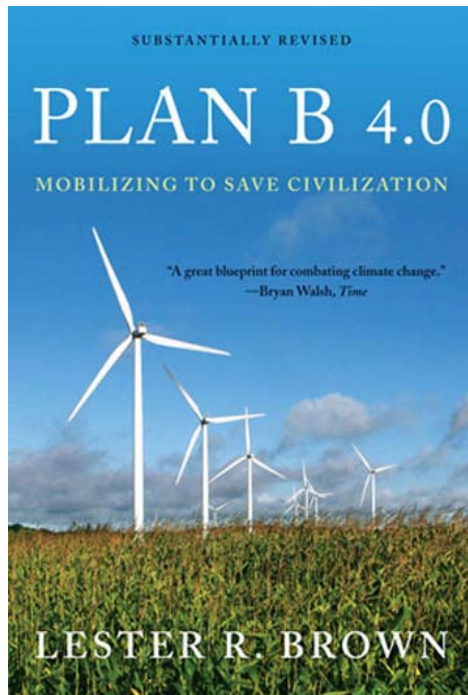


LESTER R. BROWN

# Plan B 4.0

## Mobilizing to save civilization

Summary by Isodoor Jonker



### PREFACE

The current rise of the price of grain is a trend, caused by growing populations,

falling watertables, rising temperature, melting ice and the use of grain for fuel. We can't just use more land to boost production because all land is being used. Food security has become a highly complex issue.

Internationally negotiated climate agreements are fast becoming obsolete because no government wants to concede too much compared with other governments and negotiation and ratification simply may take too long. **We are in a race between political tipping points and natural tipping**

**points.** The rise in CO<sub>2</sub> emissions, temperature and sea levels are all moving faster than the Intergovernmental Panel on Climate Change (IPCC) worst case scenario. The good news is that the shift to renewable energy is occurring at a rate and on a scale that we could not imagine even two years ago. The question is not what we need to do, the challenge is how to do it in the time available. Unfortunately we do not know how much time remains.

## 1. Selling Our Future

Earlier civilizations declined and collapsed more often than not because of shrinking food supplies. One of the United Nations Millennium Development Goals (MDG's) is to reduce hunger and malnutrition. Until 1990 this went well, but then it started growing again jumping over 1 billion in 2009

### FOOD: THE WEAK LINK

On the demand side there are three consumption-boosting trends: population growth, the growing consumption of grain-based animal protein and, most recently, the massive use of grain to fuel cars. The supply side can hardly keep up because of soil erosion, aquifer depletion, crop-shrinking heat waves, melting ice sheets/rising sea level and melting glaciers that feed rivers and irrigation. Plus: loss of cropland to non-farm uses, diversion of irrigation water to cities and coming

reduction in oil supplies. The rise in grainland productivity is dropping and most boosting techniques have been used.

### THE EMERGING POLITICS OF FOOD SCARCITY

Dangerous geopolitics like limiting or banning exports to counter domestic food price rises that result in long-term bilateral trade agreements are rising. Affluent countries, whose population has outrun its own land and water resources (Saudi Arabia, South Korea, China, Kuwait, Libya, Egypt, Jordan, United Arab Emirates, Qatar), buy or lease land in other countries. Even though the selling or leasing countries are often low-income, have chronic hunger and malnutrition and depend on the World Food Programme (WFP) (Ethiopia, Sudan, Democratic Republic of the Congo, Zambia). These land acquisitions are also **water acquisitions**, because the food imported is made with water from that country.

These agreements lack transparency and are a major explanation of the public hostility in host countries since farmers aren't involved in the decision making, | and are often moved or duped. Pakistan even offers 100.000 men to secure 400.000 hectares of land (from hungry Pakistanis or farmers?) it wants to sell/ lease. Also countries want to bring in their own farmers and introduce large-scale commercial heavily mechanized farming, with considerable effects on employment. Also these expansions in cropland often mean clearing tropical rainforest. There are investment codes being drafted by The World Bank, the UN Food and Agriculture Organization and the African Union. All this will lead to more failing states. But even the US isn't immune, since China is its banker and US consumers will compete for the US grain harvest with 1.3 billion Chinese with rising incomes.

### OUR GLOBAL PONZI ECONOMY

Humanity's collective demands first surpassed the earth's regenerative capacity around 1980. In 2009 global demand on natural systems exceeds their sustainable yield capacity by nearly 30%. Paul Hawken: 'At present we are stealing the future, selling it to the present, and calling it gross domestic product.'

Market weaknesses: It does not respect the sustainable thresholds, it favors the short term and it does not incorporate indirect costs. Thus the market is giving us incomplete information, and we are making bad decisions. Example: After flooding of the Yangtze River valley, China calculated that trees standing are worth three times more than trees cut. We need economists who can think like ecologists or more ecological advisors.

### MOUNTING STRESSES, FAILING STATES

*Foreign Policy*: 'World leaders once worried about who was amassing power, now they worry about the absence of it.' States fail when governments lose control of their territory and can't ensure the security of their people. This leads to civil war, which can spread abroad, terroristic activity, drug production and infectious diseases. The Fund for Peace and *Foreign Policy* created an index and a list. Ranking is closely linked with key demographic and environmental indicators, like demographic fatigue. Food shortages can put intense pressures on governments, leading to stress in the social order. Other failing state characteristics are: Deterioration of the physical infrastructure, drying up of foreign investment and a resultant rise

in unemployment. The global system depends on a cooperative network of functioning nation states. Otherwise dealing with international crises like protecting endangered species becomes more difficult.

#### **PLAN B – A PLAN TO SAVE CIVILIZATION**

Plan B has four components, each linked and depending on each other: cutting net CO<sub>2</sub> emissions 80% by 2020, stabilizing population at 8 billion or lower, eradicating poverty and restoring the earth's natural systems.

## **PART I - THE CHALLENGES**

### **2. Population Pressure: Land and Water**

Because of erosion we are losing cropland globally, and because of aquifer depletion and mountain glacier melting and disappearance the irrigated area could also start to decline soon. It costs about 2000 liters of water to produce the food we eat each day. Once self-sufficient countries are now importing food. We live in a “food bubble economy”.

#### **CIVILIZATION'S FOUNDATION ERODING**

If soil erodes, the civilization depending on it will erode as well, as we have seen with ancient civilizations. Soil erosion gets more visible in the growing appearance of dust storms (Korean's call the dust storms of late winter/early spring the “fifth season”), removing topsoil nature takes centuries to replace. Erosion results in desertification and sand storms, which cause abandonment and burying of thousands of villages. Water erosion also takes a toll on soils. A massive cropland expansion is now happening in the Brazilian Amazon Basin and the *cerrado*, which could lead to a Dust Bowl like 1930's US and 1950's Soviet Union.

#### **WATER TABLES FALLING**

Saudi Arabia knows its fossil aquifer will be depleted, thus ending production of grain by 2016. Except for replenishing aquifers, fossil aquifers like the Ogallala (US Great Plains) or the one under the North China Plain will be gone. Since it takes 1,000 tons of water to produce 1 ton of grain, when China's Hai basin will be depleted, 40 billion tons of water per year will be missing, so also 40 million tons of grain, so also the food supply of 130 million people. Other countries with aquifer overpumping are India, Pakistan, Afghanistan, Iran, Israel and Mexico.

#### **FARMERS LOSING WATER TO CITIES**

It only takes 14 tons of water to make a ton of steel (compared with 1000:1 with wheat), so countries preoccupied with expanding economies and creating jobs use water there. Also selling water to cities is more profitable than selling crops. **Importing grain is the most efficient way to import water.** The Middle East and North Africa has become the world fastest-growing grain import market. Water deficits today mean grain deficits tomorrow. When will water scarcity become food scarcity?

### LAND AND WATER CONFLICTS

Population growth -> shrinkage of life-supporting resources per person -> drop living standards of millions below survival level -> social tensions (Sahelian zone in Africa, Darfur, Nigeria, Mali, Rwanda). Plots also fragment when inherited by multiple children, putting pressure on the land and causing to move to often even harder to work land (Rwanda, India). Disagreements over allocation of water. Nile: Egypt, Sudan and Ethiopia. Tigris and Euphrates: Turkey, Syria and Iraq. Also the Aral Sea basin.

### CARS AND PEOPLE COMPETE FOR GRAIN

The EU meets its biodiesel goals by planting palm oil plantations in Indonesia and Malaysia, a trend that depends on clearing rainforests. 2005, Katrina, oil prices jumped, making investments in corn-based ethanol distilleries hugely profitable.

**When the price of oil climbs, the world price of grain climbs to its oil-equivalent value.** The fuel tank of an SUV contains 25 gallons, this will feed a person for a year. Converting the entire US grain harvest to ethanol would only satisfy 18% of US automobile fuel needs. Since the average income of a car owner is ten times that of the 2 billion poorest people, the market says: fuel the cars. A better option is to use automotive fuel from fast growing trees, switchgrass, prairie grass mixtures or other cellulosic materials which can be grown on wasteland. Even better is to raise auto fuel efficiency standards 40% by 2016. The next step is (gas-)electric cars.

### THE RISING TIDE OF ENVIRONMENTAL REFUGEES

The earth is shrinking because of desertification, rising seas and the search for water. Most possible environmental refugees from rising seas: China, India, Bangladesh, Viet Nam, Indonesia, Japan, Egypt, US.

## 3. Climate Change and the Energy Transition

The earth's temperature has gone up by 0.6 C since 1970 and is projected to rise 6 C before 2100. The rise is far greater at the higher latitudes than on the equator. Seas will rise 3-6 feet by 2100. One third of all plant and animal species could be lost.

### RISING TEMPERATURE AND ITS EFFECTS

"Greenhouse" gases trap heat. That is, 63% CO<sub>2</sub> (which is caused for 43% by coal, 38% oil and 19% natural gas), 18% methane and 6% nitrous oxide, 13% several lesser gases. CO<sub>2</sub> comes mostly from electricity generation, heating, transportation and industry. Human-caused methane and nitrous oxide comes mostly from agriculture. The rising CO<sub>2</sub> level is the effect of bigger emissions than nature's capacity to absorb carbon. Methane comes from decomposition of organic material in bogs, landfills or cows, but also from thawing permafrost. This can cause a "positive feedback-loop". Also of influence are atmospheric brown clouds (ABC's) made up of burning residue. Other effects are heat waves that cause a direct human toll, the changing of seasons and the relocation of animals.

### MELTING ICE, RISING SEAS

In the regions surrounding the Arctic, winter temperatures have climbed by 3-4 degrees over the last 50 years. Food sources for the Inuit and polar bears are

diminishing, Arctic ice is melting, causing the albedo-effect (less ice to reflect light -> more melting), at an alarming rate and faster than expected. Also, water that filters through cracks lubricates glaciers and warms them faster. This also counts for Greenland and the Antarctic. Besides millions of possible environmental refugees, vast areas of reproductive farmland could be lost.

### **MELTING GLACIERS, SHRINKING HARVESTS**

Glaciers sustain rivers. This threatens food security most in the Himalayas and on the Tibet-Qinghai Plateau, serving the major rivers of China and India, the world's leading wheat and rice producers. Other places facing these problems are Central Asian countries, the Kilimanjaro, Mount Kenya, South American countries like Bolivia, Ecuador and Peru but also Spain and California.

### **RISING TEMPERATURES, FALLING YIELDS**

Crops are typically grown near their thermal optimum, a rise in temperature will shrink the harvest. This is offset until a certain height by the fertilizing effect of higher CO<sub>2</sub> concentrations. 1 C rise above the norm lowers wheat, rice and corn yields by 10%. Pollination is endangered by dehydration.

### **THE DECLINE OF OIL AND COAL**

Geological constraints in oil producing countries, security concerns in oil-importing countries. Total discoveries of conventional oil equal 2 trillion barrels, of which 1 trillion barrels of easy oil have been distracted and 1 trillion barrels of tough oil remains. Peak oil is happening or has happened. Companies are looking at tar sands and oil shale for oil, which is harder to extract and way more polluting, and uses a lot of (not present or already spoken for) water. Civilization would be better of leaving this alone.

Coal depletion is not imminent, but any strategy to stabilize climate must have the phase-out of coal as its centerpiece. It is the most damaging to human health (black lung disease, polluted air, mercury pollution, cancer). China's leading source of death is cancer, but they're planning to be the world leader in both solar and wind energy. Even though there's still one coal-fired power plant built every week, they are enforcing environmental regulations more thorough. Luckily, oil is the most easily replaced of the three fossil fuels.

### **A CHALLENGE WITHOUT A PRECEDENT**

II: short chapter summary.

## **PART II – THE RESPONSE**

### **4. Stabilizing Climate: An Energy Efficient Revolution**

Two energy revolutions: A shift to new energy-efficient technologies and an economy powered by wind, solar and geothermal energy. Cutting CO<sub>2</sub> emissions 80% by 2020, preventing CO<sub>2</sub> levels to rise above 400 parts per million (ppm)

(2008: 386 ppm), setting the stage to return to 350 ppm to avoid runaway climate change.

Also, renewable energy is more labor-intensive, providing jobs for the record number of young people entering job markets. And countries and companies that develop new energy technologies will have a competitive advantage. Enough proven technologies already exist.

### **A REVOLUTION IN LIGHTING TECHNOLOGY**

Compact Fluorescent lamps (CFL's) use 25% as much electricity as incandescent bulb, cost twice as much, but last ten times as long. We are moving towards a political tipping point in favor of change, while retailers are also joining the switch. Light-emitting diode's (LED's) use only 15% of an incandescent, but are still too costly for most uses, even though they last 50 times as long. They are already widely used in traffic lights and exit signs, and by universities. Motion sensors and dimmers are also effective technologies. Shifting to these technologies saves enough energy to close 705 of the world's 2,670 coal-fired plants.

### **ENERGY-EFFICIENT APPLIANCES**

A similar range of efficiencies is available for household appliances. Ways to implement this are raising efficiency standards, tax incentives, combined heat and power generation and real-time pricing of electricity. Example: Japan's Top Runner Program raised efficiency standards for individual appliances between 15 to 83%. The electricity used by appliances in standby mode worldwide accounts for up to 10% of total electricity consumption, causing mandates for a 1-watt limit on standby regulation in South Korea by 2010 and Australia in 2012. Other initiatives are a carbon tax, making efficient appliances more economic, and energy use labeling. These initiatives could exceed the 12% of savings in the lighting sector.

### **ZERO-CARBON BUILDINGS**

In the US, buildings account for 72% of electricity use and 38% of CO<sub>2</sub> emissions. Leadership in Energy and Environmental Design (LEED) has a certification and rating program, checking (outdoor and indoor) environmental quality, material use, energy efficiency and water efficiency. This results in buildings with lower operating costs, higher lease rates and happier, healthier occupants. The World Green Building Council is making this global. Besides building new efficient buildings, older structures are made future-proof by programs like the Energy Efficiency Building Retrofit Program of the Clinton Climate Initiative. The energy service companies provide "performance guarantees" ensuring all retrofits will be profitable. Edward Mazria launched the 2030 Challenge, having architects design buildings in 2030 that use no fossil fuels.

### **ELECTRIFYING THE TRANSPORT SYSTEM**

Oil will be replaced by electricity from wind farms and solar and geothermal power plants. We will ride in electric rail systems and gas-electric hybrid plug-in and all-electric cars. All short trips can be done almost entirely on electricity, and recharging can be done for less than \$1 per gallon of gasoline using off-peak wind generated energy.

Intercity travel will be with high speed trains, as is the case already in Japan,

saving time and energy. Europe is on its way as well, whereas the US is lacking still. The US does need to shift, because it consumes more gasoline than the next 20 country's combined.

### A NEW MATERIALS ECONOMY

We waste both materials and energy in our throwaway economy, so we should shift to a cradle to cradle economy. Steel made from recycled scrap takes only 26% as much energy as that from iron ore. Aluminum just 4%, plastics 20% and paper 64%, with far less chemicals used. Switching to more efficient techniques, like the most efficient blast furnaces, with the complete recovering of used steel, reduces energy use in the steel industry by 23%.

Cities should recycle as many components of the urban waste flow as possible. Economies with stable populations can rely primarily on the stock of materials already in the economy. Ways to encourage this are a landfill tax, a ban on all non-refillable (beverage) containers, deconstructing buildings instead of demolishing them, disposal fees for appliances that are not easily and cheaply disassembled. Caterpillar is even remanufacturing engines with the same, repaired or replaced parts. We should also discourage energy-intensive but nonessential industries, like the gold jewelry, bottled water and plastic bag industries.

### SMARTER GRIDS, APPLIANCES AND CONSUMERS

The US needs a national grid to stabilize the energy flow. The shift to two-way communication and two-way metering makes energy use also more efficient. Combined with real-time pricing, peak-hours will lessen when appliances are smart enough to turn on when demand and price are low (dishwashers), or turn off when demand and price are high (air conditioners).

### THE ENERGY SAVINGS POTENTIAL

IJ: short chapter summary

## 5. Stabilizing Climate: Shifting to Renewable Energy

A new energy economy, based on wind, solar and geothermal energy, is emerging. The 20th century was marked by the globalization of energy (oil), whereas the 21st century will be marked by the **localization of energy**, and the electrification of energy. We need full-cost pricing to see that nuclear (and coal and oil) energy is not economical. The question if these technologies can expand fast enough is answered by the recent mobile phone and personal computer expansions.

### TURNING TO THE WIND

Harnessing 1/5 of the earth's available wind energy would provide seven times as much electricity as the world currently uses. 70 countries are now harnessing wind resources, lead by the US, Germany, Spain, China (doubling each year) and India. Denmark has the biggest share of national electricity from wind, 21%. Farmers can double-crop there land, harvesting a food crop and energy. The risk to

birds is minimal compared to those who fly into skyscrapers, cars or cats, and the NIMBY factor is changing towards a PIMBY factor. Plan B wants to develop 3.000 gigawatts by 2020 (2008: 121.000 megawatts), to satisfy 40% of world electricity needs. This will be 1,5 million 2 megawatt turbines, costing \$3 million per turbine equaling \$4,5 trillion or \$409 billion a year. The idled capacity in the US automobile industry is sufficient to produce this.

### SOLAR CELLS AND THERMAL COLLECTORS

Energy from the sun can be collected using solar photovoltaics (PV's, for energy) and solar thermal collectors (or concentrating solar power, CSP, for heat). For 1.6 billion people not yet connected to a grid, it is often cheaper to install PV, and CSP, panels rooftop-by-rooftop. In the end, this will be cheaper than other forms of lighting like candles or kerosene lamps. The cost of solar energy is falling, and investors are now turning to utility-scale solar cell complexes (Spain, California, Israel, China, Italy, Japan). CSP is being used on a big scale in Nevada, Algeria, Israel, Australia, South Africa, the United Arab Emirates and Egypt, and in Europe by Austria, Germany, Greece, France and Spain. Federal tax credits support this in the US, and in 2009 US generating capacity from solar exceeded that from coal.

### ENERGY FROM THE EARTH

The heat in the upper six miles of the earth's crust contain 50.000 times as much energy as all oil and gas combined, but only 10.500 megawatts are used now. Some 24 countries convert this into electricity, notably the US and the Philippines followed by Mexico, Indonesia, Italy and Japan. The Ring of Fire countries, bordering the Pacific, are best suited. About 100.000 megawatts are used directly as heat. Besides geothermal power plants, geothermal heat pumps are used (in (green-) houses) to cool in summer and heat in winter, using the stable temperature of the earth near the surface. Plan B: 200.000 megawatts by 2020.

### PLANT-BASED SOURCES OF ENERGY

In addition to those in chapter two, forest (US and Sweden) and sugar (Brazil) industry byproducts, urban (not smart!) and livestock waste, plantations of fast-growing trees, crop residues and urban tree and yard wastes can be used for electricity, heating and automotive fuels. The potential is very limited compared to solar though. Crops can produce ethanol and biodiesel, 2009: 19 billion gallons ethanol (1/2 from US, 1/3 from Brazil) and 4 billion gallons biodiesel (Germany and France both 15%). These are under scrutiny, because ethanol drove world food prices to all-time highs in 2007 and 2008, rainforests in Indonesia and Malaysia are cleared for palm oil plantations for biodiesel and the nitrous oxide emissions from the synthetic nitrogen fertilizer used to grow biofuel crops negates the CO<sub>2</sub> | reductions. Thus, expanding US biofuel production increased annual greenhouse gas emissions dramatically, the **biofuel carbon debt**. There is no low-cost technology to convert cellulosic material into ethanol yet. Plan B: the worldwide use of plant materials for electricity: 200 gigawatts by 2020.

### HYDROPOWER: RIVERS, TIDES AND WAVES

Dams, tides (lunar power), waves and "in-stream" turbines produce 16% of the

world's electricity. Dam locations dwindled and the costs of displacing people, ecological damage and land inundation are more visible. Tidal energy is harnessed or planned in France, South Korea, United Kingdom, China, New Zealand, India and Russia. 2008: 945 gigawatts hydroelectric power, Plan B: 1.350 gigawatts by 2020, of which 270 gigawatts are already planned in China.

### THE WORLD ENERGY ECONOMY OF 2020

Developing 5.300 gigawatts of renewable generating capacity, half of it from wind, could replace all coal and oil and 70% of the natural gas now used to generate electricity. 1.500 gigawatts of thermal heating capacity will sharply reduce the use of oil and gas for heating buildings and water. Shifting to electric trains, all-electric and hybrid cars drops fossil fuel use in transportation by 70%. Buildings will be all-electric.

The system for transporting energy will change beyond recognition. Europe has plans to build the supergrid off-shore, from the Baltic Sea to the North Sea and towards South Europe. The Club of Rome's DESERTEC proposal wants to connect Europe to the solar power in North Africa and the Middle East. The localization of energy will lead to the localization and diversification of food production. Governments use policy's to help, like tax restructuring, carbon cap-and-trade systems, renewable portfolio standards and mandates.

**TABLE 5-1:  
WORLD RENEWABLE ENERGY CAPACITY IN 2008 AND PLAN B GOALS.**

Source (Electricity)	2008	Plan B Goal 2020 (gigawatts)
Wind	212	3.000
Rooftop solar electric systems	13	1.400
Solar electric power plants	2	100
Solar thermal power plants	0	200
Geothermal	10	200
Biomass	52	200
Hydropower	945	1350
<b>Total:</b>	<b>1.143</b>	<b>6.450</b>

Source (Thermal Energy)	(thermal gigawatts)	
Solar rooftop water and space heaters	120	1.100
Geothermal	100	500
Biomass	250	350
<b>Total:</b>	<b>470</b>	<b>1950</b>

## 6. Designing Cities for People

The ratio of parks to parking lots may be the best indicator of the livability of a city. (Mega)cities are growing fast, humans are for the first time an urban species (more than half live in cities), but 'Why are the public spaces for cars deemed more important than the public spaces for children?' (Enrique Peñalosa). After a certain point, cars provide immobility instead of mobility.

## THE ECOLOGY OF CITIES

Cities depend on distant sources for basic amenities (water, food, oil), we should rethink the design (Richard Register: *Ecocities*). Produce food on vacant lots and rooftops and recycle water instead of “flush-and-forget”.

## REDESIGNING URBAN TRANSPORT

Mobility, low-cost and a healthy urban environment is best achieved by combining rail lines (underground or surface light-rail), bus lines (like Bogotá’s BRT), bicycles and walking. We can reduce traffic congestion and air pollution by charging cars to enter the city (Singapore, Oslo, Bergen, Trondheim, London, Stockholm). Milan has a “pollution charge”, Paris has express lanes for buses and bicycles and a bicycle rental program. The US lags far behind, but now has a “complete streets” movement, to counter obesity, rising gas prices, carbon emissions, air pollution and mobility constraints on baby boomers.

## THE RETURN OF BICYCLES

World bicycle production climbed to 130 million in 2007 (cars: 70 million). In Italy the government started a program that pays back 30% of the cost of a bike. China has the largest fleet (430 million) but ownership rate is highest in the Netherlands (more than 1 pp) and Denmark and Germany (just under 1 pp). In the US, bike police make 50% more arrests per day than officers in squad cars, while the costs of operation are trivial. Colleges and Universities are developing programs. Realizing the potential needs a bicycle-friendly transport system.

John Pucher and Ralph Buehler (Rutgers University): ‘extensive rights-of-way in the Netherlands, Denmark and Germany are complemented by ample bike parking, full integration with public transport, comprehensive traffic education and training of both cyclists and motorists ... [these countries] make driving expensive as well as inconvenient in central cities through a host of taxes and restrictions on car ownership, use and parking.... It is the coordinated implementation of this multi-faceted, mutually reinforcing set of policies that best explains the success of these three countries in promoting cycling.’ China is big on electric bicycles.

## REDUCING URBAN WATER USE

The “flush-and-forget” system pollutes cities (resulting in disease and death), loses nutrients from agriculture, kills rivers and results in 405 “dead zones” in ocean coastal regions. The low-cost alternative is the waterless composting toilet, linked to a small compost facility. Urine can be trucked to nearby farmers and fecal material is converted into soil-like humus, odorless and 10% of the volume. This reduces residential water use, cutting bills and lowering energy needs, reduces garbage flow if table wastes are incorporated, eliminates sewage water disposal problems and restores the nutrient cycle. Also, recycling household water (indefinitely) becomes much simpler. Some industries are developing ‘closed-loop’ systems where all wastewater is reused internally. Some countries are adopting water efficiency standards and labeling for appliances.

## FARMING IN THE CITY

In 2005, urban and peri-urban farms supplied food to 700 million urban residents worldwide (Dar es Salaam, Dakar, Hanoi, Kolkata, Shanghai). Caracas created 8.000

microgardens (1m2) in the city's *barrios*. 14 % of London's residents produce some of their own food in community gardens, in Vancouver this is 44%. A parallel trend is the growing number of farmers' markets.

### UPGRADING SQUATTER SETTLEMENTS

Nearly all population growth will be in developing countries, much of it in squatter settlements. Besides improving conditions in the countryside to manage rural/urban migration, designing tracts of land for squatter settlements will make sure settlements are consistent with the development plan of a city. Installing taps and composting toilets will fight disease and give hope, and providing security of tenure and small loans will help to make incremental improvements over time.

### CITIES FOR PEOPLE

E.O. Wilson's "biophilia hypothesis" argues that those who are deprived of contact with nature suffer psychologically and that this deprivation leads to a measurable decline in well-being. This is called ecopsychology.

California mandated that employers match parking subsidies with cash for employees to use for public transport or to buy a bike. But what we need are parking fees instead of subsidies, and car-free areas (New York, Stockholm, Vienna, Prague, Rome). Subways should be functional but also attractive, even cultural centers (Russia, Washington DC's Union Station). Owning a car is beginning to lose its appeal (Japan). We can modify existing cities (PlaNYC) or build cities from scratch (Babcock Ranch in Florida or Masdar City in Abu Dhabi).

## 7. Eradicating Poverty and Stabilizing Population

UN said in 2000 they wanted to reduce extreme poverty by half by 2015. Until the economic crisis in 2007 this went well for all countries but sub-Saharan Africa. China and Brazil were doing excellent towards 2007, as were Thailand, Viet Nam and Indonesia. Brazil's Bolsa Familia program is reducing inequality and poverty at the same time. But because of higher food prices, poverty increased between 2005 and 2008 also in East Asia, the Middle East and South Asia.

Other MDG's are reducing the hungry, universal primary school education, halving the share of people without safe drinking water, reversing the spread of infectious diseases, reducing maternal mortality and under-five child mortality.

The number of hungry people is climbing because of the diversion of grain to fuel in the US, with which in 2009 340 million people could have been fed. Primary school education is on the rise, mostly in India, Bangladesh and Brazil. We should strive for an average of two children per couple, not to outgrow our natural life support systems.

### EDUCATING EVERYONE

Universal primary education needs for 75 million children to attend. Amartya Sen: 'Illiteracy and innumeracy are a greater threat to humanity than terrorism.' The World Bank supports any country with a well-designed plan through their Education for All plan. 58 of the 128 developing countries of which data is available will reach the 2015 goal. Education is the key to break out of poverty, because for girls

fertility falls, they lose fewer infants and it increases agricultural productivity. Teacher training will counter the spread of HIV Aids. Ethiopia has pioneered Girls Advisory Committees, Brazil, Bangladesh and others provide small scholarships for girls.

\$10 billion is needed to achieve universal primary education, an adult literacy program (like in Bangladesh and Iran) would add \$4 billion. One of the most successful incentives is a school lunch program, rising enrollment, stimulating academic performance and lengthening school careers. Then girls marry later and have fewer children. Launching this in the 44 lowest-income countries would cost an extra \$6 billion per year. Greater efforts are also needed to improve nutrition before children get to school age. These efforts are not expensive compared with the annual losses in productivity from hunger.

### **TOWARD A HEALTHY FUTURE**

Progress in reaching the MDG of reducing child mortality by two thirds between 1990 and 2015 is lagging badly. Ensuring access to safe and reliable water supplies is essential, and water-free waste disposal systems in many cities are more realistic than water-based sewage systems. Education about how to prepare oral rehydration solution (Bangladesh's BRAC program) to treat diarrhea, childhood immunization program's (Bill and Melinda Gates Foundation) and education about AIDS prevention concentrated on the groups that are likely to spread it (truckers, sex workers, the military and intravenous drug users) realize huge health gains. Spreading enough condoms in the developing world and Eastern Europe (another 14.7 billion annually) would cost only \$441 million.

Ignoring the need for HIV treatment is a strategic mistake, as Africa shows us. Eradication would save millions of lives, hundreds of millions of dollars in vaccination programs and billions of dollars in health care expenditures, as happened with smallpox. Great efforts with this are being made on the polio and guinea worm disease fronts. Some leading sources of premature death are lifestyle-related, like smoking and diabetes. Effective responses to many emerging health problems often lie outside the purview of the Ministry of Health, like the rise of birth defects in China's coal-producing provinces. A WHO study concluded that providing the most basic health care services in developing countries would yield enormous economic benefits.

### **STABILIZING POPULATION**

There are two reasons for shrinking populations: falling fertility (33 countries, 674 million people) and rising mortality (Lesotho and Swaziland). In 29 countries (2.5 billion people) fertility is stable but large amounts of people are reaching fertility years, thus population is still rising. At the other end, many countries are still expanding, with Ethiopia, the Democratic Republic of the Congo and Uganda projected to double by 2050.

To slow growth, 201 million women should get access to family planning services, like Iran after 1989 countering the 'military-personnel expanding peak' begin 1980's. This included a national family planning law, media to raise awareness, 15,000 "health-houses", involvement of religious leaders, a full panoply of contraceptive measures (the first Muslim country with male sterilization) and all forms of birth control for free. In addition they raised female literacy and used soap operas,

like Mexico did.

When countries quickly move to smaller families, they encounter the demographic bonus. Because growth in the number of young dependents declines relative to the number of working adults, productivity surges, savings and investment climb and economic growth accelerates (Japan in the '50's, South Korea and Taiwan followed and more recently China, Thailand and Viet Nam).

### RESCUING FAILING STATES

Only a few countries have returned from failing, like Liberia and Columbia. Project based assistance is not adequate, state failure is a systemic failure that needs a systemic response. The US needs a Department of Global Security to align the currently fragmented help, funded by shifting fiscal resources from the Department of Defense. It will help stabilize population, restore environmental support systems, eradicate poverty, provide universal primary school education and strengthen the rule of law, as deal with drugs, debt relief, market access and the coordination of domestic and foreign policy. There is no national security without global security. A Poverty Eradication Agenda and Budget

For many developing countries, the reform of farm subsidies in aid-giving industrial countries and debt relief may be equally important. This will counter the depressed world market prices. Debt relief has made it possible for Zambia to make basic health-care free, for Burundi to cancel school fees and for Nigeria to set up a poverty action fund. The initiatives in this chapter are estimated to cost \$77 billion a year, mostly for education and health.

## 8. Restoring the Earth

We depend on the earth's natural systems. Instead of destroying them by deforestation and the resulting soil erosion, we need to move at wartime speed to save them before we reach nature's thresholds.

### PROTECTING AND RESTORING FORESTS

Developing countries lose 13 million hectares and industrial countries re-grow 6 million hectares of forests, losing 7 million hectares of the 4 billion hectares annually. Industrial countries should reduce the amount of wood for paper (recycle and cloth alternatives), and developing countries should cut on the use of fuelwood (efficient cookstoves, Solar Cookers, electric hotplates).

Instead of clearcutting, only mature trees should be cut. Then there is certification like the Forest Stewardship Council (FSC) and forest plantations. These can be profitably established on deforested and degraded land, preferably at the year-growing conditions near the equator, but can also come at the expense of existing forests. There also is competition with agriculture and there are water scarcity constraints. Success stories include New England, the Soviet Union, several East European countries, South Korea and Turkey. In Niger, leaving some acacia trees standing by farmers slowed wind thus reducing erosion, fixing nitrogen thus enriching the soil, providing fodder for livestock and supplying firewood. The key was to shift ownership of the trees from the government to individual farmers. Shifting subsidies from building logger roads to planting trees would help as well.

## PLANTING TREES TO SEQUESTER CARBON

1.5 billion tons of carbon are being released in the atmosphere each year from forest loss. Deforestation in Asia is mainly caused by the demand for timber and palm oil. In Latin America demand for soybeans, beef, and sugarcane ethanol is deforesting the Amazon. In Africa, it is demand for fuelwood and land for agriculture. Indonesia and Brazil account for more than half of all deforestation. Plan B: end net deforestation and sequester carbon through tree planting and improved agricultural land management.

Thailand, the Phillipines and China have complete or partial bans on logging, the result of devastating floods or mudslides. China's Yangtze disaster moved the government to pay loggers to plant trees. Brazil is facing an even bigger disaster if the Amazon keeps diminishing. Plan B: to get 860 million tons of carbon sequestered per year by 2020 at a carbon price of \$200 per ton, costing \$17 billion a year. A good initiative is UNEP's Billion Tree Campaign inspired by Wangari Maathai, and the subsequent goal of 7 billion trees by 2010. Ethiopia, Turkey and Mexico are leaders in this initiative.

## CONSERVING AND REBUILDING SOILS

After the 1930's Dust Bowl, American farmers started planting tree shelterbelts and practiced strip cropping. In 1985 the US government started to grow vegetation on highly erodible land, and paying farmers to plant fragile cropland to grass or trees. A new tool is conservation tillage, including no-till and minimum tillage. This reduces erosion, retains water, raises soil carbon content and greatly reduces energy use for tillage.

Farming practices that reduce soil erosion and raise cropland productivity usually also lead to higher carbon content in the soil, like minimum-till and no-till, the more extensive use of cover crops, the return of all livestock and poultry manure to the land, expansion of irrigated area, a return to more mixed crop-livestock farming and the forestation of marginal farmlands.

In Morocco the government cancelled farmers' debts and converted cereal-planted areas into less-vulnerable olive and fruit orchards. The African Union launched the Green Wall Sahara Initiative, to stop the Sahara from moving south. China is planting a belt of trees to stop the expanding Gobi Desert. China pays farmers to plant their cropland in trees. Mongolia plants desert shrubs to stabilize the dunes. In many situations, sheep and goats have been banned entirely or replaced with dairy cattle on designated areas. The only viable way to eliminate overgrazing is to reduce the size of flocks and herds. Protecting the earth's soil also warrants a worldwide ban on clearcutting in favor of selective harvesting.

## REGENERATING FISHERIES

Coastal nations on the 2002 World Summit on Sustainable Development pledged to have 10% of the world's oceans turned into marine reserves or parks by 2012. In 2006 there were 4,500 marine protected areas (MPAs), covering 2.2 million km<sup>2</sup> (less than 1% of the world's oceans), of which only 0.01% has a fishing ban. Especially biological/marine hotspots should be incorporated. The most ambitious initiatives come from the US (Papahānaumokuākea near Hawaii) and Kiribati. Managing reserves that covered 30% of the world's oceans costs \$12-14 billion a year, offset by

the additional income (\$70-80 billion) from recovering fisheries, a better idea than spending \$22 billion on subsidies as governments do now.

**PROTECTING PLANT AND ANIMAL DIVERSITY**

To do this we need to stabilize human population and the earth’s climate. Without stabilization more rainforest gets cleared and rivers are drained. The traditional approach of building a fence and calling it a park is no longer sufficient. Especially the biodiversity “hotspots” deserve protection. A promising school of thought centers on the extension of species conservation in agriculture, urban landscapes, roadways and other landscapes.

**THE EARTH RESTORATION BUDGET**

IJ: mostly a summary concluding in these numbers:

**TABLE 8-1. PLAN B BUDGET:  
ADDITIONAL ANNUAL FUNDING NEEDED TO RESTORE THE EARTH.**

Activity:	Funding (billion dollars):
Planting trees to reduce flooding and conserve soil	6
Planting trees to sequester carbon	17
Protecting topsoil on cropland	24
Restoring rangelands	9
Restoring fisheries	13
Protecting biological diversity	31
Stabilizing water tables	10
<b>Total:</b>	<b>110</b>

## 9. Feeding Eight Billion People Well

We are entering a new food era, say record-high grain prices, grain-export restrictions and land-acquisitions (led by Saudi Arabia, South Korea and China), possibly leading to conflicts between land-grabbers and hungry locals. Competition for land is indirectly competition for water. We need to get to a balance, reducing demand and expanding supply. This calls for smaller families, for the affluent to move down the food chain, and to find substitutes for oil other than from food crops.

**RAISING LAND PRODUCTIVITY**

Prior to 1950, expansion of the food supply came from expansion of cropland area. After WWII the world shifted to raising land productivity, by using more fertilizer, irrigation and higher yielding varieties. Now the rise of wheat (7 tons) and rice (5 tons) per hectare is leveling off in the countries that use all technologies, only corn is still rising (10 tons).

New ideas are the breeding of crops that are more tolerant of drought and cold and expanding the area of land that produces more than one crop per year, using modified crops if necessary. Combinations include wheat and corn (China), wheat and rice (India), double or triple cropping of rice (both), winter wheat and soybeans in summer (US) or wheat or corn with soybeans (Brazil and Argentina). Africa raises productivity by planting grain and leguminous trees, raising soil fertility, doubling

grain yields within a matter of years. Securing land ownership also encourages farmers to invest and improve their land.

### **RAISING WATER PRODUCTIVITY**

It takes 1.000 tons of water to produce 1 ton of grain, thus 70% of the world's water is devoted to irrigation. Raising irrigation efficiency is raising water productivity. This means shifting from flood or furrow systems to overhead sprinklers (30% less) or drip irrigation (50% less). Simple drip irrigation will raise yields, is more labor-intensive and pays for itself in one year. Institutional shifts – moving responsibility to local associations – facilitate efficiency (Mexico, Tunisia).

Low water productivity is often the result of subsidized low water prices. Productivity can be boosted by shifting to more water-efficient crops. Moving down the food chain reduces water use, as do more water-efficient industrial processes, appliances, dry-compost toilets and urban water recycling.

### **PRODUCING PROTEIN MORE EFFICIENTLY**

Producing animal protein more efficiently raises both land and water productivity. 36% of the world grain harvest is used to produce animal protein. Cattle in feedlots use 7 kilograms of grain for 1 kilogram in weight gain, pork more than 3 to 1, poultry just over 2 to 1 and herbivorous species of farmed fish less than 2 to 1. Aquaculture has been the fastest-growing source of animal protein since 1990.

Carnivorous species (salmon) are inefficient in that they are fed other fish and shrimp farming often involves the destruction of coastal mangrove forests. For both, using offshore ponds concentrates waste, contributing to eutrophication and dead zones. Fish polyculture developed in China emulates natural aquatic ecosystems, combined with agriculture this enables farmers to use agricultural wastes to fertilize ponds.

We can get high-quality protein from soybeans, but most of soybean production is consumed indirectly as beef, pork, poultry, milk, eggs and farmed fish. Combining soybean meal with grain dramatically boosts grain to protein converting efficiency. Promising new animal protein production systems use roughage instead of grain (milk production in India) or use crop residues to produce beef (China). This is needed because diets change when incomes rise.

### **THE LOCALIZATION OF AGRICULTURE**

Urban gardening, school gardening and farmers' markets are making diets more local and seasonal. This will only grow with the reduction in the use of oil for transportation. The rise in the number of (small) farms and community gardens is reflecting this, also stimulated by Michelle Obama's White House vegetable garden, preceded by Eleanor Roosevelt's victory garden. Supermarkets and upscale restaurants are also opening up for local farmers, suited for the new locavore (local diet, like herbivore). Carbon footprint labels are being made, and small farms that return livestock manure to the nutrient cycle have an advantage over massive feeding operations because of high prices for natural gas (used for fertilizer) and phosphate.

## STRATEGIC REDUCTIONS IN DEMAND

The Plan B goal to halt population growth at 8 billion by 2040 needs population education for people to understand how fast the relationship between us and our natural support systems is deteriorating, and a crash program to get health care and birth control services to 201 million women. US people eat 800 kilograms of grain per person each year, 700 indirectly as livestock or poultry products. In India, people eat 200 kilograms of grain, almost all directly. Mediterranean diets, with everything but moderately, prove to be the healthiest.

For Americans the energy used to feed and that used for personal transportation are roughly the same. Cutting back from an SUV to a Toyota Prius or from red meat to a plant-based diet both cut greenhouse gas emissions by one fourth. Shifting diet also reduces pressure on the earth's land and water resources. When considering how much animal protein to consume, it is useful to distinguish between grass-fed and grain-fed products.

It is often assumed that we can increase the efficiency of land and water use by shifting from animal protein to high-quality plant protein (soybeans). It turns out however, that since corn yields in the US Midwest are three to four times those of soybeans, it may be more resource-efficient to produce corn and convert it into poultry or catfish at a ratio of two to one than to have everyone heavily reliant on soy.

## ACTION ON MANY FRONTS

Because carbon emissions influence crop yields (heat waves), rising sea water levels cause the inundation of rice-growing deltas and shrinking glaciers and aquifers shrink wheat, grain and rice harvests, these problems can't be solved by one ministry. Food security thus needs to be elevated from the minister of agriculture's office to that of the head of state.

# III – THE GREAT MOBILIZATION

## 10. Can We Mobilize Fast Enough?

We should watch food price and hunger trends closely as indicators of a collapsing civilization. The most basic indicator is the number of failing states. The four mutually dependent Plan B goals – stabilizing climate and population, eradicating poverty and restoring the economy's natural support systems – are all essential to restoring food security. Every country should have a population stabilizing policy, and international assistance programs need a special facility to deal with seriously ill nation states.

We are in a race between political tipping points and natural tipping points. To help us, we need an honest market that tells the ecological truth. For this, we need to reduce taxes on work and raise those on carbon emissions. Norway, Costa Rica (2021) and the Maldives (2019) plan to become carbon-neutral. By far the most effective policy tool is restructuring taxes and subsidies.

## SHIFTING TAXES AND SUBSIDIES

This means lowering taxes on income while raising those on environmentally destructive activities (Germany, Sweden, France, Italy, Norway, Spain and the United

Kingdom). This includes cigarette taxes, gasoline taxes, landfill taxes, taxing cars that enter the city or car ownership. Denmark has a registration tax of a new car exceeding the price of the car by 180% and Singapore more than triples the cost. Cap-and-trade systems, using permits and letting the market set the price, work as well, but not as good as taxes because they are administratively complicated and less well understood and monitored.

Removing subsidies that encourage ownership would cut carbon emissions in Iran by 49%, in India by 14%, Indonesia 11%, Russia 17% and Venezuela 26%. Belgium, France, Japan and Germany phased out all subsidies for coal, and China, Indonesia and Nigeria have reduced or eliminated subsidies that held fuel prices below the world market. At the other end, the US has increased its support for coal and nuclear industries.

Other subsidy shifts could include those from road construction to rail construction and from fisheries to marine parks. Subsidy shifts can help balance the books, create additional jobs and save the economy's eco-supports.

Coal: The Beginning of the End

Coal plants change the earth's climate and damage health because of mercury emissions and air pollution. If all American states would raise their energy efficiency to that of New York, 80% of the coal-fired plants could be closed.

### STABILIZING CLIMATE

Plan B: cut net carbon dioxide emissions 80% by 2020. First energy needs to be stabilized by dramatically improving efficiency and then fossil fuels need to be replaced by renewable sources of energy. We need to bring deforestation to a halt, and improve land use management to sequester carbon biologically. We need to use less corn and more switchgrass for ethanol. The good news for all countries is that the Plan B energy economy is much more labor-intensive.

**TABLE 10-1. PLAN B:  
CARBON DIOXIDE EMISSIONS REDUCTIONS AND SEQUESTRATION IN 2020**

Action	Amount (million tons carbon)
<b>Energy Restructuring</b>	
Replacing fossil fuels with renewables for electricity and heat	3.210
Restructuring the transport system	1.400
Reducing coal and oil use in industry	100
<b>Biological Carbon Sequestration</b>	
Ending net deforestation	1.500
Planting trees to sequester carbon	860
Managing soils to sequester carbon	600
<b>Total Carbon Reductions in 2020</b>	<b>7.670</b>
Carbon Dioxide Emissions in 2006	9.350
<b>Percent reduction from 2006 baseline</b>	<b>82.0%</b>

### THREE MODELS OF SOCIAL CHANGE

One: The catastrophic event model, where a dramatic event fundamentally changes the way we think and behave (Pearl Harbor). Two: reaching a tipping point after an extended period of gradual change in thinking and attitudes (Berlin Wall).

Three: a strong grassroots movement pushing for change from below, fully supported by strong political leadership at the top (sandwich model). Relying on the first is too risky, the second takes too much time, the third is ideal for rapid, historic progress, explaining the world's high hopes for the new US leadership.

### A WARTIME MOBILIZATION

Meaning the way the US restructured the automobile industry into a military industry in three months after the Pearl Harbor attacks.

### MOBILIZING TO SAVE CIVILIZATION

Besides the four Plan B goals, restore hope.

**TABLE 10-2 PLAN B BUDGET:  
ADDITIONAL ANNUAL EXPENDITURES NEEDED TO MEET SOCIAL GOALS AND TO RESTORE THE EARTH**

Goal	Funding (billions dollars)
<b>Basic Social Goals</b>	
Universal primary education	10
Eradication of adult illiteracy	4
School lunch programs for 44 poorest countries	6
Assistance to preschool children and pregnant women in 44 poorest countries	4
Reproductive health and family planning	17
Universal basic health care	33
Closing the condom gap	3
<b>Total</b>	<b>77</b>
<b>Earth Restoration Goals</b>	
Planting trees to reduce flooding and conserve soil	6
Planting trees to sequester carbon	17
Protecting topsoil on cropland	24
Restoring rangelands	9
Restoring fisheries	13
Protecting biological diversity	31
Stabilizing water tables	10
<b>Total</b>	<b>110</b>
<b>Grand Total</b>	<b>187</b>

\$187 billion is roughly one third of the current US military budget and 13% of the global military budget.

### WHAT YOU AND I CAN DO

Lifestyle changes like recycling newspapers, dietary changes and changing light bulbs are essential, but not nearly enough. Informing yourself, reading about the issues and becoming politically active is better. Pick a subject that is close to you or join a group. Contact your elected representative about the need to restructure tax and reorder fiscal priorities.

IJ = added by Isodoor Jonker, as are some **bold** emphases.