Our Task inc.
Building a mutually enhancing relationship between humans and Earth.

Assessing ICT Tools from the Perspective of the Next Generation of Policy and Decision Makers

A paper for the Transatlantic Research on Policy Modeling Workshop
January 14, 2013

Authors: Gerald O. Barney, Jerry@OurTask.org, Trustee, Our Task, and Monica Moore, Program Coordinator, Monica@OurTask.org, Our Task

Contents

P.O. Box 17076
Arlington, VA 22216-7076
www.OurTask.org

Abstract

The next generation of policy and decision makers face a unique challenge. They will either create a mutually enhancing relationship between humans and Earth, or no one will. Our human ecological footprint is already 1.5 Earths and growing, and the rate at which we humans are damaging Earth simply cannot be sustained. Information and communications technology (ICT) is vital to the success of the next generation, and improvements are needed. This paper assesses both qualitative and quantitative tools and techniques from the perspective of young adults moving into policy and decision roles in their careers. The qualitative assessment is made relative to a dozen "Plan B" documents (e.g., LR Brown, Plan B 4.0); the quantitative assessment is based on a half dozen "global outlook reports" (e.g., IEA's World Energy Outlook). The paper also describes tools and projects that young adults find particularly helpful and offers suggestions for improving tools and institutional settings.

Introduction

Our Task works with an international network of young adults aged 15-25 who are concerned about the Earth they will soon inherit. These young people are currently finishing their education and preparing to enter the work force. Some will enter policy and decision making positions. They are part of the next generation of policy and decision makers.

This paper reports on the thinking of approximately a hundred of the most thoughtful young adults we have worked with over the past six years. We call them here the "Our Taskers". While most have been raised and educated in the US, their perspectives are more global than that of the average American.

Policy issues of the future

The Our Taskers feel that ecological sustainability will be the central issue facing the next generation of policy and decision makers. They have several reasons. First, the ecological sustainability issues link together most other issues, including poverty, population, debt, energy, climate, water, food, shelter, etc. Second, while the current generation of policy and decision makers have been doing analyses, writing reports, and meeting, it has generally not been possible to achieve political agreement on actions,[1] and as a result, most difficult aspects of ecological sustainability policy will almost certainly be passed on to the Our Taskers' generation. Third, the issues of ecological sustainability will not go away any time soon, but rather will be a continuing focus of concern for the foreseeable future.

In addition, the Our Taskers feel that their generation faces a unique challenge. We humans are seriously damaging Earth[2], and we have not been able to stop ourselves. The rate at which we humans are damaging Earth – especially the biogeochemical systems -- simply cannot be sustained for yet another generation. [3] Either the Our Taskers' generation of policy and decision makers will find a way to create a mutually enhancing relationship between humans and Earth, or we humans – all of us -- will be

[1] An exception is the Montreal Protocol limiting the emission of the chemicals that deplete the atmospheric ozone layer.

[2] When referring to the planet, we use "Earth" (like Mars, and other planets) and when referring to soil, we use "earth".

[3] See: http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/; http://www.footprintnetwork.org/images/uploads/Ecological_Footprint_Atlas_2010.pdf; http://www.footprintnetwork.org/en/index.php/GFN/blog/human_demand_outstripping_natures_regenerative_capacity_at_an_alarming_rate.

drifting off into an uncontrollable era of decline and decay. The Our Taskers' generation does not have the option of passing the issues of ecological sustainability on to yet another generation. No previous generation has faced such a challenge.

Our Taskers feel that the challenges they face are reflected in many failed international meetings related to ecological sustainability. The 2009 Copenhagen climate change conference[4] and the June 2012 UN Rio + 20 Conference on sustainable development[5] are two such examples. After years of preparation for Rio + 20, many countries didn't even attend, and in the end, virtually nothing was accomplished.

The core issue we face is our species' plan for the future of Earth. Our current planet-level plan – what Our Taskers refer to as "Plan A" -- is at best the Millennium Development Goals (MDGs)[6] and at worst the "Washington Consensus".[7] Neither of these "plans" addresses adequately the global environmental sustainability issues. Both count on more physical growth as the solution to most issues. Yet, continuation of "Plan A" leads only to a still larger and more unsustainable human footprint, to a reduced capacity of the planet to support humans, and to more despair, and violence. Specific signs are everywhere -- deforestation, species losses, sea level rise, violent competition for resources, fisheries depletion, water scarcity, poverty, rising carbon dioxide emissions, food insecurity, ocean acidification, soil erosion, and on and on.

Our Taskers feel we humans desperately need a fundamentally different planet-level plan -- Plan B -- that holistically addresses the global ecological footprint, poverty, and social injustices. And we need planet-level consensus and action on achieving Plan B. The stakes are higher than anything our species has dealt with before.

The Our Taskers are doing several things to prepare themselves for leadership on the challenges their generation will face. First they are mobilizing young adults concerned about global ecological sustainability. Second, they engaged in remedial education for themselves on what is happening to Earth, a vital topic that is not part of the curriculum in most high schools, colleges, or universities. Third, they are hosting an annual "Earth 2100 Conference: What's the Plan!?" And finally they are drafting their own "Youth Plan B".

ICT for the Next Generation: Criteria and Currently Available Tools

Our Taskers recognize the need for Information and communications technology (ICT) to support the policy and decision making of the future. Models are a key part of the ICT they need and want. The issues of most concern to them are global in extent rather than national, comprehensive (integrated energy-water-climate-population-etc. models rather than energy, water, climate, population etc. separately) and long-term in outlook (e.g., 100 years, the length of time a young person might expect to live).

The currently available tools include Global Studies, "Plan B" proposals, and Global Outlook Reports.

---

[4] http://unfccc.int/meetings/copenhagen_dec_2009/meeting/6295.php.

[5] http://www.uncsd2012.org/rio20/.

[6] http://www.un.org/millenniumgoals/.

[7] http://www.cid.harvard.edu/cidtrade/issues/washington.html.

Global Studies

During the 1970s, there were a number of global studies prepared. Generally, these studies attempted to provide quantitative global projections of social, economic, resource, environmental, and technological trends for twenty or more years into the future. The models used to support most well know studies include:

- Wold2 and World3
- The Mesarovic-Pestel World Model
- MOIRA: Model is International Relations in Agriculture
- The Latin American World Model
- The UN World Model
- The [US] Government's Global Model
- The Image Model, an integrated model to assess the greenhouse effect and climate change. [8]
- EN-roads, a dynamic model to help understand how we can achieve our energy, poverty, and climate goals.[9]

T21-World model, a dynamic model to simulate the transition to a "green" economy.[10]
The first five of these models are described in part III (pages 603-684) of The Global 2000 Report to the President, The Technical Report[11]. The sixth model is described in Chapter 14 of The Global 2000 Report to the President, The Technical Report, [12] and more fully in The Global 2000 Report to the President, The Government's Global Model.[13] The seventh and eighth models are focused primarily on climate change.[14] The ninth model (T21-World) provides relatively balanced assessment of economic, energy, and climate trends under many alternative scenarios.[15]

---

[8] Jan Rotmans, *Image: An integrated Model to Assess the Greenhouse Effect*, Kluwer Academic Publishers, Dordrecht, 1990. Joseph Alcamo, Editor. *Image 2.0: Integrated Modeling of Global Climate Change*. Kluwer Academic Publishers, Dordrecht, 1994. Joseph Alcamo, Rik Leemans and Eric Kreileman, Editors. Global Change Scenarios of the 21st Century: Results from the Image 2.1 Model. Elsevier Science, Oxford. 1989.

[9] http://climateinteractive.org/simulations/C-ROADS. EN-ROADS is an extension of C-Roads.

[10] See Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication," UNEP, 2011, (http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Green%20EconomyReport_Final_Dec2011.pdf) especially Part III, "Supporting the Transition to a Global Green Economy" and Annex 1 to Part III: Annex 1. "Technical specifications of the Threshold 21 (T21) World model". Also see: "UNEP GER Global Modeling Work: Technical Background Material, available from Millennium Institute, www.Millennium-Institute.org.
http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Green%20EconomyReport_Final_Dec2011.pdf.

[11] http://geraldbarney.com/Global_2000_Report/G2000-Eng-GPO/G2000_Vol_Two.pdf, pp601-681.

[12] http://geraldbarney.com/Global_2000_Report/G2000-Eng-GPO/G2000_Vol_Two.pdf, pp451-599.

[13] http://geraldbarney.com/Global_2000_Report/G2000-Eng-GPO/G2000-GPO-Vol3.pdf.

[14] http://climateinteractive.org/simulations/C-ROADS. EN-ROADS is an extension of C-Roads

[15] See Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication," UNEP, 2011, (http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Green%20EconomyReport_Final_Dec2011.pdf) especially Part III, "Supporting the Transition to a Global Green Economy" and Annex 1 to Part III: Annex 1. "Technical specifications of the Threshold 21 (T21) World model". Also see: "UNEP GER Global Modeling Work: Technical Background Material, available from Millennium Institute, www.Millennium-

"Plan B" Proposals

Increasing numbers of research centers, institutions, and individual scholars are concluding that humans' current global "Plan A" is not working, and are proposing alternative "Plan Bs". Our Task researchers have located and summarized more than a dozen "Plan B" proposals (See Attachment A) and are continuing to collect such documents.

Generally there are no formal analytical tools supporting "Plan B" proposals. The "Plan B" proposals are in effect extended qualitative opinion pieces based on the author's mental model. While "Plan B" proposals would be much more persuasive if supported by comprehensive, long-term, global models, these documents are still the source of many useful proposals, ideas, and qualitative analyses.

Global Outlook Reports

Several international and some national organizations publish global outlook reports of social, economic, resource, environmental, and technological trends—Global Outlook Reports.

Our Task has made an effort to find respected outlook reports for many sectors (see Attachment B). Many of these reports are based on a formal computer simulation model

We have also made an assessment of the models used for investigating the future of population, economy, energy, environment, food and agriculture, technology, health, and education. In our analysis we focused on four areas:

- The cause-and-effect relationships captured by the model.
- The assumptions underlying the model's projections.
- The comprehensiveness of the models in capturing important feedback relationships.
- The consistencies and inconsistencies that exist among the projections and assumptions of different models.

Our findings:

- The causal relationships in each model are often explained for the category of interest for that model, but not for relationships outside of that category. For example economic models have much more elaborate sets of causal relationships in looking at economic variables, but fewer links are available from the impact of other categories on economic development (e.g. environment and energy categories).
- Where causal relationships exist from one category to another (e.g. from population levels to economic performance), this relationship is almost always one-directional. That is, the feedback processes that cut across multiple categories are generally missing. This is a critical point because models in each category implicitly or explicitly agree that other categories impact their projections, however, these obvious relationships are never taken into account full circle.
- In general it was hard to assess the overall consistency of different models' assumptions because many categories of interest are multidimensional (e.g. technology) and we could not determine if the trajectories assumed or derived from one model are consistent with another. Where specific variables are used by two models, typically consistent projections were drawn

---

Institute.org.
http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Green%20EconomyReport_Final_Dec2011.pdf.

upon, e.g. population trajectories used in different models didn't have any major conflict. Nevertheless, the following inconsistencies were observed in our assessment:

- Climate models project major disturbances to global economy due to rising sea levels and climate change. The magnitude of projected impact is very high and could easily reduce substantially the projected economic growth rates in other models. However, the projections of economic models or the assumptions on economic growth in other models do not include the impacts of environmental change on economy.
- The documentation for the population model does not specify the specific factors that are assumed lead to changes in fertility, mortality, and migration. Other models suggest that food, bio-diversity, and climate change may breach the current trends that are embedded in the population estimation assumptions.
- Energy availability is assumed as given in economic, food production, and population projections. However, the energy model raises some doubt about the robustness of this assumption.

Overall, we found that that leading models are very detail-rich in considering one specific sector; however, few interactions with other sectors are included in these models. For example the impact of environmental change predicted in environment models is not included in economic, population, or other projections.

Model maintenance

For a model to be useful, it must be maintained. The data and assumptions need to be kept current, and the model structures updated periodically.

Of the global models, World3 is being maintained and used. The separate sectoral models of The US Government's Global Model continue to be used regularly, but no effort has been made for over 30 years to use the sectoral models in a consistent, integrated manner, as in the Global 2000 Study. EN-roads is being maintained and used regularly for assessing alternative approaches to achieving our energy, poverty, and climate goals. There are plans to use the T21-World model for further projects.

Of the Global Outlook models, most are being updated on a regular basis to produce new editions of the global outlook reports. Models are unlikely to be updated unless they are being used to produce a regular report.

Improvements needed by the next generation

Many of the issues that will impact young adults over the course of their lives are truly global in nature and cannot be addressed effectively on a national or local scale. Climate, energy, food, migration, water, and ocean acidity are some examples. Therefore we need global models.

We also need comprehensive models. We need food and energy models that treat water as an endogenous variable so that the growing scarcity of water is taken into account dynamically.

We need long term models that look out at least over the full lifetime of a child born today. Studies need increasingly to use 100 years as their time horizon. Of course projections over 100 years have more uncertainty than do projections over 25 or 50 years, but the discipline of specifying assumptions for the long-term and modeling their implications is a useful exercise for considering the needs of young people and future generations.

Our Taskers find global studies to be highly relevant to the policy and decision making. We find the Global 2000 Report to the President to have been a particularly useful exercise and hope that the US Government might now after three decades undertake an update of the study.

We also find the global outlook reports to be helpful and would find them even more helpful if modelers from FAO, IEA, IPCC, UN Population Division, World Bank, and other international organizations could get together regularly to agree on some common assumptions as a basis for the global projections.

We would especially like the opportunity to meet with global modelers and discuss a range of scenarios that young adults would like to have investigated. Such analyses would give us a good start on the policy issues that we will soon inherit.

P.O. Box 17076
Arlington, VA 22216-7076
www.OurTask.org

Attachment A: Summaries of a Dozen Plan B Proposals

There is growing recognition that "Plan A" – business as usual -- has failed, and many groups are now proposing "Plan Bs". Our Task has collected and summarized the following proposals:

UN Environment Programme, Towards a Green Economy. Governments and the private sector should change the economic paradigm from the old business-as-usual, "brown economy" to that of a "green economy" – one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. One in which material wealth is not delivered perforce at the expense of growing environmental risks, ecological scarcities, and social disparities.

Worldwatch Institute, State of the World 2010: Transforming Cultures. Key culture-shaping institutions (education, business, government, and the media, as well as social movements and long-standing human traditions) should lead an intentional, wholesale transformation of dominant cultural patterns to a cultural paradigm where the norms, symbols, values, and traditions encourage just enough consumption to satisfy human well-being while directing more human energy toward practices that help to restore planetary well-being. Make living sustainably as natural tomorrow as consumerism is today. Develop a vision of the values, norms, and behaviors that should be seen as natural. Actively discourage consumption that undermines well-being. Replace the private consumption of goods with public consumption, the consumption of services, or even minimal or no consumption when possible.

Jay Walljasper, All That We Share. A solution to the tragedy of the commons requires the beneficiaries of the commons to agree on some means of protecting the commons, e.g., placing the commons in trust, selling (privatizing it), or forming an association to manage it.

Lester R. Brown, World on the Edge. Governments everywhere should (1) restructure taxes by lowering income taxes and raising the tax on carbon emissions to include indirect costs; (2) respect sustainable yields of natural systems; (3) change national accounting systems so that real social and environmental costs are no longer left off the books; (4) end worldwide subsidy of fossil fuel production and consumption globally by 2020; (5) increase the subsidy of renewable energy; (6) cut carbon emissions by 80% by 2020; (7) stop the construction of new coal-fired power plants and retire the old ones; (8) close coal-powered power plants fast enough to save the Greenland ice sheet; (9) eradicate poverty; (10) fill the family planning gap fast enough to help countries escape the demographic trap; (11) redefine and reorient security away from a focus on armed aggression to a focus on climate disruption, population growth, poverty, the economy's deteriorating natural support systems, and failing states, and (12) shift fiscal resources toward stabilizing climate, reforestation, soil conservation, stabilizing population, fishery restoration, universal primary school education, reproductive health care and family planning services.

World Wildlife Fund, Zoological Society of London, and Global Footprint Network, Living Planet Report, 2008. Close the gap between humanity's footprint and available biocapacity by reducing population, individual consumption, resources used, wastes emitted. Expand biologically productive areas and increase their productivity. Cut substantially the burning of fossil fuels.

Joseph Campbell, The Hero with a Thousand Faces. Every one of us must help reform the image of society, which is being worked out on unconscious level through what is bound to be a long and very frightening process. Man himself is now the critical mystery, that alien presence with whom the forces of egoism must come to terms and in whose image society is to be reformed. The modern individual who dares to heed the call must not wait for his community to cast off its … pride, fear, rationalized avarice, and sanctified misunderstanding. Every one of us shares the supreme ordeal -- not in the bright moments of his tribe's great victories, but in the silences of his personal despair.

Our Task, The Youth Earth Plan. We humans are suffering from a cultural disorder, or perhaps even a cultural pathology. We have somehow come to think that we are separate from nature and can use and abuse Earth as much as we want. We need to change our culture, and to do so we need the help of all of the institutions that develop, shape, and preserve our culture -- our international, governmental, spiritual, corporate, educational, scientific, media, and civil institutions. This document provides specific suggestions on how each culture-shaping institution can help.

Jared Diamond, Collapse: How Societies Choose to Fail or Succeed. After analyzing how a dozen human societies in the past have committed "ecocide" by choosing to unsustainably exploit their environment, the book recommends that societies choose to avoid ecocide by: (1) having the courage to practice long-term thinking and making bold, courageous, anticipatory decisions at a time when problems have become perceptible but not yet crises; and (2) having the courage to make painful decisions about values. Which of the values that formerly served society well can continue to be maintained under new, changed circumstances? Which of those treasured values must be jettisoned and replaced with other approaches?

Bill McKibben, Deep Economy. Move beyond "growth" as the paramount economic ideal and pursue prosperity locally with cities, suburbs, and regions producing more of their own food, energy, culture, and entertainment.

Thomas E. Lovejoy, et al. "The Greatest Challenge of Our Species". Realize that this planet, which brought us into existence, must be managed as the biophysical system that it is. Recognize the magnitude of problems in the biophysical system and scale up restoration efforts to the planet's ecosystems as a whole.

Thomas Homer-Dixon, The Upside of Down. Do not downplay the dangers we face from increasing scarcity of conventional oil (a large spoon full of crude oil contains energy equivalent to 8 hours of manual labor; a typical tank of gasoline contains energy equivalent to two years of manual labor); growing global economic instability and widening income gaps; demographic stress; worsening damage to land, water forests, and fisheries; and climate stress from changes in the Earth's atmosphere. Breakdown will happen, and if we are well-prepared, we may be able to use early breakdowns to achieve deep reform of institutions, social relations, technologies, and entrenched habits of behavior. Specifically, we should now: (1) Open our minds to major surprises and radically new ways of thinking about our world and the way we should live; (2) Lower the risk of catastrophic, synchronous failure by reducing the underlying tectonic stresses; (3) Boost the resilience of our energy, food, and other critical systems; and (4) Act proactively, simultaneously, and aggressively to: (a) Boost the resilience of the world's weakest societies; (b) Pour resources into reducing disease in poor countries; (c) Work to rebuild societies shattered by conflict; (d) Supporting family planning; (e) Conserve soils, forests, fisheries, and freshwater; (f) Move quickly to cleaner energy sources; (g) Sharply reduce carbon emissions; (h) Reform the international financial system; and (i) Reduce the risk of weapons of mass of mass destruction falling into the hands of small groups.

Meadows, Meadows, Randers, and Behrens: The Limits to Growth; Beyond the Limits, and Limits + 30. Make an active decision to reduce the human ecological footprint. Make a comprehensive revision of policies and practices to slow and eventually stop growth of population and physical capital; bring birth rates down to equal death rates; and bring investment in industrial capital down to the depreciation rate. Assure that rates of the use of renewable resources do not exceed their rates of regeneration; that rates of use of nonrenewable resources do not exceed the rate at which sustainable renewable substitutes are developed; and that rates of pollution emission do not exceed the assimilative capacity of the environment. Shift economic preferences toward services (e.g., education and health) and away from factory produced material goods. Design for durability, reuse, and reduced obsolescence to

reduce resource consumption and pollution. Make choices based increasingly on the long-term costs and benefits of the options and improve the signals by learning more about the real welfare of human population and about the real impact on the world ecosystem of human activity. Speed up the response time by looking actively for signals that indicate when environment or society is stressed and deciding in advance what to do if problems appear. Recognize that sustainability requires more than productivity and technology; it requires maturity, compassion, and wisdom; place a high value on producing enough food for all people; emphasize sufficiency, equity, and quality of life rather than on quantity of output.

World Bank, Inclusive Green Growth. Over the past 250 years, growth has come largely at the expense of the environment, and environmental damages are reaching a scale which threatens both growth prospects and the progress achieved in social indicators. While we must sustain robust growth, we need inclusive green growth -- growth that is efficient in its use of natural resources, minimizes pollution and environmental impacts, accounts for natural hazards and natural capital in preventing physical disasters, and is inclusive. We must avoid locking economies into unsustainable patterns, causing irreversible environmental damage, and increasing the potential for regret. Rapid change is needed to keep the costs of greening growth manageable and avoiding irreversible losses. Inclusive green growth strategy will employ environmental taxation, norms, and regulations. Economic models must be redesigned by expanding to include natural capital, and by shifting the measure of success from output to utility.

Attachment B: Respected International Outlook Sources

4 October 2012

Our Task is seeking documents that project social, resource, environmental, and technological trends globally to 2100. Below is a list of the projections we have located so far. Very few of the reports look out to 2100, and for many topics we have not been able to locate any quantities projections. Please send suggestions of additional projection reports to Jerry@OurTask.org.

Social Trends

Population

- *World Population Prospects: The 2010 Revision.* http://esa.un.org/wpp/Documentation/publications.htm esa.un.org/wpp/Documentation/pdf/WPP2010_Highlights.pdf
- *Population Projections 2011, United Nations.* http://www.unfpa.org/public/home/publications/search_pubs/swpreports

Health

- *Human Development Report 2011: Sustainability and Equity: A Better Future for All.* hdr.undp.org/en/media/HDR_2011_EN_Complete.pdf
- *World Health Report 2010.* http://www.who.int/entity/whr/2010/whr10_en.pdf
- *State of the World's Children 2012.* http://www.unicef.org/publications/files/SOWC_2012-Main_Report_EN_13Mar2012.pdf

Education

- *Oxfam Education Report*. http://www.scribd.com/doc/52579531/The-Oxfam-Education-Report
- *Education for All Global Monitoring Report 2011.* unesdoc.unesco.org/images/0019/001907/190743e.pdf (2012 version to be launched Oct. 16)

War and Conflict

- *Global Security, 2012 Reports.* http://www.globalsecurity.org/military/library/report/2012/index.html
- *Ongoing Military Conflicts.* http://en.wikipedia.org/wiki/Ongoing_wars
- *Wars 2003-2010.* http://en.wikipedia.org/wiki/List_of_wars_2003–2010
- *Wars 2011-Present.* http://en.wikipedia.org/wiki/List_of_wars_2011–present
- Cost of War. http://costofwar.com/
- *Columbia Feature Project, Current Conflicts.* http://ci.columbia.edu/ci/tools/0811_tools.html
- *Religious Tolerance.* http://www.religioustolerance.org/relviol.htm
- *Additional reports on war, conflict, and security available from the International Institute for Strategic Studies,* www.iiss.org, and from the *Stockholm International Peace Research Institute* , www.sipri.org

Resource Trends

Food, Forests, and Fisheries

- *World Agriculture: Towards 2030/2050 Interim Report, 2006.* http://www.fao.org/fileadmin/user_upload/esag/docs/Interim_report_AT2050web.pdf&sa=U&ei=8D1rUP3XAqTq0gH34oBY&ved=0CAoQFjAB&client=internal-uds-cse&usg=AFQjCNHCFVmoAztK10CvfRBxqGkaxaM7Ww
- *Rights and Resources Initiatives.* http://www.rightsandresources.org/publications.php

Water

- *The World's Water 2011-2012, Vol. 7: The Biennial Report on Freshwater Resources.* http://www.worldwater.org/books.html
- *Comprehensive Assessment of Water Management in Agriculture.* http://www.iwmi.cgiar.org/Assessment/files_new/synthesis/Summary_SynthesisBook.pdf

Non-Fuel Minerals

- *USGS International Minerals Statistics and Information.* http://minerals.usgs.gov/minerals/pubs/country/.
- *H.R. 4402, Critical Minerals Policy Act of 2012.* http://www.cbo.gov/sites/default/files/cbofiles/attachments/hr4402Senate_SPAYGO.pdf
- *Strategic Minerals: Resource Geopolitics and Global Geo-Economics.* Ewan W. Anderson, Liam D. Anderson, ISBN: 978-0-471-97402-4, February 1998
- *Strategic Minerals in the New World Order, Army War College, 1993.* http://stinet.dtic.mil/oai/oai?&verb=getRecord&metadataPrefix=html&identifier=ADA274394

Energy

- *World Energy Outlook, 2011.* World Energy Outlook 2012 to be released on Oct. 9, 2012. http://www.iea.org/Textbase/npsum/weo2011sum.pdf (Executive summary)
- *Winning the Oil Endgame.* http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0CDQQFjAD&url=http%3A%2F%2Fwww.rmi.org%2Fcms%2FDownload.aspx%3Fid=6663%26file=WinningOilEngame.pdf%26title=Winning+the+Oil+Endgame&ei=LEFsUIW4NKj30gGPhoHgAQ&usg=AFQjCNGTLZBOQ4Yh
- *Energy Resources Program; World Petroleum Assessment.* http://energy.usgs.gov/OilGas/AssessmentsData/WorldPetroleumAssessment.aspx
- *U.S. Department of Energy.* http://energy.gov/public-services/manufacturing. http://energy.gov/science-innovation/energy-efficiency

Environmental Trends

Global Overview

- *Global Environmental Outlook 5 (GEO 5).* http://www.unep.org/geo/pdfs/geo5/GEO5_report_full_en.pdf

Toxic Chemicals

- *The UNEP Global Programme of Action for Protection of the Marine Environment from Land Based Activities.* http://www.gpa.unep.org/ and go to "GPA Pollutant Source Categories"
- *2009 UNEP "*State of the Marine Environment Report for the East Asian Seas". http://www.unep.org/pdf/StateMarineEnvEastAsia2009.pdf
- *GESAMP Reports and Studies: "A Sea of Troubles", 2001.* http://www.gesamp.org/publications/publicationdisplaypages/rs70
- *15th Biennial Report on Great Lakes Water Quality, International Joint Commission, March 2011.* http://www.ijc.org/rel/boards/watershed/15biennial_report_web-final.pdf
- *The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 2011. A*rchive.basel.int/meetings/cop/cop10/documents/28e.pdf (Report of 2011 Convention), http://www.basel.int/Home/tabid/2202/mctl/ViewDetails/EventModID/9158/EventID/296/xmid/8052/Default.aspx
- *The Stockholm Convention: protecting human health and the environment from persistent organic pollutants (pop's).* http://chm.pops.int/Convention/ThePOPs/tabid/673/Default.aspx. http://chm.pops.int/Convention/ConferenceofthePartiesCOP/COPDecisions/tabid/208/Default.aspx
- *UNEP Chemicals Branch.* http://www.chem.unep.ch/default.htm
- *UNEP Regional Seas Program.* http://www.unep.org/regionalseas/. http://www.unep.org/regionalseas/publications/default.asp
- *The Ramsar Convention on Wetlands.* An intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands. http://www.ramsar.org
- Many additional reports available from *International Institute for Sustainable Development,* http://www.iisd.org/
- *UN Atlas of the Oceans.* http://www.oceansatlas.com/, use "toxic pollution" as a keyword

Climate

- *Intergovernmental Panel on Climate Change (IPCC) Assessment Report*. The Fifth Assessment Report (AR5) will be completed in 2013/2014. The Fourth Report: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#.UGxNqhhJGPw
- *The Stern Review on Climate Change Final Report.* http://webarchive.nationalarchives.gov.uk/+/http:/www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

Biodiversity

- *Millennium Ecosystem Assessment: Ecosystems and Human Well–being: Biodiversity Synthesis.* http://www.maweb.org/documents/document.354.aspx.pdf

Oceans

- *"The Future Oceans - Warming Up, Rising High, Turning sour", German Advisory Council on Global Change, 2006.* http://www.wbgu.de/en/special-reports/sr-2006-the-future-oceans/

Economic Trends

- *The World Bank, Global Economic Prospects January 2012: Uncertainties and Vulnerabilities*. siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1322593305595/8287139-1326374900917/. ExecutiveSummary_GEPJan2012_Eng.pdf
- *Global Environmental Outlook 5 (GEO 5).* http://www.unep.org/geo/pdfs/geo5/GEO5_report_full_en.pdf
- *OECD Environmental Outlook to 2050: The Consequences of Inaction,* 2012. http://www.oecd.org/env/environmentalindicatorsmodellingandoutlooks/oecdenvironmentaloutlookto2050theconsequencesofinaction.htm

Technological Trends

Agriculture Technology

- *Agricultural Assessment (IAASTD), Chapters 5 and 6.* www.agassessment.org.

Energy and Climate Related Technology

- Energy Technology Perspectives 2012 *-- Pathways to a Clean Energy System.* https://www.iea.org/W/bookshop/b.aspx
- *IPCC Special Reports.* http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml - 2.
- *Princeton Carbon Mitigation Initiative, "Stabilization Wedges".* http://cmi.princeton.edu/wedges/ http://neinuclearnotes.blogspot.com/
- *PBL Netherlands Environmental Assessment Agency.* http://www.pbl.nl/en/publications/2012

Transport Technology

- *The European Conference of Ministers of Transport is now the International Transport Forum.* http://www.internationaltransportforum.org/Pub/index.html
- *Papers and reports by Lee Schipper, World Resources Institute (WRI).* http://www.wri.org/publications/climate
- *The IEA/SMP global transport spreadsheet model* (MoMo), by Lew Fulton, may be downloaded from World Business Council for Sustainable Development: www.wbcsd.org.